



INSTRUCTIONAL MATERIALS LABORATORY  
UNIVERSITY OF MISSOURI-COLUMBIA

# Exploring Agriculture in America



In cooperation with Agricultural Education Department • College of Agriculture,  
Food and Natural Resources • University of Missouri-Columbia

In cooperation with Agricultural Education Section • Division of Vocational and Adult Education  
Elementary and Secondary Education • Jefferson City, Missouri



# Exploring Agriculture in America

Writers:

Anna L. Ball and Bradley C. Greiman  
Agricultural Education  
University of Missouri-Columbia

Consulting Editor:

James E. Dyer, Ph.D  
Agricultural Education  
University of Missouri-Columbia

Veronica J. Feilner, Senior Editor and Project Coordinator

Marie Korte, Editor  
Instructional Materials Laboratory  
University of Missouri-Columbia

Produced by:

Instructional Materials Laboratory  
University of Missouri-Columbia  
1400 Rock Quarry Center  
Columbia, Missouri 65211

Volume 32  
Number 5

Catalog Number 10-9500-I  
First Edition: July 1991  
Revised: June 2000

Available from:  
Instructional Materials Laboratory  
University of Missouri-Columbia  
1400 Rock Quarry Center  
Columbia, MO 65211-3280  
[www.iml.coe.missouri.edu](http://www.iml.coe.missouri.edu)  
1-800-669-2465

**© 2000 the Curators of the University of Missouri on behalf of the Missouri Department of Elementary and Secondary Education. All rights reserved.**

The activity that is the subject of this report was supported in whole or in part by funds from the Department of Elementary and Secondary Education, Division of Vocational and Adult Education. However, the opinions expressed therein do not necessarily reflect the position or policies of the Missouri Department of Elementary and Secondary Education or the Division of Vocational and Adult Education, and no official endorsement should be inferred.

## Acknowledgments

*Exploring Agriculture in America* is a curriculum designed to provide instruction about agriculture for seventh and eighth grade students. Funding for the curriculum development project was provided through a grant from the Missouri Department of Elementary and Secondary Education (MDESE).

Recognition is given to advisory committee members for providing their valuable time and suggestions in developing the outline for this curriculum. The committee consisted of Nancy Alford, Dan Burkemper, Leigh Burkhalter, Sammy Cox, Jim Dyer, Sheila Keener, Mike Marsch, Robin Peiter, Tim Reller, and Chuck Wilson.

Thanks are also extended to Jim Russell for his expertise in developing the presentation component of this curriculum.

Appreciation is expressed to the following staff members of the Instructional Materials Laboratory for their efforts in producing this material: Dana Tannehill, Director; Marie Korte, Editor; Janis Levsen, Assistant Editor; Susan Rhyne, Editor; Kim Freese, Graphic Artist; Keith Campbell, Computer Graphic Artist; Chris Culwell, HTML consultant; Amy Surber, Editorial Assistant; and Seth Lammers, Student Assistant.

Veronica J. Feilner, Senior Editor and Project Coordinator  
Instructional Materials Laboratory  
University of Missouri-Columbia

James E. Dyer, Assistant Professor  
Agricultural Education  
University of Missouri-Columbia

## Foreword

Instruction about agriculture is important for the development of an educated citizenry. Every person has a vested interest in agriculture. The future of human beings is directly dependent upon agriculture. *Exploring Agriculture in America* was developed to inform students about the industry that is so vital to their future.

*Exploring Agriculture in America* is a curriculum designed to provide instruction about agriculture for seventh and eighth grade students. Lessons included in the curriculum encompass a problem-solving instructional approach. Student-oriented activities have been included to provide opportunities for experiential learning. A crosswalk table is included to show where *Exploring Agriculture in America* competencies relate to Missouri's Show-Me Standards and Missouri's Frameworks for Curriculum Development. A suggested teaching calendar is included at the end of the table of contents.

This instructor guide and the corresponding student reference contain seven units: Introduction to Agriculture, Plant Science, Animals in Society, Products from Agriculture, Natural Resources and Conservation, Leadership and Personal Development, and Basic Home and Farmstead Safety and Maintenance.

James E. Dyer, Assistant Professor  
Agricultural Education  
University of Missouri-Columbia

Terry Heiman, Director  
Agricultural Education  
Department of Elementary and  
Secondary Education

# Exploring Agriculture in America

## Table of Contents

Acknowledgments.....	iii
Foreword.....	iv
Table of Contents.....	v
Competencies/Objectives .....	ix
References and Materials .....	x
Competency Crosswalk .....	xvi
Teaching Calendar.....	xix
<b>UNIT I - INTRODUCTION TO AGRICULTURE</b>	
<b>Lesson 1–Agriculture: What Is It?</b> .....	I-1
TM 1.1: Agriculture Is . . . . .	I-7
TM 1.2: Agriculture Is. . . (cont.).....	I-9
TM 1.3: World Population Growth.....	I-11
TM 1.4: Average Annual Expenditures for Typical U.S. Family .....	I-13
TM 1.5: Disposable Income Spent for Food .....	I-15
TM 1.6: Life Expectancy.....	I-17
AS 1.1: Planting Seeds .....	I-19
AS 1.2: Change in World Population (Instructor) .....	I-21
AS 1.3: Current World Population .....	I-23
AS 1.4: Agricultural Career Collage .....	I-25
AS 1.5: A to Z Agricultural Careers .....	I-27
AS 1.6: Cheeseburger, Fries, and Shake .....	I-29
AS 1.7: Name That Career (Instructor) .....	I-31
AS 1.8: Agriculture in My Community (Instructor) .....	I-33
<b>Lesson 2–Agriculture in the World</b> .....	I-35
TM 2.1: Food Deficit Countries .....	I-39
TM 2.2: World Map .....	I-41
TM 2.3: Agricultural Commodities in Major World Regions .....	I-43
TM 2.4: World Statistics for Food, Population, and Life Expectancy .....	I-45
TM 2.5: U.S. Exports Purchased.....	I-47
AS 2.1: International Auction (Instructor) .....	I-49
AS 2.1: International Auction (Student).....	I-55
AS 2.2: Travel to a Foreign Country on the Internet.....	I-57
AS 2.3: World Food Activity (Instructor).....	I-59
<b>Lesson 3–Agriculture in the United States</b> .....	I-61
TM 3.1: Map of United States .....	I-67
AS 3.1: Census of Agriculture (Instructor) .....	I-69
AS 3.1: Census of Agriculture (Student) .....	I-71
AS 3.2: Time Line of Agriculture and History (Instructor).....	I-75
<b>Lesson 4–Agriculture in Missouri</b> .....	I-77
TM 4.1: Missouri's 1998 Ranking in the United States .....	I-81
TM 4.2: How Has Missouri Agriculture Changed? .....	I-83
HO 4.1: 1997 Cash Receipts .....	I-85
AS 4.1: Name That Drawing (Instructor).....	I-87

AS 4.2: Agricultural Commodities Produced in Missouri.....	I-89
AS 4.3: Hat Day.....	I-91
<b>Lesson 5–Advances in Agricultural Technology .....</b>	<b>I-93</b>
AS 5.1: The Future and Change (Instructor) .....	I-99
AS 5.2: Future Headlines (Instructor) .....	I-101
AS 5.3: Invent a New Product for 2020.....	I-103

UNIT II - PLANT SCIENCE

<b>Lesson 1–The Importance of Plants .....</b>	<b>II-1</b>
TM 1.1: Value of Leading Missouri Crops in 1998 .....	II-5
AS 1.1: Soil Dessert (Instructor).....	II-7
AS 1.2: Landscaping Plant Material Collection .....	II-9
AS 1.3: Plant Science Businesses .....	II-11
<b>Lesson 2–Plant Parts and Processes .....</b>	<b>II-13</b>
TM 2.1: Main Parts of a Plant.....	II-19
TM 2.2: Plant Propagation .....	II-21
TM 2.3: Asexual Propagation Methods .....	II-23
TM 2.4: Methods of Taking Cuttings .....	II-25
TM 2.5: Parts of a Complete Flower .....	II-27
TM 2.6: Can You Name an Annual or Perennial?.....	II-29
TM 2.7: Monocot or Dicot?.....	II-31
TM 2.8: Stages in Germination and Emergence of a Monocot.....	II-33
TM 2.9: Stages in Germination and Emergence of a Dicot.....	II-35
AS 2.1: Starting Plants from Stem Cuttings (Asexual Propagation) .....	II-37
AS 2.2: Parts and Functions of a Complete Flower .....	II-39
AS 2.3: Effect of Light on Photosynthesis .....	II-41
<b>Lesson 3–The Growing Medium.....</b>	<b>II-43</b>
TM 3.1: Components of Soil.....	II-49
TM 3.2: Relative Sizes of Sand, Silt, and Clay.....	II-51
TM 3.3: What is in a Soilless Mix? .....	II-53
TM 3.4: Aquarium Hydroponic System .....	II-55
AS 3.1: Examining Soil.....	II-57
AS 3.2: Water-Holding Capacity of Soil (Instructor).....	II-59
AS 3.3: Design Your Own Medium .....	II-61
<b>Lesson 4–Plant Care Requirements.....</b>	<b>II-63</b>
TM 4.1: What Do the Numbers 10-15-10 Mean?.....	II-67
TM 4.2: Rules of Proper Watering .....	II-69
AS 4.1: Plant Care Contest (Instructor).....	II-71
AS 4.2: Plant Care Requirements .....	II-73
<b>Lesson 5–Technologies Used in Plant Agriculture .....</b>	<b>II-75</b>
TM 5.1: Precision Agriculture Is Managing Small Areas of a Field.....	II-79
TM 5.2: One Acre Is About the Size of a Football Field.....	II-81
TM 5.3: Gene Splicing.....	II-83
AS 5.1: Yield Maps on the Internet (Instructor) .....	II-85
AS 5.2: Wonder Plants (Instructor) .....	II-87
AS 5.2: Wonder Plants (Student).....	II-89
AS 5.3: Genetic Engineering Conference (Instructor).....	II-91
AS 5.3: Genetic Engineering Conference (Student) .....	II-93
AS 5.4: Biotechnology Survey (Instructor) .....	II-95
AS 5.4: Biotechnology Survey (Student) .....	II-97

UNIT III - ANIMALS IN SOCIETY

<b>Lesson 1–The Importance of Animals .....</b>	<b>III-1</b>
TM 1.1: Livestock in Missouri.....	III-5
TM 1.2: Animal Terminology .....	III-7
AS 1.1: Animal Industry Terms .....	III-9

AS 1.2: Services and Products .....	III-11
<b>Lesson 2–The Responsibilities of Animal Ownership .....</b>	<b>III-13</b>
AS 2.1: Animal Care Requirements .....	III-17
AS 2.2: Pet Journal .....	III-19
<b>Lesson 3–Selecting an Animal .....</b>	<b>III-21</b>
TM 3.1: Pet Concerns .....	III-25
AS 3.1: Animal Budget – Can You Afford a Pet? .....	III-27
AS 3.2: Pet Sources .....	III-29
AS 3.3: Livestock Concerns .....	III-31
<b>Lesson 4–Current and Emerging Technologies .....</b>	<b>III-33</b>
TM 4.1: Alternative Reproductive Practices .....	III-37
AS 4.1: Alternative Reproduction Technologies .....	III-39
 UNIT IV - PRODUCTS FROM AGRICULTURE	
<b>Lesson 1–Agriculture in the Food Chain .....</b>	<b>IV-1</b>
TM 1.1: Simple Food Chain in the Natural Environment.....	IV-5
TM 1.2: Simple Food Chain in the Aquatic Environment .....	IV-7
TM 1.3: Agricultural Food Chain .....	IV-9
AS 1.1: Student Chain (Instructor) .....	IV-11
AS 1.2: Food Web (Instructor) .....	IV-13
<b>Lesson 2–Food Products from Plants .....</b>	<b>IV-15</b>
TM 2.1: Cereal Food Label Ingredients.....	IV-19
TM 2.2: Key Parts of a Food Label .....	IV-21
AS 2.1: Food Inventory.....	IV-23
AS 2.2: Do You Know Your Food Label? .....	IV-25
AS 2.3: Compare Food Labels.....	IV-27
<b>Lesson 3–Food Products from Animals .....</b>	<b>IV-29</b>
TM 3.1: Wholesale and Retail Cuts of Beef.....	IV-35
TM 3.2: Meat Consumption Trends in the United States .....	IV-37
TM 3.3: Know Your Meat Label.....	IV-39
HO 3.1: Per Capita Consumption of Meat Products in the United States .....	IV-41
HO 3.2: Beef Chart.....	IV-43
HO 3.3: Pork Chart.....	IV-45
HO 3.4: Lamb Chart .....	IV-47
HO 3.5: Meat Labels .....	IV-49
AS 3.1: Identify the Most Popular Meat Product .....	IV-51
AS 3.2: Animal Food Products .....	IV-53
AS 3.3: Identifying per Capita Consumption Trends of Meat Products.....	IV-55
AS 3.4: Processing Whipped Cream and Butter.....	IV-57
AS 3.5: Reading a Meat Label .....	IV-59
<b>Lesson 4–Food Processing and Food Safety .....</b>	<b>IV-61</b>
TM 4.1: Processing Food: From Producer to Consumer.....	IV-67
TM 4.2: Recommended Safe Cooking Temperatures .....	IV-69
AS 4.1: Popcorn Processing (Instructor).....	IV-71
AS 4.1: Popcorn Processing (Student) .....	IV-73
AS 4.2: Soybean Processing (Instructor) .....	IV-75
AS 4.3: Ice Cream Processing (Instructor) .....	IV-77
AS 4.3: Ice Cream Processing (Student) .....	IV-79
AS 4.4: Food Safety Activities (Instructor) .....	IV-81
<b>Lesson 5–Fiber Products from Agriculture .....</b>	<b>IV-83</b>
TM 5.1: Steps in Processing Wool.....	IV-87
AS 5.1: Create a Sweater Pattern .....	IV-89
AS 5.2: Clothing Labels.....	IV-91
AS 5.3: Scavenger Hunt for Fiber Trivia .....	IV-93
<b>Lesson 6–Nonfood Products from Agriculture .....</b>	<b>IV-95</b>
TM 6.1: Corn Has Many Uses.....	IV-101

AS 6.1: Biodegradable Plastic.....	IV-103
AS 6.2: Cornstarch Activities (Instructor) .....	IV-105
AS 6.3: The Papermaking Kit (Instructor) .....	IV-107
AS 6.4: Nonfood Products from Cattle and Hogs .....	IV-109

**UNIT V - NATURAL RESOURCES AND CONSERVATION**

<b>Lesson 1–Conservation of Natural Resources</b> .....	V-1
TM 1.1: Inexhaustible and Exhaustible Resources .....	V-7
AS 1.1: Inexhaustible vs. Exhaustible Resources .....	V-9
AS 1.2: Resources for the Future.....	V-11
AS 1.3: Oil Pollution of Water Environment .....	V-13
<b>Lesson 2–Soil Conservation</b> .....	V-17
TM 2.1: U.S. Land Affected by Soil Erosion .....	V-21
AS 2.1: How Does Mulch Prevent Soil Loss? (Instructor).....	V-23
<b>Lesson 3–Water Quality</b> .....	V-25
TM 3.1: The Hydrologic Cycle .....	V-29
AS 3.1: Water’s Going On?!.....	V-31
AS 3.2: Edible Earth Parfaits.....	V-33
<b>Lesson 4–Air Quality</b> .....	V-35
TM 4.1: Air Pollution in the Past.....	V-39
AS 4.1: Factors Affecting Air Quality.....	V-45
AS 4.2: Pollutants in the Home .....	V-47
<b>Lesson 5–Wildlife Management</b> .....	V-49
TM 5.1: Economic Impacts of Recreation & Wildlife Watching in Missouri 1996 .....	V-53
TM 5.2: Wildlife Management Agencies .....	V-55
AS 5.1: Maintaining Wildlife Habitats .....	V-57
AS 5.2: Oh My Deer .....	V-59
<b>Lesson 6–Conservation Issues Affecting Agriculture</b> .....	V-61
AS 6.1: Conservation in Agriculture .....	V-65

**UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT**

<b>Lesson 1–Developing Leadership Skills</b> .....	VI-1
AS 1.1: Personal Leadership Qualities .....	VI-5
AS 1.2: Researching a Leader .....	VI-7
AS 1.3: Setting Goals.....	VI-9
AS 1.4: Verbal Communication Skills Checklist.....	VI-11
AS 1.5: The Parliamentary Procedure Game.....	VI-13
<b>Lesson 2–Importance of Financial Records</b> .....	VI-15
TM 2.1: A Million Dollars or a Penny? .....	VI-19
TM 2.2: Two Ways to Become a Millionaire.....	VI-21
TM 2.3: Rule of 72.....	VI-23
TM 2.4: Calculating Simple Interest .....	VI-25
HO 2.1: Two Ways to Become a Millionaire .....	VI-27
AS 2.1: Time Value of Money and Rule of 72 .....	VI-29
AS 2.2: Calculating Simple Interest.....	VI-31
AS 2.3: Tips on Saving Money.....	VI-33

**UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE**

<b>Lesson 1–Electricity</b> .....	VII-1
TM 1.1: Reading an Electric Meter.....	VII-7
TM 1.2: Fuses and Circuit Breakers .....	VII-9
AS 1.1: Daily Use of Electricity in My Home.....	VII-11
AS 1.2: Electrical Safety Checklist .....	VII-13
<b>Lesson 2–Common Measurements and Their Uses</b> .....	VII-15
TM 2.1: Reading a Ruler .....	VII-21
TM 2.2: Measures of Length, Area, Volume, and Weight.....	VII-23

AS 2.1: Reading a Ruler.....	VII-25
AS 2.2: Area Calculations .....	VII-27
AS 2.3: Volume Calculations.....	VII-29
AS 2.4: Calculating Board Feet.....	VII-31
AS 2.5: Weight Calculations.....	VII-33
<b>Lesson 3–Common Tools and Their Uses .....</b>	<b>VII-35</b>
TM 3.1: Common Hand Tools .....	VII-39
TM 3.2: Common Power Tools .....	VII-43
AS 3.1: Common Hand Tools .....	VII-45
AS 3.2: Common Power Tools.....	VII-47
<b>Lesson 4–Personal Safety Practices .....</b>	<b>VII-49</b>
<b>Lesson 5–Safety and Maintenance Procedures for Lawn and Garden Equipment.....</b>	<b>VII-53</b>
AS 5.1: Hand Lawn Tool Identification .....	VII-61
AS 5.2: Power Lawn Tool Identification.....	VII-65
AS 5.3: Two- vs. Four-Stroke Engines.....	VII-67
AS 5.4: Mower Safety Demonstration (Instructor).....	VII-69
AS 5.5: Mowing Obstacle Course (Instructor).....	VII-71
AS 5.6: Lawn Mower Safety Guidelines .....	VII-73

## COMPETENCIES/OBJECTIVES

### UNIT I - INTRODUCTION TO AGRICULTURE

1. Define agriculture and identify career opportunities in agriculture.
2. Describe the role of agriculture in the world.
3. Describe the role of agriculture in the United States.
4. Describe agriculture in Missouri.
5. Identify advances in agricultural technology and their implications.

### UNIT II - PLANT SCIENCE

1. Describe how plants affect our lives.
2. Describe the parts of a plant and major processes.
3. Describe the importance of the growing medium to plants.
4. Identify the important factors to consider in caring for plants.
5. Identify current and emerging technologies of plant agriculture.

### UNIT III - ANIMALS IN SOCIETY

1. Describe the importance of animals.
2. Describe the responsibilities of animal ownership.
3. Identify factors in selecting an animal.
4. Identify current and emerging technologies of animal agriculture.

### UNIT IV - PRODUCTS FROM AGRICULTURE

1. Describe the role of agriculture in the food chain.
2. Identify food products from plants.
3. Identify food products from animals.
4. Describe the importance of food processing and safety.
5. Identify fiber products from agriculture.
6. Describe nonfood products from agriculture.

### UNIT V - NATURAL RESOURCES AND CONSERVATION

1. Describe the importance of natural resources.
2. Describe the importance of soil conservation.
3. Describe the importance of water quality.
4. Describe the importance of air quality.
5. Describe the importance of wildlife management.
6. Describe how conservation issues affect agriculture.

## UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

1. Identify important factors in developing leadership skills.
2. Explain the importance of keeping financial records.

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

1. Understand electricity and explain precautions for the safe use of electricity.
2. Identify common measurements and give examples of their uses.
3. Identify common tools and their uses.
4. Identify personal safety practices when using hand and power tools.
5. Identify safety and maintenance procedures for lawn and garden equipment.

## REFERENCES AND MATERIALS

1. Student Reference

*Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000.

2. Teacher References

## UNIT I - INTRODUCTION TO AGRICULTURE

### **Books, pamphlets, web sites**

*Advanced Crop Science*. University of Missouri-Columbia: Instructional Materials Laboratory, 2000.

Bureau of Labor Statistics <<http://stats.bls.gov/blshome.htm>>.

*CIA--The World Factbook 1999* <<http://www.odci.gov/cia/publications/factbook/index.html>>

Cooper, E. L.. *Agriscience Fundamentals & Applications*. 2<sup>nd</sup> ed. Albany, NY: Delmar Publishers, 1997.

Crunkilton, John R., Susan L. Osborne, Michael E. Newman, Edward W. Osborne, Jasper S. Lee, *The Earth and AgriScience*. Danville, IL: Interstate Publishers 1995.

Dlabay, L. R., and J. C. Scott. *Business in a Global Economy*. Cincinnati, OH: Southwestern Educational Publishing, 1996.

FAPRI, Food and Agricultural Policy Research Institute <<http://www.fapri.org/main.htm>>.

*Farm Facts*. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068.

Food and Fiber Systems Literacy <[http://food\\_fiber.okstate.edu/](http://food_fiber.okstate.edu/)>.

*Global Vision*. National FFA Organization, P.O. Box 68960, Indianapolis, IN 46268-0960.

Herren, R. V. *Exploring Agriscience*. Albany, NY: Delmar Publishers, 1997.

Horticultural Specialties Census  
<<http://www.nass.usda.gov/census/census97/horticulture/compub.pdf>>.

Lee, J. S., & D. L. Turner. *Introduction to World Agriscience and Technology*. Danville, IL: Interstate Publishers, Inc., 1994.

Missouri Agribusiness <<http://agebb.missouri.edu/mass/moag/index.htm>>.

Missouri Agricultural Statistics Service <<http://agebb.missouri.edu/mass/index.htm>>.

Missouri Department of Conservation <<http://www.conservation.state.mo.us/>>.

Missouri Farm Bureau Farm Facts <<http://www.fb.com/mofb/farmfacts.html>>.

*Missouri Farm Facts 1999*. Missouri Department of Agriculture and U.S. Department of Agriculture. Missouri Agricultural Statistics Service, August, 1999. (Updated versions are available yearly from Missouri Agricultural Statistics Service <<http://agebb.missouri.edu/mass>>.)

Missouri State Government Web <<http://www.state.mo.us/>>.

Online Activities Population Count <[http://www.kusd.edu/schools/bolt/less\\_act/m\\_popclock.html](http://www.kusd.edu/schools/bolt/less_act/m_popclock.html)>.

Resources for Middle School Science <<http://www.nap.edu/readingroom/books/rtmss/5.25.html>>.

*Think About It* (Brochure). National FFA Organization, P.O. Box 68960, 6060 FFA Drive Indianapolis, IN 46268-0960, 1996.

U.S. Department of Agriculture <<http://www.usda.gov>>.

USDA Census of Agriculture <<http://www.nass.usda.gov/census>>.

USDA Economic Research Service <<http://www.econ.ag.gov>>.

World Population Information <<http://www.census.gov/ipc/www/world.html>>.

## **Audiovisual**

*Agriculture's New Professionals* (Ag Video 105). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia, 1990.

## UNIT II - PLANT SCIENCE

### **Books, pamphlets, web sites**

Agriculture in the Classroom <<http://www.agclassroom.com>>.

Biondo, Ronald J. and Jasper S. Lee, *Introduction to Plant and Soil Science and Technology*, Danville, IL: Interstate Publishers, Inc., 1997.

Biotechnology Industry Organization (Links) <<http://www.bio.org/links.html>>.

California Foundation for Agriculture in the Classroom <<http://www.cfaitc.org>>.

GeoFarm, Inc. <<http://www.geofarm.com>>.

*Greenhouse Operation and Management*, Instructional Materials Laboratory, University of Missouri-Columbia, 1990.

Herren, Ray V., *The Science of Agriculture: A Biological Approach*, Albany, NY: Delmar Publishers, 1997.

*Missouri Farm Facts 1999*, Missouri Department of Agriculture and U.S. Department of Agriculture. August 1999 <<http://www.agebb.missouri.edu/mass>>.

Monster Tomatoes or Bumper Harvest <<http://www.dep.org.uk/globalexpress/editions/gmo.html>>

Morgan, Mark, and Dan Ess, *The Precision-Farming Guide for Agriculturists*, Moline, IL: John Deere Publishing, 1997.

National Corn Growers Association (NCGA) Corn Curriculum, <<http://www.ncga.com>>.

Pioneer Hi-bred International <<http://www.pioneer.com>>.

*Plant Science*, Instructional Materials Laboratory, University of Missouri-Columbia, 1991.

Reiley, H. Edward, Carrol L. Shry, Jr. *Introductory Horticulture*. 5th ed. Albany; NY: Delmar Publishers, 1997.

Scented Geraniums. Michigan State University Extension Home Horticulture. January 1, 1996. <<http://www.msue.msu.edu>>.

Schroeder, Seagle, Felton, Ruter, Kelley, Kreuer, *Introduction to Horticulture Science and Technology*, 2nd ed., Danville, IL: Interstate Publishers, Inc., 1997.

*Soil Science*, Instructional Materials Laboratory, University of Missouri-Columbia, 1995.

### **Audiovisuals**

*Seeds of Progress* (Ag Video 262). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia, 1999.

*Turfgrass Management - Your Field of Dreams* (Ag Video 261). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia, 1990.

### UNIT III - ANIMALS IN SOCIETY

#### **Books, pamphlets, web sites**

Baker, M. and R. Mikesell, *Animal Science: Biology and Technology*. Danville, IL: Interstate Publishers, Inc., 1996.

Herren, R. *The Science of Animal Agriculture*, Albany, NY: Delmar Publishers, 1994.

### UNIT IV - PRODUCTS FROM AGRICULTURE

#### **Books, pamphlets, web sites**

American Sheep Industry Association <<http://www.sheepusa.org>>.

Cooper, E. L. *Agriscience Fundamentals & Applications*. Albany, NY: Delmar Publishers Inc., 1997.

The FDA Food Label <<http://starnews.webpoint.com/food/shlabel.htm>>.

Food and Fiber Systems Literacy Online <[http://food\\_fiber.okstate.edu](http://food_fiber.okstate.edu)>.

Food Safety Education <<http://www.foodsafety.gov>>.

*Food Science and Technology*. University of Missouri-Columbia: Instructional Materials Laboratory, 1994.

Herren, Ray V. *Exploring Agriscience*. Albany, NY: Delmar Publishers, Inc., 1997.

*Introduction to Animal Products*. University of Missouri-Columbia: Instructional Materials Laboratory, 1998.

Missouri Corn Online <<http://www.mocorn.org/>>.

Missouri Soybean Association <<http://www.mosoy.org/>>.

Missouri State Government <<http://www.state.mo.us/>>.

National Cotton Council of America <<http://www.cotton.org/>>.

National Pork Producers Council <<http://www.nppc.org/>>.

Partnership for Food Safety Education <<http://www.fightbac.org/>>.

Produce Marketing Association <<http://www.pma.com/>>.

### **Materials and Supplies**

Dwight and Rosemary Hall, Highway 111 West, Box 335, Oregon, MO 64473 (800) 762-1384

Lee Seed Company, 2242 Highway IA 182, Inwood, IA 51240 (712) 753-4403

The Soy Bin, Route 1, Box 99, Marienthal, KS 67863 (316)375-2746

Super Soynuts, Soybean Candies, and/or Mighty MO Munchies

### **UNIT V - NATURAL RESOURCES AND CONSERVATION**

#### **Books, pamphlets, web sites**

*Applied Environmental Science*, National Council for Agricultural Education, 1996.

Camp, W., and R. Donahue, *Environmental Science*, Albany, NY: Delmar Publishers, 1994.

Deal, Kevin, *Wildlife and Natural Resources Management*, Albany, NY: Delmar Publishers, 1996.

Dombeck, Mike. Chief, U.S. Department of Agriculture Forest Service.

Environmental Protection Agency Mission Statement <<http://www.epa.gov/history/org/origins/document.htm>> 15 May 2000.

Lee, Jasper, *Natural Resources and Environmental Technology*, Danville, IL: Interstate Publishers, 2000.

*Missouri Department of Conservation*. <<http://www.conservaion.state.mop.us/about/>> 15 May 2000.

Missouri Department of Natural Resources. <<http://www.dnr.state.mo.us/homednr.htm>>National Park Service Organic Act, 16 U.S.C.1.

Ozark National Scenic Riverways. <<http://www.americanparks.com/parklist/moozark.htm>> 30 May 2000.

Porter, Lee, Turner, and Hillan, *Environmental Science and Technology*, Danville, IL: Interstate Publishers, 1997.

U.S. Department of Agriculture National Resources Conservation Service.  
<<http://www.nrcs.usda.gov/AboutNR2.html>> 15 May 2000.

### **Materials and Supplies**

“Oh My Deer” board game, Carolina Biological Supply Co., 2700 York Road, Burlington, NC 27215.

## UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

### **Books, pamphlets, web sites**

*Agribusiness Sales, Marketing and Management*, University of Missouri-Columbia: Instructional Materials Laboratory, 1997.

DiResta, D., *Knockout Presentations*, Worcester, MA: Chandler House Press, 1998.

DuBryn, A., *The Complete Idiot's Guide to Leadership*, New York, NY: Alpha Books, 1998.

*National FFA Manual*. The National FFA Organization. Indianapolis, IN

Ricketts, Cliff. *Leadership: Personal Development and Career Success*. Albany, NY: Delmar, 1997.

*Savvy Student*. <<http://www.savvystudent.com>> 17 Mar. 2000.

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### **Books, pamphlets, web sites**

Boone Electric Cooperative. *Play It Safe – Away From Electricity*. Channing L. Bete Co. Inc., South Deerfield, MA, 1996.

Busby, King, and Graham. *Agricultural Structures (Student Reference)*. University of Missouri-Columbia Instructional Materials Laboratory, Columbia, MO, 1999.

Cooper, Elmer L. *Agricultural Mechanics Fundamentals and Applications* 3<sup>rd</sup> ed. Albany, NY: Delmar Publications, 1997.

Hamilton, William. *Agricultural Mechanics Fundamentals and Applications Lab Manual* 2<sup>nd</sup> ed., Albany, NY: Delmar Publishers, 1994.

Rasdall, Joyce O. and George W. Smith. *Understanding Electricity*, Winterville, GA: AAVIM, 1998. (Teacher copy only.)

Rodekohl and Waeckerle, *Landscaping and Turf Management*, University of Missouri-Columbia: Instructional Materials Laboratory, 1990.

*Shop Math, Advanced Math, and Precision Measuring.* St. Louis Community College, St. Louis, MO, 1993.

Walker, John R. *Exploring Drafting.* South Holland, IL: Goodheart-Willcox Co, 1972.

### **Audiovisuals**

Bergwall Productions, Inc. *Working Safely With Electricity,* Chadds Ford, PA, 1997. Available for free loan from Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.

*Safety First: Wood Shop Safety* (T&I Video 149). Available for free loan from Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.

## Exploring Agriculture in America - Competency Crosswalk

		CURRICULUM FRAMEWORKS FOR GRADES 5-8									
Duty Band & Task Statement	SHOW-ME STANDARDS										
	Knowledge (Content)	Performance (Goals)	Communication Arts	Fine Arts	Health/Physical Education	Math	Science	Social Studies			
A-1	SC 8, SS 3, SS 4, SS 6	1.1, 1.3, 1.9, 1.10, 2.6, 4.8	I/1a, I/2e, I/3g, I/6c, II/1a				VII.B 2a, VII.B 3a	II.B/3a, b, e; II.E/2a, b, c, d			
A-2	CA 4, SC 4, SS 4, SS 7	1.1, 1.6	I/2b, I/3c, I/6a				VII.A/1a, VII.A/2a, VII.A/3a	I.D/2g; II.E/4b, d			
A-3	CA 3, CA 6, SC 8, SS 5, SS 6	1.1, 1.6, 1.8	I/1a, I/3c, II/2a					II.E/2a, d, j, k; II.E/3a, b, j, k			
A-4	CA 3, CA 6, SC 8, SS 5, SS 6	1.1, 1.6	I/1a, I/3c, II/2a					II.E/2a, k; II.E/3a, j, k			
A-5	CA 1, CA 3, SC 3, SS 4, SS 5, SS 6, SS 7	1.1, 1.2, 1.6, 1.7, 2.7, 3.8	I/1a, I/3c, II/2c				II.A/2a				
B-1	CA 1, CA 3, SC 3, SS 4, SS 5, SS 6	1.2, 1.3, 1.7, 1.8, 1.10	I/1b, I/3c		II.B/1b, 2a, 2b		VI.B/4b, VII.B/2a	III.E/6c, e, f, i, n; IV.D/1h			
B-2	CA 1, CA 3, SC 3	1.1, 1.2, 1.3, 1.6	I/1d, I/3g				VII.B/1a, VII.B/2a, VII.B/3a				
B-3	CA 1, CA 3, SC 3	1.1, 1.2, 1.3					I.B/1a, VI.A/4a, VI.A/7a, VI.A/8a				
B-4	CA 1, CA 3, SC 3	1.2, 1.3, 1.8, 2.1, 3.1					VI.A/8a, VII.A/3a, VII.B/2a, VII.B/3a				
B-5	CA 1, CA 3, SC 3, SC 7, SC 8	1.1, 1.2, 1.3, 1.4, 2.7					II/1a, II/2a, VII.D/1a, VII.D/2a				

Duty Band & Task Statement		SHOW-ME STANDARDS				CURRICULUM FRAMEWORKS FOR GRADES 5-8					
		Knowledge (Content)	Performance (Goals)	Communication Arts	Fine Arts	Health/Physical Education	Math	Science	Social Studies		
C-1	CA 1, CA 5, CA 6, SC 3, SC 4, SS 4, SS 6	2.2, 2.3	I/2b, d; II/3a, b; II/5b, c, d, e					I.D/4j, I.D/7j			
C-2	CA 6, SC 3, SS 6	1.3, 1.4, 1.6, 2.3, 3.7, 3.8	I/2e	I.B/6a				I.B/1g, 1j; I.B/2g, j; I.B/3g, j			
C-3	CA 6, MA 1, SC 3, SS 6	2.3, 3.1, 3.3, 3.7					IV/2b, d; IV/3b, d; V/1a				
C-4	CA 1, CA 4, SC 3, SC 7, SC 8	1.1, 1.3, 1.5, 1.6, 1.8, 2.7, 3.5, 4.6	I/1b; I/2b, c; II/3c			VII.D/1a, VII.D/2a					
D-1	HP 2, SC 8, SS 6, SS 7	1.4, 2.7, 3.5					VIII.A/1a, b; VIII.A/2a, b; VIII.A/3a; VIII.A/4a	II.B/4b, II.B/3c, II.B/2l			
D-2	CA 3, HP 2, HP 6	1.2, 1.4, 1.5, 1.6, 1.7, 1.10									
D-3	HP 3, HP 6, SS 4, SS 6	1.1, 1.9, 1.10, 4.1					II.B/1a, b; II.B/2a, b; II.B/3a; II.B/8a				
D-4	HP 3, HP 6, SS 4, SS 6	1.1, 1.9, 1.10, 4.1					II.C/1a, b; III.A/2a; III.A/8a				
D-5	CA 3, SC 8, SS 4	1.1, 1.2	I/2b				II.C/1a, 1b, III.A/2a, III.A/8a	I.D/6l			
D-6	CA 3, SC 8, SS 4	1.1, 1.2	I/2b					I.D/2a			
E-1	CA 1, CA 3, CA 6, HP 3, SC 4, SS 5, SS 6	1.1, 1.2, 1.3, 1.6, 1.8, 3.8	I/3c, g				III.D/1a, III.D/2a, III.D/3a	VI.A/9a, VIII.A/3a, VIII.B/1a	II.E/2a, b, c; II.E/3c; d; II.E/4a; III.E/3c, e, f, g		

SHOW-ME STANDARDS		CURRICULUM FRAMEWORKS FOR GRADES 5-8							
Duty Band & Task Statement	Knowledge (Content)	Performance (Goals)	Communication Arts	Fine Arts	Health/Physical Education	Math	Science	Social Studies	
E-2	CA 3, SC 4, SC 5, SS 5, SS 6	1.1, 1.2, 1.3, 1.6, 1.8, 3.8	I/3c, g				VI.A/9a, VIII.B/2a		
E-3	CA 3, SC 4, SC 8, SS 5, SS 6	1.1, 1.2, 1.3, 1.6, 1.8, 3.8	I/3c, g				VI.A/9a, VIII.B/1a	II.E/2e; II.E/3k; II.E/4a	
E-4	CA 3, SC 5, SC 6, SS 5	1.1, 1.2, 1.3, 1.6, 1.8, 3.8	I/3c, g				VI.A/9a, VIII.B/2a		
E-5	CA 3, SC 4, SC 7, SC 8, SS 5	1.1, 1.2, 1.3, 1.6, 1.8, 3.8	I/3c, g				III.A/3a, VI.A/9a, VIII.B/2a		
E-6	CA 3, SC 4, SC 7, SC 8, SS 5	1.1, 1.2, 1.3, 1.6, 1.8, 3.8	I/3c, g				VI.A/9a, VIII.A/3a, VIII.B/2a	II.E/4e	
F-1	CA 1, CA 4, CA 6, HP 2, HP 5, SS 1, SS 3, SS 6	1.7, 2.4, 3.2, 3.4, 3.6, 4.3, 4.6	II/1a, II/2c		II.A/1a, b			II.B/7j, k, l, n	
F-2	CA 1, MA 1	1.6, 1.10, 2.1, 2.2, 3.8, 4.1				V/1b, d		II.D/6f, k	
G-1	CA 1, CA 3, SC 1	1.2, 1.3, 1.4, 1.6, 1.10	I/2e				III.B/3a, b; III.B/4a, b		
G-2	MA 1	2.5, 3.8, 4.1				VI/1g			
G-3	MA 2	1.10, 2.7				VI/3d, e, f			
G-4	HP 2, HP 5,	1.7, 3.1			II.A/1a, III.B/1a				
G-5	HP 2, HP 5	1.7, 3.1			II.A/1a, III.B/1a				

## Exploring Agriculture in America

### Teaching Calendar

	Periods for Classroom Instruction/Activities	Length for Activity Sheets (AS)
Unit I, Lesson 1	4 days	AS 1.1 .5 class period
		AS 1.2 .5 class period
		AS 1.3 .75 class period
		AS 1.4 1 class period
		AS 1.5 .5 class period
		AS 1.6 .5 class period
		AS 1.7 .75 class period
		AS 1.8 .75 class period
Unit I, Lesson 2	3 days	AS 2.1 1 class period
		AS 2.2 .75 class period
		AS 2.3 .75 class period
Unit I, Lesson 3	2 days	AS 3.1 1 class period
		AS 3.2 1 class period
Unit I, Lesson 4	3 days	AS 4.1 .75 class period
		AS 4.2 .75 class period
		AS 4.3 1 class period
Unit I, Lesson 5	3 days	AS 5.1 .5 class period
		AS 5.2 1 class period
		AS 5.3 1 class period
Unit II, Lesson 1	3 days	AS 1.1 .5 class period
		AS 1.2 1 class period
		AS 1.3 .5 class period
Unit II, Lesson 2	3 days	AS 2.1 .5 class period
		AS 2.2 .5 class period
		AS 2.3 .75 class period
Unit II, Lesson 3	3 days	AS 3.1 .5 class period
		AS 3.2 1 class period
		AS 3.3 1 class period
Unit II, Lesson 4	2 days	AS 4.1 .5 class period
		AS 4.2 .75 class period
Unit II, Lesson 5	4 days	AS 5.1 1 class period
		AS 5.2 .5 class period
		AS 5.3 4 class periods
		AS 5.4 .75 class period
Unit III, Lesson 1	2 days	AS 1.1 .5 class period
		AS 1.2 .75 class period
Unit III, Lesson 2	2 days	AS 2.1 .75 class period
		AS 2.2 .75 class period

	Periods for Classroom Instruction/Activities	Length for Activity Sheets (AS)
Unit III, Lesson 3	3 days	AS 3.1 .5 class period
		AS 3.2 .75 class period
		AS 3.3 .5 class period
Unit III, Lesson 4	2 days	AS 4.1 .75 class period
Unit IV, Lesson 1	2 days	AS 1.1 .5 class period
		AS 1.2 .75 class period
Unit IV, Lesson 2	2 days	AS 2.1 .5 class period
		AS 2.2 .5 class period
		AS 2.3 .5 class period
Unit IV, Lesson 3	4 days	AS 3.1 .5 class period
		AS 3.2 .5 class period
		AS 3.3 .5 class period
		AS 3.4 .75 class period
		AS 3.5 .5 class period
Unit IV, Lesson 4	4 days	AS 4.1 .75 class period
		AS 4.2 .5 class period
		AS 4.3 1 class period
		AS 4.4 1.5 class periods
Unit IV, Lesson 5	2 days	AS 5.1 .75 class period
		AS 5.2 .5 class period
		AS 5.3 .5 class period
Unit IV, Lesson 6	3 days	AS 6.1 .75 class period
		AS 6.2 .5 class period
		AS 6.3 1 class period
		AS 6.4 1 class period
Unit V, Lesson 1	3 days	AS 1.1 .5 class period
		AS 1.2 .75 class period
		AS 1.3 2 class periods
Unit V, Lesson 2	2 days	AS 2.1 1 class period
Unit V, Lesson 3	2 days	AS 3.1 .75 class period
		AS 3.2 1 class period
Unit V, Lesson 4	3 days	AS 4.1 .5 class period
		AS 4.2 .5 class period
Unit V, Lesson 5	2 days	AS 5.1 .75 class period
		AS 5.2 1.5 class periods
Unit V, Lesson 6	2 days	AS 6.1 .75 class period
Unit VI, Lesson 1	3 days	AS 1.1 .75 class period
		AS 1.2 .75 class period
		AS 1.3 .75 class period
		AS 1.4 .75 class period
		AS 1.5 1 class period

	Periods for Classroom Instruction/Activities	Length for Activity Sheets (AS)
Unit VI, Lesson 2	4 days	AS 2.1 1 class period
		AS 2.2 1 class period
		AS 2.3 1 class period
Unit VII, Lesson 1	3 days	AS 1.1 .75 class period
		AS 1.2 .75 class period
Unit VII, Lesson 2	2 days	AS 2.1 .5 class period
		AS 2.2 1 class period
		AS 2.3 1 class period
		AS 2.4 1 class period
		AS 2.5 .75 class period
Unit VII, Lesson 3	2 days	AS 3.1 .75 class period
		AS 3.2 .75 class period
Unit VII, Lesson 4	3 days	None
Unit VII, Lesson 5	3 days	AS 5.1 .75 class period
		AS 5.2 .75 class period
		AS 5.3 1 class period
		AS 5.4 1 class period
		AS 5.5 1 class period
		AS 5.6 2 class periods



## Exploring Agriculture in America Competency Profile

**Directions:**

Evaluate the student by checking the appropriate number or letter to indicate the degree of competency. The rating for each task should reflect **employability readiness** rather than the grades given in class.

**Rating Scale:** **3 Mastered** - can work independently with no supervision  
**2 Requires Supervision** - can perform job completely with limited supervision  
**1 Not Mastered** - requires instruction and close supervision  
**N No Exposure** - no experience or knowledge in this area

3	2	1	N

**A. Introduction to Agriculture**

1. Define agriculture and identify career opportunities in agriculture.
  2. Describe the role of agriculture in the world.
  3. Describe the role of agriculture in the United States.
  4. Describe agriculture in Missouri.
  5. Identify advances in agricultural technology and their implications.
- Other: \_\_\_\_\_

3	2	1	N

**B. Plant Science**

1. Describe how plants affect our lives.
  2. Describe the parts of a plant and major processes.
  3. Describe the importance of the growing medium to plants.
  4. Identify the important factors to consider in caring for plants.
  5. Identify current and emerging technologies of plant agriculture.
- Other: \_\_\_\_\_

3	2	1	N

**C. Animals in Society**

1. Describe the importance of animals.
  2. Describe the responsibilities of animal ownership.
  3. Identify factors in selecting an animal.
  4. Identify current and emerging technology of animal agriculture.
- Other: \_\_\_\_\_

3	2	1	N

**D. Products from Agriculture**

1. Describe the role of agriculture in the food chain.
  2. Identify food from plants.
  3. Identify food from animals.
  4. Describe the importance of food processing and safety.
  5. Identify fiber products from agriculture.
  6. Describe nonfood products from agriculture.
- Other: \_\_\_\_\_

3	2	1	N

**E. Natural Resources and Conservation**

1. Describe the importance of natural resources.
  2. Describe the importance of soil conservation.
  3. Describe the importance of water quality.
  4. Describe the importance of air quality.
  5. Describe the importance of wildlife management.
  6. Describe how conservation issues affect agriculture.
- Other: \_\_\_\_\_

3	2	1	N

**F. Leadership and Personal Development**

1. Identify important factors in developing leadership skills.
  2. Explain the importance of keeping financial records.
- Other: \_\_\_\_\_

3	2	1	N

**G. Basic Home and Farmstead Safety and Maintenance**

1. Understand electricity and explain precautions for the safe use of electricity.
  2. Identify common measurements and give examples of their uses.
  3. Identify common tools and their uses.
  4. Identify personal safety practices when using hand and power tools.
  5. Identify safety and maintenance procedures for lawn and garden equipment.
- Other: \_\_\_\_\_







## UNIT I - INTRODUCTION TO AGRICULTURE

Lesson 1: Agriculture: What Is It?

**Competency/Objective:** Define agriculture and identify career opportunities in agriculture.

### **Study Questions**

1. **What is agriculture?**
2. **How does agriculture affect your daily life?**
3. **What are the major sectors of the agricultural industry?**
4. **What are examples of agricultural careers in each sector?**

### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit I.
2. *Think About It* (Brochure). National FFA Center, P.O. Box 68960, 6060 FFA Drive, Indianapolis, IN 46268-0960, 1996.
3. *Agriculture's New Professionals* (Ag Video 105). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia, 1990.
4. Transparency Masters
  - TM 1.1 Agriculture Is . . . . .
  - TM 1.2 Agriculture Is . . . . . (cont.)
  - TM 1.3 World Population Growth
  - TM 1.4 Average Annual Expenditures for Typical U.S. Family
  - TM 1.5 Disposable Income Spent for Food
  - TM 1.6 Life Expectancy
5. Activity Sheets
  - AS 1.1 Planting Seeds
  - AS 1.2 Change in World Population (Instructor)
  - AS 1.3 Current World Population
  - AS 1.4 Agricultural Career Collage
  - AS 1.5 A to Z Agricultural Careers
  - AS 1.6 Cheeseburger, Fries, and Shake
  - AS 1.7 Name That Career (Instructor)
  - AS 1.8 Agriculture in My Community (Instructor)

## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 1: Agriculture: What Is It?

#### TEACHING PROCEDURES

##### A. **Introduction**

This lesson begins with the evolution of the term agriculture. By completing the activities and assignments, students will develop a more personal view of how agriculture affects them and will identify career opportunities available in the major sectors of agriculture.

##### B. **Motivation**

1. Conduct a word association activity where students list the first thought that comes to mind when the teacher mentions the following words: DNA, food, tractor, baseball, denim, agriculture, greenhouse, newspaper, genetic engineering, zoo, and farming. Have students share their answers.

Next, ask students to analyze the word list presented by the teacher and identify possible relationships. What words have something in common? For example, food, denim, and baseball represent processed agricultural products produced on a farm. This activity could also be accomplished in groups through a concept (web) map or by brainstorming.

Very few students will associate agriculture with many of the words. Conclude the activity by explaining that all the words are related to agriculture and this will become evident during this course.

2. To obtain a baseline on student knowledge and perceptions on agriculture, place one of the following items on a table where groups of three to four students can gather: baseball, newspaper or agricultural magazine, golf tee (traditional wood), soybean processed material used in construction, golf tee (made from biodegradable corn starch), house plant, candy made from agricultural products (such as Super Soynuts).

Each group should discuss several questions: (a) What is your item made of? (b) Is there a connection between your item and agriculture?

3. To prepare for the next unit, conduct AS 1.1. Ask students what is going to happen with the seeds they have planted. The students should check on their seeds each day to watch for growth and to care for them. Select fast-growing vegetables, such as radishes, that can be raised and consumed by students. Also plant corn and soybeans so that parts might be used in Unit II, Lesson 2.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### Q1. **What is agriculture?**

- A1. **All aspects of the global food, fiber, and natural resources systems, including the development, production, processing, marketing, and distribution of food and fiber products; the health and nutrition of food consumption; the use, conservation, and maintenance of environmental, and recreational resources; and the related**

**scientific, economic, sociological, political, and cultural characteristics of the food, fiber, and natural resources systems.**

Using TMs 1.1 and 1.2, ask students to define agriculture. Next, ask students to identify key words in the definition. Conduct AS 1.2 to have students graph how world population has increased, then show TM 1.3 to provide the answer. Have students complete AS 1.3 to get an idea of how much the population increases minute-by-minute.

**Q2. How does agriculture affect your daily life?**

**A2.**

- a) **Agriculture is the largest industry in the United States, providing approximately 20% of the jobs. The agricultural industry employs over 22 million people.**
- b) **Americans enjoy low food costs compared to all the items they buy.**
- c) **Americans spend approximately 11% of their disposable income on food, which is less than people in other countries.**
- d) **Agricultural research and a healthy food supply have contributed to a much longer life expectancy.**
- e) **Millions of dollars of taxes generated by agriculture support the local, state, and national governments. Many rural school districts receive a major portion of their funding from agricultural property taxes.**

Engage students in discussion by asking them to guess the cost of food for an average family of 2.5 people and the life expectancy for various countries in the world. Use TMs 1.4, 1.5, and 1.6 to summarize this area.

**Q3. What are the major sectors of the agricultural industry?**

**A3. There are many different ways to categorize the major sectors of agriculture; however, a common and accepted classification system is as follows:**

- a) **Agricultural systems technology**
- b) **Agricultural processing and marketing**
- c) **Agricultural supplies and services**
- d) **Forestry**
- e) **Horticulture**
- f) **Production agriculture**
- g) **Natural resources**

Show the video *Agriculture's New Professionals* as an overview of the major sectors of the agricultural careers in the United States. Student groups or individual students can complete AS 1.4 to create an agricultural career collage. Old agricultural magazines with photos could help the students.

**Q4. What are examples of agricultural careers in each sector?**

**A4. There are many answers for this question from the brochure *Think About It*. Several careers for each of the major sectors are listed below:**

- a) **Agricultural systems technology**
  - 1) **Engine technician**
  - 2) **Agricultural electrician**
  - 3) **Agricultural engineer**
- b) **Agricultural processing and marketing**
  - 1) **Meat department manager**

- 2) Food scientist
- 3) Grain elevator manager
- 4) Citrus processor
- c) Agricultural supplies and services
  - 1) Agricultural journalist
  - 2) Genetic engineer
  - 3) Agricultural loan officer (banker)
  - 4) Veterinarian
- d) Forestry
  - 1) Park ranger
  - 2) Forester
  - 3) Timber manager
- e) Horticulture
  - 1) Floral designer
  - 2) Turf grass specialist
  - 3) Landscape architect
- f) Production agriculture
  - 1) Beekeeper
  - 2) Livestock herdsman
  - 3) Grain producer
- g) Natural resources
  - 1) Soil conservationist
  - 2) Fish and wildlife specialist
  - 3) Water quality specialist

Assign students AS 1.5 to complete and bring to the next class period. Most students will name production careers such as A - Apple grower, B - Berry grower, etc. Provide students with the brochure *Think About It* and conduct AS 1.4 again but this time challenge students to identify agricultural careers that may interest them but are not in the production agriculture sector. Students should identify in which sector of agriculture each career would be found. Finally, have students complete AS 1.6, AS 1.7, and AS 1.8 to expand their knowledge of careers and agriculture-related businesses.

#### F. **Other Activities**

1. Access the Agricultural Career Center web site to research agricultural careers. <<http://www.ffa.org/careers/index.html>>
2. Order agricultural career posters ("Living Science" Poster Set, available for \$4 from Office of the Dean, Purdue University, School of Agriculture, Administration Building, West Lafayette, IN 47907-1140)

#### G. **Conclusion**

Agriculture is more than farming. The definition of agriculture has evolved to include career areas in seven major sectors of the agricultural industry. The global aspect of agriculture is concerned with the increasing world population. The country's largest employer is agriculture. Several major benefits are provided by agriculture including a low food cost compared to other countries and helping to increase the life expectancy of humans. Agriculture benefits everyone each and every day.

#### H. **Answers to Activity Sheets**

Answers to all activity sheets will vary.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.



## **Agriculture is . . . . .**

**All aspects of the global food, fiber, and natural resources systems, including**

- **the development, production, processing, marketing, and distribution of food and fiber products;**
- **the health and nutrition of food consumption;**

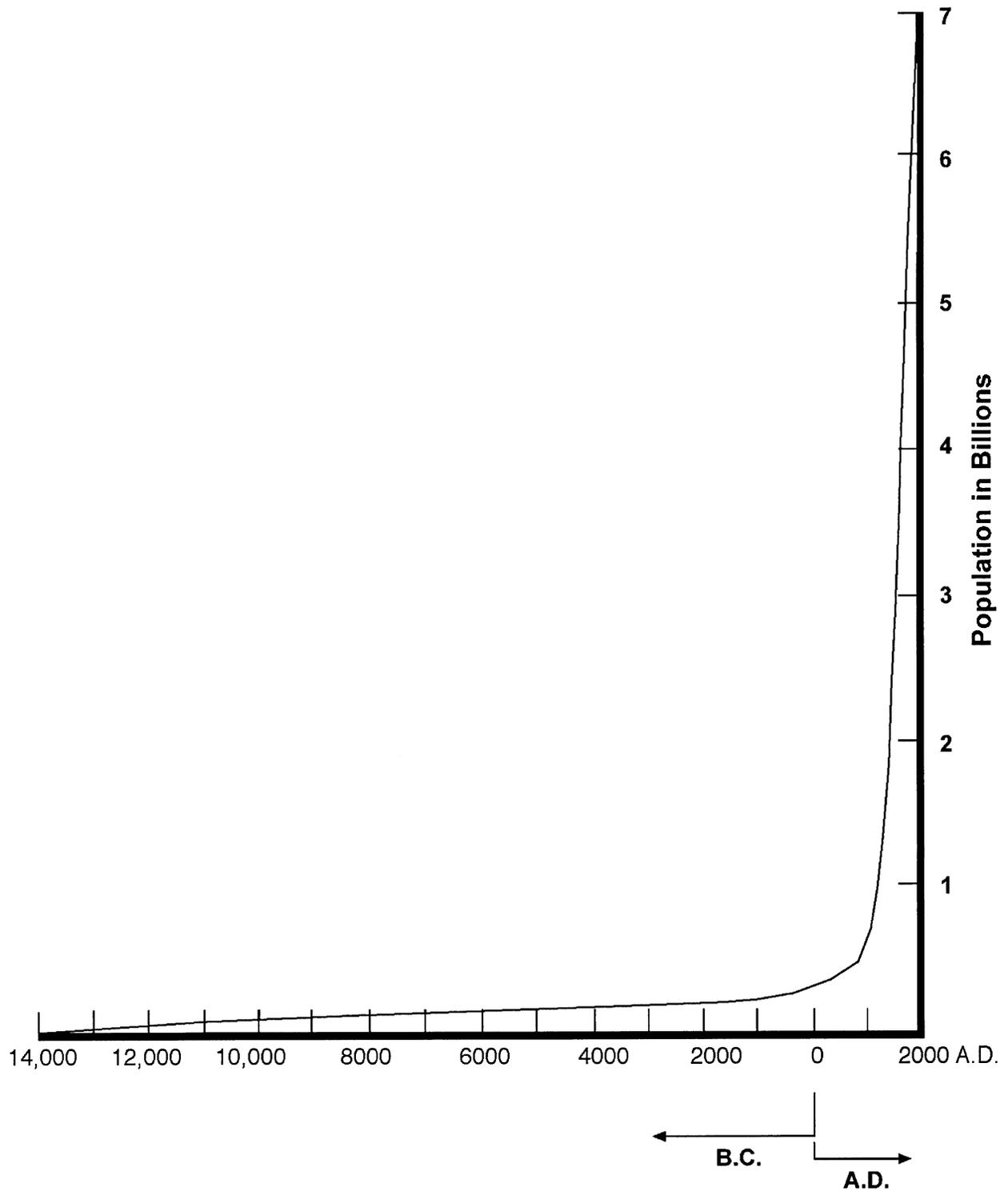


## **Agriculture is . . . . (cont.)**

- **the use, conservation, and maintenance of environmental and recreational resources;**
- **and the related scientific, economic, sociological, political, and cultural characteristics of the food, fiber, and natural resources systems.**

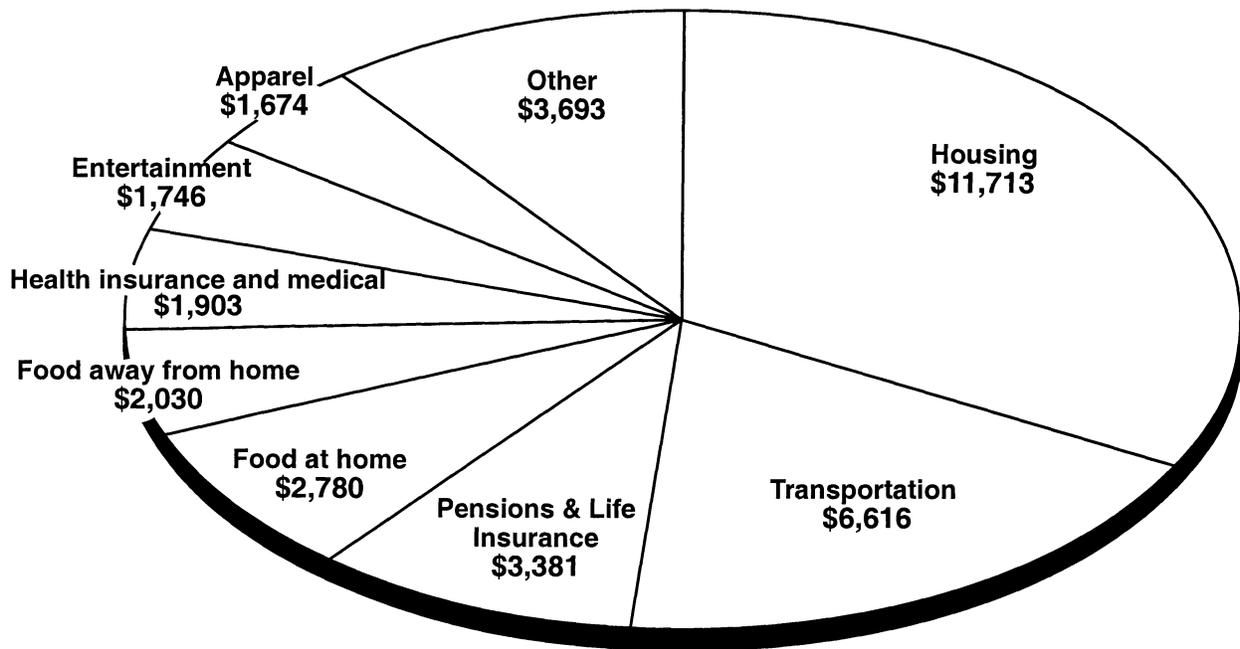


# World Population Growth





## Average Annual Expenditures for Typical U.S. Family

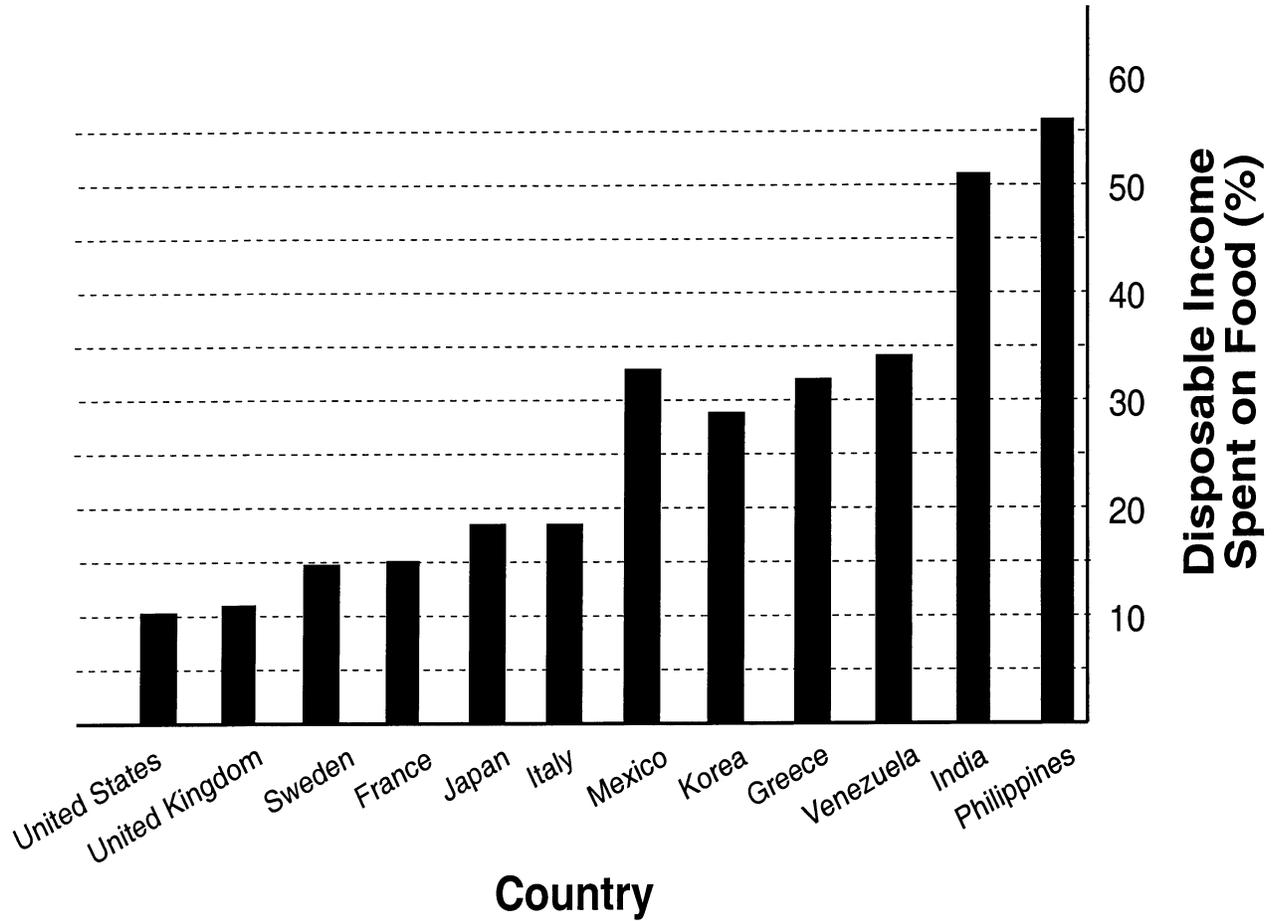


Total Expenditures = \$35,536

Source: U.S. Department of Labor - Bureau of Labor Statistics (1998)  
Average Number in Family: 2.5  
Average Number of Earners: 1.3



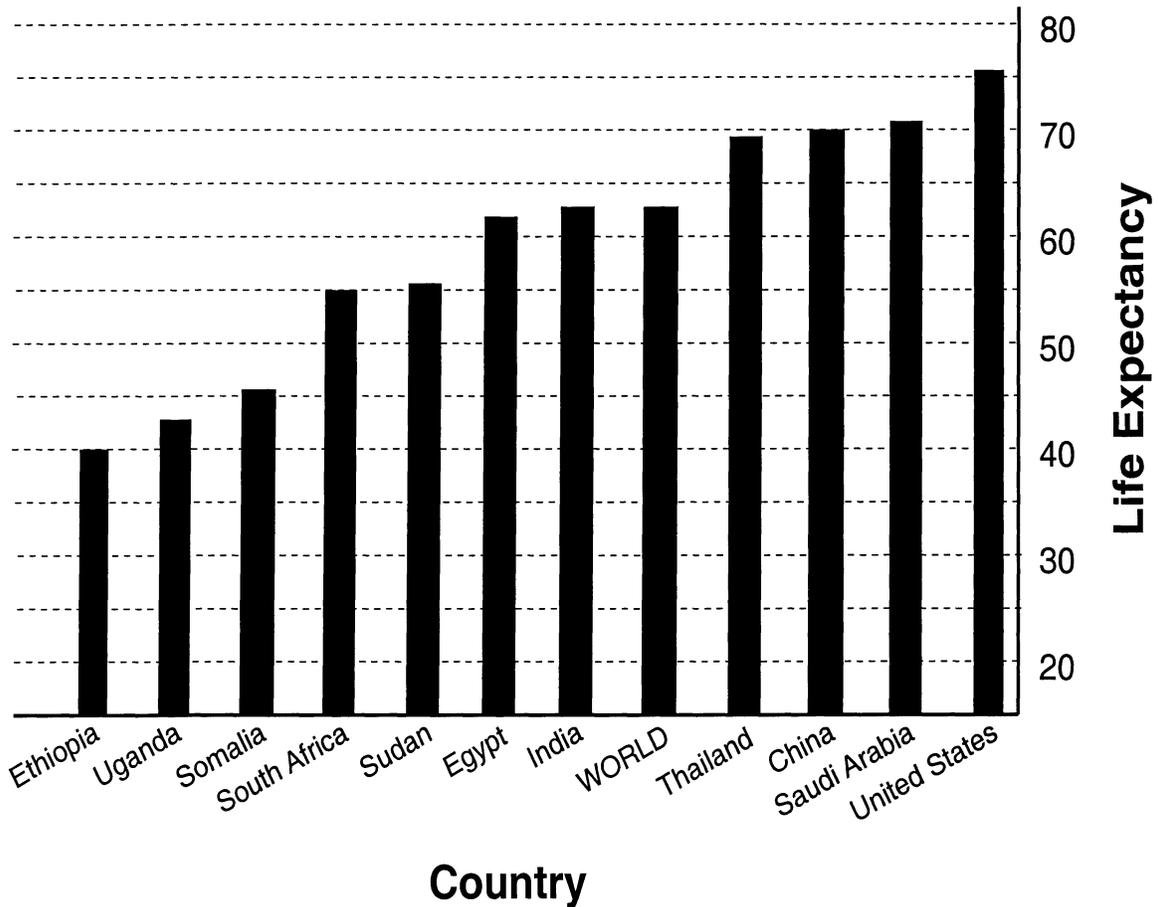
# Disposable Income Spent for Food



Source: U.S. Department of Agriculture (1996)



# Life Expectancy



Source: Central Intelligence Agency - *The World Fact Book* (1999)



Lesson 1: Agriculture: What Is It?

Name\_\_\_\_\_

### **Planting Seeds**

**Objective:** Students will be able to demonstrate how to plant seeds.

**Materials and Equipment:**

1 container – flowerpot, cup, etc.  
Potting soil  
Seeds - to be provided by instructor  
Water

**Procedure:**

1. First watch the instructor demonstrate how to plant seeds. You will follow these directions.
2. If you are using a cup instead of a flowerpot, place a hole in the bottom so the water can drain out.
3. Fill the pot with soil up to 1/2 inch from the top.
4. Use your finger to make a small hole in the soil.
5. Place the seed in the hole and cover lightly with the soil.
6. Water thoroughly.
7. Place the pot in a well-lighted area, such as by a window.
8. Examine your plant every day and water it when it is dry.



**Change in World Population**

**Objective:** Students will develop an understanding of the increasing world population.

**Directions:** Use the chalkboard or white board to construct a graph of world population. The vertical axis represents billions of people in the world and the horizontal axis represents years, starting from the beginning of recorded time to the present. To show the concept of increasing world population, it is important to use an accurate scale to represent time. In addition, the starting point of recorded history will challenge students to remember social studies issues and they may want to talk to a social studies teacher about this concept.

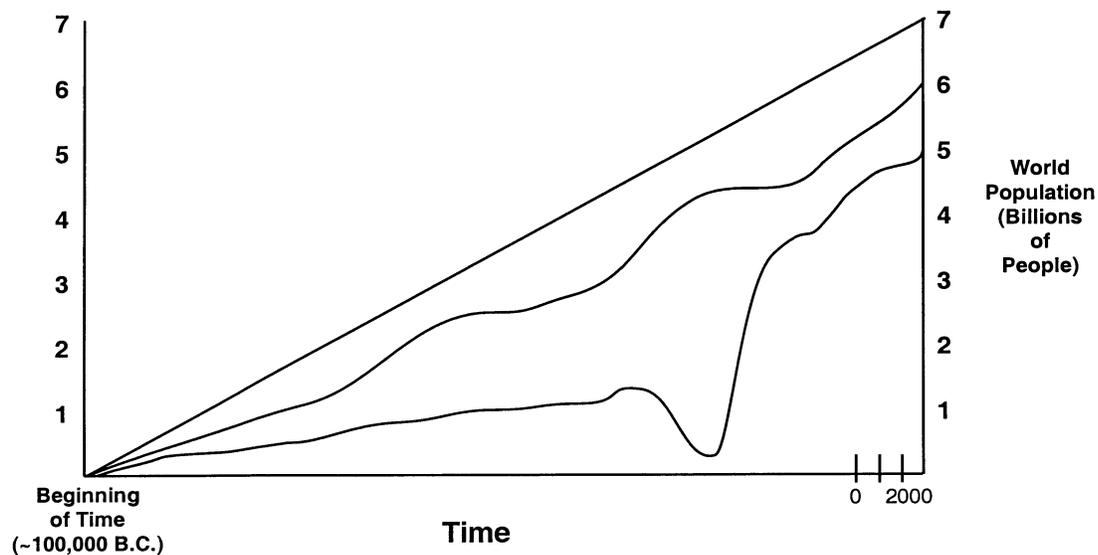
Provide students with the data below or have students do research. An excellent source to use is the U.S. Census Bureau, which can be accessed on the Internet at <<http://www.census.gov/ipc/www/world.html>>. Ask for student volunteers to draw what they think has been the change in population over time. After students have drawn the graph, show TM 1.3 to summarize the concept of increasing world population.

**Teacher-Provided World Population Data**

Following are the approximate world populations for the indicated years.

Year	Population in Billions
1825	1.0
1925	2.0
1960	3.0
1975	4.0
1987	5.0
1999	6.0

The following graph shows typical student responses.



As an additional assignment, students could predict the future world population by using a math skill called extrapolation. Students can research this topic as well on the U.S. Census Bureau web site.



**Current World Population**

**Objective:** Students will develop an understanding of how the increasing world population relates to agriculture.

**Directions:** Use the U.S. Census Bureau World Population Information on the Internet <<http://www.census.gov/ipc/www/world.html>> to answer the following questions.

After going to the above address, click on the **World POPClock** link, find the dynamic **World POPCLOCK**, and gather up-to-the-minute world population data. You will record the population every minute for 10 minutes. In the table below, record the time, population, and change in population during the last minute. Record the data, wait 1 minute, and then press the reload button to get the new data. Continue to press the reload button every minute.

Minutes	Actual Time Listed at the Web Site	World Population	Population Change During the Last Minute
Start			N/A
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
<b>Total Increase in World Population During Previous 10 Minutes</b> (Add values in the 4 <sup>th</sup> column)			

**Key Questions:**

- Does the population change the same amount during each of the 10 minutes?
- Assuming a constant rate, how much would you expect the world population to increase in 1 day (total increase in world population during previous 10 minutes x 6 x 24)?

3. How much would you expect the population to increase in 1 year (365 days), assuming a constant rate?
  
4. If you assume that the population of the world increases at the same rate, what will the population be in 20 years?
  
5. List some variables that could cause your 20-year prediction to be inaccurate.
  
6. Why do you think the ability to predict the world's population is important?

Lesson 1: Agriculture: What Is It?

Name \_\_\_\_\_

**Agricultural Career Collage**

**Objective:** Students will develop an understanding for the various career sectors in agriculture.

**Directions:** Select one of the following sectors of the agricultural industry and develop a collage that represents that sector.

The agricultural industry consists of seven sectors:

1. Agricultural systems technology
2. Agricultural processing and marketing
3. Agricultural supplies and services
4. Forestry
5. Horticulture
6. Production agriculture
7. Natural resources

You will be evaluated according to the following scoring guide.

Item	Points Possible	Your Score
<b>Representative:</b> Collage represents the sector.	5	
<b>Diversity:</b> Various careers, businesses, and geographic areas are represented.	5	
<b>Colorful:</b> Color pictures are more appealing than black and white.	5	
<b>Creativity:</b> Special effects such as poster shape, words, 3-D, etc., are used rather than a basic rectangular design.	5	
<b>Total</b>	20	

Comments:



**A to Z Agricultural Careers**

**Objective:** Students will identify career opportunities available in agriculture.

**Directions:** Identify agricultural careers by each letter of the alphabet.

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

E \_\_\_\_\_

F \_\_\_\_\_

G \_\_\_\_\_

H \_\_\_\_\_

I \_\_\_\_\_

J \_\_\_\_\_

K \_\_\_\_\_

L \_\_\_\_\_

M \_\_\_\_\_

N \_\_\_\_\_

O \_\_\_\_\_

P \_\_\_\_\_

Q \_\_\_\_\_

R \_\_\_\_\_

S \_\_\_\_\_

T \_\_\_\_\_

U \_\_\_\_\_

V \_\_\_\_\_

W \_\_\_\_\_

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_



Lesson 1: Agriculture: What Is It?

Name \_\_\_\_\_

**Cheeseburger, Fries, and Shake**

**Objective:** Students will identify how careers in agriculture affect their everyday life.

**Directions:** Identify all of the careers associated with cheeseburger, fries, and shake. Place each of the agricultural careers into one of the seven sectors of agriculture. How many are agricultural or related to agriculture? \_\_\_\_\_

1. Agricultural systems technology
  
2. Agricultural processing and marketing
  
3. Agricultural supplies and services
  
4. Forestry
  
5. Horticulture
  
6. Production agriculture
  
7. Natural resources



**Name That Career**

**Objective:** Students will identify careers based on descriptions.

**Directions:** This is an activity that can be conducted during this unit or at other times.

1. Each student first researches an agricultural career of his/her choice and writes information about the following key points:
  - a. Job description
  - b. Skills needed
  - c. Work environment
  - d. Work alone or with others
  - e. Equipment, tools, or machinery used
2. Collect the career reports.
3. Form teams of three to five students, depending on the class size.
4. Randomly hand out one career report to each team and instruct each team not to tell the other team(s) what career they have.
5. Instruct students in each team to briefly study their career so they can answer questions about it.
6. One member of the first team selects a person on the second team and asks a "yes" or "no" question about the career. The objective is to identify the career with the least number of questions.
7. Set the number of questions each team member can ask. Usually two or three works well.
8. Give each team a point for each question asked. The lowest score wins.



### **Agriculture in My Community**

**Objective:** Students will identify businesses in their community that are agriculture-related.

**Materials:**

Local phone directories (one for each student)  
Poster paper

**Directions:**

1. Divide students into groups of three and assign each group a portion of the alphabet. For example, five groups would receive the following assignments: A-E, F-J, K-O, P-T, U-Z.
2. Using the phone books, have students list on poster paper the businesses that are related to agriculture. Challenge groups to see how many businesses they can list and justify as related to agriculture.
3. Have students categorize each business as one of the seven major sectors of agriculture.
4. Finally, students should identify one business in each of the seven major sectors that best represents that career area of agriculture.



## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 2: Agriculture in the World

**Competency/Objective:** Describe the role of agriculture in the world.

#### **Study Questions**

1. **Why is agriculture important in the world?**
2. **How and why does agriculture vary throughout the world?**
3. **What commodities are produced in the major world regions?**
4. **What is the role of U.S. agriculture in the world market?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit I.
2. Global Vision instructional material and video. National FFA Organization, P.O. Box 68960, Indianapolis, IN 46268-0960, free.
3. Transparency Masters  
TM 2.1 Food Deficit Countries  
TM 2.2 World Map  
TM 2.3 Agricultural Commodities in Major World Regions  
TM 2.4 World Statistics for Food, Population, and Life Expectancy  
TM 2.5 United States Exports Purchased
4. Activity Sheets  
AS 2.1 International Auction (Instructor)  
AS 2.1 International Auction (Student)  
AS 2.2 Travel to a Foreign Country on the Internet  
AS 2.3 World Food Activity (Instructor)

## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 2: Agriculture in the World

#### TEACHING PROCEDURES

##### A. **Review**

In the previous lesson we discussed how the definition of agriculture has evolved to encompass all aspects of the global food, fiber, and natural resources systems. This lesson examines the role of agriculture in the world – its importance, why it varies, and where agricultural commodities are produced.

##### B. **Motivation**

1. Put agricultural items that are imported to the United States on tables and have students sample them for taste. Some product examples and the major countries where they are grown are as follows: bananas (Costa Rica, Ecuador), cashews (Brazil, India), coffee (Columbia, Brazil, Mexico), olives (Spain, Morocco, Greece), and peppers (Mexico). Have students guess where the items are grown. Summarize that all of the items have a connection in that they are examples of agricultural products grown in the world that are imported to the United States.
2. Talk about a world issue, make announcements, etc., for one minute and then ask students to estimate how many people were born in the world during that time span. In 1999, the number was 250. What does this mean for agriculture? Can we produce enough food for these people? Put this number in terms of students in a class, school, city, etc., so the issue becomes relevant. For example, in the past minute, a school our size was born in the world.

World figures for 1999 available through the U.S. Census Bureau are as follows (figures may not add to totals due to rounding).

<b>Time Unit</b>	<b>Births</b>	<b>Deaths</b>	<b>Natural Increase</b>
Second	4.2	1.7	2.5
Minute	250	103	147
Hour	15,008	6,181	8,827
Day	360,187	148,348	211,839
Month	10,955,686	4,512,252	6,443,434
Year	131,468,233	54,147,021	77,321,212

3. Conduct AS 2.1. The Instructor version explains how to conduct the international auction.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### **Q1. Why is agriculture important in the world?**

##### **A1.**

- a) **Provides food, clothing, and shelter**
- b) **Provides income for other purchases**

**c) Provides medicines and pharmaceuticals**

The survival of many countries is dependent upon the products of other countries. Agricultural producers play an important role in the world economy. Use TM 2.1 to identify the countries that do not produce enough food to feed themselves. Engage the class in a discussion of what they observe on this map emphasizing that the countries shaded in black have much less food available to them. Ask students what they think it would be like to live in one of those countries. Some countries export agricultural products to get money needed to buy products they are not able to produce. Show the Global Vision video. It has two 12-minute segments.

**Q2. How and why does agriculture vary throughout the world?**

**A2.**

- a) **Climate**
- b) **Soil fertility, drainage, and topography**
- c) **Economic development**
- d) **Technology**
- e) **Marketing and distribution system**

Conduct AS 2.2 by assigning each student a country to research. Select countries from each of the continents so there is representation throughout the world. This will also be helpful during AS 2.3. Go to the computer lab and access the Internet. When students report on their country, it will be very evident how and why agriculture varies in the world.

**Q3. What commodities are produced in the major world regions?**

**A3.**

- a) **Africa - cotton, metals, and petroleum products**
- b) **Asia - rice and tea**
- c) **Australia - wheat, sheep, and wool**
- d) **Europe - floriculture, potatoes, cereal grains, and textiles**
- e) **North America - corn, soybeans, beef, pork, and wood products**
- f) **South America - coffee, soybeans, metals, and wood products**

Show TM 2.2 and ask students where and what commodities are produced in the world. Show TM 2.3 to summarize the answers.

**Q4. What is the role of U.S. agriculture in the world market?**

**A4.**

- a) **Supplies the food needed to feed its citizens**
- b) **Exports food and other products needed by other countries**
- c) **Provides technical and educational assistance**
- d) **Administers foreign food assistance programs**

The United States has sufficient resources to produce nearly all of the food needed to feed its population. Agriculture in the United States also provides support for many developing nations. Other countries are less fortunate and buy food produced in the United States to feed their people. Agricultural exports are vitally important to the United States' economy and totaled \$61.8 billion in 1998. Discuss TMs 2.4 and TM 2.5 as an introduction to conducting AS 2.3.

**F. *Other Activities***

G. ***Conclusion***

Agricultural products play an important role in the world economy. Agriculture varies from country to country primarily due to climate and technology. Imports supply countries with agricultural products that cannot be produced in that country. The United States continues to play a key role in providing assistance to countries that cannot produce the food and other products needed for their citizens. Such programs involve providing technical and educational assistance to developing countries.

H. ***Answers to Activity Sheets***

Answers to all activity sheets will vary.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# Food Deficit Regions



 Indicates Regions with Deficits

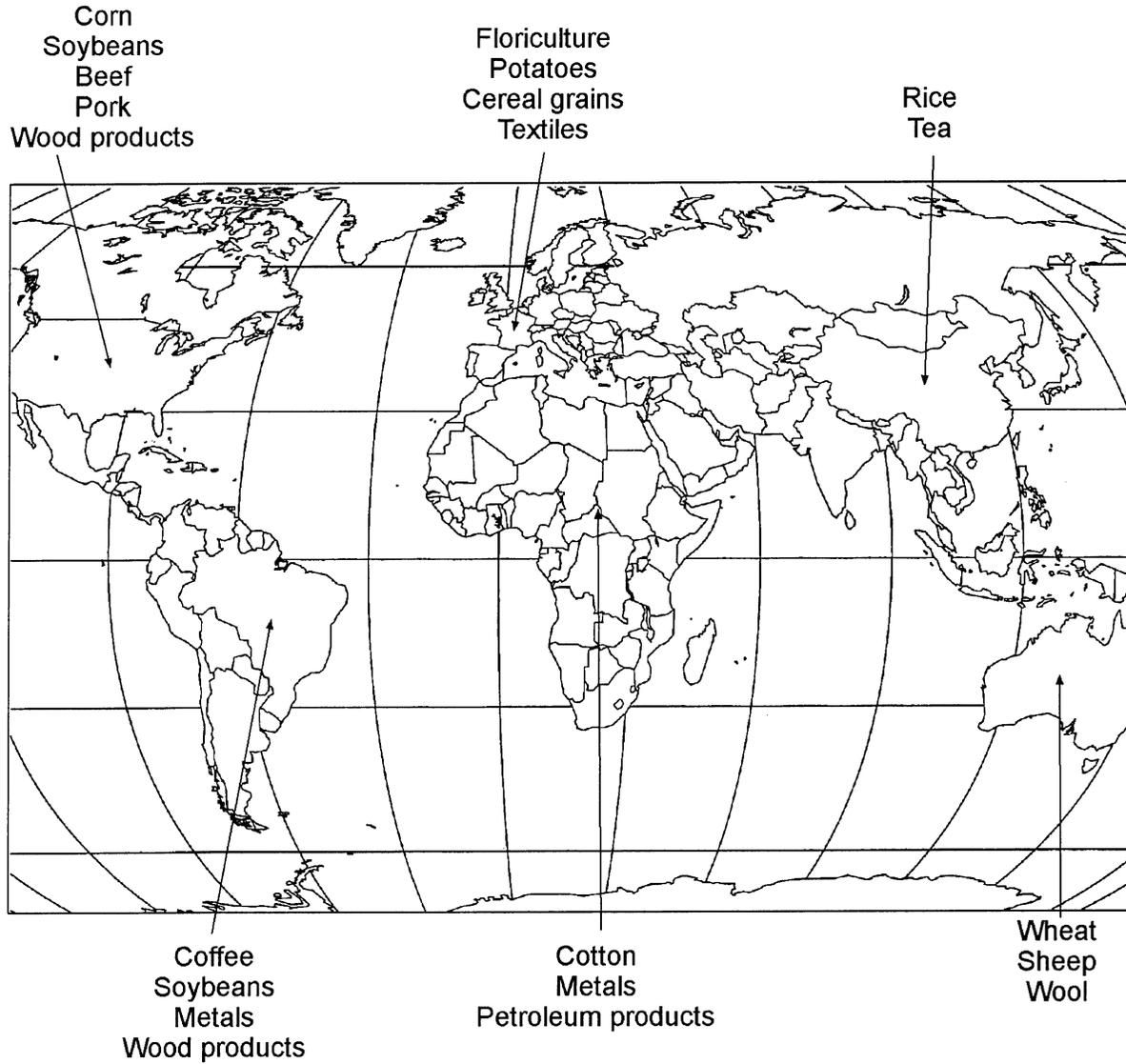


# World Map





# Agricultural Commodities in Major World Regions





## World Statistics for Food, Population, and Life Expectancy

<b>Continent</b>	<b>World Food Consumed (%)</b>	<b>World Population (%)</b>	<b>Life Expectancy</b>
Africa	8	13	54
Asia	23	61	64
Europe	36	12	74
North America	22	8	74
South America	11	6	67

**Source:** *World Population Prospects*, United Nations Population Division (1999)



## U.S. Exports Purchased

<b>Country</b>	<b>Amount of U.S. Agricultural Exports Purchased (in Billions of Dollars)</b>	<b>Percent of U.S. Agricultural Exports</b>
Japan	\$12.1	19.6%
European Union (15 countries)	\$10.0	16.3%
Canada	\$9.0	14.6%
Mexico	\$6.3	10.2%
South Korea	\$2.4	3.9%



**International Auction**

**Objective:** Students will gain a better understanding of how funds available to purchase agricultural products on the world market affect food distribution.

**Directions:** Before class begins, copy five pages of "food product" coupons and five pages of "other product" coupons (provided on the next two pages). Cut out the coupons.

Divide the class into groups of three or four students. Assign each group to represent a country from the list provided below. Provide each group with the amount of money indicated, which is the amount of money available to buy agricultural products on the world market. Tell each group how much money it has available and how many food coupons it needs to purchase to feed the country's population. Distribute a copy of AS 2.1 (Student) to each group (country) to record its purchases.

Each group should purchase the food first; additional products may be purchased if the amount of food is adequate. Have each group report its position after all trading has been completed.

<u>Country</u>	<u>Units of Food Needed</u>	<u>Funds Available</u>
USA	1	\$50 billion
England	1	\$10 billion
France	1	\$10 billion
Australia	1	\$10 billion
USSR	5	\$20 billion
China	10	\$10 billion
India	15	\$10 billion
Japan	5	\$30 billion
Ethiopia	10	\$5 billion
Saudi Arabia	5	\$40 billion

Conduct an auction, beginning with the food product coupons until each group (country) has spent all of its money or does not wish to make any more purchases. At the end of the auction, have each group explain what was purchased and how much money is left over.

Students should be guided to the conclusion that some countries lack sufficient resources to raise or purchase the food needed to feed their people. Other countries are wealthy enough to supply the food and also to purchase other products to improve the quality of life for their citizens. Also, note that countries with a large amount of funds available usually get those funds by exporting other products. Countries with limited funds usually have fewer products that they can sell as exports.







OTHER PRODUCT COUPONS

Automobiles \$2 Billion	Crude Oil \$2 Billion
Electronic Equipment \$3 Billion	Military Aircraft \$3 Billion
Medicine \$1 Billion	Tractors \$1 Billion
Lumber \$1 Billion	Steel \$1 Billion
Airplanes \$3 Billion	Agricultural Equipment \$1 Billion
Shoes \$1 Billion	Clothing \$1 Billion



**International Auction**

**Objective:** Students will gain a better understanding of how funds available to purchase agricultural products on the world market affect food distribution.

**Directions:** Fill in the blanks as indicated. As purchases are made, record what was purchased and how much was spent on each purchase.

Country \_\_\_\_\_

Food Units Needed \_\_\_\_\_

Funds Available \$ \_\_\_\_\_

Units Purchased	Funds Spent
Ending Balance: \$	

Were you able to purchase enough food to feed your country? Why or why not?



Lesson 2: Agriculture in the World

Name \_\_\_\_\_

**Travel to a Foreign Country on the Internet**

**Objective:** Students will identify key information about foreign countries.

**Directions:** Use the *1999 World Fact Book* (<<http://www.odci.gov/cia/publications/factbook/index.html>> and then click on the Country Listing link to find the following key information about your country.

Country \_\_\_\_\_

<b>Location</b>	
<b>Area</b> (comparative)	
<b>Land Use</b>	
<b>Environment</b> (current issues)	

<b>Age Structure</b> 0-14 years 15-64 years 65 years and over	
<b>Literacy</b> definition total population	
<b>Population Growth Rate</b>	
<b>Life Expectancy At Birth</b> total population male female	
<b>Languages</b> (official)	
<b>Population Below Poverty Line</b>	
<b>Unemployment Rate</b>	
<b>Agriculture</b> (products)	

### World Food Activity

**Objective:** Students will be able to understand the relationship between people and food in the global setting.

**Materials and Equipment:**

Food items such as donuts, bread sticks, candy, etc., work the best for this activity. The quantity and the exact food item will depend on the size of the class and the time of day the class meets. Cutting utensils, plates, and napkins may also be needed, depending on the food items selected.

**Procedure:**

Note: An example is provided on the next page to help understand these procedures.

1. Put food item on a table at the front of the room and explain that the food represents all the food that will be consumed in the world today.
2. Write each continent name on a piece of cardboard, and then fold into a tent shape. Place these names at tables so students know which continent each group of students represents.
3. Based on the percent of world population in each continent (found in the example), and the number of students in the class, make slips of paper to represent this distribution. For example, Africa has 13% of the world population. In a class of 20 students, 13% or approximately 3 students ( $.13 \times 20$ ) would represent Africa.
4. In addition, indicate poor country, rich country, or country with political power on the slips of paper (see example). Not all counties located on their respective continents are equal, so this aspect adds some realism. This information will help students role-play the financial and political status of the country they represent.
5. Have each student randomly draw the continent/country that he/she will represent. After this random selection, students will gather by continent around a table(s) or section of the room.
6. Before each continent is given its amount of food (see example), each group must develop a plan for distribution to each country. Students must discuss and form a consensus as to how their food will be consumed. If the students can't come to a consensus, the instructor will make the decision.
7. Ask each continent to explain its food distribution plan. Finally, have a representative come forward to obtain that continent's food supply. How do students who did not get as much food to eat feel? Continents may offer to trade items for another continent's excess food. Do students think there is a connection between life expectancy and food?
8. Will students give the same portion to everyone? Or will they give larger portions to the ones who have more monetary or political power? Will the poor countries receive any food at all?
9. Continents with a low food supply or those with excess food may wish to discuss importing or exporting. Encourage this discussion and after each continent receives its food, discussion will become more serious. Will an "international conflict" take place?

**Example:** Using 10 donuts for a class of 20 would result in the following donut distribution:

<b>Continent</b>	<b>Donut</b>	<b>% Food</b>	<b>% Population</b>	<b>Life Expectancy</b>
Africa	1	8	13	54
Asia	2 ¼	23	61	64
Europe	3 ½	36	12	74
North America	2 ¼	22	8	74
South America	1	11	6	67

These continent/country indicator names are in the correct proportion based on world population and a class of 20 (use these for the slips of paper for the drawing):

Africa (rich country)

Asia (poor country)

Africa (poor country)

Asia (poor country)

Africa (poor country)

Asia (poor country)

Asia (country with political power)

Asia (poor country)

Asia (rich country)

Asia (poor country)

Asia (rich country)

Europe (rich country)

Asia (rich country)

Europe (poor country)

Asia (poor country)

North America (rich country)

Asia (poor country)

North America (poor country)

Asia (poor country)

South America

## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 3: Agriculture in the United States

**Competency/Objective:** Describe the role of agriculture in the United States.

#### **Study Questions**

1. **Where are major products produced in the United States?**
2. **What enables agriculture to be successful in the United States?**
3. **What are the goals of agriculture in the United States?**
4. **How has the U.S. agricultural industry evolved?**
5. **How have changes in agriculture impacted U.S. history?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit I.
2. Transparency Master  
TM 3.1 Map of United States
3. Activity Sheets  
AS 3.1 Census of Agriculture (Instructor)  
AS 3.1 Census of Agriculture (Student)  
AS 3.1 Census of Agriculture (Supplement)  
AS 3.2 Time Line of Agriculture and History (Instructor)

UNIT I - INTRODUCTION TO AGRICULTURE

Lesson 3: Agriculture in the United States

TEACHING PROCEDURES

A. **Review**

Previously we learned the importance of agriculture in the world. This lesson examines the role of the agricultural industry in the United States. Discussion about our country's largest employer will focus on the evolution of agriculture, how it has impacted U.S. history, and important characteristics of agriculture.

B. **Motivation**

1. Ask students to guess how much of the following food items each person (per capita) consumes each year. These 1996 figures are available from the USDA web site at <<http://www.nass.usda.gov/pa/annsum98/page88.htm>>.

<b>Food Item</b>	<b>Per Capita Consumption</b>
Beef	64 lb.
Pork	46 lb.
Chicken	50 lb.
Fish	15 lb.
Potatoes	145 lb.
Fruit	228 lb.
Vegetables	253 lb.
Ice cream	16 lb.
Milk	24 gal.
Coffee	22 gal.
Carbonated soft drinks	52 gal.
Bottled water	14 gal.

2. Conduct a word association activity where students list the first thought that comes to mind regarding agriculture when the teacher announces the following states: Texas, Idaho, California, Iowa, Georgia, Kansas, Minnesota, Washington, Florida, Wisconsin, North Carolina. This motivational activity will help the teacher assess the basic knowledge level students have about agriculture in the United States.

C. **Assignment**

D. **Supervised Study**

E. **Discussion**

**Q1. Where are major products produced in the United States?**

**A1. Based on the 1997 Census of Agriculture:**

<b>Agricultural Product</b>	<b>Leading States</b>
Beef cows	Texas, Missouri, Nebraska, Oklahoma, South Dakota
Market beef	Texas, Kansas, Nebraska, Colorado, Iowa
Dairy cows/products	California, Wisconsin, New York, Pennsylvania, Minnesota
Market pigs	Iowa, North Carolina, Minnesota, Illinois, Indiana
Sheep and lambs	Colorado, Texas, Wyoming, California, South Dakota
Egg production (layers)	California, Ohio, Pennsylvania, Iowa, Indiana
Chickens (broilers)	Georgia, Arkansas, Alabama, North Carolina, Mississippi
Turkeys sold	North Carolina, Minnesota, Virginia, Arkansas, California
Corn	Iowa, Illinois, Nebraska, Minnesota, Indiana
Wheat	Kansas, North Dakota, Montana, Washington, Oklahoma
Soybeans	Iowa, Illinois, Minnesota, Indiana, Ohio
Cotton	Texas, California, Georgia, Mississippi, Arkansas
Peanuts	Georgia, Texas, Alabama, North Carolina, Florida
Potatoes	Idaho, Washington, Wisconsin, Oregon, Colorado
Alfalfa hay	California, Wisconsin, South Dakota, Nebraska, Idaho
Green peas	Minnesota, Wisconsin, Washington, Oregon, New York
Lettuce	California, Arizona, Florida, New Jersey, Colorado
Sweet corn	Minnesota, Wisconsin, Washington, New York, Oregon
Tomatoes	California, Florida, Ohio, Michigan, Indiana
Apples	Washington, Michigan, New York, California, Pennsylvania
Oranges	Florida, California, Texas, Arizona, Hawaii
Grapefruit	Florida, California, Texas, Arizona, Hawaii
Pears	Washington, California, Oregon, New York, Michigan
Peaches	California, Georgia, South Carolina, New Jersey, Michigan
Pecans	Georgia, Texas, New Mexico, Arizona, Oklahoma
Strawberries	California, Florida, Oregon, Washington, Michigan

Have students complete AS 3.1 to answer this study question. Use more current data if available. Using the answers for AS 3.1 and the U.S. map on TM 3.1, locate the states that grow the major commodities.

**Q2. What enables agriculture to be successful in the United States?**

**A2.**

- a) **Fertile soil - some of the finest in the world**
- b) **Growing conditions - very favorable for producing a variety of crops**
- c) **New technology and many discoveries by leaders, inventors, researchers, and scientists**
- d) **Technology adopted by entrepreneurs to improve production and efficiency**
- e) **Advanced and extensive transportation and marketing system**

Discuss with students the successful characteristics of a business. Relate those factors to agriculture.

**Q3. What are the goals of agriculture in the United States?**

**A3.**

- a) **Provide food, clothing, and shelter**
- b) **Protect the environment**
- c) **Ensure food safety**
- d) **Use technology to benefit consumers**

Have students provide examples of how agriculture fulfills each of the four goals. Identify how the goals of agriculture have changed over time.

**Q4. How has the U.S. agricultural industry evolved?**

**A4.**

- a) **The United States has shifted from a nation of farmers at the time of the Revolutionary War (90% of the colonists were farmers) to an agribusiness economy.**
- b) **Technology has made it possible for less than 2% of the U.S. population to be farmers and approximately 20% to be employed in agribusiness.**
- c) **Many advances have taken place in production agriculture due to management, technology, and agricultural research. In general, crop yields have increased and meat animals have become leaner and more cost efficient.**

Refer to Table 3.1 in the Student Reference and discuss why the production of corn has increased over the years while hours of labor have decreased. Discuss how more people can be fed through fewer hours of labor and fewer farm workers.

**Q5. How have changes in agriculture impacted U.S. history?**

**A5. Significant events in U.S. agricultural history:**

- a) **1793 - Eli Whitney invented the cotton gin.**
- b) **1836 - The grain combine was patented.**
- c) **1837 - John Deere plows were first manufactured.**
- d) **1862 - Morrill Land-Grant College Act was passed.**
- e) **1867 - Barbed wire was invented.**
- f) **1892 - John Froelich built the first gasoline tractor.**
- g) **1914 - Smith-Lever Act established the Extension Service.**
- h) **1917 - Smith-Hughes Act was passed.**
- i) **1922 - Hybrid seed corn was developed.**
- j) **1950s - Mechanization increased and commercial fertilizer was adopted.**
- k) **1960s - Herbicides and insecticides gained popularity.**
- l) **1970s - Use of confinement structures began and artificial insemination of livestock increased.**
- m) **1980s - Use of conservation tillage and computers increased.**
- n) **1990s - Global positioning systems technology emerged.**
- o) **Mid 1990s - First crops improved through biotechnology were commercialized.**
- p) **1997 - A sheep was genetically cloned from adult cells.**

Discuss the evolution of agriculture in America. Conduct AS 3.2 to have students research and create a time line of other events that have impacted U.S. agricultural history.

**F. *Other Activities***

1. Bring in a variety of food items for students to sample. Identify the state where the item or major ingredient(s) or processed product was raised and produced.

2. Have students research and report on the role of agriculture in the westward expansion of the United States.
3. Have students select a significant event in agricultural history and present a report either oral or written.
4. Students may develop pen pals in different states as a means to explore agriculture across the United States. One possibility is the discussion group on National FFA Online <<http://www.ffa.org/ffatalk.html>>.
5. Have each student write to a department of agriculture in a different state. Each student should request information about agriculture in that state such as pictures, maps, product samples, etc.

G. **Conclusion**

The United States is fortunate to have ideal growing conditions for the production of a variety of crops and livestock. Many inventors, legislators, researchers, scientists, and entrepreneurs were instrumental in the development of agriculture in the United States. They have contributed to the efficiency and productiveness of American agriculture. At the same time, agriculture has remained true to its goal of providing food, clothing, and shelter as well as fulfilling the recent goals of protecting the environment, ensuring a safe food supply, and using technology to benefit consumers.

H. **Answers to Activity Sheets**

AS 3.1 Census of Agriculture

See the answer to study question 1 for data from 1997.

AS 3.2 Time Line of Agriculture and History

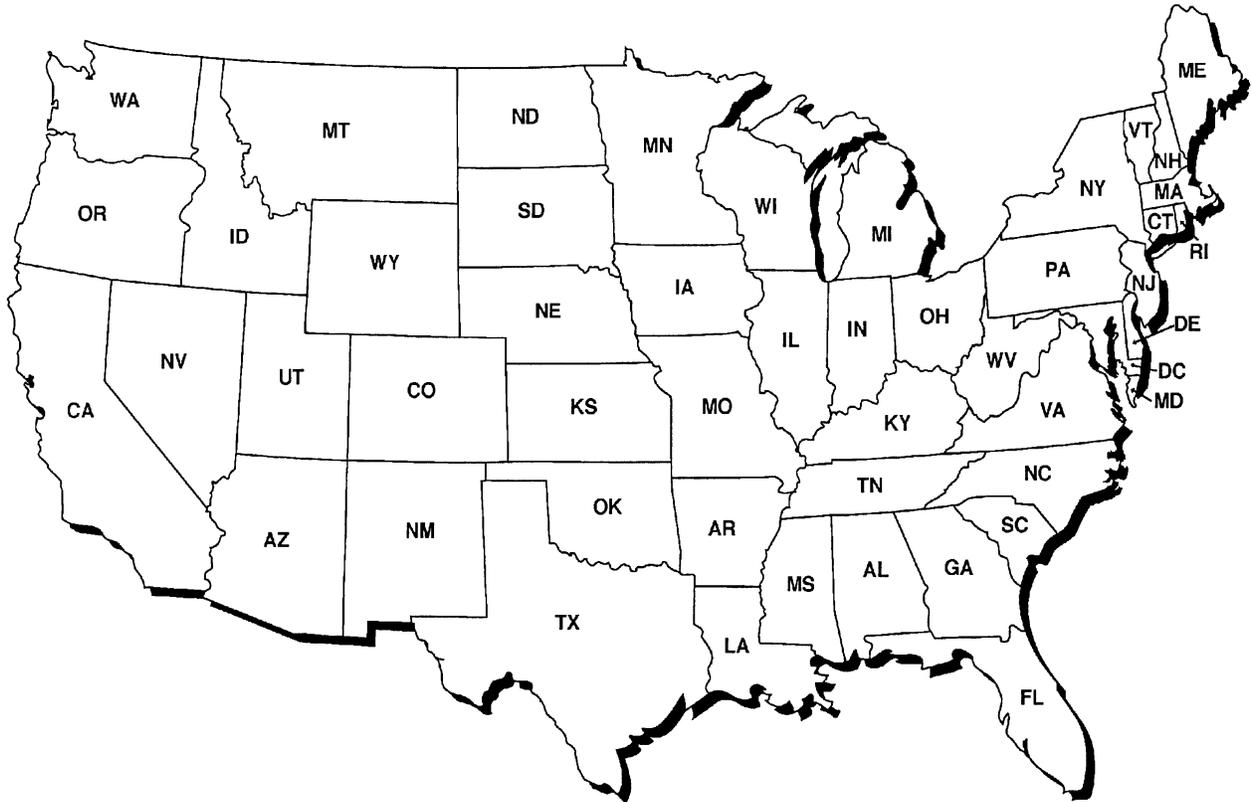
Answers will vary.

I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.



# Map of United States





### **Census of Agriculture**

**Objective:** Students will investigate where agricultural products are grown in the United States.

**Directions:**

1. There are 26 agricultural commodities listed on AS 3.1.
2. This assignment can be completed several ways.
  - a. It may be a take-home assignment where each student completes the entire sheet.
  - b. It may be a take-home assignment where each student finds rankings for one or two products.
  - c. Teams of students could find a certain number of items.
  - d. A computer lab at school can be used for research.
3. After the information on AS 3.1 is found, each student could identify where the major production areas are in the United States using AS 3.1 Supplement or TM 3.1.
4. Have students or teams orally present where their agriculture products are primarily produced in the United States.
5. Finally, students will help develop a bulletin board with their research.
  - a. Obtain or make a large map of the United States.
  - b. Post it on a bulletin board or another area of the classroom.
  - c. Have students or teams make a symbol for the agricultural product(s) they researched. Place the symbol on the leading state(s) on the bulletin board display.



**Census of Agriculture**

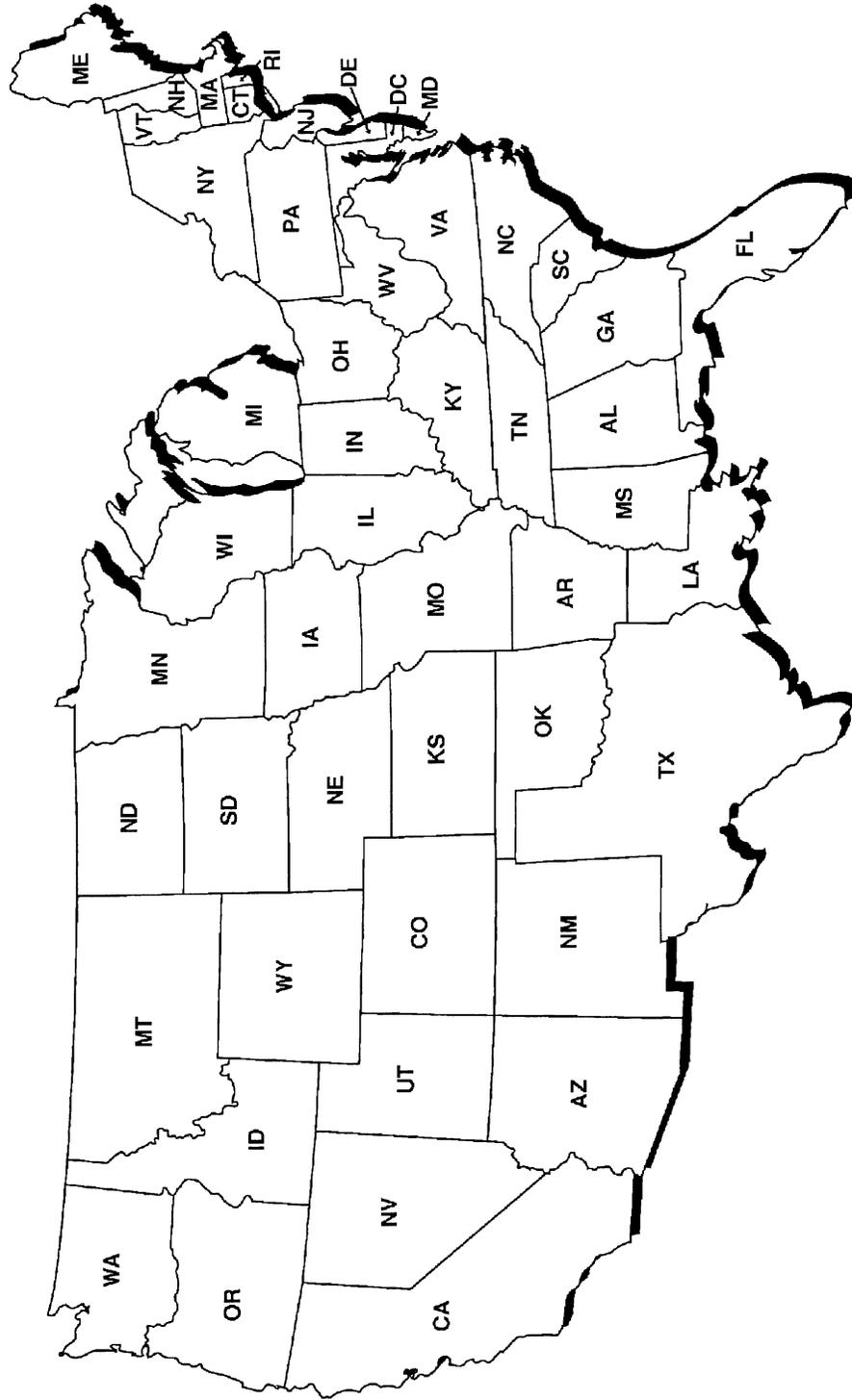
**Objective:** Students will investigate where agricultural products are grown in the United States.

**Directions:** Using the 1997 Census of Agriculture, locate the following information. Tables with this information can be found at <<http://www.hass.usda.gov/census/census97/rankings/tablist.htm>>. Ask your instructor if information for a more recent year is available.

Agricultural Product	Leading States
Beef cows	
Market beef	
Dairy cows/products	
Market pigs	
Sheep and lambs	
Egg production (layers)	
Chickens (broilers)	
Turkeys	
Corn	
Wheat	
Soybeans	
Cotton	
Peanuts	
Potatoes	
Alfalfa hay	
Green peas	
Lettuce	
Sweet corn	
Tomatoes	
Apples	
Oranges	
Grapefruit	
Pears	
Peaches	
Pecans	
Strawberries	



Map of the United States





### **Time Line of Agriculture and History**

**Objective:** Students will discover historical events that impacted agriculture in the United States.

**Materials and Equipment:**

Poster paper that can be cut into a long time line  
Markers

**Procedure:**

1. Divide the students into groups of three to five, depending on the size of the class. Assign the groups a span of years, for example, 1750-1800, 1801-1850, 1851-1900, 1901-1950, and 1951-2000. Have them use the "Historical Impact of Changes in Agriculture" section in the Student Reference as a starting point.
2. Students will need to research other important historical events. These dates will help to integrate social studies and agriculture. Events that might be added could include dates of major wars, important inventions, formation of organizations, sporting events, legislation, etc.
3. Each group will put its time line on the poster paper.
4. Tape the time lines together and post them around the room.



## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 4: Agriculture in Missouri

**Competency/Objective:** Describe agriculture in Missouri.

#### **Study Questions**

1. **What commodities are produced in Missouri?**
2. **Why is agriculture important in Missouri?**
3. **Why and how has Missouri agriculture changed?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit I.
2. *Missouri Farm Facts 1999*. Missouri Department of Agriculture and U.S. Department of Agriculture. Missouri Agricultural Statistics Service, August, 1999. (Updated versions are available yearly from Missouri Agricultural Statistics Service <<http://agebb.missouri.edu/mass>>.)
3. Transparency Masters  
TM 4.1 Missouri's 1998 Ranking in the United States  
TM 4.2 How Has Missouri Agriculture Changed?
4. Handout  
HO 4.1 1997 Cash Receipts
5. Activity Sheets  
AS 4.1 Name That Drawing (Instructor)  
AS 4.2 Agricultural Commodities Produced in Missouri  
AS 4.3 Hat Day

## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 4: Agriculture in Missouri

#### TEACHING PROCEDURES

##### A. **Review**

Agriculture is a major industry in the United States. Agricultural products provide food for U.S. consumers and are exported to several foreign countries. Agriculture is also an important industry in the state of Missouri.

##### B. **Motivation**

Conduct AS 4.1 so that students will appreciate the diverse components of Missouri agriculture.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What commodities are produced in Missouri?**

##### A1.

- a) **The following commodities and their rank among the other 49 states per 1998 data are as follows:**
- 1) **Number of farms - 2<sup>nd</sup>**
  - 2) **Beef cows - 2<sup>nd</sup>**
  - 3) **Grain sorghum - 4<sup>th</sup>**
  - 4) **Hay (all types)- 4<sup>th</sup>**
  - 5) **Turkeys raised - 5<sup>th</sup>**
  - 6) **Concord grapes - 6<sup>th</sup>**
  - 7) **Rice - 6<sup>th</sup>**
  - 8) **Soybeans - 6<sup>th</sup>**
  - 9) **Hogs and pigs - 7<sup>th</sup>**
  - 10) **Cheese - 9<sup>th</sup>**
  - 11) **Watermelons - 9<sup>th</sup>**
  - 12) **Broilers - 10<sup>th</sup>**
  - 13) **Corn - 10<sup>th</sup>**
  - 14) **Winter wheat - 11<sup>th</sup>**
  - 15) **Cotton - 12<sup>th</sup>**
  - 16) **Ice cream - 12<sup>th</sup>**
  - 17) **Tobacco - 12<sup>th</sup>**
  - 18) **Eggs - 14<sup>th</sup>**
  - 19) **Milk - 15<sup>th</sup>**
- b) **Logging and wood products manufacturing contribute \$3 billion each year to Missouri's economy.**
- c) **Horticultural businesses produced almost \$68 million in sales in 1998.**
- d) **Missouri is a large supplier of Golden and Red Delicious, and Jonathan apples. More than 40 million pounds of apples are produced annually.**

Divide students into groups and have them list agricultural commodities produced in Missouri. Write their answers on the board and discuss them. Next, show the left half of TM 4.1. Ask students to guess Missouri's ranking in the United States.

Have students complete AS 4.2 using copies of *Missouri Farm Facts* or the Internet <<http://agebb.missouri.edu/mass/farmfact/index.htm>>.

**Q2. Why is agriculture important in Missouri?**

**A2.**

- a) **A diversity of environmental factors enables agriculture to be produced in Missouri.**
  - 1) **Geography**
  - 2) **Vegetation**
  - 3) **Climate**
  - 4) **Soil fertility**
- b) **The value of agricultural products produced in Missouri each year is approximately \$4.5 billion.**
- c) **In addition to production agriculture, many people are employed in other areas of the agricultural industry.**
  - 2) **Agribusiness employs more than 15% of Missouri's labor force, which is one in every six workers in the state, or more than 400,000 people.**
  - 3) **The agricultural processing and marketing sector employs approximately 92,000 people.**

Missouri produces a variety of crops and other agricultural products. Use HO 4.1 to identify Missouri counties where crop and livestock production is concentrated. (The instructor should update the handout using the most current *Missouri Farm Facts*.) Conduct AS 4.3 to familiarize students with various agricultural careers.

**Q3. How has Missouri agriculture changed?**

**A3.**

- a) **Medium-size farms have declined the most.**
- b) **The average size of farms has increased.**
- c) **The average age of producers has increased.**
- d) **There are lower numbers of producers under the age of 35.**
- e) **Agricultural businesses are hiring more employees, especially females.**
- f) **Producers are continuing to adopt new technology.**
- g) **More attention is paid to soil conservation and water quality.**
- h) **The trend has been toward larger farming operations, the formation of farmer cooperatives, and the consolidation of agricultural businesses.**
- i) **The number of businesses involved in biotechnology and life sciences are increasing in Missouri.**

Use TM 4.2 to discuss changes in Missouri agriculture.

**F. *Other Activities***

- 1. Use the Missouri Agricultural Statistics service <<http://agebb.missouri.edu/mass/index.htm>> and county Agri-Facts to identify key information about your county.
- 2. Ask a representative from the Missouri Department of Agriculture or the Cooperative Extension Service to talk to the class.

3. Have students write for their own copy of *Missouri Farm Facts* for home. They can request a copy from Missouri Agricultural Statistics Service, P.O. Box L, Columbia, MO 65205, (573) 876-0950, <<http://agebb.missouri.edu/mass>>.

**G. Conclusion**

Agriculture is very diverse in Missouri and is the most important industry. Agricultural production provides raw products, agricultural business, and career opportunities that directly contribute to the state's economy. More than 15% of Missouri's labor force is employed in agribusiness. Missouri products are used by consumers in the state, across the United States, and throughout the world. Missouri has changed and will continue to change agriculturally. However, the importance of the industry to the economy of the state will continue.

**H. Answers to Activity Sheets**

AS 4.1 Name That Drawing

There are no answers for this activity.

AS 4.2 Agricultural Commodities Produced in Missouri

Answers should be checked to the most current *Missouri Farm Facts*. The answers given below are for 1998 production.

Commodity	Area of Production
Corn	Northern half and Bootheel
Cotton	Bootheel
Wheat	North central and Bootheel
Soybeans	Northwest, north central, and Bootheel
Hay	Southwest
Dairy cattle	Southwest
Hogs and pigs	North and north central
Beef cows	Southwest
Sheep and lambs	Northern third
Grain sorghum	West central, central and Bootheel
Rice	Bootheel
Tobacco	Missouri River bottom

AS 4.3 Hat Day

The instructor should determine if the answers are appropriate.

**I. Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## Missouri's 1998 Ranking in the United States

Category/Commodity	Rank
Number of farms	2 <sup>nd</sup>
Beef cows	2 <sup>nd</sup>
Grain sorghum	4 <sup>th</sup>
Hay (all types)	4 <sup>th</sup>
Turkeys raised	5 <sup>th</sup>
Concord grapes	6 <sup>th</sup>
Rice	6 <sup>th</sup>
Soybeans	6 <sup>th</sup>
Hogs and pigs	7 <sup>th</sup>
Cheese	9 <sup>th</sup>
Watermelons	9 <sup>th</sup>
Broilers	10 <sup>th</sup>
Corn	10 <sup>th</sup>
Winter wheat	11 <sup>th</sup>
Cotton	12 <sup>th</sup>
Ice cream	12 <sup>th</sup>
Tobacco	12 <sup>th</sup>
Eggs	14 <sup>th</sup>
Milk	15 <sup>th</sup>

Source: *Missouri Farm Facts 1999*



## How Has Missouri Agriculture Changed?

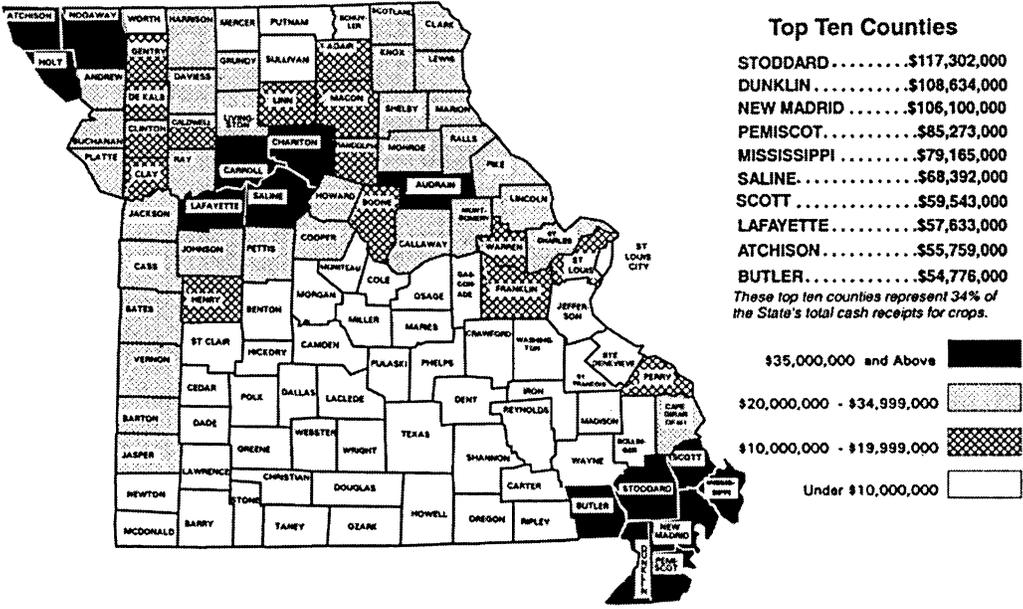
Variable	Year	
	1982	1997
Land in farms (acres)	29,266,609	28,826,182
Percent of land in farms	66.3	65.3
Number of farms	112,447	98,860
Average size of farm (acres)	260	292
Number of farm operators by age		
• under 25	3,606	1,257
• 25-34	14,231	7,133
• 35-44	21,546	18,523
• 45-54	24,517	22,285
• 55-64	25,924	22,192
• 65 years or older	22,623	27,470
Average age of producers	51	55
Operator's principal occupation (percent)		
• Farming	52	45
• Other	48	55
Farms by value of sales (number)		
• Less than \$9,999	61,236	54,982
• \$10,000-\$49,999	32,053	26,664
• \$50,000-\$99,999	10,004	6,529
• \$100,000 or more	9,126	10,685

Source: Missouri Farm Facts 1999

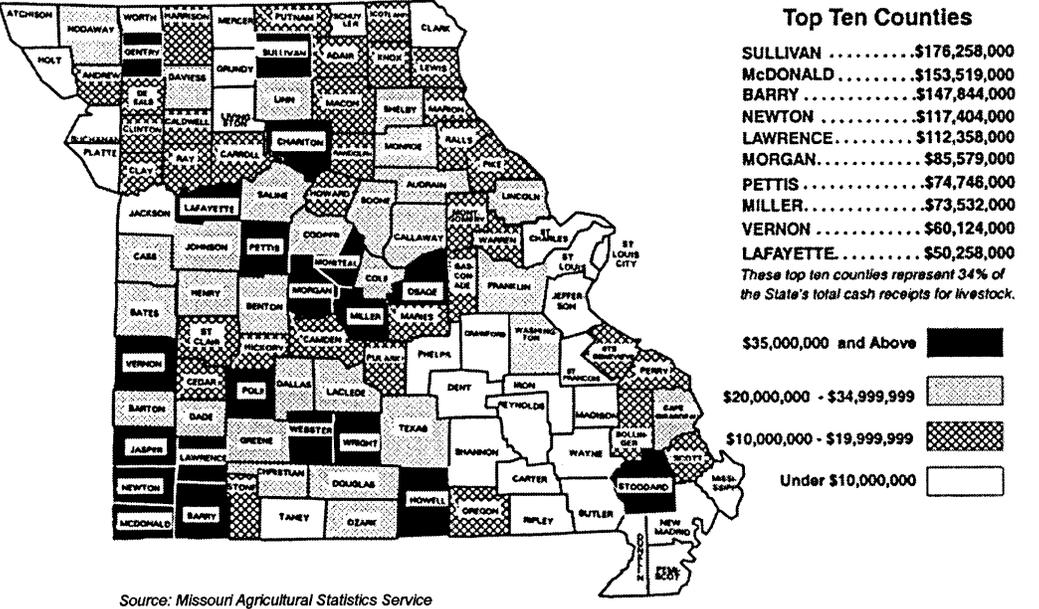


# 1997 Cash Receipts

## 1997 Cash Receipts, Crops By Counties



## 1997 Cash Receipts, Livestock By Counties



Source: Missouri Agricultural Statistics Service



**Name That Drawing**

**Objective:** Students will understand different components of Missouri agriculture.

**Materials and Equipment:**

Poster paper, white board, or blackboard  
Markers or colored chalk  
Note cards

**Procedure:**

1. Write each of the words listed below for the four concepts on separate note cards.
2. Divide the class into four teams of four to six students. Each team will be given a set of cards for a specific concept. (If there are more students in the class, additional concepts should be developed.)
3. Explain the rules below:
  - a. Each team will select a person to draw an image to represent the word on the card.
  - b. All the words lead to a concept and each of the concepts has a commonality.
  - c. Each word is worth 5 points, the concept is worth 10 points, and the commonality is worth 15 points.
  - d. There is no talking between the team members and the person drawing.
  - e. Each team will have 2 minutes to guess all of its words and solve the concept puzzle.
  - f. The person drawing may pass on one word.
  - g. If a team does not correctly state its concept, each of the other teams can write the answer on a note card and gain the 10 points.
  - h. At the end of the game, each team will write its answer (commonality) on a note card.
4. The following are examples of words that can be used.

Words

Corn  
Tractor  
Planter  
Soil  
Weeds

Words

Pig  
Cow  
Lamb  
Steak  
Feed

Words

Lawn  
Flower  
Greenhouse  
Tree  
Vegetable

Words

DNA  
Cloning  
Laboratory  
Scientist

Concept

Agronomy

Concept

Livestock or Animals

Concept

Horticulture

Concept

Biotechnology

Commonality

The concepts should build to the commonality that all describe agriculture in Missouri.



Lesson 4: Agriculture in Missouri

Name \_\_\_\_\_

**Agricultural Commodities Produced in Missouri**

**Objective:** Students will identify where major commodities are produced in Missouri.

**Directions:** Twelve agricultural commodities produced in Missouri are listed below. Using *Missouri Farm Facts*, identify areas of the state that have high concentrations of the commodity listed. Some information may be found on the Internet at <<http://agebb.missouri.edu/mass/farmfact/index.htm>>. One commodity has been done for you.

Commodity	Area of Production
Corn	Northern half and Bootheel
Cotton	
Wheat	
Soybeans	
Hay	
Dairy cattle	
Hogs and pigs	
Beef cows	
Sheep and lambs	
Grain sorghum	
Rice	
Tobacco	



**Hat Day**

**Objective:** Students will identify various jobs or careers in agriculture.

**Directions:** Interview a person who has a job in agriculture and answer the questions below. Role-play the person's job by wearing the hat to class and explaining what the person does.

1. Name of person you interviewed \_\_\_\_\_
2. Job title \_\_\_\_\_
3. Name of the business the person works for \_\_\_\_\_
4. Major sector of agriculture (one of seven identified in Unit I, Lesson 1)  
\_\_\_\_\_
5. What did you find out about the person's job?
  - a. Responsibilities \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - b. Favorable aspects \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - c. Least favorable aspects \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - d. Advice \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 5: Advances in Agricultural Technology

**Competency/Objective:** Identify advances in agricultural technology and their implications.

#### **Study Questions**

1. **What are recent changes in agriculture?**
2. **How will agriculture change in the future?**
3. **What are the implications of changes in agriculture?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit I.
2. Activity Sheets  
AS 5.1 The Future and Change (Instructor)  
AS 5.2 Future Headlines (Instructor)  
AS 5.3 Invent a New Product for 2020

## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 5: Advances in Agricultural Technology

#### TEACHING PROCEDURES

##### A. **Review**

Agriculture is a diverse industry. Many discoveries have been made in recent years that keep American agriculture on the leading edge of technology. There is a bright future for agriculture in America and for the people of this nation and the world. In this lesson, breakthroughs in agricultural technology and their effects on food and fiber production will be discussed.

##### B. **Motivation**

1. Pass out small, individual boxes of raisins to each student. While they eat the raisins, ask them to guess how much time it takes to process grapes into raisins. They should estimate the time needed to dump the product into the hopper, de-stem, sort by size and quality, wash, dry, package, and stack the containers. Write the students' answers on the board. The correct answer is 8 minutes. Show the video *Green Cows, Quags, and Mummies* available from the Missouri Resource Center for Career & Technical Education. Many of the concepts in the video have taken place. Discuss how technology will affect the production and marketing of food products in the future.
2. Using a microwave, cook two kinds of hot dogs, cut them into pieces, and have the students sample each. One package should be "all-beef" hot dogs. The other package should be made of turkey, chicken, or soybean products. Conduct a taste test to see which hot dogs students prefer. Explain the differences in the cost of the two products.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. What are recent changes in agriculture?

##### A1.

- a) **Computers**
  - 1) Maintenance of management records
  - 2) Communication by e-mail
  - 3) Information through the Internet
  - 4) Environmental monitoring of facilities
  - 5) Computer chips for animal identification
- b) **Mechanical**
  - 1) Electronic monitoring
  - 2) Laser-guided equipment
  - 3) Surveying instruments
  - 4) Robotics
- c) **Livestock management**
  - 1) Automated systems of feeding, watering, and waste disposal
  - 2) Totally controlled environments
  - 3) Increased building size and more located in areas favorable for production
- d) **Embryo transfer**

- 1) Eggs from superior female animals implanted into recipient females
- 2) Multiple offspring from one animal in a year
- e) Cloning
  - 1) Fertilized egg reproduced to create identical individual
  - 2) Individuals with superior genetics produced
- f) Genetically-modified crops or genetically-modified organisms (GMOs)
  - 1) Corn resistant to corn borer
  - 2) Soybeans resistant to herbicides
- g) Precision agriculture
  - 1) More efficiency through use of global positioning systems (GPSs)
  - 2) "Farming by the inch" made possible

Present AS 5.1 to students and discuss how advancements in agricultural research continue to change America.

**Q2. How will agriculture change in the future?**

**A2.**

- a) Biotechnology and precision agriculture will increase production.
- b) Crop yields will increase.
- c) Machinery and animals will become more cost efficient.
- d) Value added to products will create new uses for by-products.
- e) Combining science, agriculture, food, and health research will result in new products.

Technology has increased the production efficiency of American producers. New methods, equipment, and techniques have been developed to improve the quantity and quality of agricultural production. Some of the technology is very expensive and must be modified before it can be adopted in agriculture. Conduct AS 5.2 to get students thinking about future events.

**Q3. What are the implications of changes in agriculture?**

**A3.**

- a) The challenge is to continue to increase agricultural productivity with about the same amount of land.
- b) Global trade has increased and its importance must be recognized.
- c) New career opportunities will be created.

Have students complete AS 5.3 to stimulate their thinking about agricultural inventions that would be useful in the future.

**F. *Other Activities***

1. Invite a veterinarian, agronomist, or biotechnologist to class to discuss advances in technology.
2. Conduct a class experiment on hydroponics, growing plants in nutrient solutions without soil.
3. Have students do research papers on biotechnology.
4. Have students write an essay on what their town will be like in 50 years.
5. Invite a retired farmer to class to explain how technology has changed in agriculture.

G. **Conclusion**

Agriculture has and will continue to change. The fundamental goal will be to continue to produce quality food and fiber for the increasing population. New technology and research will help to increase productivity without compromising resources. Preserving natural resources is a top concern for everyone in agriculture. There will be many career opportunities in agriculture as the demand for food and fiber continues to increase.

H. **Answers to Activity Sheets**

AS 5.1 The Future and Change

There are no answers for this activity.

AS 5.2 Future Headlines

There are no answers for this activity.

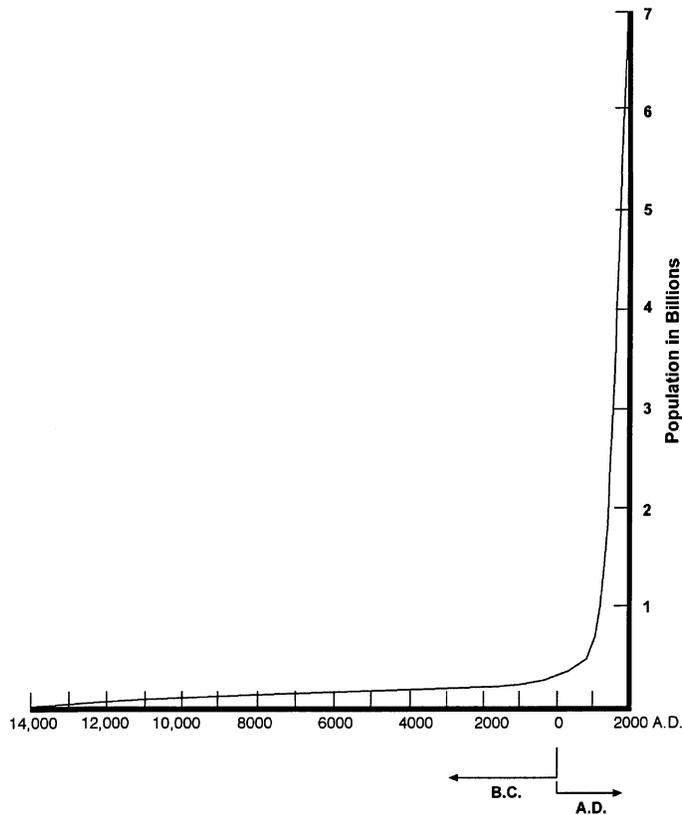
AS 5.3 Invent a New Product for 2020

The instructor should determine if the answers are appropriate.

I. **Answers to Evaluation**

1. c
2. a
3. d
4. a
5. b
6. b
7. c
8. d
9. a
10. c
11. b
12. d
13. b
14. c
15. d
16. c
17. d
18. a
19. c

20.



21. Any two of the following are correct: agriculture is more than farming, agriculture is the country's largest employer, variety of careers and opportunities, or bright future.
22. The instructor will need to determine if the answer is appropriate. Any one of the following is a suggested answer: hybrid seed corn developed, tractors replaced horses on farms, commercial fertilizers adopted, or crops improved through biotechnology.
23. a
24. c
25. c
26. f or g
27. c
28. c or b
29. e
30. e
31. e
32. b
33. d or g
34. c
35. f or e
36. g
37. c
38. f or e
39. c
40. c
41. g or c

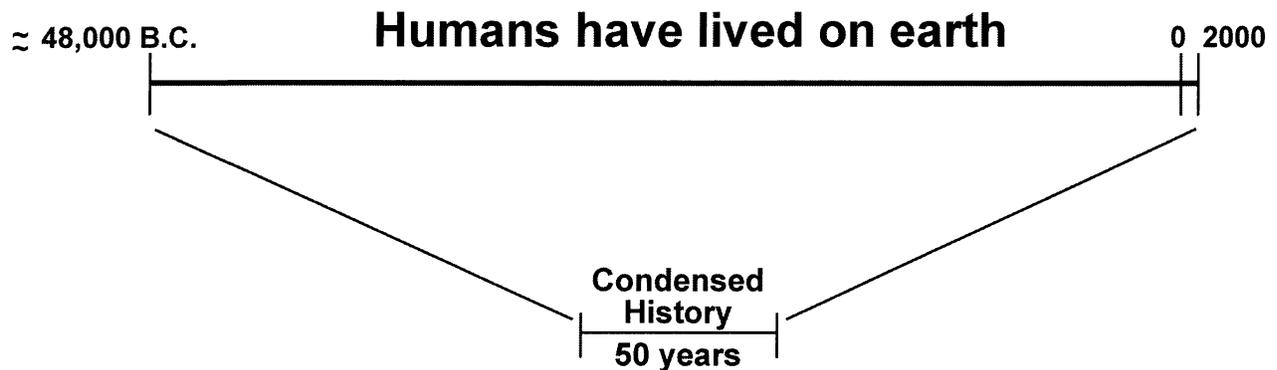


### The Future and Change

**Objective:** Students will gain perspective of the time humans have existed and will make predictions about the future.

**Directions:** Have students discuss the following questions.

1. Ask students how long people have been around. Many answers will be given. Lead the group into agreeing on the following scenario that can be put on the blackboard.



2. Read the following information to students. Fill in the correct dates or have students create a time line that could include more events that are significant to students.

There are many ideas about how long humans have been on the earth. According to some scientists, humans have lived on this planet about 50,000 years. Due to our limited time on earth, it is practically impossible for anyone to accurately conceive 50,000 years. However, to provide a reference, imagine that everything that has happened to humans has occurred in a reduced period of time, namely, 50 years. With the scale so reduced, here is a scenario of what has happened:

- 11 years ago, or in \_\_\_\_\_, humans stopped living in caves.
- 5 years ago, or in \_\_\_\_\_, picture writing was invented.
- 2 years ago, or in \_\_\_\_\_, Christianity began.
- Approximately 8 months ago, \_\_\_\_\_, the printing press was invented.
- 10 days ago, electricity was discovered.
- Yesterday, the Wright brothers flew their first airplane at Kitty Hawk.
- Television was invented this morning.
- Jets came into being since we began talking about the future and change.
- The last 60 seconds brought about all our operations in space.
- The computer was invented in the last 20 seconds.

Just about every convenience that makes up our material world, from cars to jets, has been invented within the last 24 hours.

3. What will education and the world be like in the new millennium? Technological advances change our lives on a daily basis.



### **Future Headlines**

**Objective:** Students will consider possibilities for future society.

**Materials and Equipment:**

Overhead transparencies  
Markers

**Procedure:**

1. Have students individually respond to the following question at the beginning of class, or assign this question as homework for the next day.

What do you predict will be the newspaper headlines in the year 2020?

Instruct them that agriculture has to be one of the areas for their predictions.

2. Review with students the basic rules of brainstorming.
  - a. Write down every idea.
  - b. Every idea or suggestion is a possibility (no put downs allowed).
  - c. The objective is to generate as long a list of ideas as possible.
  - d. The procedure is to go around the circle with each person offering one idea at a time.
3. Divide students into groups of three to five, depending on the size of the class.
4. After brainstorming, distribute the transparencies and markers to each group. Instruct the students to identify at least five of their favorite headlines, of which at least one must pertain to agriculture. (Sports, movies, music, cars, etc. are other possibilities.)
5. Have the groups share their headlines and discuss what the effects would be if their predictions were to happen.



**Invent a New Product for 2020**

**Objective:** Students will develop an idea for an invention that will be useful in the future of agriculture.

**Directions:**

1. Use magazines, books, agribusiness material, the Internet, etc., to research the latest in agricultural technology.
2. Use this research to invent a new agricultural product to be marketed in 2020.
3. Write a report that briefly explains the new product, its intended use, and its biggest advantage over the competition. Attach the magazine article, agribusiness material, or Internet information you used for research on the topic.
4. Prepare a brief oral report about your new invention.



UNIT EVALUATION

Circle the letter that corresponds to the best answer.

1. What is the meaning of the word agriculture in Latin?
  - a. Culture of growers
  - b. Merger of humankind and the environment
  - c. Science and art of cultivating the soil
  - d. Art of plants and animals
  
2. The largest industry in the United States is \_\_\_\_\_.
  - a. Agriculture
  - b. Automotive manufacturing
  - c. Computer technology
  - d. Transportation
  
3. Approximately \_\_\_\_\_ % of the jobs in the United States are related to agriculture.
  - a. 2
  - b. 5
  - c. 10
  - d. 20
  
4. Less than \_\_\_\_\_ % of the U.S. population are farmers.
  - a. 2
  - b. 5
  - c. 10
  - d. 20
  
5. The average American family spends approximately \_\_\_\_\_ % of its income for food.
  - a. 5
  - b. 11
  - c. 25
  - d. 32
  
6. Compared to other countries in the world, people in the United States enjoy \_\_\_\_\_ food prices and have \_\_\_\_\_ life expectancies.
  - a. Low, average
  - b. Low, long
  - c. Average, long
  - d. High, average

7. All of the following are top U.S. agricultural exports except \_\_\_\_\_.
- a. Soybeans
  - b. Consumer food (e.g., beef, pork, lamb)
  - c. Petroleum products
  - d. Grains (e.g., corn, oats, barley, sorghum, rye)
8. Agricultural differences throughout the world do not include \_\_\_\_\_.
- a. Climate
  - b. Soil fertility
  - c. Topography
  - d. Population
9. The United States imports \_\_\_\_\_ from Columbia, Brazil, and Mexico.
- a. Coffee
  - b. Automobiles
  - c. Petroleum products
  - d. Olives
10. In general, livestock production in the United States is located \_\_\_\_\_.
- a. In warmer regions
  - b. By research facilities
  - c. Where crops used for livestock food is readily available
  - d. On wheat farms
11. Which of the following choices is not a factor in why agriculture is successful in the United States?
- a. Favorable growing conditions
  - b. Good ventilation
  - c. Fertile soil
  - d. Many leaders, inventors, researchers, and scientists
12. One of the goals of U.S. agriculture is to \_\_\_\_\_.
- a. Learn how to grow bananas
  - b. Maintain traditions
  - c. Devote more land to farming
  - d. Protect the environment
13. Most of the first settlers who came to the United States were \_\_\_\_\_.
- a. Ship builders
  - b. Farmers
  - c. Blacksmiths
  - d. Carpenters
14. Based on statistics from 1998, Missouri is second in \_\_\_\_\_.
- a. Winter wheat and rice
  - b. Hay and cheese
  - c. Number of farms and number of beef cows
  - d. Turkeys and number of farmers

15. Missouri's hilly and wooded areas in the \_\_\_\_\_ provide timber, pasture, and favorable weather for growing fruits and vegetables.
- Central region
  - Northwest region
  - Northeast region
  - Ozarks
16. One of the ways Missouri agriculture has changed is that the \_\_\_\_\_.
- Medium-size farms have increased
  - Average age of producers has decreased
  - Number of producers under the age of 35 has decreased
  - Hiring in agribusinesses has declined
17. Which of the following choices is not a recent change in agriculture?
- Computer technology
  - Embryo transfer
  - Genetically-modified crops
  - Commercial fertilizer
18. One of the predicted changes for agriculture is \_\_\_\_\_.
- Increased crop yields
  - Machinery and animals will become obsolete
  - Biotechnology will decrease production
  - Precision farming will be phased out
19. Which of the following statements is not one of the implications of agricultural change?
- Crop yields will increase using the same amount of land.
  - Global trade will become increasingly important.
  - The United States will isolate itself from the world market.
  - New career opportunities will be created.

**Complete the following short-answer questions.**

20. Identify how world population has changed through history. Explain this by drawing a graph and properly labeling the horizontal axis (years) and vertical axis (population).

21. A fellow student asks you about the career opportunities in agriculture. What are two important points to tell the student?
  - a.
  - b.
  
22. There are many important events in U.S. agricultural history. Identify one that you personally consider significant and justify your selection.

**Match the career area of agriculture (a-g) with the job title. All are used at least once. Some job titles could have several answers, however select the one that describes its major job responsibility.**

- |           |                                    |    |                                       |
|-----------|------------------------------------|----|---------------------------------------|
| 23. _____ | Agricultural Electrician           | a. | Agricultural systems technology       |
| 24. _____ | Agricultural Journalist            | b. | Agricultural processing and marketing |
| 25. _____ | Agricultural Loan Officer (Banker) | c. | Agricultural supplies and services    |
| 26. _____ | Beekeeper                          | d. | Forestry                              |
| 27. _____ | Farm Broadcaster                   | e. | Horticulture                          |
| 28. _____ | Federal Meat Inspector             | f. | Production agriculture                |
| 29. _____ | Floral Designer                    | g. | Natural Resources                     |
| 30. _____ | Greenhouse Manager                 |    |                                       |
| 31. _____ | Landscape Architect                |    |                                       |
| 32. _____ | Meat Department Manager            |    |                                       |
| 33. _____ | Park Ranger                        |    |                                       |
| 34. _____ | Pet Shop Operator                  |    |                                       |
| 35. _____ | Raspberry Grower                   |    |                                       |
| 36. _____ | Soil Conservationist               |    |                                       |
| 37. _____ | University Professor               |    |                                       |
| 38. _____ | Vegetable Producer                 |    |                                       |
| 39. _____ | Veterinarian                       |    |                                       |
| 40. _____ | Youth Leader (4-H)                 |    |                                       |
| 41. _____ | Zoo Manager                        |    |                                       |

## UNIT II - PLANT SCIENCE

Lesson 1: The Importance of Plants

**Competency/Objective:** Describe how plants affect our lives.

### **Study Questions**

1. **What are the benefits of plants?**
2. **What are the areas of science related to plants?**
3. **What is the economic importance of plants in Missouri?**

### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit II.
2. *Turfgrass Management - Your Field of Dreams* (Ag Video 261). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia, 1990.
3. Transparency Master  
TM 1.1 Value of Leading Missouri Crops in 1998
4. Activity Sheets  
AS 1.1 Soil Dessert (Instructor)  
AS 1.2 Landscaping Plant Material Collection  
AS 1.3 Plant Science Businesses

## UNIT II - PLANT SCIENCE

### Lesson 1: The Importance of Plants

#### TEACHING PROCEDURES

##### A. **Introduction**

Plants are an important part of life. Without plants, humans would not be able to breathe or eat. They also help make the environment more enjoyable. This unit on plant science is designed to provide a basic understanding of the importance of plants and the related areas of agronomy and horticulture. It will provide information about plant growth and plant care, and students will have an opportunity to care for a plant and watch it grow.

##### B. **Motivation**

1. Conduct AS 1.1. Introduce basic concepts (e.g., common plant names, reproduction, benefits of plants, signs of plant health, and types of soil) that will be learned during this unit.
2. Bring in a wide variety of materials from horticulture and the related sciences. Mushrooms, ferns, garden flowers, lumber samples, fruits, vegetables, grain crops, cattails, cut flowers, and peanut butter are some examples. Have the students discuss how the items are similar and how they are different. Discuss how each item is or is not important to humans.
3. Have students identify and make a list of the houseplants that are in their homes and plants that grow in their yards and gardens. They may also use relatives' or neighbors' homes. Relatives and friends are encouraged to help them identify the plants. Discuss their plant lists and what benefits the plants provide.
3. Obtain scented geraniums and have students guess the fragrance after carefully rubbing the leaves. The foliage is used in potpourris and jellies, and the oil in the leaves is often distilled for perfume making.
4. Students will care for the plants each day that they grew earlier in the course.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What are the benefits of plants?**

##### A1.

- a) **Biological benefits**
  - 1) **Convert carbon dioxide to oxygen**
  - 2) **Provide food**
- b) **Physical benefits**
  - 1) **Provide materials for shelter**
  - 2) **Provide materials for clothing**
  - 3) **Provide shade, cooling, and wind control**
  - 4) **Reduce wind and water erosion**

- 5) **Provide energy sources**
- 6) **Provide habitat for wildlife**
- c) **Emotional benefits**
  - 1) **Provide beauty from landscapes and individual specimens**
  - 2) **Provide an enjoyable hobby**
  - 3) **Provide a relaxing effect**

Bring in several items made from plants that are important to people. Examples might include peanut butter, cotton clothing, a board, firewood, vegetables, fruits, and a blooming flower. Ask students why each item is important.

**Q2. What are the areas of science related to plants?**

**A2.**

- a) **Botany is the science of plants: anatomy, ecology, pathology, physiology, and taxonomy.**
- b) **Horticulture includes producing, processing, and marketing of fruits, vegetables, flowers, ornamental shrubs, and trees; nursery and landscaping; and turf management.**
- c) **Agronomy is the study of field crops and soil management.**
- d) **Forestry is the science of managing trees for lumber, paper, and other wood products.**

Bring in samples of plants that fall into these areas and discuss which area of plant science they belong in. Some examples might include algae or plankton for botany; field corn, cotton, or hay for agronomy; a walnut or redwood board to represent forestry; and examples of fruits, vegetables, and ornamental plants for horticulture. Assign AS 1.2 for students to complete by themselves or in teams. The fall quarter is an excellent time for this activity.

**Q3. What is the economic importance of plants in Missouri?**

**A3. The value of plants in Missouri in 1998 was approximately \$3 billion.**

Show TM 1.1 and ask students how they are personally affected by the various amounts of money represented in this chart. Is their life enriched in any way? What advantages do they enjoy? Are any members of their family affected by the plants in Missouri? Several businesses are derived from the economic importance of plants as seen in AS 1.3.

**F. *Other Activities***

- 1. Have people from plant industries talk to the class.
- 2. Make a bulletin board with examples of how people benefit from plants or with pictures of different plant science careers.
- 3. Take a field trip to a floral shop, greenhouse, nursery, orchard, agronomy research facility or park.
- 4. Have students make a bud vase or small flower arrangement.

**G. *Conclusion***

Plants are essential for humans to breathe and eat. Plants make life more comfortable because they provide shelter, clothing, and shade. Plants also make our world more pleasant through their beauty. Botany, horticulture, agronomy, and forestry are all related plant sciences. The

value of plants produced in Missouri in 1998 was approximately \$3 billion, which would make the Fortune 500 list.

H. ***Answers to Activity Sheets***

The instructor should determine if answers to all activity sheets are appropriate.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## Value of Leading Missouri Crops in 1998

Crop	Approximate Value (Millions of Dollars)
Soybeans	857
Corn	550
Hay	533
Winter wheat	137
Cotton	119
Rice	64
Grain sorghum	46
Floriculture	44
Tobacco	11
Potatoes	10
Watermelons	6
Apples	5
Peaches	4
Grapes	1
Oats	1

## Major Areas of Floriculture Production by Commercial Growers

Item	Wholesale Value (Millions of Dollars)
Bedding plants (flats) & baskets	21
Indoor/patio plants	11
Cut flowers	.6

Reference: *Missouri Farm Facts 1999*



### Soil Dessert

**Objective:** Students will become aware of some basic plant science concepts.

**Materials and Equipment:**

Ingredients for soil dessert recipe (see below)

One houseplant  
One medium flowerpot  
Plastic wrap  
Bowls  
Plates and spoons  
Serving utensils

Soil dessert recipe

24 oz. chocolate sandwich cookies (such as Oreos)  
1 cup powdered sugar  
8 oz. cream cheese  
Two 3-oz. boxes instant chocolate pudding  
2 cups milk  
One 12-oz. container whipped topping (such as Cool Whip)  
1 package gummy worms candy

**Procedure:**

Note: This activity is to be used as an interest approach and an introduction to basic concepts about soil and plants. Depending on the portion and number of students, a bigger batch of soil dessert may have to be made.

1. Complete steps 2 through 9 below before class begins.
2. Crush cookies (mixture one) and set aside.
3. Mix powdered sugar and cream cheese (mixture two) and set aside.
4. Mix instant chocolate pudding and milk, then blend with whipped topping (mixture three).
5. Layer the three mixtures in numerical order in the flowerpot, saving some crushed cookies (mixture one) to sprinkle on top.
6. Place gummy worms into the dessert.
7. Chill in a refrigerator for approximately three hours.
8. Put plastic wrap around the root system of the houseplant. The roots may have to be pruned. Put the houseplant in the soil dessert in the flowerpot.
9. Keep the rest of the mixtures in the refrigerator until needed.
10. Use the houseplant as an interest approach to begin the lesson. Place the houseplant on a table at the front of the classroom. Ask students the key questions below to assess their prior knowledge of some basic plant science concepts.

- a. What type of plant is it? What are some names of other common houseplants?
  - b. How does it reproduce? Could you cut off part of the plant and make a new one? (Actually do this, especially if it is a plant that can asexually reproduce.)
  - c. What does the plant provide us?
  - d. Is it a healthy plant? (You may want to select an unhealthy plant.) How can you tell and what do you look for?
  - e. What is in the potting mix or soil? Does the type of soil have an effect on the plant?
11. Finally, surprise the students by asking them if they would like a closer look at the soil. Serve them some soil.

**Landscaping Plant Material Collection**

**Objective:** Students will press, mount, and identify plants.

**Directions:** Collect, press, mount and correctly identify 12 plants from the list below. Your sample should be representative so a positive identification can be made. Be sure to include stems, leaves, flowers, and seeds as appropriate.

**Materials and Equipment:**

- Cardboard
- Newspaper or paper
- Heavy objects like books or bricks
- Clear contact paper

**Procedure:**

1. Immediately after collecting your sample, place it between a newspaper or other paper and then place it between some cardboard.
2. Place the cardboard, containing the sample, between or under books, bricks, or other heavy objects. The purpose of pressing the plant is to remove moisture and make a more representative sample.
3. Leave the plant in the press for 2 or 3 days.
4. Take the sample out of the press and cover it with clear contact paper.
4. Label the plant by common name and include a picture and description from the publication\* provided by your instructor.
5. Organize your collection by making a cover. Decide how to arrange the plants in the collection and put in a notebook, binder, ring, etc.

This major assignment is due on \_\_\_\_\_.

The collection is worth a total of 30 points with each plant worth 2 points. Neatness in labeling and applying contact paper, cover design, and organization will be worth 6 of the points. Up to 5 extra credit points can be earned by collecting more than 12 plants from the list or other plants found in the publication.

- |  |                                       |  |
|--|---------------------------------------|--|
| <input type="checkbox"/> Arborvitae          | <input type="checkbox"/> Ginkgo       | <input type="checkbox"/> Oak             |
| <input type="checkbox"/> Ash, White          | <input type="checkbox"/> Honey Locust | <input type="checkbox"/> Pine            |
| <input type="checkbox"/> Barberry            | <input type="checkbox"/> Juniper      | <input type="checkbox"/> Spruce          |
| <input type="checkbox"/> Birch               | <input type="checkbox"/> Linden       | <input type="checkbox"/> Winged Euonymus |
| <input type="checkbox"/> Dogwood             | <input type="checkbox"/> Maple        | <input type="checkbox"/> Yew             |
| <input type="checkbox"/> Flowering Crabapple |                                       |  |

\*Suggested publication: *Effective Landscaping*, Missouri Landscape and Nursery Association, 23750 State Route V, Clarksdale, MO 64430, 816-233-1481



Lesson 1: The Importance of Plants

Name \_\_\_\_\_

**Plant Science Businesses**

**Objective:** Students will be able to identify plant science businesses in the community.

**Directions:** Using a phone book, list the names of plant science businesses that are examples of the following categories.

- |   |                                |
|---|--------------------------------|
| 1. Nursery                                | 6. Lawn Management             |
| a.  | a.                             |
| b.  | b.                             |
| 2. Floral Designer                        | 7. Tree Specialist or Arborist |
| a.  | a.                             |
| b.  | b.                             |
| 3. Landscape Designer or Landscape Artist | 8. Seed Store                  |
| a.  | a.                             |
| b.  | b.                             |
| 4. Greenhouse                             | 9. Agronomist/Research         |
| a.  | a.                             |
| b.  | b.                             |
| 5. Golf Course                            |                                |
| a.  |                                |
| b.  |                                |



## UNIT II - PLANT SCIENCE

### Lesson 2: Plant Parts and Processes

**Competency/Objective:** Describe the parts of a plant and major processes.

#### **Study Questions**

1. **What are the functions of the parts of a plant?**
2. **How do plants reproduce?**
3. **What are the parts of a flower?**
4. **What is germination?**
5. **What is photosynthesis?**
6. **What is the difference between annuals, biennials, and perennials?**
7. **What is the difference between monocots and dicots?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000. Unit II.
2. Transparency Masters
  - TM 2.1 Main Parts of a Plant
  - TM 2.2 Plant Propagation
  - TM 2.3 Asexual Propagation Methods
  - TM 2.4 Methods of Taking Cuttings
  - TM 2.5 Parts of a Complete Flower
  - TM 2.6 Can You Name an Annual, Biennial, or Perennial?
  - TM 2.7 Monocot or Dicot?
  - TM 2.8 Stages in Germination and Emergence of a Monocot
  - TM 2.9 Stages in Germination and Emergence of a Dicot
3. Activity Sheets
  - AS 2.1 Starting Plants from Stem Cuttings (Asexual Propagation)
  - AS 2.2 Parts and Functions of a Complete Flower
  - AS 2.3 Effect of Light on Photosynthesis

## UNIT II - PLANT SCIENCE

### Lesson 2: Plant Parts and Processes

#### TEACHING PROCEDURES

##### A. **Review**

Plants provide people with oxygen to breathe, food to eat, clothing, shelter, and landscaping beauty. Many plant science careers are available in agronomy, horticulture, and forestry.

##### B. **Motivation**

1. Show examples of seeds that are small (bentgrass) and large (lima bean). Ask students if they are living or dead. What causes them to sprout (germinate)?
2. Bring in examples of plants showing different stress problems such as excessive light, too little light, excessive water, compacted soil, lack of fertilizer, or pollution damage. Discuss the plant problems and what caused them. Discuss how proper conditions would allow for better growth.
3. Is a room with plants healthier than one without? If this were true, why would plants make a difference? Discuss photosynthesis with students.
4. Demonstrate several methods of plant propagation. Examples may include air layering a rubber plant, grafting a fruit tree, planting a bulb or tuber, or dividing a perennial flower.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What are the functions of the parts of a plant?**

##### A1.

- a) **Roots**
  - 1) **Absorb water and minerals from the soil**
  - 2) **Anchor the plant**
  - 3) **Food storage area**
- b) **Stem**
  - 1) **Supports the plant's leaves and flowers**
  - 2) **Transports water, minerals, and manufactured food to all parts of the plant**
  - 3) **Site of some photosynthesis**
  - 4) **Food storage area**
- c) **Leaves**
  - 1) **Major producer of food for the plant (through photosynthesis)**
  - 2) **Food storage area**
  - 3) **Site of respiration and transpiration**
- d) **Flower**
  - 1) **Site of sexual propagation**
  - 2) **Source of fruit and seed**
  - 3) **Attracts pollinators**

Bring into class a flowering plant and have the class discuss the main parts. Ask students to tell the function of the main parts. Use TM 2.1 to display the main parts of a plant.

**Q2. How do plants reproduce?**

**A2.**

- a) **Sexually**
  - 1) **Sexual propagation occurs within the flower as a result of pollination.**
  - 2) **This produces fruit and seeds.**
- b) **Asexually**
  - 1) **Asexual propagation uses vegetative parts.**
  - 2) **Asexual techniques can produce new plants from leaves, stems, and roots, depending on the plant.**
  - 3) **There are several common asexual propagation methods.**
    - (a) **Cuttings**
    - (b) **Grafting**
    - (c) **Division**
    - (d) **Layering**
    - (e) **Budding**
    - (f) **Tissue culture**
  - 4) **There are four main reasons for using asexual propagation.**
    - (a) **Some plants do not produce seed or seeds are difficult to germinate.**
    - (b) **It is usually a faster process than seeding.**
    - (c) **It is more economical.**

Bring in some garden flower seeds to show the product of sexual propagation and how easily they may be handled. Also, bring in a banana and a naval orange to illustrate the need for asexual propagation due to their lack of viable seeds. Remind students about the seeds that they planted in Unit I, Lesson 1. Point out that starting plants from seed is sexual propagation. Use TMs 2.2, 2.3, and 2.4 to illustrate plant reproduction.

Bring in samples of several plants or pictures of plants propagated by the various asexual propagation methods. Discuss how they were propagated. Pass out AS 2.1 and demonstrate how to take stem cuttings, then allow students to take some cuttings. Students should be allowed to take cuttings from several different plants.

**Q3. What are the parts of a flower?**

**A3.**

- a) **Petals - attract insects for pollination**
- b) **Pistil**
  - 1) **Female structure of the flower**
  - 2) **Site of fruit and seed formation**
  - 3) **Contains the stigma, style, and ovary**
- c) **Sepal - protects flower in the early stages**
- d) **Stamen**
  - 1) **Male structure of the flower**
  - 2) **Produces pollen**
  - 3) **Contains the anther and filament**

Bring in a flower, such as a tulip, lily, or petunia, or a model of a flower to illustrate the different parts and explain their importance. Use TM 2.5 to review the process of pollination after discussing the parts of a flower. Have students complete AS 2.2 to test their knowledge on plant parts and functions.

**Q4. What is germination?**

**A4.**

- a) **Germination is the beginning of plant growth as seen by the sprouting of the seed.**
- b) **The seed is in a dormant, or resting, stage with a supply of food and a protective seed coat until the requirements for germination are met.**
- c) **The following are needed for a seed to germinate:**
  - 1) **Favorable temperature that varies by species**
  - 2) **Sufficient moisture**
  - 3) **Air**
  - 4) **Presence or absence of light (depends on plant species)**

Ask students for their definition of germination. Bring in some soybeans and cover them with water. Ask students what they think will happen to the soybeans overnight. The soybeans will swell to rupture the seed coat, the first stage of germination.

**Q5. What is photosynthesis?**

**A5. Photosynthesis is the process that occurs in green parts of plants. The chlorophyll in the plant reacts with water, carbon dioxide, and sunlight to produce oxygen and simple sugars.**

Bring in examples of plants with different leaf sizes and colors and have the students discuss how plants may differ in their ability to photosynthesize. Have students complete AS 2.3 to illustrate how light and lack of light affects plant growth.

**Q6. What is the difference between annuals, biennials, and perennials?**

**A6.**

- a) **Annuals are plants that complete their life cycle (grows, flowers, produces seed, and dies) in one year.**
- b) **Biennials are plants that grow during one year and flower, produce seed, and die during the next year. They live for two years.**
- c) **Perennials are plants that live for more than two years. They can grow year after year without replanting.**

Ask students to identify common plant examples that are annuals, biennials, and perennials. Use TM 2.6 to show examples of each life cycle.

**Q7. What is the difference between monocots and dicots?**

**A7.**

- a) **Monocots (e.g., corn, wheat)**
  - 1) **One cotyledon (seed leaf)**
  - 2) **Leaves with parallel veins**
  - 3) **Fibrous root system**
- b) **Dicots (e.g., soybeans, alfalfa)**
  - 1) **Two cotyledons**
  - 2) **Leaves with netted veins**
  - 3) **Taproot system**

Summarize using TMs 2.7, 2.8, and 2.9 to illustrate the differences in physical makeup and germination stages.

F. **Other Activities**

1. Do an in-depth study of one of the propagation techniques and demonstrate it to the class.
2. Ask someone from a nursery to demonstrate advanced propagation techniques, such as grafting, budding, or tissue culture.
3. Get a tissue culture kit from a science supply company (e.g., Carolina Biological Supply Co.). Do the tissue culture experiment with the help of the class.
4. Bring in potatoes and have the students cut them into pieces and plant them in pots. Have the students discuss why they will grow.
5. Show the videos *Plant Propagation* Vol. I and II (Ag Video 46 & 47) available from the Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.

G. **Conclusion**

Plants have major parts that serve important functions and are important for plant survival or reproduction. Plants can be reproduced sexually by germinating seeds or asexually using vegetative plant parts. The main parts of a flower are the petals, pistil, sepal, and stamen. Germination is the sprouting of a seed when conditions are favorable. Photosynthesis occurs when the chlorophyll in the plant reacts with water, carbon dioxide, and sunlight to produce oxygen and simple sugars (food for the plant). The plant's life cycle may be completed in one year (annual), two years (biennial), or more than two years (perennial). Plants may be classified as monocots (single-seed leaf) or dicots (two-seed leaves).

H. **Answers to Activity Sheets**

AS 2.1 Starting Plants from Stem Cuttings (Asexual Propagation)

The instructor should determine if the student completes the activity in an appropriate manner.

AS 2.2 Parts and Functions of a Complete Flower

- |    |          |
|----|----------|
| A. | Petals   |
| B. | Anther   |
| C. | Filament |
| D. | Stamen   |
| E. | Sepal    |
| F. | Ovary    |
| G. | Style    |
| H. | Stigma   |
| I. | Pistil   |
- 
- |    |   |
|----|---|
| A. | Attracts insects for pollination                        |
| D. | Male part of flower, produces pollen                    |
| E. | Protects the flower in the bud stage                    |
| I. | Female part of flower, site of fruit and seed formation |

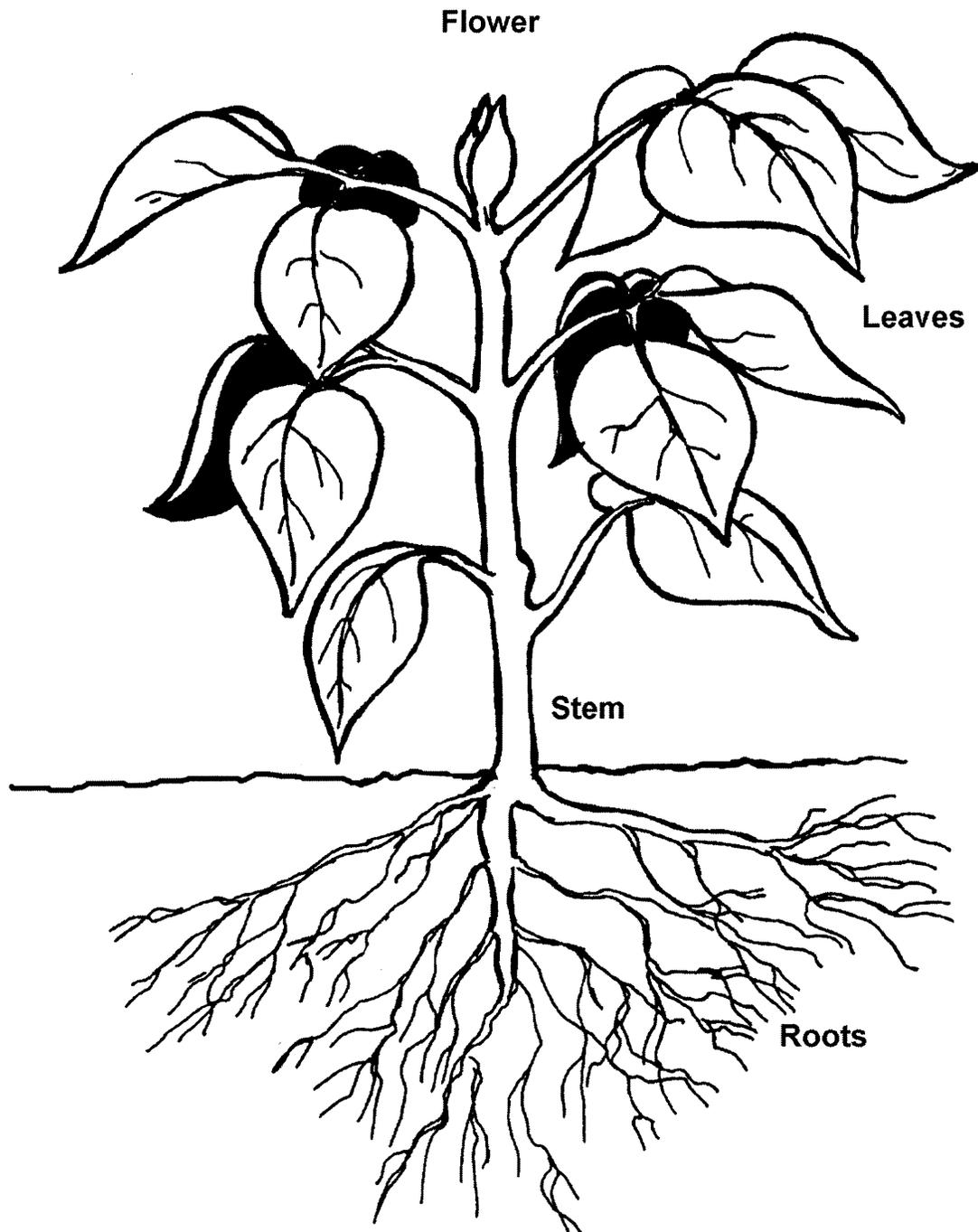
AS 2.3 Effect of Light on Photosynthesis

The instructor should determine if answers are appropriate.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# Main Parts of a Plant





# Plant Propagation

Propagation – To increase in number, to reproduce

## Two Methods

- 1) Sexual – by seed
- 2) Asexual – vegetative method

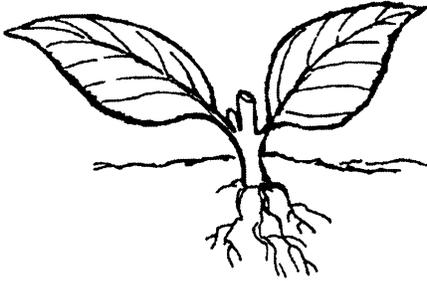
## Examples of Asexual Propagation

- 1) Cuttings
- 2) Grafting
- 3) Division
- 4) Layering
- 5) Budding
- 6) Tissue culture

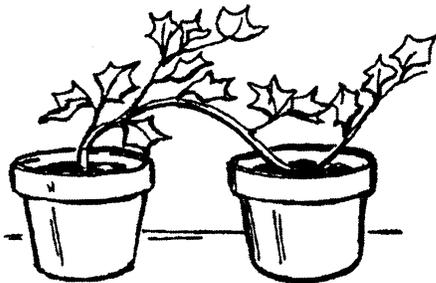
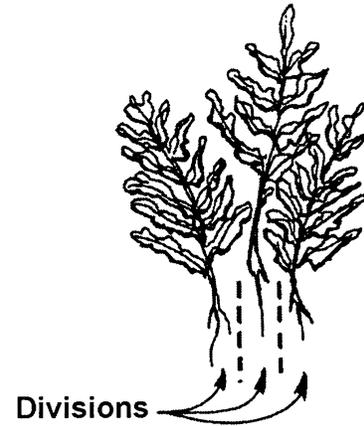


# Asexual Propagation Methods

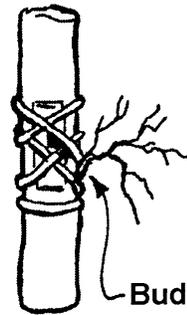
Cutting



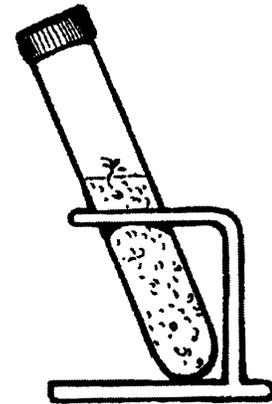
Grafting



Layering



Budding

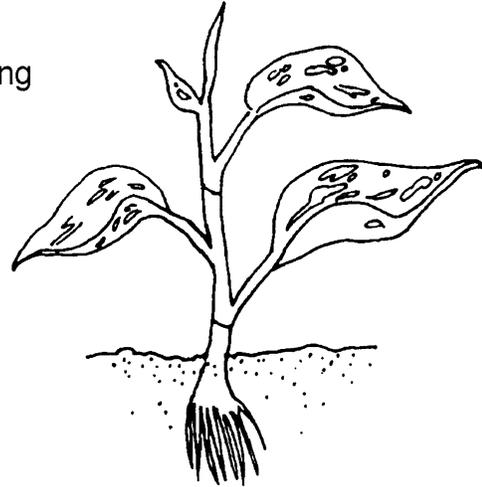
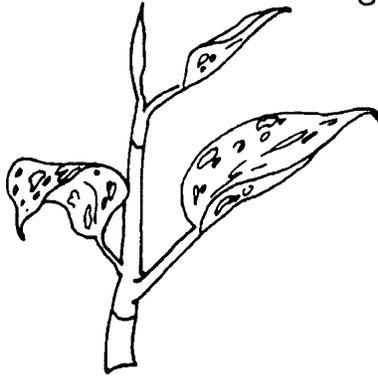


Tissue Culture

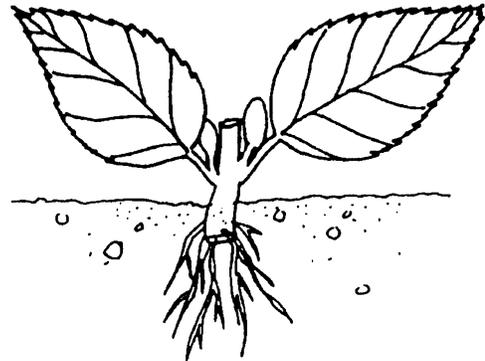
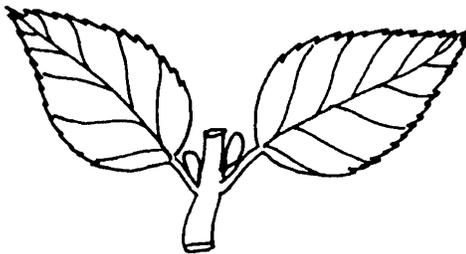


# Methods of Taking Cuttings

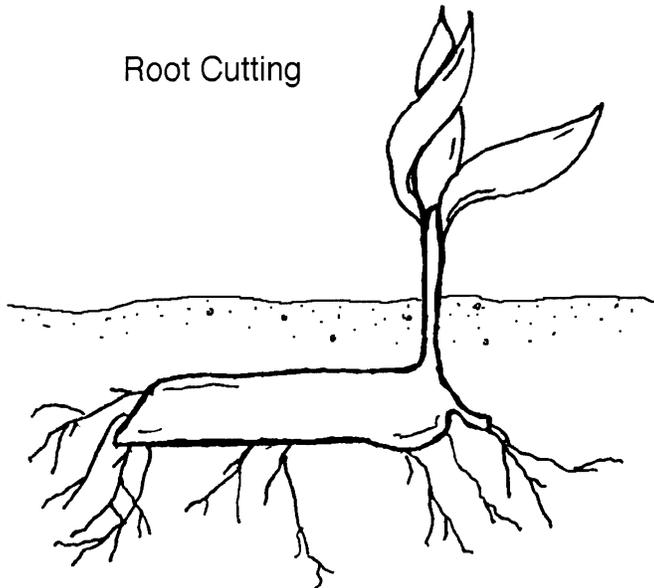
Stem Cutting



Leaf and Bud Cutting

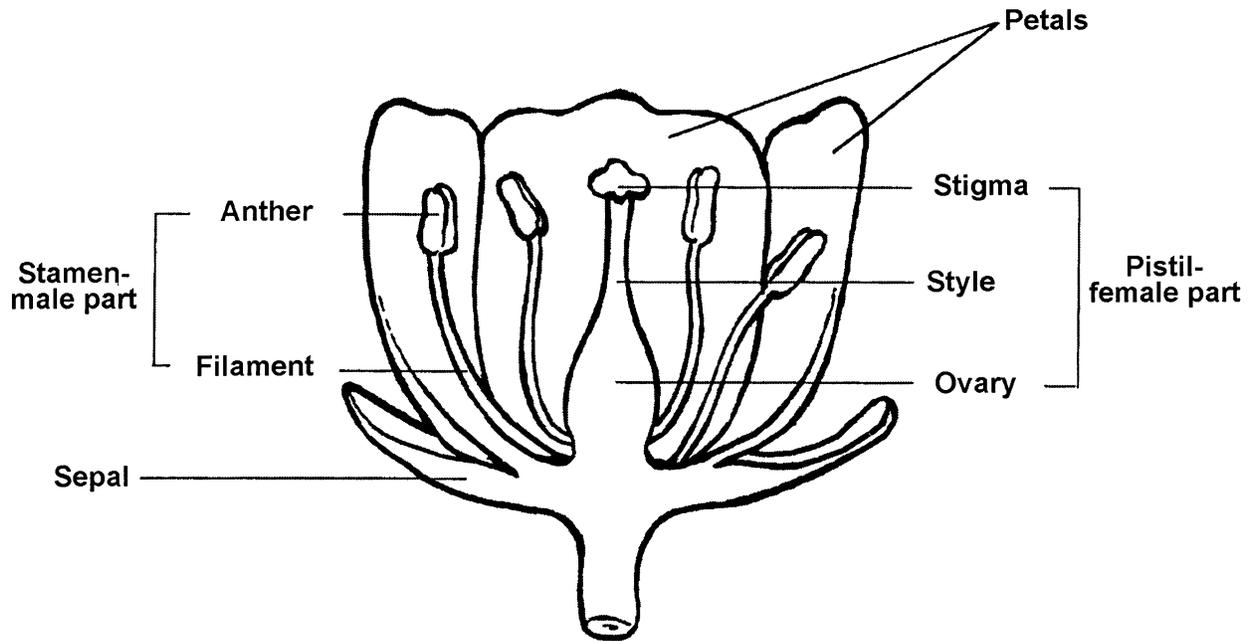


Root Cutting





# Parts of a Complete Flower





# Can You Name an Annual or Perennial?

**Annual**

**Vegetables:** Cucumber  
 Lettuce  
 Peas  
 Radish  
 Snap bean  
 Sweet corn

**Flowers:** Petunia  
 Geranium  
 Impatiens  
 Marigold

**Perennial**

**Vegetable:** Asparagus

**Fruit:** Strawberry

**Flowers:** Chrysanthemum  
 Hibiscus  
 Peony

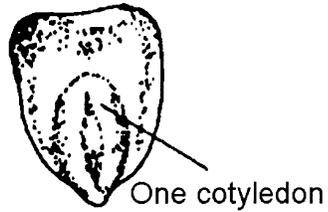
**All trees**

**Source:** *Introduction to Horticulture: Science and Technology* (1995)

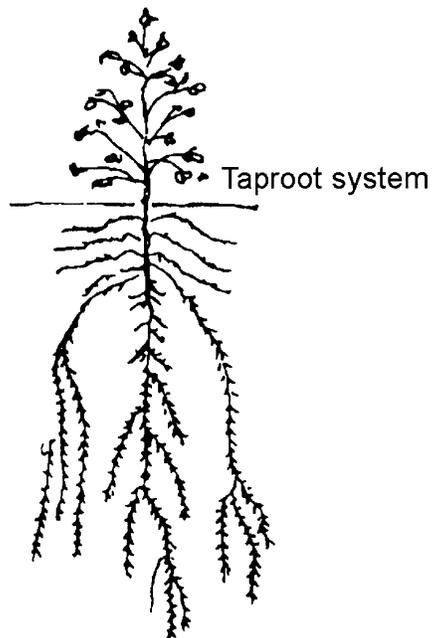
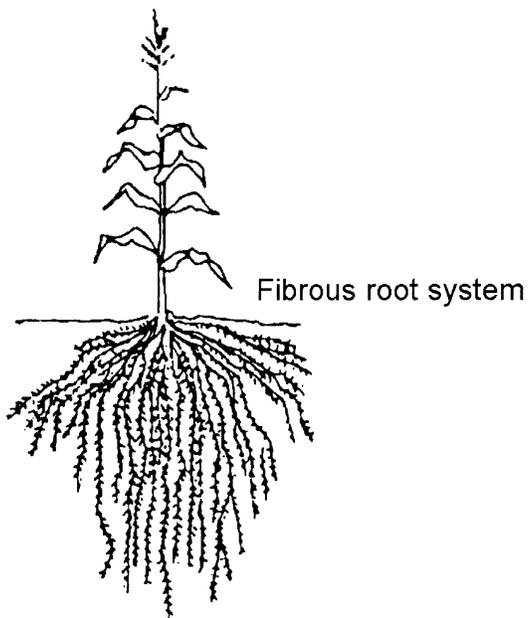
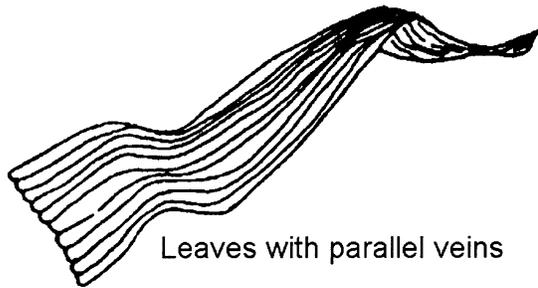
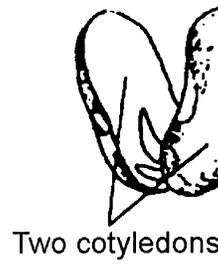


# Monocot or Dicot?

MONOCOT (e.g. Corn)

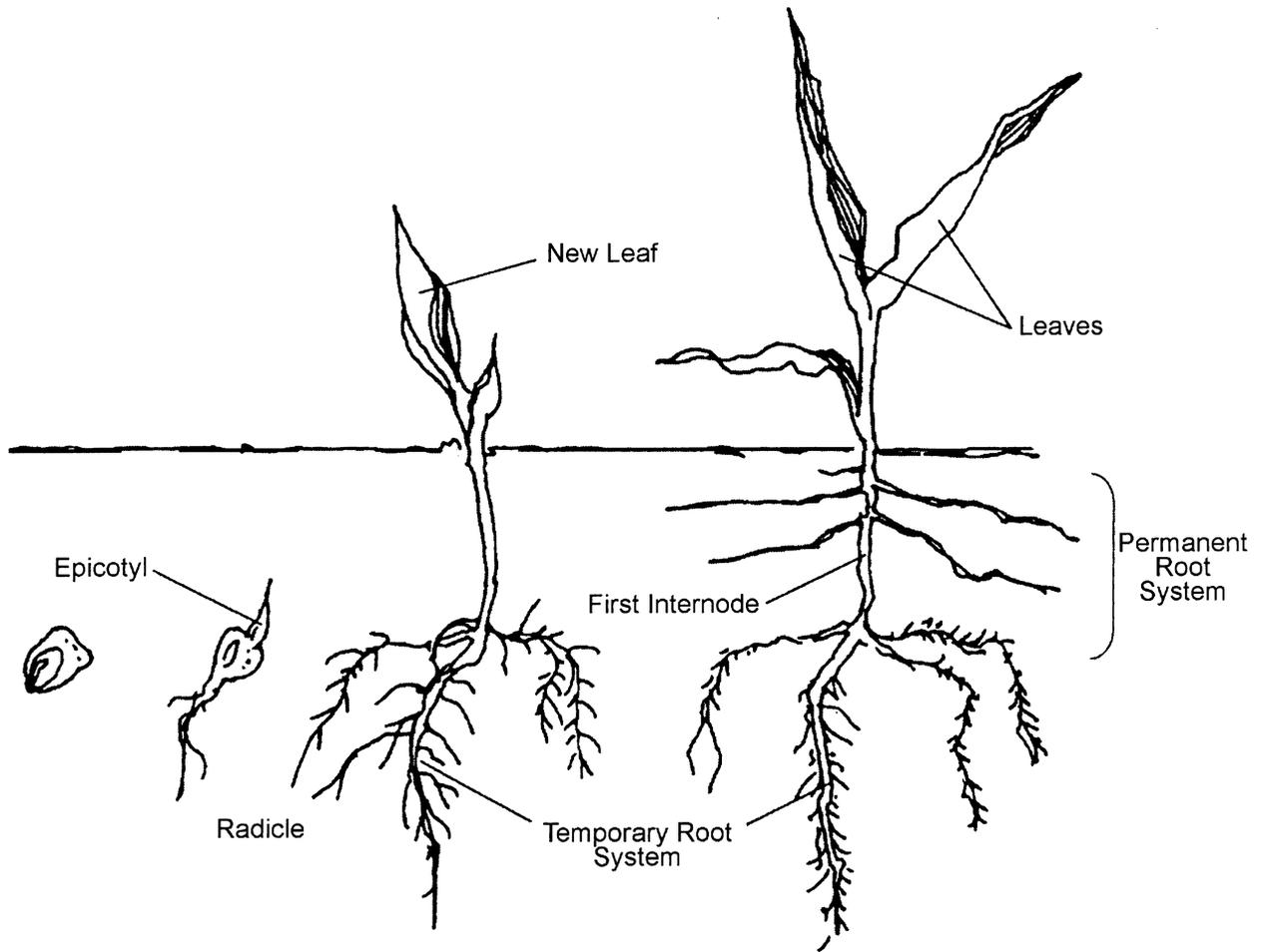


DICOT (e.g. Bean)



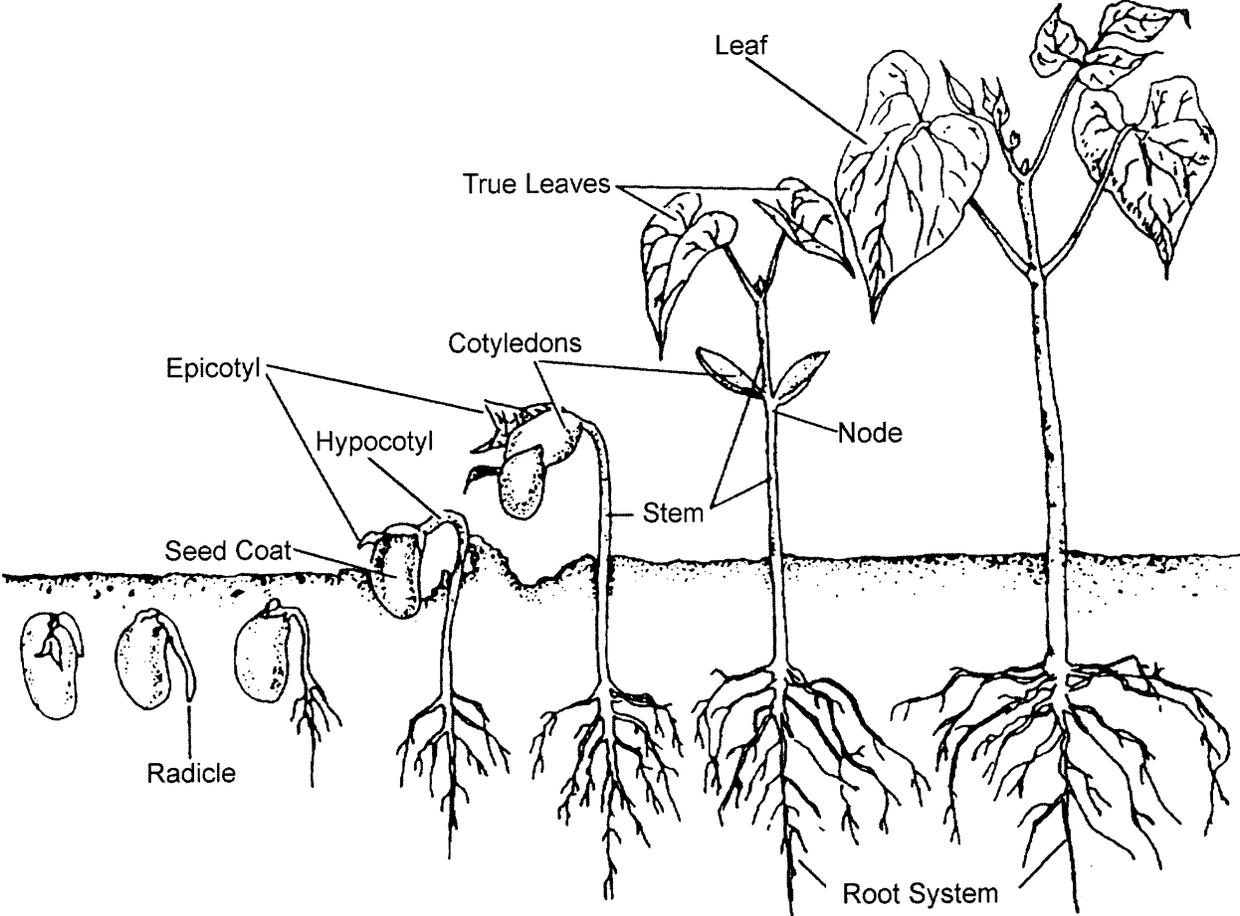


# Stages in Germination and Emergence of a Monocot





# Stages in Germination and Emergence of a Dicot





**Starting Plants from Stem Cuttings  
(Asexual Propagation)**

**Objective:** Students will be able to start a plant from a stem cutting.

**Materials and Equipment:**

Potting soil  
Pot, flowerpot, cup, etc.  
Plant for stem cutting such as Swedish ivy  
Rooting hormone  
Knife  
Water  
Small clear plastic bag with tie

**Procedure:**

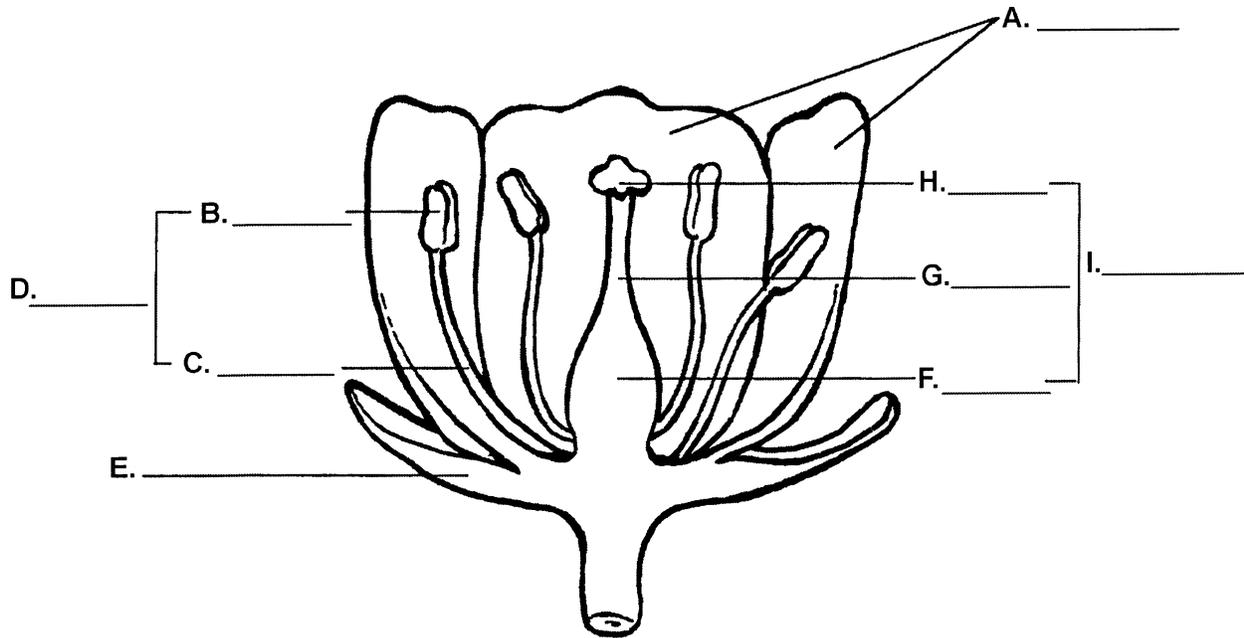
1. Watch the instructor demonstrate how to start plants from stem cuttings.
2. If you are using a cup instead of a pot, place a small hole in the bottom so the water can drain out.
3. Fill the pot with the soil up to 1/2 inch from the top.
4. Use your finger to make a hole 1 inch deep in the soil.
5. Take the stem cutting from a plant determined by the instructor.
6. The cutting should have three to seven leaves or nodes.
7. Remove the bottom two leaves from the stem.
8. Place rooting hormone on the bottom 1/2 inch of the stem.
9. Insert the cutting into the soil and firm the soil around it.
10. Water thoroughly.
11. Place the pot in a small clear plastic bag and tie it closed to hold in the moisture.
12. Place the pot in a well-lighted area.
13. Check the pot every day. Open the plastic bag and water the soil when it is dry to the touch.



**Parts and Functions of a Complete Flower**

**Objective:** Students will be able to identify the parts of a complete flower and give their functions.

**Directions:** Label the parts of a complete flower and give their functions below.



Functions:

A. \_\_\_\_\_

D. \_\_\_\_\_

E. \_\_\_\_\_

I. \_\_\_\_\_







## UNIT II - PLANT SCIENCE

### Lesson 3: The Growing Medium

**Competency/Objective:** Describe the importance of the growing medium to plants

#### **Study Questions**

1. **What is soil?**
2. **What are the components of soil?**
3. **What is a growing medium?**
4. **What is a soilless mix and where is it used?**
5. **What is hydroponics?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit II.
2. Transparency Masters
  - TM 3.1 Components of Soil
  - TM 3.2 Relative Sizes of Sand, Silt, and Clay
  - TM 3.3 What Is in a Soilless Mix?
  - TM 3.4 Aquarium Hydroponic System
3. Activity Sheets
  - AS 3.1 Examining Soil
  - AS 3.2 Water-Holding Capacity of Soil (Instructor)
  - AS 3.3 Design Your Own Medium

## UNIT II - PLANT SCIENCE

### Lesson 3 - The Growing Medium

#### TEACHING PROCEDURES

##### A. **Review**

The major parts of plants are essential to the growth and reproduction of the plant. The roots and stem absorb and transfer nutrients, the leaves are the primary site for photosynthesis, and the flower is the site of sexual reproduction. Many plants can also be reproduced by asexual (vegetative) methods using stems, leaves, and roots.

##### B. **Motivation**

1. Obtain a soil profile(s) (monolith(s)-undisturbed sample in a frame) from the soil and water conservation district in your area and measure the depth of topsoil. Discuss other differences that can be seen.
2. Obtain samples of different colors of soil (light, dark, red, mottled, gray, etc.) and ask students why there is a variation in color. There are several explanations as follows. Color of soil can be a result of rainfall and vegetation. In general, more rainfall results in more vegetation. This increased organic matter coats the mineral particles of soil and gives it a dark color. Brighter subsoils (red and yellow) result from low-moisture levels. Dark subsoils (gray tones) result from poor air and water relationships as evident in water-logged soils.
3. What is the difference between soil and dirt? Discuss this question with students.
4. Ask students the ways soil is important to them.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### Q1. **What is soil?**

###### A1.

- a) **Soil is the naturally occurring top layer of the earth's surface that provides food, water, air, and support for plant life.**
- b) **Soil is a natural resource that humans depend on for food, clothing, and materials for shelter.**
- c) **Soil is composed of a great amount of life. Scientists agree there is more life below the surface of the earth than there is above it. The life-forms are earthworms, insects, bacteria, fungi, and many other microscopic organisms.**
- d) **Soil is not dirt. Dirt is misplaced soil.**

Prepare for AS 3.1 by obtaining some soil. Using a spade, obtain soil that includes the vegetation on top, the topsoil, and subsoil. Place the soil on shop or classroom tables and have students identify and list all items found in the soil. Depending on the time of year and weather conditions, this activity could be conducted outside at a field or other location near the school. In either case, the instructor will do the digging and provide the soil. When completing AS 3.1, the students must be encouraged to examine and sort

through the soil. This activity will lead into identifying the components of soil. The students will also identify items that cannot be seen (fungi, bacteria, etc.).

**Q2. What are the components of soil?**

**A2.**

**The ideal soil contains the following components:**

- a) 45% mineral matter - inorganic (not from plants or animals) and varies in size**
  - 1) Sand - largest particles**
  - 2) Silt - medium-size particles**
  - 3) Clay - smallest particles**
- b) 5% organic matter - originates from a living source, usually a plant or animal**
- c) 25% water**
- d) 25% air**

Use TM 3.1 to review components of soil and TM 3.2 to demonstrate relative sizes of mineral matter particles. Conduct AS 3.2 to illustrate the water-holding capacity of soil. Have students assist you as you conduct this activity. The instructor may want to organize this activity by groups. In this case, ensure that proper safety rules are followed.

**Q3. What is a growing medium?**

**A3.**

- a) Growing medium (singular) or growing media (plural) are the materials in which the roots of plants grow.**
- b) The growing medium supports, or anchors, the plant in place, even after watering.**
- c) The growing medium must retain sufficient moisture, yet be porous enough to allow excess water to drain.**

Plants derive nutrients from a variety of growing media. Each plant has its own medium that supports its growing needs best.

**Q4. What is a soilless mix and where is it used?**

**A4.**

- a) A soilless mix is a medium that contains no soil.**
- b) Soilless mixes contain various combinations of the following materials.**
  - 1) Perlite - gray-white material of volcanic origin used to improve aeration**
  - 2) Vermiculite - heat-treated mica (a very thin, layered mineral) with a high moisture-holding capacity**
  - 3) Peat moss - partially decomposed vegetation with a high moisture-holding capacity**
  - 4) Tree bark - usually the bark of fir, pine, or cedar as a source of organic matter**
- c) Almost all greenhouses and nurseries use a soilless medium to grow plants in flats, pots, and other containers.**

Use TM 3.3 to discuss the items found in a soilless mix. Put each of the items (perlite, vermiculite, peat moss, and tree bark) in a separate sealed plastic bag and pass them around the class during discussion.

Have students examine the contents of a soilless medium and identify each of the components listed on the label. Finally conduct AS 3.3 to have students design their own medium. Before conducting this activity, pasteurize the sand and soil by heating at 180° F for at least 30 minutes.

**Q5. What is hydroponics?**

**A5.**

- a) **Hydroponics is a method of growing plants in water (nutrient solution) rather than soil.**
- b) **This technique is used to grow high-value crops in greenhouses, especially during the winter.**
- c) **Some hydroponic systems use sand, gravel, rockwool, peatlite, or sawdust, rather than soil.**
- d) **Bare root systems mist the roots of plants at regular intervals with a nutrient solution, use shallow pools with plants floating on the surface, or use recirculating streams of nutrient solutions.**

Explain hydroponics to the students using TM 3.4 to illustrate.

**F. *Other Activities***

1. Invite an agronomist, horticulturist, soil conservationist, turf manager, etc., to speak to the class.
2. Take a field trip to a greenhouse to assist in mixing media and transplanting seedlings, and to observe a hydroponics system, etc.
3. Take a soil sample of the school lawn and have students analyze the soil using a soil testing kit. Kits can be obtained from companies such as NASCO, 1-800-558-9595. Optionally, the sample can be sent to a commercial lab for analysis and students can review the analysis.
4. Tour a golf course and have the superintendent discuss how the course was managed relative to the growing medium.
5. Grow plants hydroponically in an aquarium or at the school greenhouse.
6. Have students investigate the produce department at area grocery stores and report if vegetables have been grown hydroponically. Rather than ask produce workers, have students check for labels indicating the process was used. Optionally, this activity could be assigned for extra credit to have one student call an area store.

**G. *Conclusion***

The plant's underground environment is very important to its overall health. Nearly every product people use or consume can be traced back to the soil. The ideal soil is 45% mineral matter, 5% organic matter, 25% water, and 25% air. The growing medium is the material in which the roots of plants grow and is critical to the overall health of a plant. Today almost all greenhouses and nurseries use a soilless mix to grow plants in flats, pots, and containers. Hydroponics is a technique of growing plants in water (nutrient solution) rather than soil.

**H. *Answers to Activity Sheets***

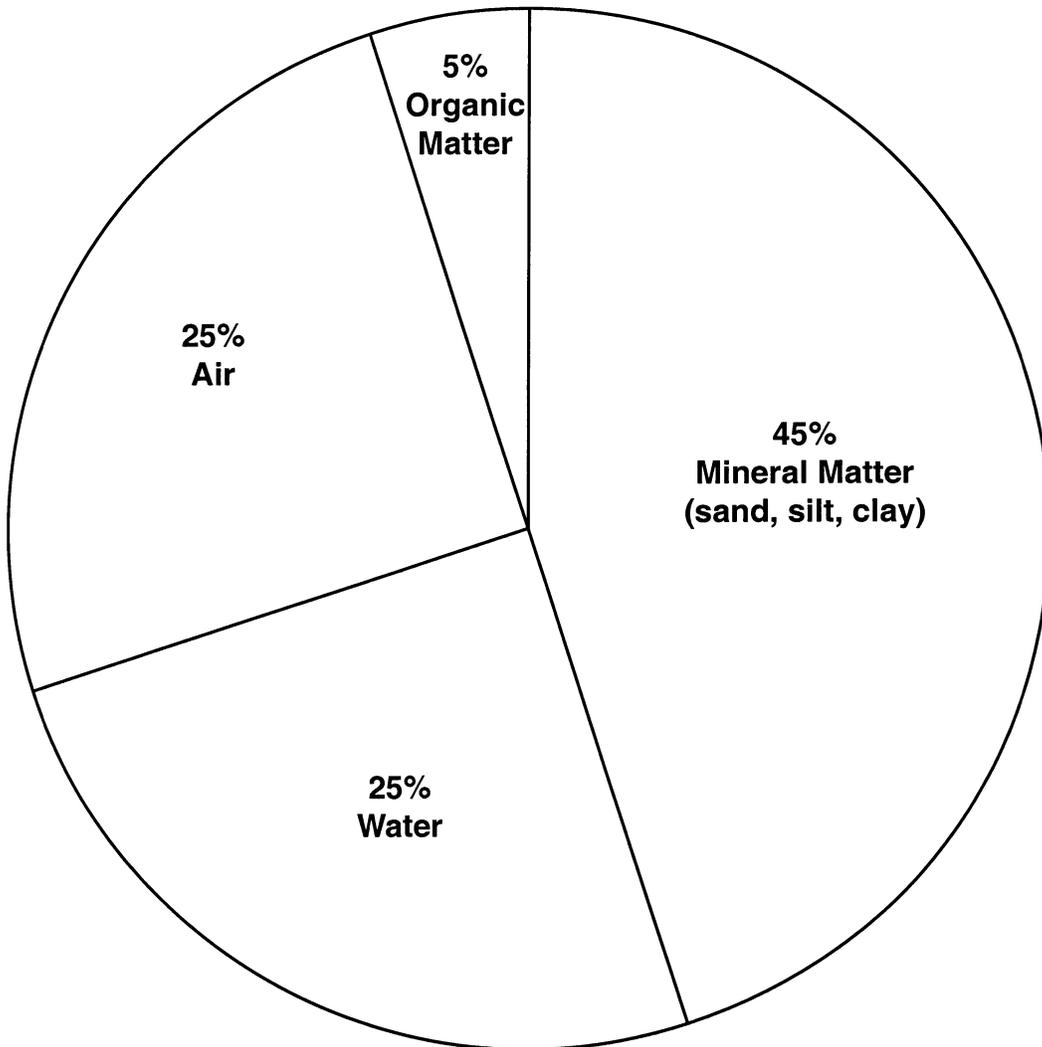
The instructor should determine if the answers are appropriate.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

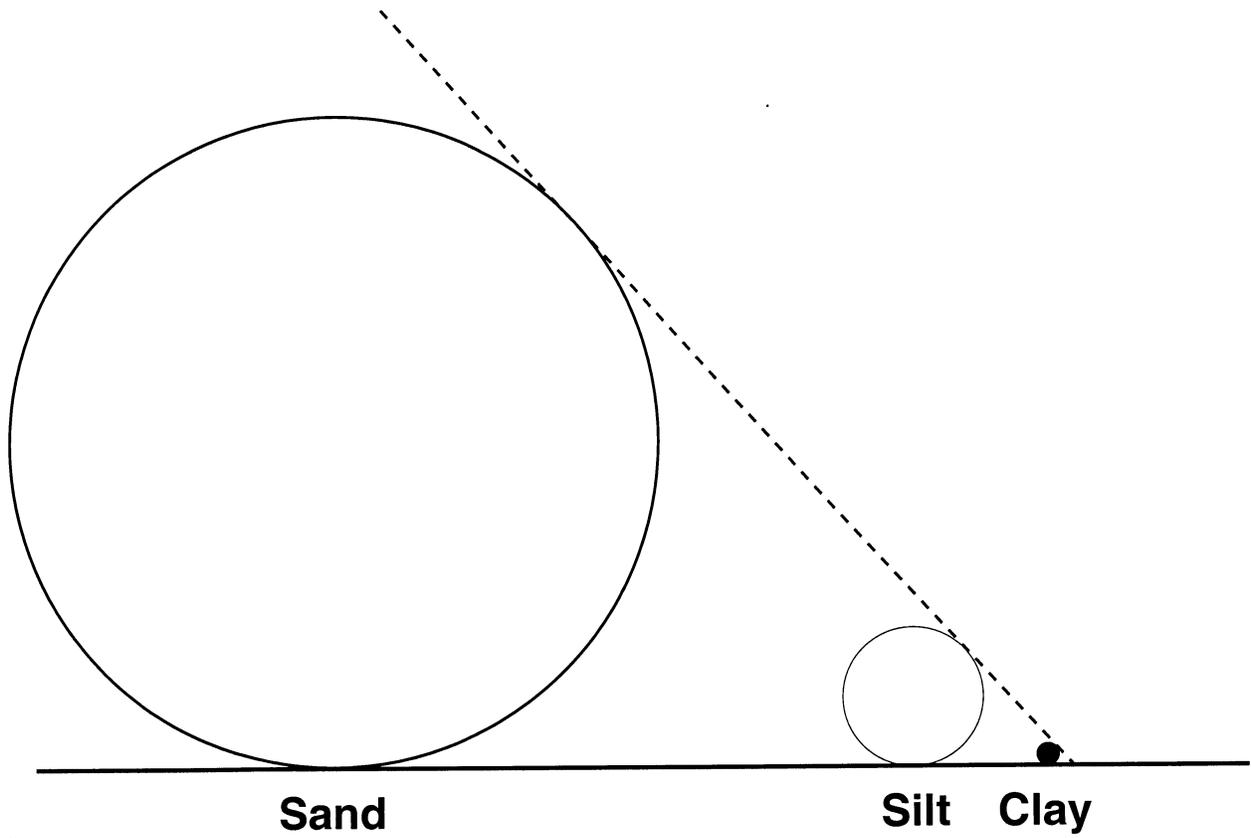


# Components of Soil





# Relative Sizes of Sand, Silt, and Clay





## What Is in a Soilless Mix?

### **Perlite**

- Gray-white material of volcanic origin
- Improves aeration

### **Vermiculite**

- Heat-treated mica
- Improves moisture-holding capacity

### **Peat Moss**

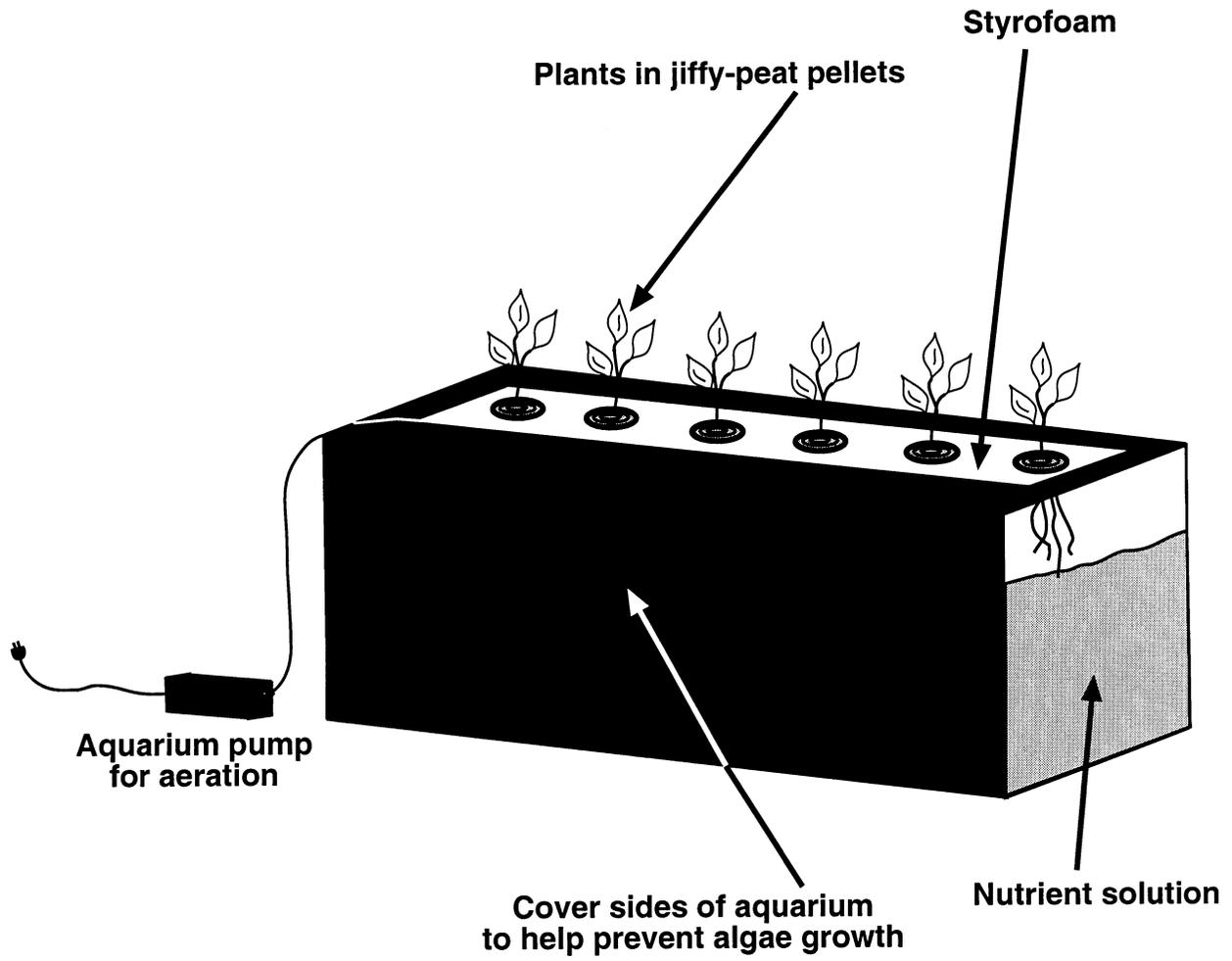
- Partially decomposed vegetation
- Improves moisture-holding capacity

### **Tree Bark**

- 1/4" diameter or less pieces of fir, pine, or cedar bark
- Source of organic matter



# Aquarium Hydroponic System









**Water-Holding Capacity of Soil**

**Objective:** Students will identify the water-holding capacity of soil.

**Materials and Equipment:**

- Three 1-gallon containers (e.g., plastic milk containers)
- Three soil samples with different particle sizes (sand, loam, and clay)
- Measuring equipment to collect water (1/2 gallon)
- Timer

**Procedure:**

1. With a nail and hammer, punch small holes in the caps of the 1-gallon containers. Cut a hole in the bottom of each container so soil and water can be added.
2. Select three students to assist. One student fills the first gallon container with sand, another student fills the second with loam, and the third student fills the last container with clay. Do not completely fill each container, but rather fill the container about ¾ full.
3. Have each student place the measuring equipment under his/her container to collect the water.
4. Each student then slowly pours ½ gallon of water into his/her container.
5. The entire class records the following observations in the table below.

SOIL	AMOUNT OF WATER COLLECTED				
	After 1 min.	After 2 min.	After 3 min.	After 4 min.	After 5 min.
Sand					
Loam					
Clay					

6. Students record their conclusions from this experiment.



**Design Your Own Medium**

**Objective:** Students will design a medium for plants.

**Materials and Equipment:**

- Seedlings or small plants started by you or supplied by the instructor
- Cups/containers for measuring parts
- Quart or ½ gallon container for medium
- Flats or containers for mixing the ingredients
- Perlite
- Vermiculite
- Peat moss
- Pasteurized sand
- Pasteurized soil

**Procedure:**

1. Select each ingredient you want for your medium.
2. Match the total amount of medium to your container size. For example, a medium for a quart container could consist of 1 cup (part) of peat moss, 1 cup of perlite, 1 cup of sand, ½ cup of vermiculite, and ½ cup of soil.
3. Measure each ingredient using cups or containers and record the information in the chart below.

INGREDIENT	WEIGHT OR PARTS

4. Mix and blend the ingredients so your medium is a uniform consistency.
5. Transplant the seedling or small plant into your container.
6. Pour your medium around the plant's root system and then fill the entire container.
7. Water the plant and check for dryness at regular intervals. Water when the medium is dry to the touch.



## UNIT II - PLANT SCIENCE

Lesson 4: Plant Care Requirements

**Objective:** Identify the important factors to consider in caring for plants

### **Study Questions**

1. **What are the factors affecting plant growth?**
2. **What are the essential nutrients for plant growth?**
3. **What care should be provided for indoor plants?**
4. **What care should be provided for outdoor plants?**

### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit II.
2. Transparency Masters  
TM 4.1 What Do the Numbers 10-15-10 Mean?  
TM 4.2 Rules of Proper Watering
3. Activity Sheets  
AS 4.1 Plant Care Contest (Instructor)  
AS 4.2 Plant Care Requirements

## UNIT II - PLANT SCIENCE

### Lesson 4: Plant Care Requirements

#### TEACHING PROCEDURES

##### A. **Review**

The previous lesson focused on the underground environment of plants, which is very important to their overall health. Nearly every product people use or consume can be traced back to the soil. This lesson will focus on the aboveground needs and the essential nutrients for plant growth.

##### B. **Motivation**

1. Ask students how many have houseplants at home. Discuss the problems they have noticed. Identify procedures a parent, brother/sister, or they do that result in healthy plants. See if the concept of proper watering of houseplants surfaces as the number one factor in plant survival.
2. Bring in samples of healthy plants and samples of plants showing water stress, soil problems, sun damage, or pest problems. Have students look at the top growth and root system. Discuss the differences between the healthy plants and those with problems. Discuss how proper care could help prevent these problems.
3. Ask students what humans need to survive. What do plants need to survive and grow?
4. Have students begin AS 4.1. Remind them that the information they learned earlier about plants will assist them in this activity.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. What are the factors affecting plant growth?

##### A1.

- a) **Water**
  - 1) **Essential for photosynthesis**
  - 2) **Maintains cell shape**
  - 3) **Enables nutrients to be absorbed and transported throughout the plant**
  - 4) **Transports manufactured food to all parts of the plant**
- b) **Growing medium**
  - 1) **Provides support for the roots**
  - 2) **Allows water and air filtration and movement**
  - 3) **Stores needed nutrients**
- c) **Nutrients (fertilizer) - 16 nutrients essential for plant growth**
- d) **Light**
  - 1) **Plants need different levels of light intensity.**
  - 2) **Light is required for photosynthesis.**
- e) **Temperature**
  - 1) **Plants differ greatly in their tolerance for hot and cold temperatures.**
  - 2) **Extremes in temperature can cause slow growth, fruit or flower damage, or death of the plant.**

- f) **Humidity - to help prevent leaves from drying**
- g) **Gases - important in photosynthesis**
- h) **Pest control - increases plant growth**

Bring in samples of plants with different water requirements, such as cactus, water lily, and philodendron. Discuss how knowledge of their water requirements is important. Also bring in plants that have different light requirements, such as ferns, hostas, and geraniums. Discuss how trying to grow them under the same conditions will result in the death of some plants.

**Q2. What are the essential nutrients for plant growth?**

**A2. The 16 essential nutrients are broken down into four categories:**

- a) **Primary macronutrients (large amounts)**
  - 1) **Nitrogen (N)**
  - 2) **Phosphorus (P)**
  - 3) **Potassium (K)**
- b) **Secondary macronutrients (moderate amounts)**
  - 1) **Calcium (Ca)**
  - 2) **Magnesium (Mg)**
  - 3) **Sulfur (S)**
- c) **Micronutrients (small amounts)**
  - 1) **Boron (B)**
  - 2) **Chlorine (Cl)**
  - 3) **Copper (Cu)**
  - 4) **Iron (Fe)**
  - 5) **Manganese (Mn)**
  - 6) **Molybdenum (Mo)**
  - 7) **Zinc (Zn)**
- d) **Elements from air**
  - 1) **Carbon (C)**
  - 2) **Hydrogen (H)**
  - 3) **Oxygen (O)**

Most fertilizers contain three primary macronutrients: nitrogen (N), phosphorus (P), and potassium (K). Bring in a lawn fertilizer bag and have students identify the nutrients supplied by the fertilizer. Show TM 4.1 during your discussion.

**Q3. What care should be provided for indoor plants?**

**A3.**

- a) **Provide proper water.**
  - 1) **Use a well-drained growing medium.**
  - 2) **Water plants as needed.**
  - 3) **Water thoroughly at every watering.**
- b) **Control humidity levels.**
- c) **Maintain appropriate temperature range.**
- d) **Maintain appropriate light levels.**
- e) **Fertilize the growing medium as needed.**
- f) **Provide appropriate pinching and pruning.**
  - 1) **Pinch or prune dead/damaged leaves and branches.**
  - 2) **Pinch or prune to maintain plant shape.**

Ask students what care should be provided for indoor plants. Bring in several plants and discuss their care requirements. Use TM 4.2 to discuss proper watering rules.

**Q4. What care should be provided for outdoor plants?**

**A4.**

- a) **Watering is usually only required during dry periods.**
- b) **Grow in areas where they are adapted.**
- c) **Select tolerant plants for locations where pollution can be a problem.**
- d) **Fertilizer is generally only needed once per year.**
- e) **Prune occasionally to remove dead and damaged leaves and branches.**
- f) **Prune to maintain the plant's natural shape, when required.**

Ask students to discuss the growing conditions that outdoor plants need. Which conditions are supplied by nature? Have students complete AS 4.2 to reinforce what they have learned about plant care.

**F. *Other Activities***

1. Provide plants for students to care for at the school or in the community for several weeks. Students could help the garden club or city plant flowers downtown or in parks.
2. Have students design experiments to see how different levels of light, water, fertilizer, etc., affect plant growth.
3. Plant several trees at the school or conduct a landscaping project at the school or in the community.
4. Allow a geranium to grow naturally from the start of the course to the end. Pinch a second geranium to develop a more compact and desired shape during the course. Compare them at the conclusion of the course.

**G. *Conclusion***

Many factors need to be considered in caring for plants. Plants differ in their need for these factors depending on the variety and location. However, all plants require three major nutrients: nitrogen (N), phosphorus (P), and potassium (K). A key skill to be mastered in caring for plants is watering. More plants are damaged or die from overwatering than underwatering. Keeping a plant in good health will reduce the possibility of having pest problems.

**H. *Answers to Activity Sheets***

The instructor should determine if the answers are appropriate.

**I. *Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# What Do the Numbers 10-15-10 Mean?



**10% Nitrogen (N)**  
**15% Phosphorus (P)**  
**10% Potassium (K)**



## **Rules of Proper Watering**

### **Use a well-drained growing medium.**

- The medium should be porous yet retain water.

### **Water plants as needed.**

- Observe the color of the medium.
- Test for moisture by touch.

### **Water thoroughly at every watering.**

- Water should flow out the bottom of the container.



### **Plant Care Contest**

**Objective:** Students will demonstrate their ability to care for plants.

**Directions:** Provide students with a small/young houseplant that does not have critical care requirements (a geranium is a good example). The school or a commercial greenhouse might provide a plant for each student. The horticultural science class could start enough vegetative or seed geraniums for Exploring Agriculture in America students to use. A key factor for this project is to have uniform plants for the students.

Use AS 4.2 as a way to obtain important plant care requirements. Start the project at school and use this activity to teach students how to care for indoor plants. After one or two weeks, the students can take the plants home and care for them for the rest of the course.

During the last week of the course, students should bring their plants back to class. Evaluate the students on how good their plants look. In addition, it may be time to put the houseplant in a larger container. The instructor can demonstrate repotting, and then students can do the same with their plants.

Prizes could be awarded to the largest, smallest, best looking, etc.



**Plant Care Requirements**

**Objective:** Students will identify care requirements of selected plants.

**Procedure:**

1. Select two houseplants and two outdoor plants to research.
2. Use general references such as the ones listed below to find care information about the plants to fill in the chart. One example has been provided.

A few suggested references include:

*Green and Blooming Plants.* Redbook Florist Services, 1992.  
 (Available for free loan at the Missouri Resource Center for Career & Technical Education (MRCCTE), University of Missouri-Columbia.)

Ingels, Jack E. *Ornamental Horticulture: Principles & Practices.* Albany, NY: Delmar Publishers, 1985.  
 (Available for free loan at the MRCCTE, University of Missouri-Columbia.)

Reiley, H. Edward and Shry Jr., Carroll L. *Introductory Horticulture,* 5<sup>th</sup> ed. Albany, NY: Delmar Publishers, 1997.

The Ohio State University Horticulture and Crop Science in Virtual Perspective, <<http://www.hcs.ohio-state.edu/hcs/hcs.html>>.

University Extension Bulletins: University of Missouri-Columbia.

Plant Name	Light Needs	Water Needs	Fertilizer Needs	Type of Growing Medium	Common Pests	Other Information
Boston Fern	partial sun	keep moist	feed lightly every 4 months	1-peat 2-sand 1-soil	mealy bugs	50-70°F temperature, mist often



## UNIT II - PLANT SCIENCE

### Lesson 5: Technologies Used in Plant Agriculture

**Competency/Objective:** Identify current and emerging technologies of plant agriculture.

#### **Study Questions**

1. **How are satellite systems used in plant production?**
2. **How is genetic engineering used in plant production?**
3. **What are the effects of emerging technologies on plant production?**
4. **What are the major issues with plant technologies?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit II.
2. Current news and magazine articles regarding emerging plant technologies (e.g., *U.S. News & World Report*).
3. *Seeds of Progress* (Ag Video 262). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia, 1999.
4. Transparency Masters  
TM 5.1 Precision Agriculture Is Managing Small Areas of a Field  
TM 5.2 One Acre Is About the Size of a Football Field  
TM 5.3 Gene Splicing
5. Activity Sheets  
AS 5.1 Yield Maps on the Internet (Instructor)  
AS 5.2 Wonder Plants (Instructor)  
AS 5.2 Wonder Plants (Student)  
AS 5.3 Genetic Engineering Conference (Instructor)  
AS 5.3 Genetic Engineering Conference (Student)  
AS 5.4 Biotechnology Survey (Instructor)  
AS 5.4 Biotechnology Survey (Student)

## UNIT II - PLANT SCIENCE

### Lesson 5: Technologies Used in Plant Agriculture

#### TEACHING PROCEDURES

##### A. **Review**

The previous lessons in this unit have focused on the importance of plants, plant parts and processes, the growing medium, and plant care requirements. This lesson will help students become familiar with current and emerging technologies of plant agriculture.

##### B. **Motivation**

1. Ask students where they live. After sharing answers such as street address, house number, section number, township, three miles south of town, etc., ask them if it would be important to know exactly where they live. Would latitude, longitude, and altitude be useful in locating where they live?
2. Have students ever been lost? How did they find their way back home? Could they have used technology called Global Positioning System (GPS)?
3. Ask students if they have ever used a lawn spray (herbicide) to kill weeds. What happens if the weed killer gets on good plants such as trees, flowers, etc.? Discuss selective herbicides that only kill certain weeds, and nonselective herbicides that kill any plant they are sprayed on. The nonselective types are an excellent weed killer. It would be great to use them on crops and not worry about killing the good plants. Ask students if they think this will be possible in the future. Due to genetic engineering, it is possible today. Herbicide resistance is available in soybeans, cotton, and corn with the Roundup Ready gene.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **How are satellite systems used in plant production?**

##### A1.

- a) **Global Positioning System (GPS) uses 24 satellites to identify the location of a tractor, combine, or person. With the most accurate and expensive equipment, an item can be pinpointed to the nearest centimeter (.4 inch).**
- b) **Precision farming is managing crop inputs such as fertilizer, seed, herbicide, and insecticide on a subfield basis.**

Show TM 5.1 to illustrate precision farming. Show TM 5.2 to illustrate how large an acre is. Conduct AS 5.1 so students can learn how a yield map works.

#### Q2. **How is genetic engineering used in plant production?**

- ##### A2.
- Genetic engineering is modifying and enhancing the genetic components of organisms to benefit society. This technology is being used to develop new plants with extraordinary potential for increasing productivity that will help to feed the world.**

Show TM 5.3, which depicts gene splicing, and conduct AS 5.2 and AS 5.3 to have students imagine what new products might emerge.

**Q3. What are the effects of emerging technologies on plant production?**

**A3.**

- a) **Plants of the future will be developed with a much more specific purpose than today. It will mean food can be produced that will be more nutritious, taste better, and be of better quality.**
- b) **Two new areas of plant science will be developed as a result of genetic engineering:**
  - 1) **Nutraceuticals - health supplements or vitamins delivered through food**
  - 2) **Farmaceuticals - use of antibodies, medicines, or vaccines that can be inserted into plant-based products.**

Discuss the advantages of these new products. Ask students how they think they could be developed. Students could suggest new products or new uses for plants.

**Q4. What are the major issues with plant technologies?**

**A4.**

- a) **Safety of consuming genetically modified food**
- b) **Labeling of genetically modified food**
- c) **Effect on the environment of growing genetically modified plants**
- d) **Ethics of genetic engineering and cloning**
- e) **Impact of biotechnology on the structure of agriculture**

Show the *Seeds of Progress* video, which presents the positive aspects of biotechnology. Discuss the positive aspects and challenge students to identify concerns not addressed on the video. Read AS 5.4 (Instructor) and assign AS 5.4 (student) to have students survey individuals about their view on biotechnology.

**F. Other Activities**

1. Invite an agronomist, crop consultant, or equipment dealer, etc., who uses GPS in his/her work to speak to the class. Ask the guest to bring color yield maps and demonstrate using the GPS receiver and other equipment.
2. Obtain GPS receivers by borrowing them from a local community college or purchasing them and have students locate various sites on the school property.
3. Visit a plant or agronomy research facility to learn about its future plans with genetic engineering.

**G. Conclusion**

Current and emerging technologies will help to improve productivity and help feed and clothe the increasing world population. Humans will be supplied with more nutritious, higher quality, and better tasting food. Plant scientists continue to work on genetic engineering so medicines and vitamins can be delivered through food. The use of new technology, particularly genetic engineering, will cause close scrutiny by many people and organizations. Biotechnology promises to raise food production to new levels, but concerns held by the public may slow its acceptance.

**H. Answers to Activity Sheets**

The instructor should assign students to

I. **Answers to Evaluation**

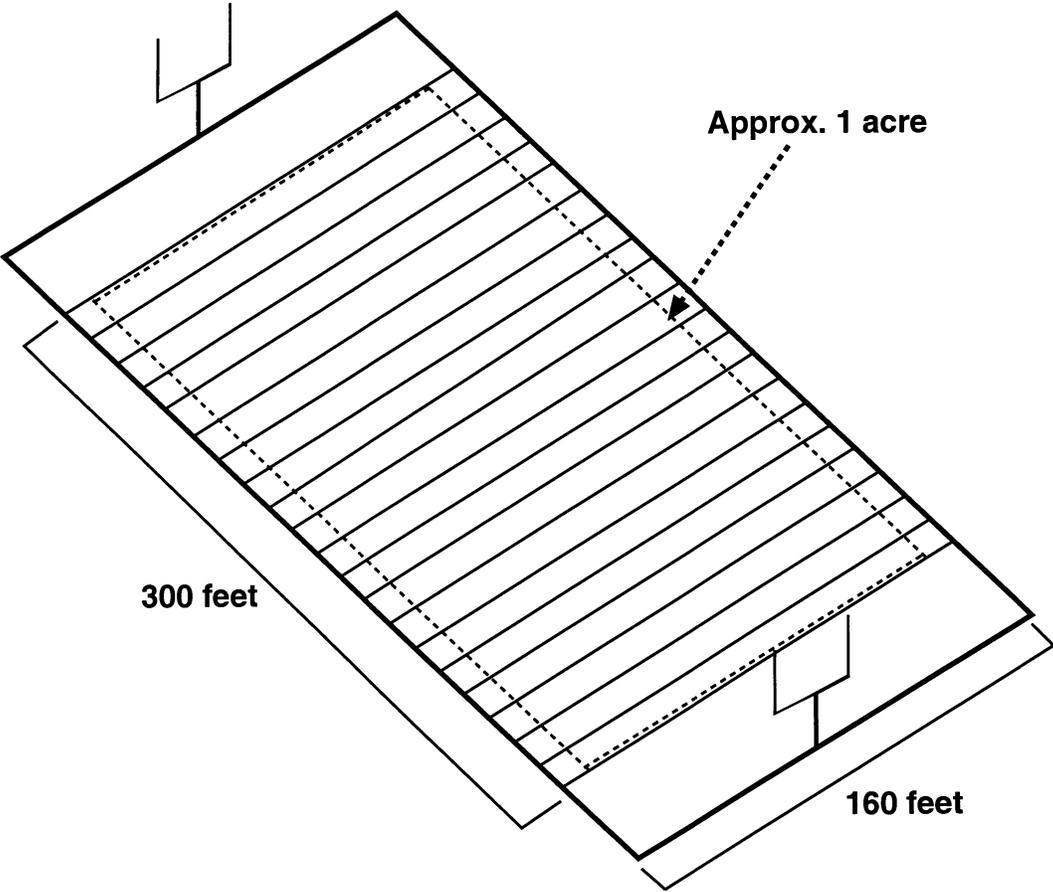
1. a
2. c
3. d
4. c
5. b
6. d
7. d
8. b
9. a
10. c
11. c
12. c
13. d
14. a
15. d
16. b
17. a
18. c
19. c
20. b
21. b
22. a
23. d
24. d
25. c
26. b
27. a
28. d
29. c
30. a
31. b
32. Any two of the following:
  - a. Some plants do not produce seed.
  - b. Some plants germinate with difficulty.
  - c. It is a faster process than seeding.
  - d. It is more economical.
33. Water only when needed by (1) observing the color of the medium and (2) using the finger test by checking the media at the one-inch level.
34. Soil is the living and naturally occurring top layer of the earth's surface. Dirt is misplaced soil.
35. Any two of the following:
  - a. Increased productivity that will help to feed the world
  - b. Less dependence on pesticides
  - c. More nutritious food or nutraceuticals
  - d. Higher quality food
  - e. Better tasting food
  - f. Pharmaceuticals
36. Any two of the following:
  - a. Safety of consuming genetically-modified food
  - b. Labeling of genetically-modified food
  - c. Effect on the environment of growing genetically-modified plants
  - d. Ethics of genetic engineering and cloning
  - e. Impact of biotechnology on the structure of agriculture

# Precision Agriculture Is Managing Small Areas of a Field

4 ½ Acres				
90-ACRE FIELD				

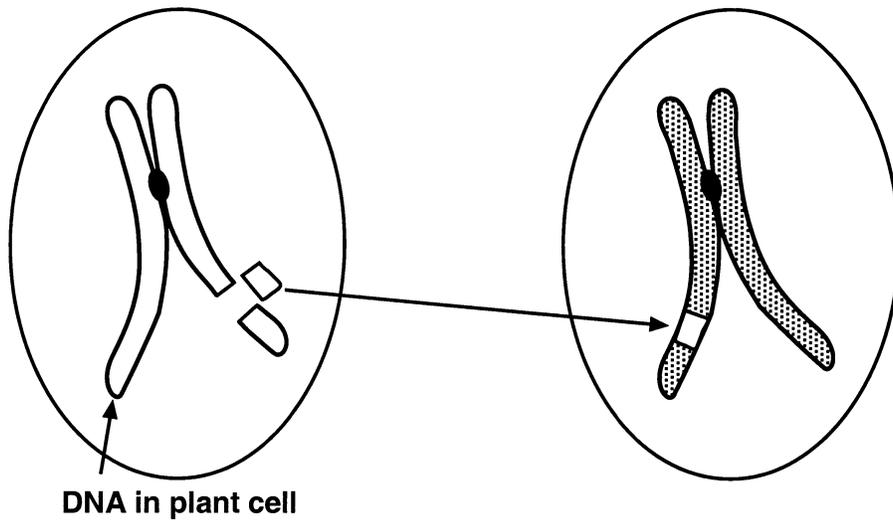


# One Acre Is About the Size of a Football Field





# Gene Splicing



**Enzymes are used to separate the DNA at a particular location on the gene.**

**The cut DNA is combined with DNA of another plant cell.**



### **Yield Maps on the Internet**

**Objective:** Students will analyze how a yield map works.

**Directions:**

1. Have students access this site: <<http://www.geofarm.com>> for a look at a yield map of a 57.8-acre cornfield.
2. Students should click on the "NEW FOR KIDS! Yield Map Math" link.
3. Students can follow the directions on-line and answer questions related to the yield map. Answers are provided at the end of each section.



**Wonder Plants**

**Objective:** Students will generate ideas for new genetically engineered plants by brainstorming.

**Directions:** The instructor should remind students that this is a brainstorming activity. The assignment does not require students to conduct research on the topic, but rather to think of problems in producing, processing, and marketing crops or food products from plants. The instructor may wish to use one of the examples below to start students thinking about possible wonder plants.

<b>Problem or Trait to be Improved</b>	<b>Name of Plant to be Genetically Modified</b>	<b>Plant or Organism that will Supply the Genetic Material by Gene Splicing</b>	<b>Result</b>
Strawberries can't grow in freezing conditions	Strawberry	Alaska tundra plant	Strawberries could be grown year-round
Corn will die in drought conditions	Corn	Desert cactus	A corn plant that could grow in the desert and thus conserve water resources
Malnutrition of people in poor, third-world countries	Wheat	Vitamin A, C, D, etc., sources from the orange, etc.	A nutritious food source with all essential vitamins represented

Other possible plant GMOs:

1. Adding flavor to products, thus reducing the processing
  - a. Chocolate-flavored fruits and vegetables
  - b. Cucumbers with pickle flavoring
  - c. Popcorn with caramel flavor
  
2. Weather- or environment-tolerant plants
  - a. Cold tolerant
  - b. Drought tolerant
  - c. Green grass the entire year
  - d. Crops that can be grown in salty water
  
3. Growth-regulation plants - faster-growing landscaping shrubs and trees
  
4. Nutritious and healthy plants
  - a. Plants that reduce cholesterol
  - b. Vitamin plants
  - c. Apples that are a completely balanced meal
  - d. Plants that prevent or treat diseases like cancer
  
5. Insect-resistant plants
  
6. Pesticide-resistant plants



**Wonder Plants**

**Objective:** Students will generate ideas for new genetically engineered plants by brainstorming.

**Background Information:**

Genetic engineering has been defined as the process in which genetic material (DNA) is taken from one organism and inserted into the cells of another organism. It also can be the rearrangement of the location of genes.

A procedure to accomplish genetic engineering is called gene splicing. It can be compared to the cut and paste feature on a word processing program. You take information from one computer document and cut and paste it into a different document.

**Scenario:**

You are a genetic engineer in a biotechnology company who has been challenged to brainstorm possible genetically modified organisms (GMO). You are to list at least five new plants to be genetically engineered and leave the feasibility and ethical issues for other departments in the company.

**Assignment:**

Complete the chart below, listing at least five new plant GMOs that will be developed by gene splicing. Reminder: This is a brainstorming activity and allows you to be creative.

Problem or Trait to be Improved	Name of Plant to be Genetically Modified	Plant or Organism that will Supply the Genetic Material by Gene Splicing	Result



### Genetic Engineering Conference

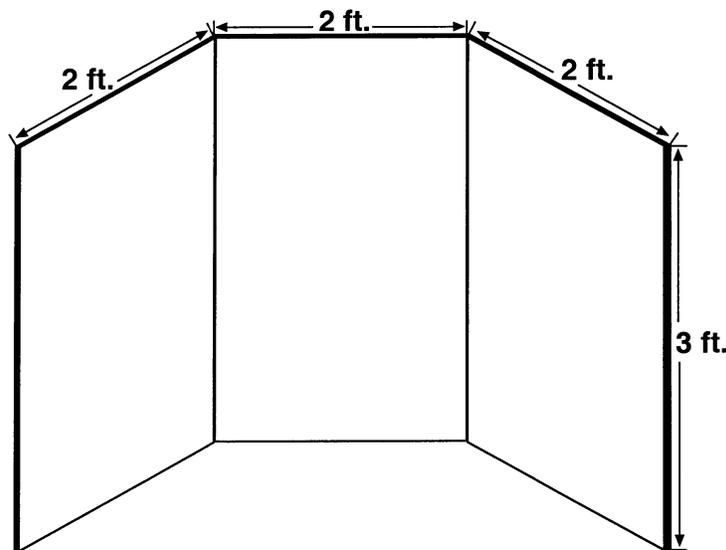
**Objective:** Students will demonstrate their knowledge of genetic engineering.

**Materials and Equipment:**

Cardboard or sheets of poster paper

**Directions:**

1. Have students individually brainstorm new plant GMOs by completing AS 5.2 (Student).
2. Organize students into teams of three.
3. Have students develop a three-way display board with the approximate measurements shown below.



You can assist students in finding cardboard by contacting stores in the area that might receive merchandise in large cardboard packages such as appliance stores, furniture stores, etc.

These displays could be put up at school functions or special observations like National Agriculture Week, etc. Another option would be to use one to three sheets of poster paper. Then the displays could be posted on walls in the classroom, etc.

4. Arrange for administrators, teachers, ag business persons, etc., to view the displays at the conference. One suggested format is for each team or team member to prepare a short explanation about the new plant GMO. Then the conference can take place with judges moving from display to display in a science fair format, and they can ask questions about the new product in a one-on-one environment that is less stressful for students.

5. Depending on the time available, there are several additional components or modifications that could be part of the project:
  - a) Computers - Create brochures and product-information pamphlets.
  - b) Business - Discuss and apply advertising and buying motives.
  - c) Careers - Identify the new job titles the GMO will create.
  - d) Inventions - Expand the concept to future inventions rather than just plant GMOs.

**Genetic Engineering Conference**

**Objective:** Students will demonstrate their knowledge of genetic engineering.

**Scenario:** You are part of a vision team for a genetic engineering company, whose task is to design new plant products. At an upcoming genetic engineering conference, large cash awards will be given to the GMO that offers the best potential to benefit society. The award is intended to fund production of the product and market it to the public. Your team will be given the opportunity to promote your new GMO to the judges. Complete the following steps before the conference begins.

1. Use your creativity to develop a company name. Use the results from AS 5.2 to brainstorm your new plant. Consider developing a logo and information the customer could keep.
2. Create a display for the conference. Your instructor will explain the type and size of display to develop. Key areas to address in the display are the following:
  - a) Display is attractive and attention-getting.
  - b) Potential benefits to society are clearly explained with before and after improvements noted.
  - c) The drawing/model of the plant GMO encourages customer business.
  - d) The display addresses buying motives and convinces the customer to purchase.
  - e) The price of the new plant GMO has been established.
3. Your instructor will explain the format the conference will follow. Consider the following concerning your communication about the new plant GMO.
  - a) Be enthusiastic.
  - b) Show conviction and passion for the benefits that customers will receive.
  - c) Develop something the customers could take with them so they might contact you later for further information or to purchase.
  - d) Thank the judges for visiting your display.



**Biotechnology Survey**

**Objective:** Students will investigate the reactions of the public to biotechnology.

**Procedure:**

1. Give each student four copies of AS 5.4, because they must interview four people.
2. When the surveying is complete, have students assist in tabulating the results.
  - a) First, sort the surveys into age groups and have four groups of students tabulate the results.
  - b) Post the results on the board to compare, contrast, and summarize.
3. If desired, share the results with the school newspaper, local newspaper, radio station, etc.

Other options:

The survey technique can also be expanded to the entire eighth grade and other middle school grade levels. It can be used to gain local input on other timely agricultural issues. Other teachers may be interested in an interdisciplinary unit on issues and projects of this nature. Biotechnology is an issue that applies to social studies, science, family and consumer science, and math, as well as agriculture.



Lesson 5: Technologies Used in Plant Agriculture

Name \_\_\_\_\_

**Biotechnology Survey****Objective:** Students will investigate the reactions of the public to biotechnology.**Directions:** Survey four people about their views on biotechnology. Select one person from each age group, and have the person respond to each of the questions. The survey should be administered individually and not in a group situation where opinions might be influenced.

Age group (circle one): Under 20   20-40   41-50   Over 50

Gender (circle one): Male   Female

1. Food products from genetically modified plants are safe to eat.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

2. Genetically modified foods sold in a grocery store should carry a label that states they are genetically modified.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

3. As foods are processed, it may be impossible to keep genetically modified foods separate from nongenetically modified foods.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

4. The U.S. Food and Drug Administration (FDA) has concluded that genetically modified foods are "virtually unchanged," and do not require labels. What is your reaction to this conclusion?

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

5. I feel that all genetically modified plants should be banned from agriculture.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

6. I feel that accidents in the environment may result from growing genetically modified plants.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

7. Genetically modifying plants is ethically wrong.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

8. Genetic engineering will help increase food production in the next ten years.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

9. Biotechnology will improve the profits of producers.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

10. Biotechnology will help to reduce the use of pesticides in agriculture.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral or Unsure	Agree	Strongly Agree

Additional comments on biotechnology: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

UNIT EVALUATION

Circle the letter that corresponds to the best answer.

1. Which of the following is a biological benefit provided by plants?
  - a. Oxygen
  - b. Shade
  - c. Clothing
  - d. Stress reduction
  
2. The production, processing, and marketing of fruits, vegetables, flowers, ornamental shrubs, and trees; nursery and landscaping; and turf management is called \_\_\_\_\_.
  - a. Ornamental horticulture
  - b. Botany
  - c. Horticulture
  - d. Agronomy
  
3. The study of field crops and soil management is called \_\_\_\_\_.
  - a. Ornamental horticulture
  - b. Botany
  - c. Horticulture
  - d. Agronomy
  
4. In 1998, the value of crops produced in Missouri was approximately \_\_\_\_\_.
  - a. \$10 million
  - b. \$100 million
  - c. \$3 billion
  - d. \$4 billion
  
5. Which part of the plant is the major plant food producer?
  - a. Root
  - b. Leaf
  - c. Stem
  - d. Flower
  
6. Which part of the plant is the site of sexual propagation?
  - a. Root
  - b. Leaf
  - c. Stem
  - d. Flower
  
7. Which of the following is an asexual propagation method?
  - a. Pollination
  - b. Multiplication
  - c. Petal
  - d. Cuttings

8. The \_\_\_\_\_ is the female structure of the flower.
- a. Petal
  - b. Pistil
  - c. Sepal
  - d. Stamen
9. What is needed for a seed to germinate?
- a. Sufficient moisture
  - b. Fertilizer
  - c. Tissue culture
  - d. Grafting
10. What is photosynthesis?
- a. The reproduction of plants
  - b. The absorption of water and nutrients
  - c. The process of food production for the plant
  - d. The process of cooling the plant
11. \_\_\_\_\_ is a plant that lives for more than 2 years and can grow year after year without replanting.
- a. Annual
  - b. Biennial
  - c. Perennial
  - d. Dicot
12. An example of a dicot is \_\_\_\_\_.
- a. Corn
  - b. Wheat
  - c. Soybeans
  - d. Bluegrass
13. Organic matter \_\_\_\_\_.
- a. Is sand
  - b. Is a herbicide
  - c. Was clay at one time
  - d. Originated from a living source
14. An ideal soil contains \_\_\_\_\_ % mineral matter, \_\_\_\_\_ % organic matter, \_\_\_\_\_ % air, and \_\_\_\_\_ % water.
- a. 45, 5, 25, 25
  - b. 50, 5, 25, 20
  - c. 25, 25, 45, 5
  - d. 45, 10, 15, 20
15. Which statement below is not true about soilless media?
- a. They are sterile.
  - b. They drain very well.
  - c. They are lightweight.
  - d. They have poor drainage.

16. Hydroponics is \_\_\_\_\_.
- Growing plants in soil without water
  - Growing plants in water (nutrient solution)
  - Raising fish
  - A new propagation method
17. Which item below is not important for plant growth?
- wind
  - humidity
  - light
  - gases
18. N-P-K are \_\_\_\_\_.
- Herbicides
  - Micronutrients
  - Primary macronutrients
  - Pesticides
19. A key watering principle for indoor plants is \_\_\_\_\_.
- Water once per month
  - Water the same amount each time
  - Water thoroughly at each watering
  - Prune when watering
20. Outdoor plants usually require \_\_\_\_\_.
- shade
  - regular watering during dry periods
  - full sun
  - daily pruning
21. GPS was developed by \_\_\_\_\_.
- The Extension Service
  - The U.S. Department of Defense
  - The U.S. Department of Agriculture
  - The U.S. Aviation Association
22. GPS uses \_\_\_\_\_ to determine exact locations.
- 24 satellites orbiting the earth
  - The Internet
  - Four laser beam systems
  - 80 acres as subfields
23. An example of a GMO is \_\_\_\_\_.
- Nitrogen fertilizer
  - Fish grown through aquaculture
  - Round-down wheat
  - Bt corn

**Match the definition in the right column with the term in the left column.**

- |           |             |    |  |
|-----------|-------------|----|--|
| 24. _____ | Peat moss   | a. | Heat-treated mica with high moisture-holding capacity                          |
| 25. _____ | Perlite     | b. | Source of organic matter in soilless mixes                                     |
| 26. _____ | Tree bark   | c. | Gray-white material of volcanic origin used to improve aeration.               |
| 27. _____ | Vermiculite | d. | Spongy, partially decomposed vegetation with a high moisture-holding capacity. |

**Match the definition in the right column with the term in the left column.**

- |           |                     |    |  |
|-----------|---------------------|----|--|
| 28. _____ | Farmaceuticals      | a. | Health supplements or vitamins delivered through food                  |
| 29. _____ | Genetic engineering | b. | Managing small areas (subfields) within a field                        |
| 30. _____ | Nutraceuticals      | c. | Modifying and enhancing the genetic component of organisms             |
| 31. _____ | Precision farming   | d. | Inserting antibodies, medicines, or vaccines into plant-based products |

**Complete the following short answer questions.**

32. Identify two reasons asexual propagation would be used to propagate plants.
- a.
  - b.
33. Explain two ways to prevent overwatering of indoor plants.
- a.
  - b.
34. Explain the difference between soil and dirt.
35. Identify two advantages provided by biotechnology.
- a.
  - b.
36. List two concerns about biotechnology.
- a.
  - b.

## UNIT III - ANIMALS IN SOCIETY

### Lesson 1: The Importance of Animals

**Competency/Objective:** Describe the importance of animals.

#### **Study Questions**

1. **Why are animals important to us?**
2. **What are the major types of production animals in agriculture?**
3. **What are the major types of companion and specialty animals in agriculture?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit III.
2. Transparency Masters  
TM 1.1 Livestock in Missouri  
TM 1.2 Animal Terminology
3. Activity Sheets  
AS 1.1 Animal Industry Terms  
AS 1.2 Services and Products

## UNIT III - ANIMALS IN SOCIETY

### Lesson 1: The Importance of Animals

#### TEACHING PROCEDURES

##### A. **Introduction**

Animals and the products and services they provide are essential to humans. Early man hunted animals for food, used their hides for clothes, used their bones for tools, and used them to provide a means of transportation and service. Animals were domesticated and continue to provide food, clothing, medicine, and many valuable products.

##### B. **Motivation**

Break the class into small groups of three or four and have them brainstorm the following statements. After 10-15 minutes, have the groups report their ideas to the class as a whole and generate a discussion on the importance of animals.

- List all of the ways animals are important in your everyday lives.
- List all of the ways your lives would change if people could not use animals for food or have pets as companions.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **Why are animals important to us?**

##### A1. **People need animals for food, clothing, and a variety of products.**

Animal agriculture, along with being essential to civilized humanity, also contributes to the agricultural economy. Show TM 1.1 to show students the importance of animals in Missouri agriculture.

- Food**
- Clothing**
- By-products**
- Medicine/medical research**
- Recreation/companionship**
- Specialized services for the disabled and for law enforcement**

Discuss the services and products animals provide and have students complete AS 1.2. Have students think of as many animals and their uses as possible to expand the list, stressing the point that animals are valuable to society in a variety of ways.

#### Q2. **What are the major types of production animals in agriculture?**

##### A2.

- Beef cattle**
- Dairy cattle**
- Sheep**
- Swine**
- Poultry**
- Goats**

- g) **Ostrich and emu**
- h) **Bison**
- i) **Fish**
- j) **Bees**

Show TM 1.2 to discuss types of animals in agriculture. Have students complete AS 1.1. It is important for people studying animal science to be familiar with the terms used in animal agriculture.

**Q3. What are the major types of companion and/or specialty animals in agriculture?**

**A3.**

- a) **Horses**
- b) **Dogs**
- c) **Cats**
- d) **Birds**
- e) **Rabbits**

**F. *Other Activities***

1. Have students prepare a report on one of the following topics:
  - The domestication of animals
  - The functions of animals
  - Animal by-products and their uses
2. Have students choose a species of animal and create a poster illustrating the products and services provided by that species.

**G. *Conclusion***

Whether through food, clothing, by-products, medical research, or recreation, animals improve society and the agricultural economy in a variety of ways. Important production animals include beef and dairy cattle, sheep, swine, poultry, goats, ostrich and emu, bison, fish, and bees. Important companion and specialty animals include horses, dogs, cats, birds, and rabbits. The domestication of animals made it possible for early man to settle and develop from basic hunters into the civilized society of today.

**H. *Answers to Activity Sheets***

**AS 1.1 Animal Industry Terms**

- 1. J
- 2. E
- 3. A
- 4. D
- 5. H
- 6. B
- 7. G
- 8. I
- 9. C
- 10. F

**AS 1.2 Services and Products**

The instructor should determine if the answers are appropriate. Suggested answers are listed below.

<b>Animal</b>	<b>Use</b>	<b>Product</b>
Beef	Food	Beef
Dairy	Food	Milk, cheese
Swine	Food	Pork
Sheep	Product	Wool
Poultry	Food	Eggs, chicken, turkey
Goats	Food	Goat milk, goat cheese
Bison	Food	Bison meat
Ostrich	Food	Ostrich meat
Fish	Food	Fish meat, fish oils
Bees	Product	Beeswax, honey

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# **Livestock in Missouri**

(1999 Value)

	Total Value
All Cattle and Calves	\$2,420,000,000
All Hogs and Pigs	\$ 158,400,000
All Sheep and Lambs	\$ 7,650,000



# Animal Terminology

<b>CATEGORY</b>	<b>CATTLE</b>	<b>SHEEP</b>	<b>SWINE</b>	<b>CHICKEN</b>	<b>TURKEY</b>	<b>HORSE</b>
<b>Mature male</b>	<b>Bull</b>	<b>Ram</b>	<b>Boar</b>	<b>Rooster</b>	<b>Tom</b>	<b>Stallion</b>
<b>Mature female</b>	<b>Cow</b>	<b>Ewe</b>	<b>Sow</b>	<b>Hen</b>	<b>Hen</b>	<b>Mare</b>
<b>Young male</b>	<b>Bull</b>	<b>Ram Lamb</b>	<b>Shoat</b>	<b>Cockerel</b>	<b>Poult</b>	<b>Colt</b>
<b>Young female</b>	<b>Heifer</b>	<b>Ewe Lamb</b>	<b>Gilt</b>	<b>Pullet</b>	<b>Hen Poult</b>	<b>Filly</b>
<b>Castrated male</b>	<b>Steer</b>	<b>Wether</b>	<b>Barrow</b>	<b>Capon</b>	<b>Capon</b>	<b>Gelding</b>
<b>Group</b>	<b>Herd</b>	<b>Flock</b>	<b>Herd</b>	<b>Flock</b>	<b>Flock</b>	<b>Herd</b>
<b>Young Animal</b>	<b>Calf</b>	<b>Lamb</b>	<b>Pig</b>	<b>Chick</b>	<b>Poult</b>	<b>Foal</b>



Lesson 1: The Importance of Animals

Name \_\_\_\_\_

**Animal Industry Terms****Objective:** Students will become familiar with animal industry terms.**Directions:** Place the letter in the blank that correctly matches its definition.

- |  |             |
|--|-------------|
| 1. ____ A male chicken of breeding age                 | A. Herd     |
| 2. ____ A male beef animal castrated for meat purposes | B. Bull     |
| 3. ____ A group of beef or dairy cattle                | C. Gelding  |
| 4. ____ A male sheep of breeding age                   | D. Ram      |
| 5. ____ A female swine who has given birth             | E. Steer    |
| 6. ____ A male beef animal of breeding age             | F. Stallion |
| 7. ____ A male swine of breeding age                   | G. Boar     |
| 8. ____ A mature female sheep                          | H. Sow      |
| 9. ____ A castrated male horse                         | I. Ewe      |
| 10. ____ A male horse of breeding age                  | J. Rooster  |



**Services and Products**

**Objective:** Students will identify animals that are important to people in a variety of ways.

**Directions:** Beside the use for each animal, list one appropriate product provided.

Animal	Use	Product
Beef	Food	
Dairy	Food	
Swine	Food	
Sheep	Product	
Poultry	Food	
Goats	Food	
Bison	Food	
Ostrich	Food	
Fish	Food	
Bees	Product	



## UNIT III - ANIMALS IN SOCIETY

### Lesson 2: The Responsibilities of Animal Ownership

**Competency/Objective:** Describe the responsibilities of animal ownership.

#### **Study Questions**

- 1. What are the responsibilities of animal ownership?**
- 2. What is meant by the term “animal welfare” vs. “animal rights”?**
- 3. What are the purposes of animal control regulations?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit III.
2. Activity Sheets  
AS 2.1 Animal Care Requirements  
AS 2.2 Pet Journal

## UNIT III - ANIMALS IN SOCIETY

### Lesson 2: Responsibilities of Animal Ownership

#### TEACHING PROCEDURES

##### A. **Review**

Lesson 1 described the importance of animals, including the products and services they provide. This lesson will discuss the responsibilities of owning and caring for animals.

##### B. **Motivation**

Write the word “dog” on the board. Have the class brainstorm a list of responsibilities, daily activities, resources, and costs involved in raising the dog. Then discuss whether all of the items on the list are required to raise the dog in a humane manner. Have students discuss what is included in proper care.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### **Q1. What are the responsibilities of animal ownership?**

##### **A1. Animal owners should provide for these needs properly.**

- a) Food
- b) Health care
- c) Shelter
- d) Knowledge of purchase and maintenance costs

Different animals require different types of food, shelter, health care, and attention costs. Have students complete AS 2.1 and discuss differences among types of animals. Then have students complete AS 2.2, tracking the care of their own pet or a pet of a friend or relative. Discuss the responsibilities of pet ownership.

#### **Q2. What is meant by the term “animal welfare” versus “animal rights”?**

##### **A2. Animal welfare is providing proper care to ensure the health and well-being of an animal. Animal rights refers to the belief that animals should be treated in the same manner as humans and have the same rights.**

Animal welfare and animal rights are topics that mean different things to different groups of people. Conduct a debate on animal welfare vs. animal rights. Divide the class into two teams and select a position for each side. Allow time for students for research their position. The first team debates for 10 minutes with a 5-minute rebuttal from the opposite side. The first team then can refute the rebuttal for 5 minutes. The second team then presents its case for 10 minutes with 5 minutes for rebuttal and 5 minutes to refute the rebuttal.

#### **Q3. What are the purposes of animal control regulations?**

##### **A3.**

- a) Fencing, caging, and leash laws protect people and other animals from harm.

- b) **Health regulations prevent the spread of disease.**
- c) **Identification regulations prove animal ownership.**
- d) **Abuse ordinances protect animals from cruel treatment.**
- e) **Fishing and hunting regulations control type and amount killed.**

Animal control regulations provide protection for animals from people as well as for people from animals. Discuss various regulations that are essential.

F. ***Other Activities***

1. Have a local veterinarian speak to the class regarding the proper care, attention, and maintenance of pets and livestock.
2. Divide the class into groups to debate the ethics of showing an animal in a championship contest.
3. Visit a local animal control facility and have an animal control officer speak to the class on the importance of animal control regulations.
4. View the video, *Cattlemen Care About Animal Welfare*, Ag Video 188, available from the Missouri Resource Center for Career & Technical Education (MRCCTE), University of Missouri-Columbia.

G. ***Conclusion***

Animal ownership is a responsibility to be taken very seriously. Owners of animals should provide proper food, shelter, and medical care to ensure the welfare of animals under their care. The term “animal welfare” means providing the proper care to ensure the well-being of an animal. The term “animal rights” refers to the belief that animals should be treated in the same manner, with the same rights as humans. Animal control laws and regulations are designed to protect humans and animals.

H. ***Answers to Activity Sheets***

AS 2.1 Animal Care Requirements

The answers to this activity will vary.

AS 2.2 Pet Journal

The answers to this activity will vary.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.



**Animal Care Requirements**

**Objective:** Students will identify how animal care requirements differ according to animal species.

**Directions:** Assume that you plan to purchase a basset hound. Under each category in the table below, list the appropriate supplies necessary to care for this animal. Make additional entries for a cat, a goldfish, and a rabbit.

<p style="text-align: center;"><b>FOOD</b></p>	<p style="text-align: center;"><b>SHELTER</b></p>
<p style="text-align: center;"><b>HEALTH CARE</b></p>	<p style="text-align: center;"><b>KNOWLEDGE OF PURCHASE AND MAINTENANCE NEEDS</b></p>



**Pet Journal**

**Objective:** Students will identify how time is spent on daily pet care.

**Directions:** Record all pet responsibilities accomplished for a pet of your choice each day for a week.

	FOOD	WATER	EXERCISE & PLAY	CLEANING, BRUSHING, BATHING, OR CLEANING PEN	OTHER
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					
Day 6					
Day 7					



## UNIT III - ANIMALS IN SOCIETY

### Lesson 3: Selecting an Animal

**Competency/Objective:** Identify factors in selecting an animal.

#### **Study Questions**

1. **What facilities and resources are needed to raise animals?**
2. **What factors should be considered in selecting a pet?**
3. **What are the sources of pets?**
4. **What factors should be considered in selecting a livestock and fish species?**
5. **What are the sources of livestock and fish?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit III.
2. Transparency Master  
TM 3.1 Pet Concerns
3. Activity Sheets  
AS 3.1 Animal Budget – Can You Afford a Pet?  
AS 3.2 Pet Sources  
AS 3.3 Livestock Concerns

## UNIT III - ANIMALS IN SOCIETY

### Lesson 3: Selecting an Animal

#### TEACHING PROCEDURES

##### A. **Review**

Lesson 2 discussed various responsibilities of owning animals, addressed issues concerning animal welfare, and illustrated animal control regulations. This lesson discusses components in selecting animals such as purpose, costs, facilities and resources, selection criteria, and sources of animals.

##### B. **Motivation**

List on the board several different types of animals. These should include common pets, farm animals, and exotic animals. Have students provide positive and negative aspects that each animal might present. Explain to students that in this unit they will learn factors to consider when selecting animals.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. What facilities and resources are needed to raise animals?

##### A1. These facilities and resources are needed.

- a) Food and water supply
- b) Shelter
- c) Cleaning supplies
- d) Bathing and grooming supplies or equipment
- e) Exercise and recreation equipment
- f) Medical equipment and supplies
- g) Start-up and maintenance costs

Discuss the costs involved and the resources needed to raise animals, then have students complete AS 3.1.

#### Q2. What factors should be considered when selecting a pet?

##### A2.

- a) Purpose
- b) Cost
- c) Maintenance
- d) Space
- e) Time

Use TM 3.1 to help describe the considerations involved in the selection of a pet.

#### Q3. What are the sources of pets?

##### A3.

- a) Animal shelters
- b) Seedstock producers

- c) **Newspaper advertising**
- d) **Pet stores**

Discuss sources where people can purchase or receive pets for free. Use AS 3.2 to have students investigate the advantages and disadvantages of each source.

**Q4. What factors should be considered when selecting a livestock and fish species?**

**A4.**

- a) **Owner's goals**
- b) **Money**
- c) **Space**
- d) **Time**

Discuss the considerations of each factor and how it varies between livestock species. Have the students complete AS 3.3 to better illustrate factors that affect the type of livestock people choose to raise.

**Q5. What are the sources of livestock and fish?**

**A5.**

- a) **Seedstock producers**
- b) **Sale barns**
- c) **Commercial feeders**
- d) **Independent advertisers**
- e) **Fish hatcheries**

Discuss the sources of livestock and emphasize that the source of purchase is largely affected by the purpose of the animal.

**F. *Other Activities***

1. Have a local pet store owner speak to the class about different types of pets.
2. Visit a local livestock or small animal breeder to learn about the operation and facilities, or invite that person to speak to the class regarding the resources needed to raise a specific animal.
3. Have students create a poster or collage showing an animal of their choice and the equipment and resources needed to raise it properly.

**G. *Conclusion***

Livestock and pets require money, time, and a multitude of resources for proper maintenance. The consumer should think carefully about time, equipment, space, and money concerns when selecting an animal that best fits those resources. Pets can be obtained from a variety of sources, such as animal shelters, seedstock producers, or from advertisements in the newspaper. Selecting livestock entails identifying one's goals and assessing how much money, space, and time can be devoted to the species. Livestock can be obtained from seedstock producers, sale barns, and commercial feeders, as well as independent advertisers.

**H. *Answers to Activity Sheets***

AS 3.1 Animal Budget – Can You Afford a Pet?

Answers will vary.

### AS 3.2 Pet Sources

Suggested answers are as follows:

<b>Source</b>	<b>Advantages</b>	<b>Disadvantages</b>
Animal Shelter	Pets are free or low cost. Adoption for displaced pets	Pet history is unknown.
Breeders	Registered, purebred pets Health regimen is followed.	Can be expensive
Pet Stores	History is known. Can purchase supplies Can find exotic/rare breeds	Can be expensive
Newspaper Ads	Pets are free or low cost.	Pet may not be registered.

### AS 3.2 Animal Budget – Can You Afford a Pet?

Answers will vary.

### AS 3.3 Livestock Concerns

Answers will vary.

#### I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## **Pet Concerns**

### **What Do You Want from a Pet?**

Do you like exotic pets?

Do you like affectionate pets?

Do you want a low- or a high-maintenance pet?

### **What Is Your Budget?**

How much does the pet cost?

How much are food & other ongoing supplies?

Can you afford to maintain the pet?

### **Where Do You Live?**

Are pets allowed?

Will the pet be inside or outside?

How much space is available for the pet?

### **How Much Time Can You Spend?**

Will the pet need to be exercised?

Does the pet & the cage require cleaning & upkeep?

Does the pet require a great deal of attention?

### **Which Type of Pet Is Best for You?**



Lesson 3: Selecting an Animal

Name \_\_\_\_\_

**Animal Budget - Can You Afford a Pet?**

**Objective:** Students will determine a budget for a pet.

**Directions:** Complete the following budget for the animal of your choice.

Animal \_\_\_\_\_

	START-UP COSTS (\$)
Purchase price	
Registration	
Neutering	
Vaccinations	
House/shelter	
Lot/pasture	
Equipment	
Toys/leash	
Bath supplies	
1 bag of food	
Vitamins	
Dishes	
Fencing	
Other	
<b>TOTAL</b>	

Ongoing Expenses:

Bag food \$ \_\_\_\_ x \_\_\_\_ bags/month x 12 months/year = A. \_\_\_\_\_

Monthly Cleaning \$ \_\_\_\_ x 12 months/year = E. \_\_\_\_\_

Supplements \$ \_\_\_\_ x \_\_\_\_ /month x 12 months/year = B. \_\_\_\_\_

Monthly lot rent \$ \_\_\_\_ x 12 months/year = F. \_\_\_\_\_

Registration Fees or Annual Dues  
C. \_\_\_\_\_

Other  
H. \_\_\_\_\_

Yearly Vaccination/ Veterinarian Fees  
D. \_\_\_\_\_

**Total Yearly Maintenance:** \_\_\_\_\_



**Pet Sources**

**Objective:** Students will investigate sources for obtaining a pet and determine the advantages and disadvantages of each.

**Directions:** Use various resources (interviews, Internet, reference books, etc.) to determine the advantages and disadvantages of each source for obtaining a pet. Put the information in the chart below.

Source	Advantages	Disadvantages
Animal Shelter		
Breeders		
Pet Stores		
Newspaper Ads		







## UNIT III - ANIMALS IN SOCIETY

### Lesson 4: Current and Emerging Technologies

**Competency/Objective:** Identify current and emerging technologies in animal agriculture.

#### Study Questions

1. **What is natural mating in animal reproduction?**
2. **What are alternative reproductive practices?**
3. **What are the effects of emerging technology in animal agriculture?**

#### References

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit III.
2. Transparency Master  
TM 4.1 Alternative Reproductive Practices
3. Activity Sheet  
AS 4.1 Alternative Reproduction Technologies

## UNIT III - ANIMALS IN SOCIETY

### Lesson 4: Current and Emerging Technologies

#### TEACHING PROCEDURES

##### A. **Review**

The previous lesson discussed the factors involved in selecting animals, resources needed, and sources of animals. This lesson introduces advancements that have changed and continue to change the nature of animal agriculture.

##### B. **Motivation**

Have students brainstorm and discuss recent advancements in agriculture that have improved the care and production of animals or animal products.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### **Q1. What is natural mating in animal reproduction?**

#### **A1. Natural mating allows animals to breed by copulation without human assistance.**

Explain the basics of natural mating so that the students will be able to see a contrast to the following study question on alternative reproductive practices.

#### **Q2. What are alternative reproductive practices?**

##### **A2.**

- a) **Artificial insemination**
- b) **Cloning**
- c) **Embryo transfer**
- d) **Genetic engineering - genetically modified organisms (GMOs)**
- e) **Hand-mating**

Display TM 4.1 and discuss alternative reproductive practices that have improved animal agriculture. Then have students complete AS 4.1 and discuss their research findings of an alternative reproductive technology. The students can be assigned this project on an individual basis or it can be assigned to student groups. The information should be presented orally to the whole class.

#### **Q3. What are the effects of emerging technology in animal agriculture?**

##### **A3.**

- a) **Animal needs can be monitored by computers.**
- b) **Management decisions are made by computer readings.**
- c) **Automated systems have reduced amount of manual labor involved in caring for animals.**
- d) **Large production units manage several thousand head of animals.**
- e) **Advanced breeding can select superior genetic traits.**
- f) **Alternative animal markets are developed.**

- g) **Animals are identified so that they can be tracked from produce to processing.**
- h) **Totally controlled environments are created in animal facilities.**
  - 1) **Environment is totally controlled.**
  - 2) **Timing devices reduce manual labor hours and reduce wasted food.**
  - 3) **Self-cleaning systems remove animal wastes.**

Technology provided by automated systems has decreased the amount of manual labor to run successful livestock operations. Today, just one person can manage thousands of animals correctly and efficiently.

**F. *Other Activities***

1. Assign students to topics in emerging agricultural technology such as cloning, biotechnology, etc. Have them present reports on their findings.
2. Have a local veterinarian speak or demonstrate artificial insemination or embryo transfer.
3. Have students debate arguments for or against genetic engineering.

**G. *Conclusion***

Natural reproduction allows animals to breed without human assistance. Technological advances in animal production and breeding have allowed agriculture to evolve into a precision business geared on creating superior products for the consumer. Advancements will continue to decrease manual labor as well as produce genetically superior animals resistant to disease with maximum production capabilities. There are several alternatives to reproduction practices, such as artificial insemination, cloning, and embryo transfer, to name a few.

**H. *Answers to Activity Sheet***

The instructor should determine if the answers are appropriate.

**I. *Answers to Evaluation***

1. c
2. d
3. c
4. Any two of the following: food, clothing, by-products
5. Any four of the following: beef cattle, dairy cattle, sheep, swine, poultry, horses
6. Any three of the following: recreation/companionship, food, clothing, by-products, medical research, special services to disabled or law enforcement
7. Any two of the following:
  - a. Protect people and other animals from harm
  - b. Prevent spread of disease
  - c. Protect animals from cruel treatment
  - d. Control populations
  - e. Provide proof of ownership
8. Any three of the following: food and water, shelter, cleaning supplies, bath and grooming supplies, exercise and recreation, medical supplies
9. Any two of the following: purpose, cost, maintenance, space, time
10. Any two of the following: animal shelter, purebred breeder, pet store, newspaper
11. One of the following: money, space, owner's goal
12. One of the following: purebred breeders, sale barn, commercial feeders

13. Any two of the following:
  - a. Monitor animals by computer
  - b. Management decisions made by computer
  - c. Reduced labor
  - d. Larger operations
  - e. Alternative markets
  - d. Advanced breeding that results in superior genetic traits
14. Any two of the following:
  - a. Artificial insemination
  - b. Cloning
  - c. Embryo transfer
  - d. Genetic engineering
  - e. Hand-mating

# **Alternative Reproductive Practices**

## **Artificial Insemination**

Placing of sperm in the female reproductive tract by other than natural means

## **Cloning**

A process through which genetically identical organisms are produced

## **Embryo Transfer**

Process of flushing the embryos from the reproductive tracts of superior, donor females and implanting them in other females

## **Genetic Engineering**

Alteration of the genes of animals by human intervention







UNIT EVALUATION

**Circle the letter that corresponds to the best answer.**

1. One important responsibility of animal ownership would include \_\_\_\_\_.
  - a. Becoming an animal rights activist
  - b. Owning as many animals as possible
  - c. Providing proper food, health care, and shelter
  - d. Finding a home for a stray
  
2. What is the general definition of animal welfare?
  - a. Eating only animal products
  - b. Setting all animals free to roam
  - c. Living with as many animals as possible
  - d. Provide proper care necessary to ensure the well-being of animals
  
3. Select the term that best describes natural mating in animal reproduction.
  - a. Artificial insemination
  - b. Embryo transfer
  - c. Copulation
  - d. Cloning

**Complete the following short answer questions.**

4. List two ways that animals in agriculture are important to humans.
  - a.
  - b.
  
5. List four types of animals in agriculture.
  - a.
  - b.
  - c.
  - d.
  
6. List three services or products provided by animals.
  - a.
  - b.
  - c.

7. List two purposes of animal control regulations.
  - a.
  - b.
8. List three resources needed to raise a pet in a small fenced lot in town.
  - a.
  - b.
  - c.
9. List two factors to consider before purchasing the pet in question 8.
  - a.
  - b.
10. List two resources that could be used to purchase a pet.
  - a.
  - b.
11. List one factor that should be considered when selecting livestock to raise on a small farm.
12. List one resource where livestock can be purchased.
13. List two positive effects of emerging technology in animal agriculture.
  - a.
  - b.
14. List two alternative reproductive practices.
  - a.
  - b.

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 1: Agriculture in the Food Chain

**Competency/Objective:** Describe the role of agriculture in the food chain.

#### **Study Questions**

1. **What is the food chain?**
2. **Why do people manipulate the food chain?**
3. **What is the role of agriculture in the food chain?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit IV.
2. Transparency Masters  
TM 1.1 Simple Food Chain in the Natural Environment  
TM 1.2 Simple Food Chain in the Aquatic Environment  
TM 1.3 Agricultural Food Chain
3. Activity Sheets  
AS 1.1 Student Chain (Instructor)  
AS 1.2 Food Web (Instructor)

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 1: Agriculture in the Food Chain

#### TEACHING PROCEDURES

##### A. **Introduction**

This lesson is about the food chain and how agricultural activities affect the process.

##### B. **Motivation**

Explain to students that during this lesson we will look at the food chain. Discuss what comes to mind when we say "chain." Answers such as "connected," "links," "chain letter," etc., will be given. Explain that we are going to make a student chain. Then conduct AS 1.1 as a motivational interest approach.

##### C. **Assignment**

##### D. **Supervised Study**

To be prepared for AS 6.2 in lesson 6 of this unit, order the following materials now.

Obtain biodegradable golf tees from the following address:

ECO GOLF  
Box 17872  
Indianapolis, IN 46217  
<<http://www.ecogolf.com>>  
888-326-3003  
fax (317) 889-9921

Obtain cornstarch superabsorbent polymer from the following address:

Grain Processing Corporation  
1600 Oregon Street  
Muscatine, IA 52761-1494  
<<http://www.grainprocessing.com>>  
(319) 264-4265  
[sales@grainprocessing.com](mailto:sales@grainprocessing.com)

To be prepared for AS 6.3, order the following materials now.

Minnesota Forest Industries  
902 Medical Arts Building  
324 West Superior Street  
Duluth, MN 55802  
(218) 722-5013  
<<http://www.minnesotaforests.com>>

##### E. **Discussion**

###### **Q1. What is the food chain?**

###### **A1. The food chain is a sequence in which living organisms obtain food. There are four main parts to a food chain: sun, producer, consumer, and decomposer.**

Ask students to give an example of a food chain. Use TM 1.1 to illustrate the simple food chain in the natural environment. Use TM 1.2 to illustrate the food energy flow in the aquatic environment. In nature, lower animal forms are consumed by higher animal forms. Ultimately, consumption by humans, the highest animal form, is the end of the food chain. Garbage and waste products are then consumed by bacteria, etc., and the food chain process begins again. Conduct AS 1.2 to have students create a food chain with a more complex web of interconnections.

###### **Q2. Why do people manipulate the food chain?**

**A2. Humans cannot survive by only using food produced by the natural food chain.**

Ask students why people alter the food chain. Discuss why natural food chains can no longer provide the food that people need. Management of the food chains allows producers to raise more food in a shorter amount of time than would be possible naturally.

**Q3. What is the role of agriculture in the food chain?**

**A3.**

- a) **Controlled, large-scale production of food crops**
- b) **Domestication of animals and plants for food**
- c) **Protection of the environment and natural food chain for wildlife**

Discuss the role of agriculture in the food chain. As the human population increases, the need for food increases as well. Agricultural practices enable people to produce larger amounts of food than would be produced naturally in the food chain. Use TM 1.3 to illustrate the various food sources and their path to human consumption. Agriculture strives to maximize positive environmental factors (e.g., fertilizers, confinement housing, and vaccinations) while minimizing adverse factors (e.g., competition from weeds, weather conditions, and diseases).

**F. *Other Activity***

Have students list as many food products as they can, categorizing them into plant or animal products. Also, list as many producers and consumers of these products as possible.

**G. *Conclusion***

Natural food chains occur throughout the world in every environment. Agriculture and agricultural practices have enabled people to produce larger amounts of food than would be produced naturally in the food chain. Domestication of animals and plants has helped to produce food and clothing for humankind. Agricultural practices must protect the environment and the natural food chain for wildlife.

**H. *Answers to Activity Sheets***

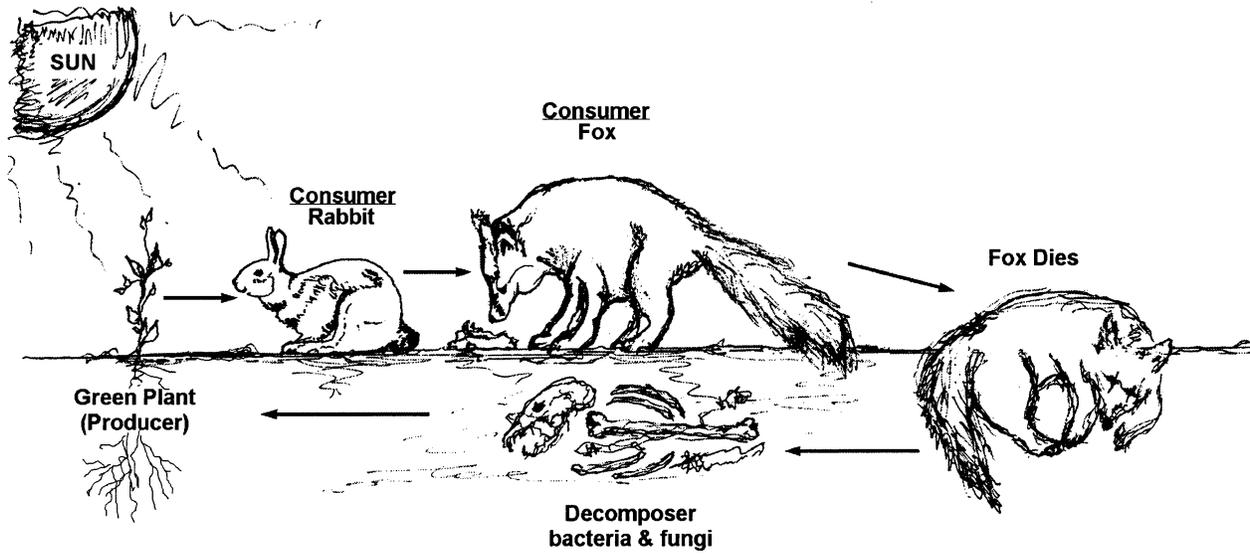
Answers will vary.

**I. *Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

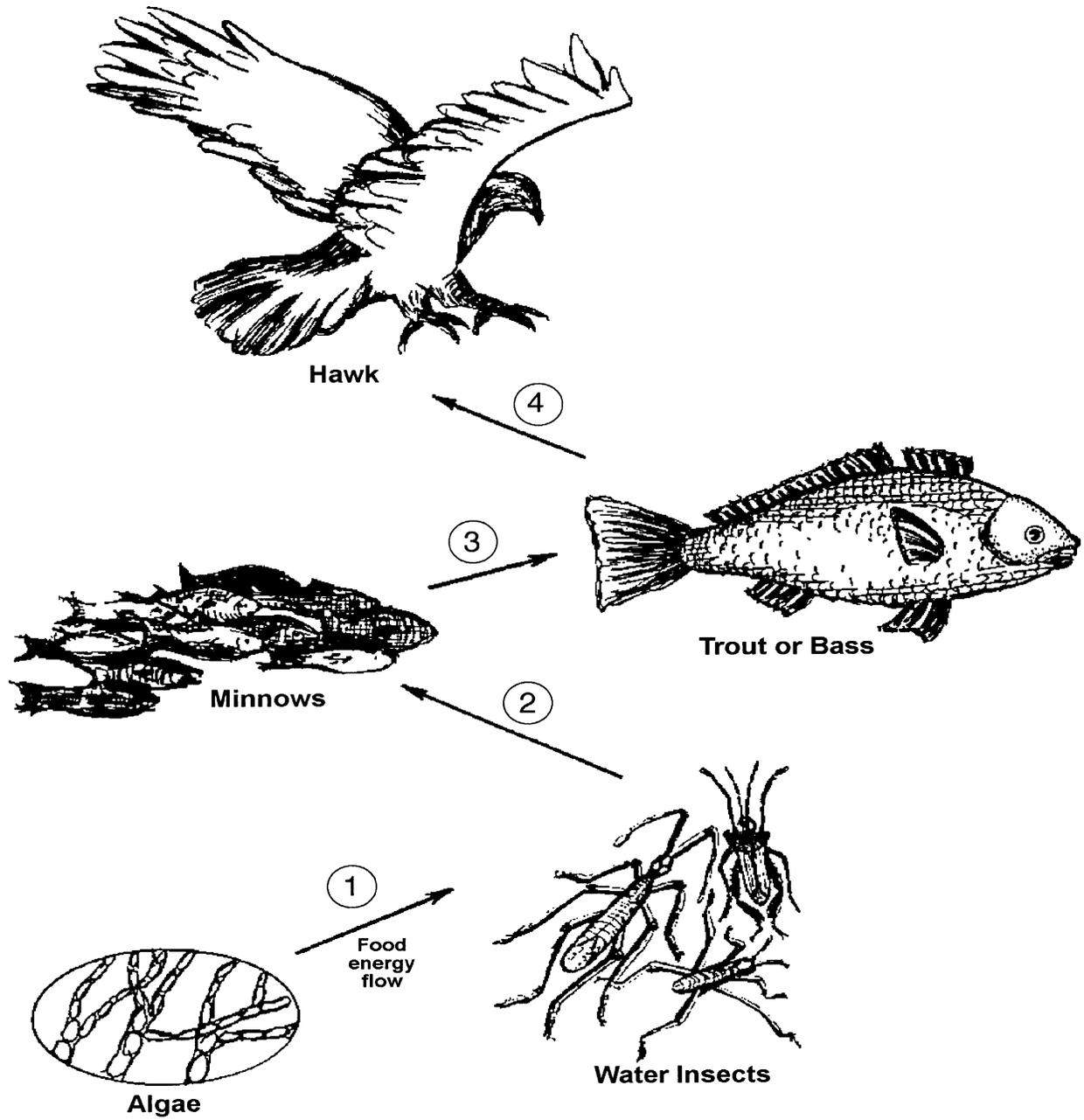


# Simple Food Chain in the Natural Environment



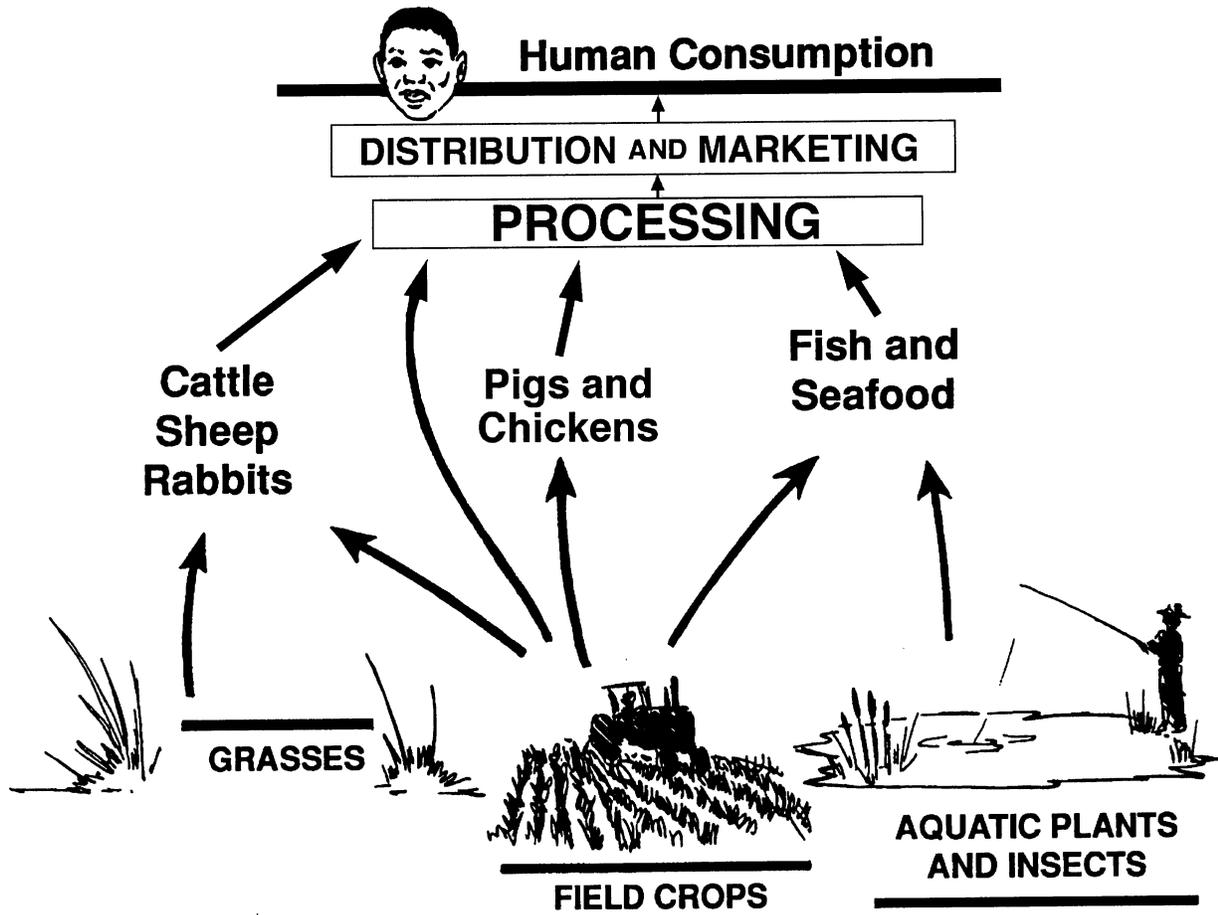


# Simple Food Chain in the Aquatic Environment





# Agricultural Food Chain





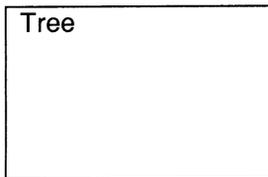
**Student Chain**

**Objective:** Students will understand the concept of a "chain" to be used in developing knowledge about food chains.

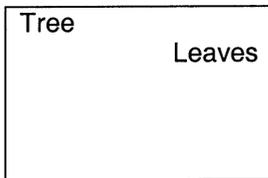
**Directions:** This motivational activity compares the interconnections in a food chain with the various word associations students make with a word like "tree." As students see how various words all link back to the same source (tree), they will be able to appreciate the concept of links in the food chain. There is not a right or wrong answer to this activity.

**Procedure:**

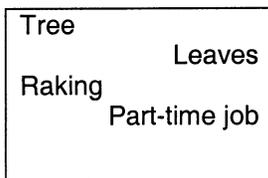
1. Give the first person in a row or table a piece of paper with "tree" printed in the upper corner. Other words selected by the instructor may be used in place of "tree."



2. Tell the first student to write a connection with tree and then pass the paper to the next student.



3. The second student writes a connection to the first person's word. In turn, the third, fourth, fifth, etc., person follows the same process.



4. Finally, the last student writes down his/her connection on the paper and brings it to the instructor.
5. Share the series of connections with the class. Be sure to ask each student to share how each connection relates back to the previous connection.
6. In closing, tell the students that there are many food chains, just like there were many different connections made by students in this activity.



### Food Web

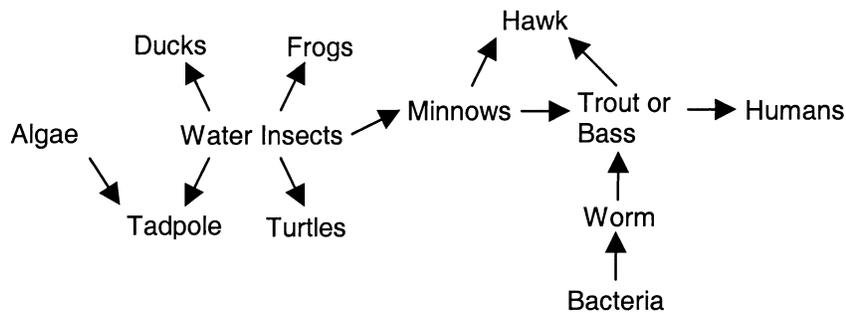
**Objective:** Students will develop an understanding of how food webs work.

**Materials and Equipment:**

Poster paper  
Markers

**Procedure:**

1. Discuss TM 1.1 and 1.2 so students have a basic understanding of a food chain.
2. Next, expand this concept to a food web by asking students what else might eat the rabbit, what might eat the fox, etc.
3. Using poster paper and markers, have students brainstorm and create graphs listing a large food web using at least 15 organisms (see example below). Remind students to show the correct food energy flow with the arrows.



4. Note which group has the longest food chain with the most numbers of organisms involved.
5. Post them and have students explain the interconnections.



## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 2: Food Products from Plants

**Competency/Objective:** Identify food products from plants.

#### **Study Questions**

1. **What food products come from grain?**
2. **What food products come from vegetables?**
3. **What food products come from fruits?**
4. **What food products come from other plants?**
5. **What information is contained in the food label?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000. Unit IV.
2. Transparency Masters  
TM 2.1 Cereal Food Label Ingredients  
TM 2.2 Key Parts of a Food Label
3. Activity Sheets  
AS 2.1 Food Inventory  
AS 2.2 Do You Know Your Food Label?  
AS 2.3 Compare Food Labels

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 2: Food Products from Plants

#### TEACHING PROCEDURES

##### A. **Review**

In the last lesson, we discussed the many food chains in the natural environment (ecosystem). People in agriculture have learned to manage the food chains to produce larger amounts of food than would be produced naturally. We will now focus on the variety of food products provided by plants.

##### B. **Motivation**

1. Bring in a name brand, grocery store brand, and generic brand of potato chips. Have students sample some of each. Ask students which one was the healthiest, cost the least or most, tasted the best, etc.
2. Bring in several items produced from plants such as fresh fruits or vegetables, canned fruits or vegetables, or other processed foods from plants. Ask students to identify the products and where they are produced.
3. Bring in five to seven fresh vegetables (e.g., green bean, broccoli, cauliflower, and spinach). Encourage students to taste the raw vegetables. The next day have the vegetables cooked for students to taste. Discuss the students' reactions.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### **Q1. What food products come from grains?**

##### **A1.**

- a) **Flour**
- b) **Cereals**
- c) **Cooking oils**
- d) **Pasta**
- e) **Protein and soybean meal**
- f) **Starch**
- g) **Dextrose for sweeteners**
- h) **Snack chips and crackers**
- i) **Popcorn**

Bring in and discuss samples of grains grown in the area and some products produced from those grains. Ask students to think of other products made from locally produced grains. Show TM 2.1 and identify the ingredients that came from plants.

#### **Q2. What food products come from vegetables?**

##### **A2.**

- a) **Fresh vegetables**
- b) **Canned vegetables**
- c) **Frozen vegetables**

- d) **Vegetable juices**
- e) **Soups**

Bring in various food items that contain vegetables and have the students identify the vegetables on the list of ingredients. Discuss the vegetables in those products and other products.

**Q3. What food products come from fruits?**

**A3.**

- a) **Fresh fruit**
- b) **Canned fruit**
- c) **Frozen fruit**
- d) **Dried fruit**
- e) **Fruit juices**
- f) **Jams and jellies**

Ask students to discuss what products are processed from fruits. Bring in various dried fruits and have students try to identify them. Students can then eat the dried fruit.

**Q4. What food products come from other plants?**

**A4.**

- a) **Maple syrup**
- b) **Herbs**
- c) **Chocolate**
- d) **Nuts**
- e) **Mustard**
- f) **Tea**
- g) **Coffee**
- h) **Spices**

Divide the class into groups of three or four students. Have them brainstorm other food products that come from plants. Students may think of products that are not listed above. Assign AS 2.1 to have students identify various food products from plants that they have at home or can find in a grocery store.

**Q5. What information is contained in the food label?**

**A5. The following items can be found in the Nutrition Facts food label:**

- a) **Serving size**
- b) **Total calories and calories from fat**
- c) **Percentage (%) daily value**
- d) **Total fat**
- e) **Cholesterol**
- f) **Sodium**
- g) **Potassium**
- h) **Carbohydrates**
- i) **Protein**
- j) **Vitamins and minerals**
- k) **Daily values footnote**
- l) **Calories per gram footnote**
- m) **Ingredients**

Show TM 2.2 to illustrate the key parts of a food label. The numbers on the graphic correspond to the listing of key parts in the Student Reference. Assign AS 2.2 to have

students find information on a food label. For more practice in reading food labels, have students complete AS 2.3.

F. **Other Activities**

1. For a week, have students inventory foods served in school lunches to determine which foods came from plants or have plant products in them.
2. Visit a farmers' market to see which fruits and vegetables are grown locally.
3. Invite a 4-H representative to class to discuss food products from plants.

G. **Conclusion**

Foods from plants make up a large portion of the human diet. Foods from grains, vegetables, fruits, and other plants may be eaten fresh or in a variety of processed forms. Food labels provide nutritional information to help consumers make informed buying decisions.

H. **Answers to Activity Sheets**

AS 2.1 Food Inventory

Answers will vary.

AS 2.2 Do You Know Your Food Label?

1. 10
2. 450
3. 12
4. Cholesterol
5.
  - a. corn
  - b. vegetable oil
  - c. soybean
  - d. cottonseed

AS 2.3 Compare Food Labels

Answers will vary.

I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## Cereal Food Label Ingredients

**INGREDIENTS:** OAT FLOUR, SUGAR, WHEAT STARCH, DRIED APPLE PIECES, BROWN SUGAR, CORN SYRUP, MALT, SALT, PARTIALLY HYDROGENATED VEGETABLE OIL (CONTAINS ONE OR MORE OF THE FOLLOWING OILS: CANOLA, SOYBEAN), CINNAMON, CALCIUM CARBONATE, TRISODIUM PHOSPHATE, SODIUM ASCORBATE (VITAMIN C), ZINC OXIDE, NIACINAMIDE, REDUCED IRON, CALCIUM PANTOTHENATE, BHT (A PRESERVATIVE), VITAMIN A PALMITATE, THIAMIN MONONITRATE (VITAMIN B1), PYRIDOXINE HYDROCHLORIDE (VITAMIN B6), RIBOFLAVIN (VITAMIN B2), FOLIC ACID, VITAMIN B12, AND VITAMIN D.



# Key Parts of a Food Label

<b>Nutrition Facts</b>			
Serving Size 1 cup (30g)			
Servings Per Container about 14			
		Cereal with 1/2 cup Vitamins A&D	
Amount Per Serving	Cereal	Skim Milk	
<b>Calories</b>	110	150	
Calories from Fat	0	0	
<b>% Daily Value**</b>			
<b>Total Fat</b> 0g*	<b>0%</b>	<b>0%</b>	
<b>Saturated Fat</b> 0g	<b>0%</b>	<b>0%</b>	
<b>Cholesterol</b> 0mg	<b>0%</b>	<b>0%</b>	
<b>Sodium</b> 120mg	<b>5%</b>	<b>8%</b>	
<b>Potassium</b> 35mg	<b>1%</b>	<b>7%</b>	
<b>Total Carbohydrate</b> 26g	<b>9%</b>	<b>11%</b>	
<b>Dietary Fiber</b> 2g	<b>8%</b>	<b>8%</b>	
<b>Sugars</b> 15g			
<b>Other Carbohydrate</b> 9g			
<b>Protein</b> 2g			
<b>Vitamin A</b>	25%	30%	
<b>Vitamin C</b>	25%	25%	
<b>Calcium</b>	0%	15%	
<b>Iron</b>	25%	25%	
<b>Vitamin D</b>	10%	25%	
<b>Thiamin</b>	25%	30%	
<b>Riboflavin</b>	25%	35%	
<b>Niacin</b>	25%	25%	
<b>Vitamin B6</b>	25%	25%	
<b>Folate</b>	25%	25%	
<b>Phosphorus</b>	2%	15%	
<b>Magnesium</b>	2%	6%	
<b>Zinc</b>	25%	30%	
*Amount in cereal. One-half cup skim milk contributes an additional 40 calories, 65mg sodium, 6g total carbohydrate (6g sugars), and 4g protein.			
**Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:			
	Calories:	2,000	2,500
<b>Total Fat</b>	Less than	65g	80g
<b>Saturated Fat</b>	Less than	20g	25g
<b>Cholesterol</b>	Less than	300mg	300mg
<b>Sodium</b>	Less than	2400mg	2400mg
<b>Potassium</b>		3500mg	3500mg
<b>Total Carbohydrate</b>		300g	375g
<b>Dietary Fiber</b>		25g	30g
Calories per gram: Fat 9 • Carbohydrate 4 • Protein 4			

**INGREDIENTS:** OAT FLOUR, SUGAR, WHEAT STARCH, DRIED APPLE PIECES, BROWN SUGAR, CORN SYRUP, MALT, SALT, PARTIALLY HYDROGENATED VEGETABLE OIL (CONTAINS ONE OR MORE OF THE FOLLOWING OILS: CANOLA, SOY-BEAN), CINNAMON, CALCIUM CARBONATE, TRISODIUM PHOSPHATE, SODIUM ASCORBATE (VITAMIN C), ZINC OXIDE, NIACINAMIDE, REDUCED IRON, CALCIUM PANTOTHENATE, BHT (A PRESERVATIVE), VITAMIN A PALMITATE, THIAMIN MONONITRATE (VITAMIN B1), PYRIDOXINE HYDROCHLORIDE (VITAMIN B6), RIBOFLAVIN (VITAMIN B2), FOLIC ACID, VITAMIN B12, AND VITAMIN D.







**Do You Know Your Food Label?**

**Objective:** Students will read information found on a food label.

**Directions:** Answer the following questions about the food label at the right.

1. There are \_\_\_\_\_ chips in one serving.
2. It's Friday Video Night and you eat 1/4 of the bag (30 chips) during the evening. This is \_\_\_\_\_ calories.
3. One serving of the chips supplies \_\_\_\_\_ % of the daily requirement for fat.
4. The chips do not contain \_\_\_\_\_. (Hint: High levels of this substance contribute to heart problems.)
5. List the ingredients that came from plants:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_

<b>Nutrition Facts</b>			
Serving Size 1 oz (28g/about 10 chips)			
Servings Per Container 12			
<b>Amount Per Serving</b>			
<b>Calories 150</b>	Calories from Fat 70		
<hr/>			
	% Daily Value*		
<b>Total Fat 8g</b>	<b>12%</b>		
Saturated Fat 1.5g	8%		
<b>Cholesterol 0mg</b>	<b>0%</b>		
<b>Sodium 170mg</b>	<b>7%</b>		
<b>Total Carbohydrate 18g</b>	<b>6%</b>		
Dietary Fiber 1g	4%		
Sugars 0g			
<b>Protein 2g</b>			
<hr/>			
Vitamin A 0%	•	Vitamin C 0%	
Calcium 2%	•	Iron 2%	
*Percent daily values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:			
	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g
<hr/>			
Calories per gram:			
Fat 9 • Carbohydrate 4 • Protein 4			

**INGREDIENTS**

CORN, VEGETABLE OIL (MAY CONTAIN ONE OR MORE OF THE FOLLOWING: CORN, PARTIALLY HYDROGENATED SOYBEAN, COTTONSEED), SALT.



**Compare Food Labels**

**Objective:** Students will compare food labels of two brands of a favorite food.

**Directions:** Obtain the following information from the Nutrition Facts food label found on the package of two brands of your favorite crackers, chips, cereals, pop, popcorn, etc. Make sure the serving size is the same, record what you paid for each item at the grocery store, and attach both labels to this assignment. Answer the questions on the next page.

<b>Name of Product</b>		
Serving Size		
Servings per Container		
Calories per Serving		
Calories from Fat		
Total Fat (g)		
Saturated Fat (g)		
Cholesterol (mg)		
Sodium (mg)		
Potassium (mg)		
Total Carbohydrate (g)		
Dietary Fiber (g)		
Sugars (g)		
Protein (g)		
Vitamin A (%)		
Vitamin C (%)		
Iron (%)		
Calcium (%)		
Wt. of Total Package		
Price		
Price/Serving (price÷servings per container)		



## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 3: Food Products from Animals

**Competency/Objective:** Identify food products from animals.

#### **Study Questions**

1. What food products come from beef cattle?
2. What food products come from hogs?
3. What food products come from sheep?
4. What food products come from poultry?
5. What food products come from dairy animals?
6. What are some examples of fish and seafood?
7. What are some examples of processed meats?
8. What information is contained in the meat label?

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit IV.
2. Transparency Masters  
  
TM 3.1 Wholesale and Retail Cuts of Beef  
TM 3.2 Meat Consumption Trends in the United States  
TM 3.3 Know Your Meat Label
3. Handouts  
  
HO 3.1 Per Capita Consumption of Meat Products in the United States  
HO 3.2 Beef Chart  
HO 3.3 Pork Chart  
HO 3.4 Lamb Chart  
HO 3.5 Meat Labels
4. Activity Sheets  
  
AS 3.1 Identify the Most Popular Meat Product  
AS 3.2 Animal Food Products  
AS 3.3 Identifying per Capita Consumption Trends of Meat Products  
AS 3.4 Processing Whipped Cream and Butter  
AS 3.5 Reading a Meat Label

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 3: Food Products from Animals

#### TEACHING PROCEDURES

##### A. **Review**

Americans eat many foods produced from plants. They are essential for a balanced diet. However, a number of food products are also produced from animals.

##### B. **Motivation**

1. Ask students what category of meat is most popular in the United States. This will lead to listing and explaining the major categories: beef, chicken, fish, lamb, pork, turkey, and veal. Explain the concept of per capita consumption and then distribute AS 3.1. Use HO 3.1 to provide the actual figures. Discuss and compare answers.
2. Ask students what is in a hamburger. Obviously, it is ground beef. Then ask them why it is called hamburger, a pork name, when it is actually beef. Offer extra credit to the student(s) with the answer the following day. (It originated in Hamburg, Germany.)
3. Bring in samples of a variety of meats and have students try to distinguish between different types of meat.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What food products come from beef cattle?**

A1.

- a) Hamburger
- b) Steak
- c) Roast
- d) Veal - young cattle

Show TM 3.1, distribute copies of HO 3.2, and discuss the common cuts of beef.

#### Q2. **What food products come from hogs?**

A2.

- a) Pork chops
- b) Ham
- c) Bacon

Distribute HO 3.3 and discuss the common cuts of pork.

#### Q3. **What food products come from sheep?**

A3.

- a) Lamb chops
- b) Leg of lamb

Distribute HO 3.4 and discuss the common cuts of lamb. Have student complete AS 3.2 to test their knowledge of beef, pork, and lamb cuts.

**Q4. What food products come from poultry?**

**A4.**

- a) **Eggs**
- b) **Meat**

Ask students to discuss what foods come from poultry. Assign AS 3.3 to have students graph the U.S. meat consumption trends. Show TM 3.2 to better illustrate meat consumption trends.

**Q5. What food products come from dairy animals?**

**A5.**

- a) **Milk**
- b) **Cheese**
- c) **Ice cream**
- d) **Yogurt**
- e) **Sour cream**
- f) **Cottage cheese**
- g) **Butter**

Bring in samples of butter and margarine. Conduct a taste test to see if students can tell the difference between the two products. The taste difference in butter comes primarily from the fat content. Have students do AS 3.4 to create whipped cream and butter from cream. This can be a group activity or an individual student activity.

**Q6. What are some examples of fish and seafood?**

**A6.**

- a) **Fish**
  - 1) **Catfish**
  - 2) **Trout**
  - 3) **Bass**
  - 4) **Tuna**
  - 5) **Salmon**
  - 6) **Halibut**
  - 7) **Cod**
  - 8) **Shark**
- b) **Seafood**
  - 1) **Lobster**
  - 2) **Crabs**
  - 3) **Oysters**
  - 4) **Scallops**
  - 5) **Shrimp**
  - 6) **Clams**

Ask students to identify fish and seafood they have eaten. List suggestions on the board. Ask students to describe their experiences in catching some of the fish and/or seafood they identified.

**Q7. What are some examples of processed meats?**

**A7.**

- a) **Processed beef and pork**
  - 1) **Luncheon meats**
  - 2) **Hot dogs**
  - 3) **Pepperoni**
- b) **Processed chicken patties and nuggets**

Discuss the various types of processed meats and have students tell their favorites.

**Q8. What information is contained in the meat label?**

**A8.**

- a) **Species**
- b) **Wholesale cut**
- c) **Retail cut**
- d) **Total price**
- e) **Price/lb.**
- f) **Net weight**
- g) **"Sell by" date**

Show TM 3.3 and discuss the key information on a meat label. Distribute copies of HO 3.5 and assign AS 3.5 to have students answer questions about sample meat labels.

**F. *Other Activities***

1. Conduct a cooking/tasting day with a variety of meats and fish.
2. Visit a farm to observe how livestock are raised.
3. Write to livestock breed associations and ask for additional information on the meat characteristics of each breed.
4. Tour a grocery store meat department or packing plant to observe meat processing activities.

**G. *Conclusion***

There is a wide variety of food products produced from animals. Some foods are served fresh while others are processed. Meat contains protein needed to maintain good health. Protein can also be acquired from dairy and fish products. Information is provided on meat labels to help consumers make informed decisions.

**H. *Answers to Activity Sheets***

AS 3.1 Identify the Most Popular Meat Product

Answers will vary.

### AS 3.2 Animal Food Products

CUT OF MEAT	TYPE OF MEAT ANIMAL		
	BEEF	PORK	SHEEP
1. Bacon		X	
2. Sirloin steak	X		
3. T-bone steak	X		
4. Lamb chops			X
5. Filet mignon	X		
6. Loin chop		X	X
7. Kabobs	X		X
8. Flank steak	X		
9. Rump roast	X		
10. Sausage		X	
11. Rib steak	X		
12. Fresh arm picnic		X	
13. Tenderloin	X	X	
14. Round steak	X		
15. Ham slice		X	
16. Loin roast		X	
17. Shoulder steak	X		
18. Leg of lamb			X
19. Short ribs	X		
20. Blade steak	X	X	

### AS 3.3 Identifying per Capita Consumption Trends of Meat Products

Answers will vary.

### AS 3.4 Processing Whipped Cream and Butter

There are no answers for this activity.

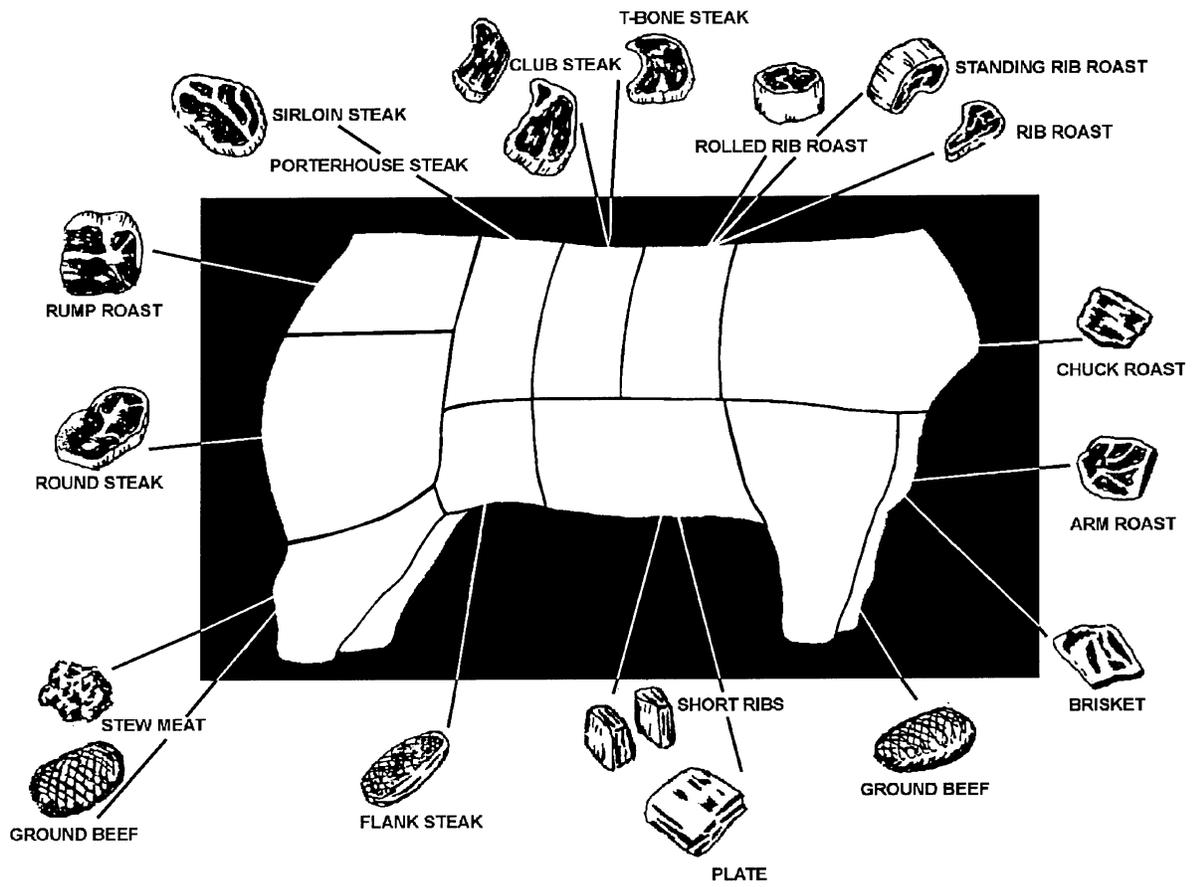
### AS 3.5 Reading a Meat Label

1. Species
2. Wholesale cut
3. Retail cut
4. Total price
5. Price/lb.
6. Net wt.
7. "Sell by" date
8. \$4.22
9. Ground beef - 70% lean
10. Loin
11. Dec. 14
12. T-bone pot roast
13. 8, \$ 0.30

### I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

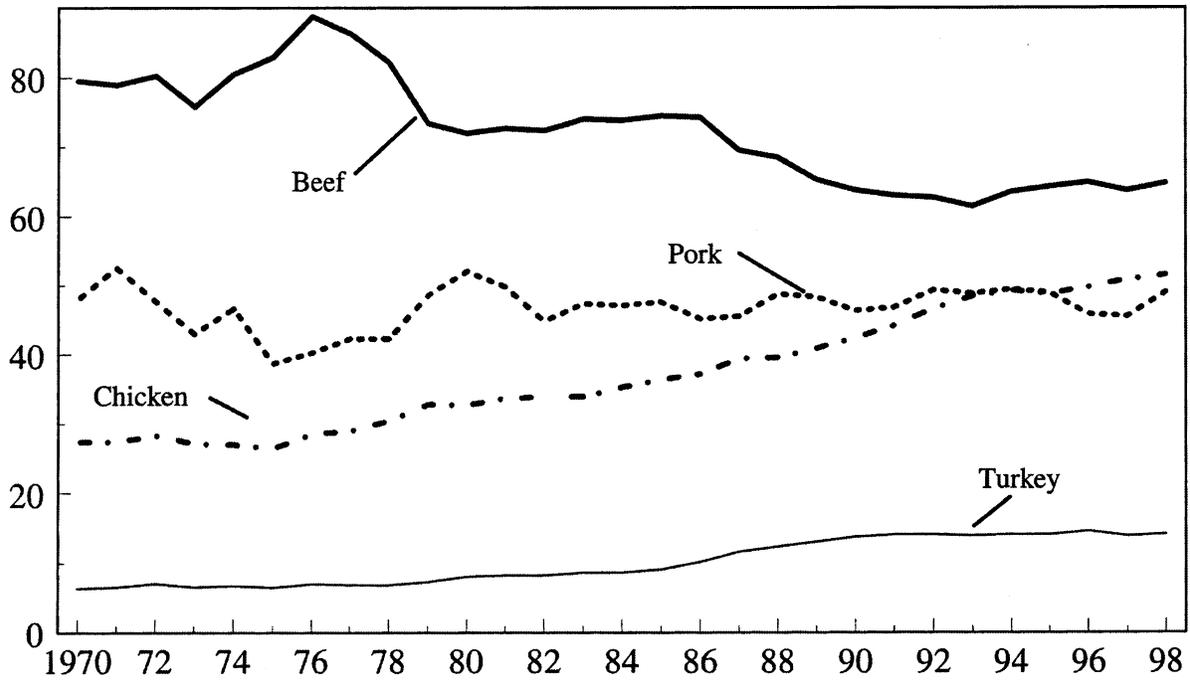
# Wholesale and Retail Cuts of Beef





# Meat Consumption Trends in the United States

Pounds per capita<sub>1/</sub>

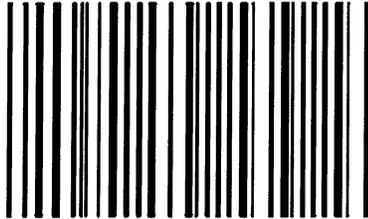


<sub>1/</sub> Boneless, trimmed equivalent.

Source: USDA/Economic Research Service.



# Know Your Meat Label



**Greiman Angus Meats  
FOOD GIANT STORES**

Columbia, Missouri

Species →	<b>BEEF</b>	<b>RIB</b>	← Retail cut
Wholesale cut →	<b>RIBEYE</b>	<b>STEAK</b>	
"Sell by" date →	<b>SELL BY 06-04-00</b>	<b>TOTAL PRICE \$4.76</b>	← Total price
Net weight →	<b>NET WT/CT 0.75 lb.</b>	<b>UNIT PRICE \$6.35</b>	← Price/lb.



# Per Capita Consumption of Meat Products in the United States <sup>1/</sup>

Year	U.S. Total Population July 1 2/	Beef	Veal	Pork	Lamb	Total 3/	Chicken 4/ & 5/	Turkey	Total 3/	Fish and Shellfish	Total 3/
Millions		-----Pounds-----									
1970	205.052	79.6	2.0	48.0	2.1	131.7	27.4	6.4	33.8	11.7	177.3
1971	207.661	79.0	1.9	52.6	2.1	135.5	27.4	6.6	34.0	11.5	181.0
1972	209.896	80.3	1.6	47.8	2.2	131.8	28.3	7.1	35.4	12.5	179.7
1973	211.909	75.8	1.2	43.0	1.7	121.8	27.1	6.6	33.7	12.7	168.2
1974	213.854	80.6	1.6	46.7	1.5	130.4	27.0	6.8	33.8	12.1	176.3
1975	215.973	83.0	2.8	38.7	1.3	125.8	26.4	6.5	32.9	12.1	170.9
1976	218.035	88.8	2.7	40.3	1.2	133.0	28.5	7.0	35.5	12.9	181.4
1977	220.239	86.3	2.6	42.3	1.1	132.3	29.0	6.9	35.9	12.6	180.9
1978	222.585	82.2	2.0	42.3	1.0	127.5	30.4	6.9	37.3	13.4	178.2
1979	225.055	73.5	1.4	48.6	1.0	124.4	32.8	7.3	40.1	13.0	177.6
1980	227.726	72.1	1.3	52.1	1.0	126.4	32.7	8.1	40.8	12.4	179.6
1981	229.966	72.8	1.3	49.9	1.0	125.1	33.7	8.3	42.1	12.6	179.7
1982	232.188	72.5	1.4	44.9	1.1	119.8	33.9	8.3	42.2	12.4	174.4
1983	234.307	74.1	1.4	47.4	1.1	123.9	34.0	8.7	42.7	13.3	180.0
1984	236.348	73.9	1.5	47.2	1.1	123.7	35.3	8.7	44.0	14.1	181.7
1985	238.466	74.6	1.5	47.7	1.1	124.9	36.4	9.1	45.5	15.0	185.4
1986	240.651	74.4	1.6	45.2	1.0	122.2	37.2	10.2	47.4	15.4	184.9
1987	242.804	69.6	1.3	45.6	1.0	117.4	39.4	11.6	51.0	16.1	184.5
1988	245.021	68.6	1.1	48.8	1.0	119.5	39.6	12.4	51.9	15.1	186.6
1989	247.342	65.4	1.0	48.4	1.0	115.9	40.9	13.1	53.9	15.6	185.4
1990	249.949	63.9	0.9	46.4	1.0	112.3	42.4	13.8	56.3	15.0	183.5
1991	252.636	63.1	0.8	46.9	1.0	111.9	44.2	14.1	58.3	14.8	185.1
1992	255.382	62.8	0.8	49.4	1.0	114.1	46.7	14.1	60.8	14.7	189.5
1993	258.089	61.5	0.8	48.9	1.0	112.1	48.5	14.0	62.5	14.9	189.5
1994	260.602	63.6	0.8	49.5	0.9	114.7	49.3	14.1	63.3	15.1	193.2
1995	263.039	64.4	0.8	49.0	0.9	115.1	48.8	14.1	62.9	14.9	193.0
1996	265.453	65.0	1.0	45.9	0.8	112.8	49.8	14.6	64.4	14.7	191.8
1997	267.901	63.8	0.9	45.6	0.8	111.0	50.9	13.9	64.8	14.5	190.3
1998 P	270.290	64.9	0.7	49.1	0.9	115.6	51.6	14.2	65.8	14.5	195.9

P = Preliminary

1/ Excludes shipments to territories. Boneless equivalent for red meat derived from carcass weight, using conversion factors shown in supply and utilization tables. Boneless equivalent for chicken and turkey derived from ready-to-cook weight, using conversion factors shown in supply and utilization tables. Boneless equivalent or edible weight for fish is calculated by the U.S. Department of Commerce (see fishery products per capita table). 2/ Excludes U.S. territories. 3/ Computed from unrounded data. 4/ Includes skin, neck meat, and giblets. 5/ Excludes the amount of ready-to-cook chicken going to pet food as well as some water leakage that occurs when chicken is cut up before packaging.

Source: USDA/Economic Research Service and U.S. Department of Commerce/National Marine Fisheries.



# Beef Chart

RETAIL CUTS OF BEEF – WHERE THEY COME FROM AND HOW TO COOK THEM

<p><b>CHUCK</b> Braise. Cook in Liquid.</p>	<p><b>RIB</b> Roast, Broil, Panbroil, Panfry.</p>	<p><b>SHORT LOIN</b> Roast, Broil, Panbroil, Panfry.</p>	<p><b>SIRLOIN</b> Broil, Panbroil, Panfry.</p>	<p><b>ROUND</b> Braise. Cook in Liquid.</p>
<p><b>FORE SHANK</b> Braise. Cook in Liquid.</p>	<p><b>BRISKET</b> Braise. Cook in Liquid.</p>	<p><b>SHORT PLATE</b> Braise. Cook in Liquid.</p>	<p><b>FLANK</b> Braise. Cook in Liquid.</p>	<p><b>TIP</b> Braise.</p>

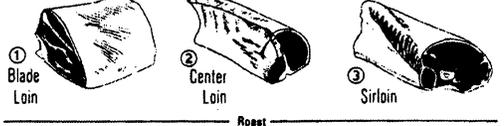
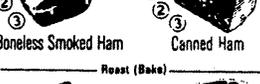
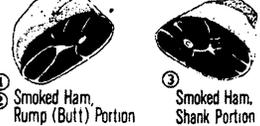
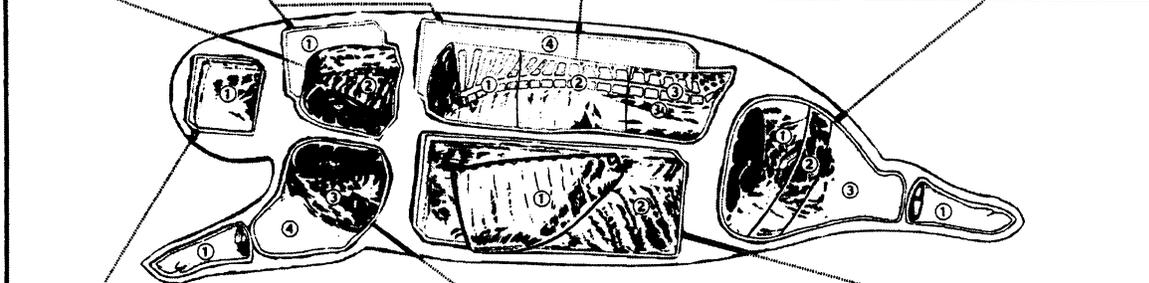
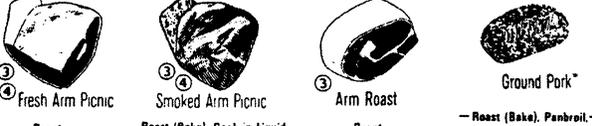
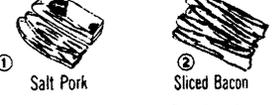
\*May be Roasted, Broiled, Panbroiled or Panfried from high quality beef.  
\*\*May be Roasted, (Baked), Broiled, Panbroiled or Panfried.

This chart approved by  
**National Live Stock and Meat Board**



# Pork Chart

RETAIL CUTS OF PORK — WHERE THEY COME FROM AND HOW TO COOK THEM

 <p>Cubed Steak* Pork Cubes</p> <p>— Braise, Cook in Liquid, Broil —</p>  <p>Blade Steak Smoked Shoulder Roll</p> <p>— Braise, Panfry — — Roast (Bake), Cook in Liquid —</p>	 <p>Blade Chop Rib Chop Loin Chop Sirloin Chop</p>  <p>Cubed Steak* Butterfly Chop Top Loin Chop Sirloin Cutlet</p> <p>— Braise, Broil, Panbroil, Panfry —</p>	 <p>Boneless Leg (Fresh Ham) Sliced Cooked (Boiled) Ham</p> <p>— Roast — — Heat or Serve Cold —</p>
 <p>Boneless Blade Boston Roast Blade Boston Roast</p> <p>— Braise, Roast —</p>  <p>Fat Back Lard</p> <p>— Pastry, Cook in Liquid — — Pastry, Cookies, Quick Breads, Cakes, Frying —</p> <p>① CLEAR PLATE ② FAT BACK</p>	 <p>Country-Style Ribs Back Ribs Smoked Loin Chop Canadian-Style Bacon</p> <p>— Roast (Bake), Braise, Cook in Liquid — — Roast (Bake), Broil, Panbroil, Panfry —</p>  <p>Boneless Top Loin Roast Boneless Top Loin Roast (Double) Tenderloin</p> <p>— Roast — — Roast (Bake), Braise, Panfry —</p>  <p>Blade Loin Center Loin Sirloin</p> <p>— Roast —</p>	 <p>Boneless Smoked Ham Canned Ham</p> <p>— Roast (Bake) —</p>  <p>Boneless Smoked Ham Slices Center Smoked Ham Slice</p> <p>— Broil, Panbroil, Panfry —</p>  <p>Smoked Ham, Rump (Butt) Portion Smoked Ham, Shank Portion</p> <p>— Roast (Bake), Cook in Liquid —</p>
		
<p><b>JOWL</b></p>  <p>Smoked Jowl</p> <p>— Cook in Liquid, Broil, Panbroil, Panfry —</p>  <p>Pig's Feet</p> <p>— Cook in Liquid, Braise —</p>	<p><b>PICNIC SHOULDER</b></p>  <p>Fresh Arm Picnic Smoked Arm Picnic Arm Roast Ground Pork*</p> <p>— Roast — — Roast (Bake), Cook in Liquid — — Roast — — Roast (Bake), Panbroil, Panfry —</p>  <p>Fresh Hock Smoked Hock Neck Bones Arm Steak Link Sausage* Roll</p> <p>— Braise, Cook in Liquid — — Cook in Liquid — — Braise, Panfry — — Panfry, Braise, Bake —</p>	<p><b>① SPARERIBS ② BACON (SIDE PORK)</b></p>  <p>Spareribs Slab Bacon</p>  <p>Salt Pork Sliced Bacon</p> <p>— Bake, Broil, Panbroil, Panfry, Cook in Liquid — — Bake, Broil, Panbroil, Panfry —</p>

\*May be made from Boston Shoulder, Picnic Shoulder, Loin or Leg

This chart approved by  
**National Live Stock and Meat Board**

©National Live Stock and Meat Board



# Lamb Chart

RETAIL CUTS OF LAMB — WHERE THEY COME FROM AND HOW TO COOK THEM

SHOULDER	NECK	RIB	LOIN	SIRLOIN	LEG
<ul style="list-style-type: none"> <li>Cubes for Kabobs** (Broil)</li> <li>Boneless Blade Chops (Saratoga) (2) (Broil)</li> <li>Blade Chop (2) (Broil, Panbroil, Pantry)</li> <li>Boneless Shoulder (2, 3) (Roast)</li> <li>Arm Chop (3) (Broil, Panbroil, Pantry)</li> <li>Cushion Shoulder (2, 3) (Roast)</li> <li>Square Shoulder (2, 3) (Roast)</li> </ul>	<ul style="list-style-type: none"> <li>Neck Slices (1) (Braise)</li> </ul>	<ul style="list-style-type: none"> <li>Frenched Rib Chops (1) (Broil, Panbroil, Pantry)</li> <li>Rib Chops (1) (Broil, Panbroil, Pantry)</li> <li>Crown Roast (1) (Roast)</li> <li>Rib Roast (1) (Roast)</li> </ul>	<ul style="list-style-type: none"> <li>Loin Chops (1) (Broil, Panbroil, Pantry)</li> <li>Boneless Double Loin Chop (1) (Broil, Panbroil, Pantry)</li> <li>Boneless Double Loin Roast (1) (Roast)</li> <li>Loin Roast (1) (Roast)</li> </ul>	<ul style="list-style-type: none"> <li>Leg Chop (Steak) (2, 3) (Broil, Panbroil, Pantry)</li> <li>Combination Leg (1, 2, 3, 4) (Broil, Panbroil, Pantry)</li> <li>Sirloin Chop (1) (Broil, Panbroil, Pantry)</li> <li>Boneless Sirloin Roast (1) (Roast)</li> <li>Sirloin Roast (1) (Roast)</li> </ul>	<ul style="list-style-type: none"> <li>Center Leg (2, 3) (Roast)</li> <li>Rolled Leg (1, 2, 3, 4) (Roast)</li> <li>American Leg (2, 3, 4) (Roast)</li> <li>Sirloin Half of Leg (1, 2) (Roast)</li> <li>Shank Half of Leg (3, 4) (Roast)</li> <li>French-Style Leg (1, 2, 3, 4) (Roast)</li> <li>French-Style Leg, Sirloin Off (2, 3, 4) (Roast)</li> </ul>
FORE SHANK	BREAST	HIND SHANK	GROUND OR CUBED LAMB*		
<ul style="list-style-type: none"> <li>Fore Shank (1) (Braise, Cook in Liquid)</li> </ul>	<ul style="list-style-type: none"> <li>Breast (2) (Roast, Braise)</li> <li>Rolled Breast (2) (Roast)</li> <li>Stuffed Breast (2) (Roast)</li> </ul>	<ul style="list-style-type: none"> <li>Hind Shank (4) (Braise, Cook in Liquid)</li> </ul>	<ul style="list-style-type: none"> <li>(Large Pieces) Lamb for Stew* (Small Pieces)</li> <li>(Braise, Cook in Liquid)</li> </ul>		
<ul style="list-style-type: none"> <li>Riblets (2) (Braise, Cook in Liquid)</li> <li>Boneless Riblets (2) (Braise, Roast (Bake))</li> <li>Spareribs (2) (Braise, Roast (Bake))</li> <li>Stuffed Chops (2) (Broil, Panbroil, Pantry)</li> </ul>	<ul style="list-style-type: none"> <li>Cubed Steak** (Broil, Panbroil, Pantry)</li> <li>Lamb Patties* (Broil, Panbroil, Pantry)</li> <li>Ground Lamb* (Roast (Bake))</li> </ul>				

\* Lamb for stew or grinding may be made from any cut.

\*\* Kabobs or cube steaks may be made from any thick solid piece of boneless Lamb.

This chart approved by  
National Live Stock and Meat Board

©National Live Stock and Meat Board

Source: Uniform Retail Meat Identity Standards, National Live Stock and Meat Board



# Meat Labels



201589 005212



Columbia, Missouri

1.06LB. \$1.29  
NT WT/CT PRICE/LB.

**\$1.37**

TOTAL PRICE

GROUND BEEF  
NOT LESS THAN 70% LEAN

DEC 12

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

1.45lb \$3.69  
NT WT/CT PRICE/LB.

**\$5.35**

TOTAL PRICE

BONELESS & SKINLESS  
CHICKEN BREAST

DEC 16

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

3.30lb \$1.58  
NT WT/CT PRICE/LB.

**\$5.21**

TOTAL PRICE

GROUND BEEF  
NOT LESS THAN 60% LEAN

DEC 20

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

0.65lb \$6.49  
NT WT/CT PRICE/LB.

**\$4.22**

TOTAL PRICE

BEEF RIB  
RIBEYE STEAK  
USDA CHOICE

SEP 11

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

1.00LB. \$1.79  
NT WT/CT PRICE/LB.

**\$1.79**

TOTAL PRICE

GROUND BEEF  
NOT LESS THAN 85% LEAN

DEC 12

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

4.19lb \$1.89  
NT WT/CT PRICE/LB.

**\$7.92**

TOTAL PRICE

BEEF CHUCK  
T-BONE POT ROAST  
USDA CHOICE

DEC 14

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

1.16LB. \$2.19  
NT WT/CT PRICE/LB.

**\$2.54**

TOTAL PRICE

GROUND BEEF  
NOT LESS THAN 90% LEAN

DEC 12

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

1.70lb \$1.49  
NT WT/CT PRICE/LB.

**\$2.53**

TOTAL PRICE

FRESH PORK LOIN  
ASSORTED CHOPS

DEC 14

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

0.59LB. \$1.99  
NT WT/CT PRICE/LB.

**\$1.17**

TOTAL PRICE

BEEF CHUCK SHOULDER  
BONELESS CHARCOAL STEAK  
USDA CHOICE

SEP 12

STORE NO. KEEP REFRIGERATED PURCHASE BY



201589 005212



Columbia, Missouri

0.39lb \$2.19  
NT WT/CT PRICE/LB.

**\$0.85**

TOTAL PRICE

FRESH PORK LOIN  
SIRLOIN CHOPS BONELESS

DEC 14

STORE NO. KEEP REFRIGERATED PURCHASE BY



**Identify the Most Popular Meat Product**

**Objective:** Students will estimate the average amount of meat they consume per year.

**Directions:** How much of these items did you eat during the past year? Estimate your consumption. Your instructor will provide the latest actual figures.

CATEGORY	POUNDS PER YEAR	
	MY ESTIMATE	ACTUAL
Beef		
Chicken		
Fish		
Lamb		
Pork		
Turkey		
Veal		



**Animal Food Products**

**Objective:** Students will be able to identify the type of meat animal that produces various cuts of meat.

**Directions:** Using HO 3.2, HO 3.3, and HO 3.4, place a check in the box to identify the type of meat animal that produces the cut of meat. Certain cuts of meat can come from more than one animal.

CUT OF MEAT	TYPE OF MEAT ANIMAL		
	BEEF	PORK	SHEEP
1. Bacon			
2. Sirloin steak			
3. T-bone steak			
4. Lamb chops			
5. Filet mignon			
6. Loin chop			
7. Kabobs			
8. Flank steak			
9. Rump roast			
10. Sausage			
11. Rib steak			
12. Fresh arm picnic			
13. Tenderloin			
14. Round steak			
15. Ham slice			
16. Loin roast			
17. Shoulder steak			
18. Leg of lamb			
19. Short ribs			
20. Blade steak			



**Identifying per Capita Consumption Trends of Meat Products**

**Objective:** Students will be able to graph current trends of consumption and predict future trends.

**Directions:** Use HO 3.1 to develop a graph that will show the trends of consumption in the United States.

1. Plot per capita consumption (pounds per person) of beef, pork, lamb, chicken, and turkey on the vertical (Y) axis and time (years) on the horizontal (X) axis.
2. Next, extend your graph to the year 2030 and predict what you think the trends will be.



### **Processing Whipped Cream and Butter**

**Objective:** Students will be able to make whipped cream and butter from cream.

**Materials and Equipment:**

1/2 pint of cream (in store container)

Salt

Crackers

**Procedure:**

1. Shake container for 10 minutes.
2. Open the container to see if the cream has become whipped cream. Shake slightly longer if whipped cream has not formed.
3. Close the container tightly.
4. Continue shaking until butter forms, approximately 10 minutes.
5. Pour off the liquid, "buttermilk."
6. Add salt to taste.
7. Spread butter on crackers. Enjoy!



**Reading a Meat Label**

**Objective:** Students will be able to recognize and use information found on meat labels.

**Directions:** Answer each of the following questions in the space provided.

Typically, seven items of information are found on a meat label in a grocery store. They are:

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_

Use HO 3.5 to answer questions 8 to 12.

- 8. What is the total price you will pay when buying the ribeye steak? \_\_\_\_\_
- 9. Which retail item costs the least per pound? \_\_\_\_\_
- 10. Which wholesale cut do pork chops (assorted) come from? \_\_\_\_\_
- 11. On what date should the pork sirloin chops be removed from the meat counter? \_\_\_\_\_
- 12. Which retail cut weighs the most? \_\_\_\_\_
- 13. Hamburger costs \$1.20 per pound. You purchase 2 pounds and plan to make quarter pound hamburgers. How many hamburgers can you make? \_\_\_\_\_  
How much does each hamburger cost? \_\_\_\_\_



## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 4: Food Processing and Food Safety

**Competency/Objective:** Describe the importance of food processing and safety.

#### **Study Questions**

1. **What is food processing?**
2. **Why is food processed?**
3. **How are food products processed?**
4. **What are the steps in processing food from producer to consumer?**
5. **How do you know your food is safe?**
6. **How does food preparation affect quality and safety?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000. Unit IV.
2. Super Soynuts, Soybean Candies, and/or Mighty MO Munchies  
  
Lee Seed Company  
2242 Highway IA 182  
Inwood, IA 51240  
712-753-4403  
  
The Soy Bin  
Route 1, Box 99  
Marienthal, KS 67863  
316-375-2746  
  
Dwight and Rosemary Hall  
Highway 111 West, Box 335  
Oregon, MO 64473  
800-762-1384
3. Transparency Masters  
  
TM 4.1 Processing Food: From Producer to Consumer  
TM 4.2 Recommended Safe Cooking Temperatures
4. Activity Sheets  
  
AS 4.1 Popcorn Processing (Instructor)  
AS 4.1 Popcorn Processing (Student)  
AS 4.2 Soybean Processing (Instructor)  
AS 4.3 Ice Cream Processing (Instructor)  
AS 4.3 Ice Cream Processing (Student)  
AS 4.4 Food Safety Activities (Instructor)

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 4: Food Processing and Food Safety

#### TEACHING PROCEDURES

##### A. **Review**

Foods of plant origin come from grains, vegetables, fruits, and other plants. Foods of animal origin come from beef, pork, poultry, sheep, fish, and seafood. Many consumers prefer to eat processed plant food products rather than the raw form. Most meat products are processed as well. This lesson will discuss reasons for food safety and techniques of food processing that help provide nutritious, quality foods for consumers.

##### B. **Motivation**

1. Bring in samples of dehydrated food such as dried fruit (raisins or apple slices), beef jerky, etc. for students to eat. Then ask students how the food items were processed and why.
2. Obtain samples of a soy-based snack food such as Super Soynuts, Soybean Candies, or Mighty MO Munchies. See References for where to get these foods. Perform a taste test with students to see if they can tell that soybeans were processed to make the product(s).
3. Bring a bag of potatoes to class along with a variety of products made from potatoes (e.g., chips, french fries, shoestring potatoes, and hash browns). Ask students to describe how each of the products was processed.
4. Bring in several different food items and draw a flowchart of the processes those food items go through from producer to consumer. Discuss these processes with the students.
5. Bring in processed meats (bologna, wieners, Spam, chicken strips, etc.) and discuss how they were processed.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### Q1. **What is food processing?**

###### A1. **Processing is used to change a raw agricultural product into a consumable product and includes the following steps.**

- a) **Cleaning**
- b) **Drying**
- c) **Weighing**
- d) **Refrigerating**
- e) **Preserving**
- f) **Storing**
- g) **Changing the form**

Discuss processing. Processing can be a very simple or complicated process. Processing strawberries to be frozen whole is quite simple as compared to processing flour. Strawberries have to be washed, sorted, and destemmed before freezing. Wheat has to be cleaned, dried, weighed, and graded for quality before it can be ground into flour.

Depending on the type of flour, it may also be separated into bran and germ before being ground. Have students complete the popcorn activity (AS 4.1). Note that processing also involves the methods and conditions of proper storage.

**Q2. Why is food processed?**

**A2.**

- a) **To improve taste**
- b) **To maintain quality**
- c) **To prevent spoilage**
- d) **To ensure food is safe to eat**
- e) **For the convenience of consumers**

Food is an important part of everyday life. Foods must not only be nutritious but also safe from spoilage or contamination. Maintaining food quality is important for consumer acceptance. High-quality foods generally command higher prices than would lower-quality food products. Although quality and safety are important, the convenience of food to the consumer is also an important factor affecting how food is processed.

**Q3. How are food products processed?**

**A3.**

- a) **Freezing - reducing the temperature to 0°F to stop microbial growth**
- b) **Heating - heating food to a temperature greater than 180°F; pasteurization for dairy products**
- c) **Dehydration - removing water from foods: beef jerky and raisins**
- d) **Fermentation - breaking down complex carbohydrates: pickles and yogurt**
- e) **Smoking and curing - preserving foods by using salt, brine, smoke, or aging**
- f) **Vacuum packing - removing air from the food product container**
- g) **Irradiation - using radiant energy to improve food safety and extend shelf life**
- h) **Grinding - reducing the particle size: flour and ground beef**
- i) **Homogenization - breaking large fat globules into smaller ones: milk**
- j) **Emulsification - holding together ingredients that normally repel and separate from each other: salad dressing and ice cream**
- k) **Extrusion - puffing a product with high pressure to form a new shape: cereal**
- l) **Separation - removing bone and fat from product**

Discuss the different techniques used to process food. Bring in sample foods that have been processed using these techniques. Conduct AS 4.2 to illustrate food processing procedures. Conduct AS 4.3 as an additional exposure to food processing.

**Q4. What are the steps in processing food from producer to consumer?**

**A4.**

- a) **Producer - grows plants or raises animals**
- b) **Harvesting - removing the edible portions from plants in the field**
- c) **Processing - cleaning, separating, handling, and preparing food for distribution**
- d) **Distributing - storing food until it is needed by wholesalers**
- e) **Wholesaling - selling fresh or processed foods to retailers**
- f) **Retailing - selling food to consumers**
- g) **Consumer - eats fresh or processed foods**

Raw agricultural products can go through many steps before they reach the consumer. The more steps a product goes through the higher the marketing cost. If the consumer purchases the product straight from the producer, much of the marketing cost is reduced. For products like apples, purchasing from the producer may be very cost-efficient. For other products like wheat, it would cost the consumer a lot of time to process the wheat into flour. Show TM 4.1 and explain how food is processed, step by step, from a raw commodity to a consumable product.

**Q5. How do you know your food is safe?**

**A5. Food quality is monitored by federal government agencies.**

- a) **Environmental Protection Agency (EPA)**
- a) **Food and Drug Administration (FDA)**
- b) **U.S. Department of Agriculture (USDA)**
- c) **The livestock industry has responded by implementing quality assurance programs.**

Food safety is a major concern to consumers. Many steps are taken to ensure that food sold to consumers is safe to eat and is high quality. Several government agencies such as EPA, FDA, and the USDA regulate practices that affect the safety of the nation's food supply. Government inspectors are trained to identify potential problems before they reach consumers. Ask students how they or their parents can avoid this problem.

**Q6. How does food preparation affect quality and safety?**

**A6. Food should be prepared according to the following four steps to keep it safe from harmful bacteria.**

- a) **Clean - Wash hands in hot, soapy water before preparing food.**
- b) **Separate - Keep raw meats away from ready-to-eat foods.**
- c) **Cook - Cook foods long enough and at a high enough temperature to kill harmful bacteria.**
- d) **Chill - Refrigerate or freeze leftovers within 2 hours or less.**

Review the four steps to keep food safe from harmful bacteria. Refer to TM 4.2 and explain the recommended safe cooking temperatures. Emphasize the importance of avoiding the temperature danger zone where bacteria grows most rapidly. Food needs to be either cooked quickly or chilled quickly to avoid this temperature zone. Conduct AS 4.4 to help students understand food safety issues.

**F. *Other Activities***

1. Have each student bring a label from a food product. These can be read in class with a discussion about the different processing needs. Identify preservatives and additives that are used to maintain the quality of the food.
2. Bring a food product or raw food ingredient and put it through selected processes to become the finished product. This product can be eaten in class when complete. Examples of foods and their products include apples for applesauce, oranges for orange juice, chuck steak for hamburger.
3. Access the National Pork Producers' web page and take the "Can Your Kitchen Pass the Food Safety Test?" The address of the page is <<http://www.nppc.org/CONS/SAFETY/START.html>>.

G. **Conclusion**

Food safety and processing affects everyone because of the need for safe, wholesome food. Processing involves all the steps of going from a raw agricultural product to a consumable product. We process food to improve taste, maintain quality, prevent spoilage, and to provide a safe and convenient product for consumers. Many different methods and steps can be used to process food. U.S. government inspectors monitor the food processing industry to ensure safe food for consumers. Keeping food safe from harmful bacteria is an important food safety principle.

H. **Answers to Activity Sheets**

AS 4.1 Popcorn Processing

Answers will vary.

AS 4.2 Soybean Processing

There are no answers for this activity.

AS 4.3 Ice Cream Processing

1. The freezing point of water is actually lowered by adding rock salt to the ice. Ice cream freezes at 21<sup>o</sup>F.
2. The amount of milk fat affects the flavor and amount of calories in ice cream. The greater the milk fat, the richer the flavor and the higher amount of calories.

AS 4.4 Food Safety Activities

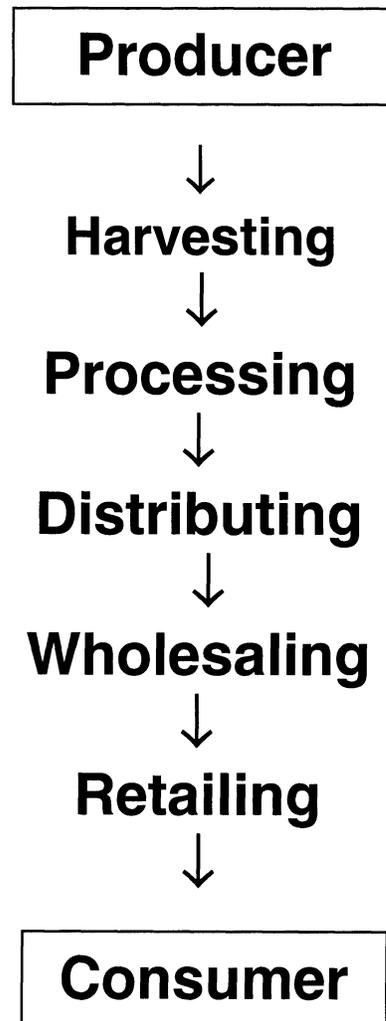
Results will vary.

I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

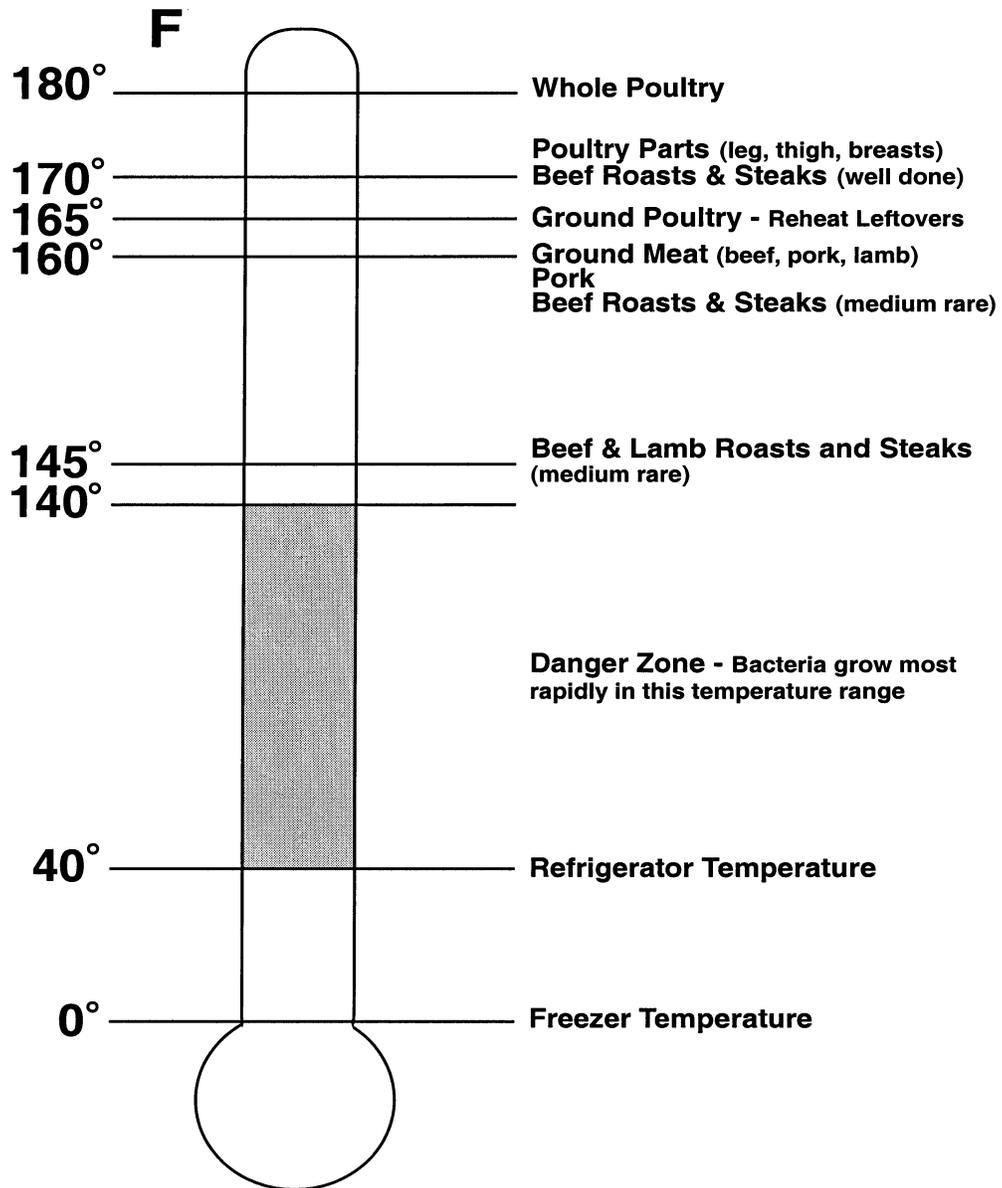


# Processing Food: From Producer to Consumer





# Recommended Safe Cooking Temperatures





### Popcorn Processing

**Objective:** Students will describe the importance of maintaining proper moisture level during the processing and storage of popcorn.

**Materials and Equipment:**

Popcorn (3/4 cup per group of five to six students)  
Water  
Oven  
Popcorn poppers (one per group)  
Vegetable oil (not needed if using air poppers)  
Paper towels or napkins  
Salt

Before conducting this activity the instructor should:

1. Divide popcorn into three equal-sized samples.
2. Place one sample of popcorn in water overnight.
3. Place a second sample of popcorn in an oven at 200°F for 2 hours.
4. Keep a third sample in a sealed plastic bag to maintain moisture content.

**Procedure:**

1. Divide class into groups of five or six students.
2. Have students follow the procedures outlined on AS 4.1 (Student). You may modify the activity by not discussing what happened to each popcorn sample before students begin. Then they could brainstorm ideas/theories of why the two samples did not pop.
3. Lead a discussion. What happened? Did all three samples pop? Why not?

The first two samples should not pop because the moisture level is not right. The third sample should pop because the moisture level was maintained around 13%. The moisture level must stay between 11.5 and 14.5% for the popcorn to pop. Have students sample the popped corn.

**Problem-Solving Challenge:**

Ask students to prevent a popcorn kernel from popping. They must understand that the hull (outer covering) on a popcorn kernel holds in water found inside. When the kernel is heated, the water boils, turns to steam, and expands. Finally, the pressure builds high enough for the kernel to explode. Students might think of puncturing the kernel to allow air to dry it out in addition to adding water or heating the kernel. Would freezing affect the popcorn kernel?

Discuss with the students that proper handling of the raw product during processing is a key step.



**Popcorn Processing**

**Objective:** Students will describe the importance of maintaining proper moisture level during the processing and storage of popcorn.

**Materials and Equipment:**

- 1/4 c - Sample #1 - popcorn that has been soaked in water
- 1/4 c - Sample #2 - popcorn baked in the oven
- 1/4 c - Sample #3 - popcorn straight out of the bag
- Vegetable oil (if needed)
- Popcorn popper
- Three bowls or containers for the popped corn
- Salt
- Paper towels or napkins

**Procedure:**

1. The instructor will place sample #1 in popper and turn popper on. Allow 10 minutes for popping then turn the popper off.  
  
CAUTION: Do not allow popcorn to pop too long. It will burn.
2. Pour corn into bowl.
3. Record the results in the table below.
4. Repeat steps 1, 2, and 3 for sample #2.
5. Repeat steps 1, 2, and 3 for sample #3.
6. Add salt to the popped corn. Enjoy!

Popcorn	Did the sample pop?	Why or why not?
Sample #1		
Sample #2		
Sample #3		

**Key Question:**

How do processing and storage affect the quality of popcorn?



### **Soybean Processing**

**Objective:** Students will learn how to process the soybean into an edible food product.

**Activity Length:** Overnight soak, 1-hour dry time, 1 lab period

**Materials and Equipment:**

Soybeans, dry (must be cleaned)

Water

1 quart vegetable oil for frying

Salt

Deep fat fryer

Paper towels

**Procedure:**

1. Clean soybeans by removing all foreign material and washing thoroughly.
2. Soak soybeans in water overnight.
3. Drain beans thoroughly. The skins may be removed if desired. Place beans on absorbent paper and allow to air-dry about 1 hour.
4. Place oil in a deep fat fryer or a heavy, deep saucepan. Heat oil to 350<sup>o</sup> F.  
CAUTION: Oil is very hot. Be careful when working around the heated oil.
5. Put about 1 cup of beans in a fryer basket. Lower basket slowly into the hot fat. Moisture in the beans may cause excessive splattering if beans are lowered rapidly into the fat.
6. Fry beans about 6 to 8 minutes or until crisp and lightly browned.
7. Remove from oil.
8. Drain beans on absorbent paper.
9. Sprinkle with salt.
10. When cool, sample. The remaining beans should be stored in a tightly covered container.

Credit: The Missouri Soybean Association and the Missouri Soybean Merchandising Council, P.O. Box 104778, Jefferson City, MO 65110.



### **Ice Cream Processing**

**Objective:** Students will process ice cream.

***Variations for the Activity:***

1. Nuts may be added to the ice cream by putting this ingredient with the 1 cup of milk, 1 cup of whipping cream, etc., that goes in the quart freezer bag.
2. We used 2% milk. Students could try this with 1% and skim milk to see if they like the flavor as well as the 2% milk.
3. If you want pairs of students to conduct this activity rather than groups of four, divide the ingredients in half and use pint and half-gallon freezer bags.







**Food Safety Activities**

**Objective:** Students will develop an awareness of food safety.

**Activity 1 - Home Refrigerator Survey****Procedure:**

Have students check the temperature of their home refrigerator and compile the results. Then tell them that refrigerators should stay at 40°F or less. This temperature won't kill the bacteria, but it will keep bacteria from multiplying.

**Activity 2 - Removing Bacteria from Your Hands****Procedure:**

1. Ask for three student volunteers. (This activity could be modified for more students or the whole class.)
2. Each student rubs 1 tablespoon of cooking oil all over his/her hands until completely coated.
3. Next sprinkle bacteria (1 teaspoon of cinnamon) on each student's hands. Students should rub it around until evenly distributed.
4. Each student will wash hands by rubbing them briskly for 20 seconds as follows:  
Student 1: wash hands with cold water and no soap  
Student 2: wash hands with warm water and no soap  
Student 3: wash hands with warm water and soap
5. Have the class observe the student volunteers' hands after washing to determine the method that removed the least and most bacteria.

**Activity 3 - Visual Bacteria****Materials and Equipment:**

Two small apples washed in advance

Small clean knife

Cutting board

Potato peeler (if available)

Two sterilized jars with screw-top lids (Use rubbing alcohol to sterilize. Label one "unwashed hands" and the other "washed hands.")

**Procedure:**

1. Ask students to raise their hands if they haven't washed their hands for several hours. Select one student to assist with the experiment. (This activity could be modified for the whole class.)
2. Have the student peel one apple and cut it in half on the cutting board. Place half of the apple in the jar labeled "unwashed hands." Screw the lid on tightly.
3. Next the student should briskly wash his/her hands in hot, soapy water for 20 seconds. In addition, wash the potato peeler, knife, and cutting board with hot, soapy water and wipe items

with a disinfectant cleaner.

4. Have the student peel the second apple and cut it in half. Place half of the apple in the jar labeled "washed hands." Screw the lid on tightly.
5. Place the jars in a warm place and observe daily for a week. (If the experiment was conducted properly, an increased level of bacteria-related growth should be evident on the "unwashed hands" sample.)

## UNIT IV – PRODUCTS FROM AGRICULTURE

### Lesson 5: Fiber Products from Agriculture

**Competency/Objective:** Identify fiber products from agriculture.

#### **Study Questions**

1. **What fiber products come from plants?**
2. **What fiber products come from animals?**
3. **What are synthetic fibers?**
4. **How do natural fibers differ from synthetic fibers?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit IV.
2. Transparency Master  
TM 5.1 Steps in Processing Wool
3. Activity Sheets  
AS 5.1 Create a Sweater Pattern  
AS 5.2 Clothing Labels  
AS 5.3 Scavenger Hunt for Fiber Trivia

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 5: Fiber Products from Agriculture

#### TEACHING PROCEDURES

##### A. **Review**

Cattle, hogs, sheep, poultry, and plants are commonly produced for food. Some plants and animals also provide fiber products. This lesson will discuss some of the fiber products from agriculture.

##### B. **Motivation**

1. Ask students to identify the name of the covering material found on pool tables. They should answer "felt." Hold up a sample of felt and ask students how it is made. Explain that felt is a nonwoven fabric made by layering thin sheets of carded wool fibers and treating them with heat, moisture, and pressure to produce a fabric that does not fray or ravel.
2. Use dye or markers to turn white cotton balls into red, blue, black, etc. Ask students how cotton became that color. A typical answer is by dyeing. Are there other ways? Ask students to think back to the genetic engineering lesson. Will we see blue cotton growing in our fields in the future?

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What fiber products come from plants?**

##### A1.

- a) Cotton
- b) Linen - flax
- c) Rope, burlap, and twine - hemp
- d) Acetate and rayon - manufactured from cellulose from trees

Pass around samples of cotton, polyester, linen, rayon, acetate, rope, burlap, and twine. After students have had an opportunity to look at the samples, ask them to identify the samples and what they are made from.

#### Q2. **What fiber products come from animals?**

##### A2.

- a) Wool - sheep
- b) Mohair - Angora goats
- c) Silk - silkworms
- d) Paint brush fibers - animal hair
- e) Violin strings - animal intestines
- f) Feathers for pillows and quilts - chickens and ducks
- g) Surgical sutures - animal intestines

Bring in an article of clothing made from wool and a sample of raw wool. Discuss where

wool comes from. Note that many of the fibers from animals are by-products of animal production and processing. Take a field trip to see lambs being sheared. Refer to TM 5.1 to demonstrate the steps in processing wool. Conduct AS 5.1 so students can participate in creating a pattern for a sweater. Ask students when wool can be dyed during the process. Answer: Each wool fiber absorbs dyes so deeply that dying at any processing step after scouring is effective. Wool dyed immediately after it is scoured is stock-dyed. If spun into yarn first, it's yarn-dyed. And if weaved into a piece of fabric and then dyed, it is piece-dyed. To weave a patterned fabric, stock-dyed or yarn-dyed threads are used. Plain-colored fabrics are usually piece-dyed. More information on this topic is available from the American Wool Council's general wool information web site at <http://www.sheepusa.org/>.

**Q3. What are synthetic fibers?**

**A3. Synthetic fibers are made entirely from chemicals derived from raw materials such as coal, petroleum, and natural gas.**

- a) **Acrylic**
- b) **Nylon**
- c) **Polyester**

Bring in some samples of polyester, nylon, and acrylic cloth. Describe how these fibers were developed when the raw materials were relatively inexpensive. As the price of the raw materials increases, so will the cost of these fibers.

**Q4. How do natural fibers differ from synthetic fibers?**

**A4.**

- a) **Natural fibers come from inexhaustible resources.**
- b) **Synthetic fibers come from exhaustible resources.**

Discuss how synthetic fibers differ from natural fibers. Explain the difference between inexhaustible and exhaustible resources. Note that exhaustible resources are limited in supply. Conduct AS 5.2 to illustrate the different types of ingredients in synthetic fibers and natural fibers. Have students debate the use of natural fibers versus synthetic fibers. Assign AS 5.3 in which students use the Internet to discover information about cotton, polyester, and wool.

**F. *Other Activities***

1. Have students develop a bulletin board or display to illustrate the variety of fiber materials produced in agriculture.
2. Bring in small samples of hemp rope and nylon rope. Have students evaluate the differences. Look at roughness, durability, etc.
3. Have a clothing and textiles expert compare cost, care, appearance, etc., of clothing made from natural fibers to clothing made from synthetic fibers.
4. Order educational materials about cotton at <http://www.cotton.org/ncc/education/index.htm>. Some are free.

**G. *Conclusion***

Many fiber materials are processed from agricultural products. Cotton and wool are produced in the United States to help meet the demand for quality fabrics. Cotton is grown in southern states. Wool

is from sheep that are raised throughout the United States. Many other fiber products are by-products of agricultural production. Fiber products produced from agricultural sources are inexhaustible whereas synthetic fibers are produced from raw materials that are limited in supply.

H. **Answers to Activity Sheets**

AS 5.1 Create a Sweater Pattern

Results will vary.

AS 5.2 Clothing Labels

Answers will vary.

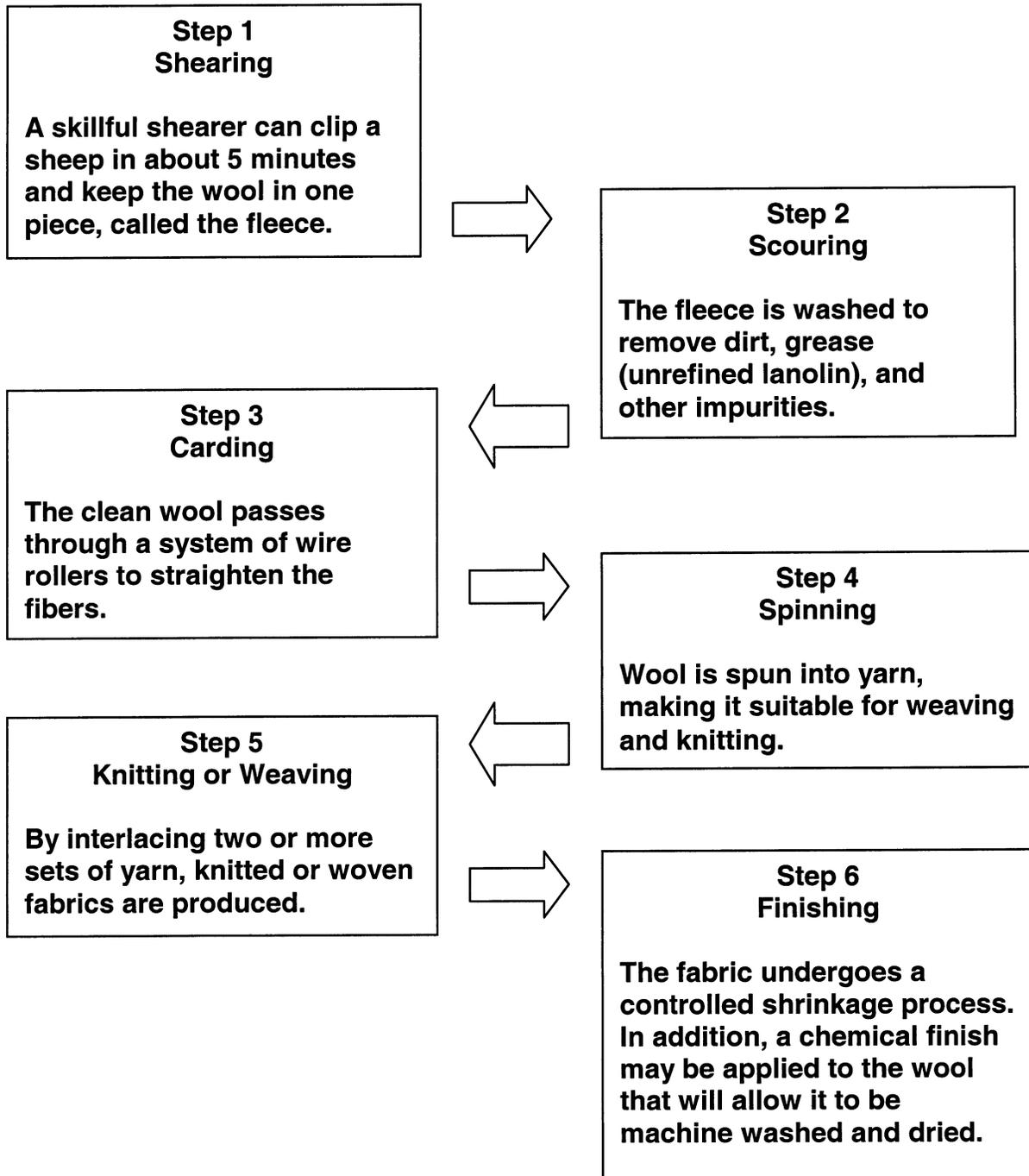
AS 5.3 Scavenger Hunt for Fiber Trivia

1. This material has received a fabric treatment that strengthens the hydrogen "bridges" that connect cellulose molecules in a cotton fiber.
2. Cotton outsells all synthetic fibers combined.
3. In 1880, U.S. Navy sailors were issued an elbow- and hip-length undershirt. When laid out on a flat surface, it resembled a perfect "T."
4. It was said to be a miracle fiber that could be worn for 68 days straight without ironing and still look presentable.
5. Sales declined in the 70s because of negative public image in the late 60s as a result of the polyester double-knit fabrics.
6. It is heated, extruded through the spinnerets, and cools upon hitting the air.
7. It is a fiber with a minuscule diameter, which allows it to be woven into very fine fabrics. These fabrics can be made to look and feel like silk.
8. It has tiny pores that open and take the dye inside the fiber.
9. It helps wool to withstand repeated machine laundering while still retaining softness, shape, and color.

I. **Evaluation**

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# Steps in Processing Wool





**Create a Sweater Pattern**

**Objective:** Students will design a color pattern for a sweater.

**Materials and Equipment:**

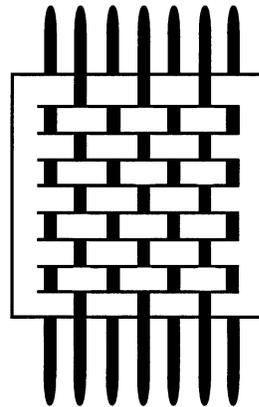
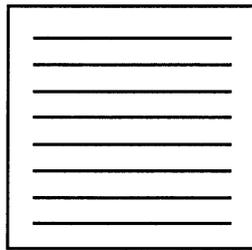
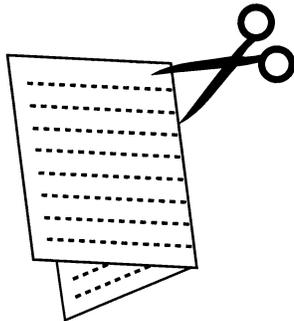
Paper (8 ½ x 11, white and colored)

Scissors

Markers

**Directions:** You are a member of the design team for Riley Unlimited Sweaters. Your task is to design a color pattern for the new fall sweaters. Read the following steps before beginning.

1. Weaving produces cloth by interlacing two sets of yarn at right angles. To make the first set of yarn, fold a piece of paper in half and make cuts from the fold out to about 1 inch from the edge. Open the paper.
2. Next, cut long narrow strips of paper to weave in and out of the paper. These represent the second set of yarn.
3. To make the design of your new sweater more interesting, you may vary the width of your cuts or make your cuts wavy. You may use different colors of paper in your second set. Finally, glue or tape the strips in place along the edges.





**Clothing Labels**

**Objective:** Students will develop an understanding of the differences in synthetic fibers and natural fibers.

**Directions:** Search for clothing labels that have 100% of one fiber and others that are made from a number of different fibers. Record the information below and bring in two examples of the synthetic and natural fibers.

Name of Clothing Item	Ingredients



**Scavenger Hunt for Fiber Trivia**

**Objective:** Students will use the Internet to discover information about cotton, polyester, and wool.

**Directions:** Using the web sites listed below, answer the following questions about these three common fiber products.

<<http://ipmwww.ncsu.edu/cottonpickin>>

<<http://einstein.human.cornell.edu/polyester/polyester.home.html>>

<<http://www.fabriclink.com/faq.html>>

Cotton

1. What is wrinkle-resistant cotton?
2. What fiber do consumers buy the most?
3. How did the T-shirt get its name?

Polyester

4. When polyester was first introduced to the American public in 1951, what unique claim was made?
5. Why did polyester sales drastically decline in the 1970s?
6. Polyester is a "melt spun" fiber. Explain.
7. What is a polyester microfiber?

Wool

8. Why does wool dye so well?
9. What is superwash?



## UNIT IV - PRODUCTS FROM AGRICULTURE

Lesson 6: Nonfood Products from Agriculture

**Competency/Objective:** Describe nonfood products from agriculture.

### **Study Questions**

1. **What nonfood products are made from grains?**
2. **What nonfood products are made from trees?**
3. **What nonfood products are made from other plants?**
4. **What nonfood products are made from livestock?**

### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit IV.
2. Transparency Master  
TM 6.1 Corn Has Many Uses
3. Activity Sheets  
AS 6.1 Biodegradable Plastic  
AS 6.2 Cornstarch Activities (Instructor)  
AS 6.3 The Papermaking Kit (Instructor)  
AS 6.4 Nonfood Products from Cattle and Hogs

## UNIT IV - PRODUCTS FROM AGRICULTURE

### Lesson 6: Nonfood Products from Agriculture

#### TEACHING PROCEDURES

##### A. **Review**

Many of the fibers in clothing come from agriculture. Cotton has remained one of the most common fabrics used for clothing. Wool is also popular for suits and sweaters. This lesson will discuss many of the other nonfood products from agriculture.

##### B. **Motivation**

1. Obtain packing peanuts made from cornstarch. Put one in a jar of water. Screw the lid on and shake it. Open the lid and have students verify that the packing peanut has "disappeared." Ask students why this occurred. The answer is the packing peanut is 95% cornstarch and naturally degrades when it comes into contact with water. This process is similar to leaving a slice of bread outside.
2. Hold up a magazine or newspaper. Ask students what the newspaper has to do with agriculture. Many answers can be justified. In this unit, however, the answer to emphasize is as follows: Soy ink was used to print the newspaper. Ask students how they can tell soy ink was used. The answer is the logo "PRINTED WITH SOY INK" can be found in the publication.
3. Bring to class a leather basketball, baseball glove, shoe (or boot), and jacket. Ask students to identify what the articles have in common. Have students identify other products that could be made from leather.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What nonfood products are made from grains?**

##### A1.

- a) Ethanol (grain alcohol)
- b) Packing peanuts
- c) Noncorrosive road deicer
- d) Superabsorbent polymers
- e) Biodegradable plastics
- f) Animal feed
- g) Industrial products
- h) Soy printing ink
- i) Construction materials
- j) Soy diesel

Ask students to discuss nonfood products processed from grains such as ethanol and biodegradable plastics. Describe how the use of these products helps reduce Americans' dependence on petroleum-based products. Show TM 6.1 to illustrate uses of corn. Conduct AC 6.1 in which students create biodegradable plastic and AS 6.2 in which students

can experiment with materials that contain cornstarch. Students can work in groups of three or four or on their own.

**Q2. What nonfood products are made from trees?**

**A2.**

- a) **Lumber**
- b) **Paper**
- c) **Cardboard**
- d) **Christmas trees**
- e) **Charcoal**
- f) **Bark chips and mulch**
- g) **Turpentine**
- h) **Varnish**
- i) **Paints**

Ask students to name products from trees. List the answers on the chalkboard as they are discussed. Conduct the papermaking activity in AS 6.3.

**Q3. What nonfood products are made from other plants?**

**A3.**

- a) **Ornamentation, landscaping, erosion control, and shade - trees, shrubs, ground covers, and grasses**
- b) **Flower arrangements - flowers**
- c) **Insecticides**
- d) **Medicines - aloe vera**
- e) **Perfume**

Pass around a bottle of shampoo or hand lotion containing aloe vera. Have students discuss the aloe and other plants that provide ingredients for nonfood products.

**Q4. What nonfood products are made from livestock?**

**A4.**

- a) **Detergents, soaps, glues, and candles - animal fats**
- b) **Insulin and replacement heart valves for humans - hogs**
- c) **Feathers - chickens and ducks**
- d) **Leather - cattle and hogs**
  - 1) **Clothing**
  - 2) **Upholstery**
  - 3) **Book covers**
  - 4) **Luggage**
- e) **Lanolin - wool**
- f) **Meal products, fertilizers, animal feeds - bones, feathers, blood, and fish**

Ask students why the agricultural industry wants to find new uses for animal parts. Why is it beneficial to be able to use feathers and leather? Describe the economic benefits of using the by-products of production or processing systems. Note that many of the nonfood products are made from materials that would be wasted or thrown away if alternative uses were not discovered. Assign AS 6.4 to have students research nonfood products from cattle and hogs.

F. **Other Activities**

1. Divide the class into transportation groups, which represent the following sources of fuel or energy:
  - Fossil (gasoline, diesel)
  - Inexhaustible (ethanol, soy diesel)
  - Electric
  - Solar
  - NuclearUsing the Internet, allow one class period for students to research their group. Have students identify advantages and disadvantages and then report to the class.
2. Have students write a paper about nonfood products from animals or plants.
3. Have students develop a chart with a cow, pig, chicken, soybeans, or corn in the center. Around the outside, provide examples of nonfood products that are derived from the raw material.
4. Show videos about wood products available from the Missouri Department of Conservation <<http://www.conservation.state.mo.us/>>.

G. **Conclusion**

Many nonfood products are processed from animals and plants. Some plants and animals are raised specifically for the special products they provide. Other products are by-products of plant or animal production.

H. **Answers to Activity Sheets**

AS 6.1 Biodegradable Plastic

The instructor should determine if the results are satisfactory.

AS 6.2 Cornstarch Activities

The instructor should determine if the results are satisfactory.

AS 6.3 The Papermaking Kit

The instructor should determine if the results are satisfactory.

AS 6.4 Nonfood Products from Cattle and Hogs

Category	Nonfood Products from Cattle	Nonfood Products from Hogs
Pharmaceuticals/Health Care	Blood factor Collagen Heparin Insulin Thrombin	Heart valves Insulin Skin

Category	Nonfood Products from Cattle	Nonfood Products from Hogs
Household Products	Candles Ceramics Deodorants Detergents Floor wax Insulation	Linoleum Mouthwash Paints Plastic Soups Toothpaste
Textiles/Clothing	Shoes Boots Belts Wallets Gloves Luggage	Buttons Fabric dye
Travel	Antifreeze Asphalt Lubricants Tires	Antifreeze Tires

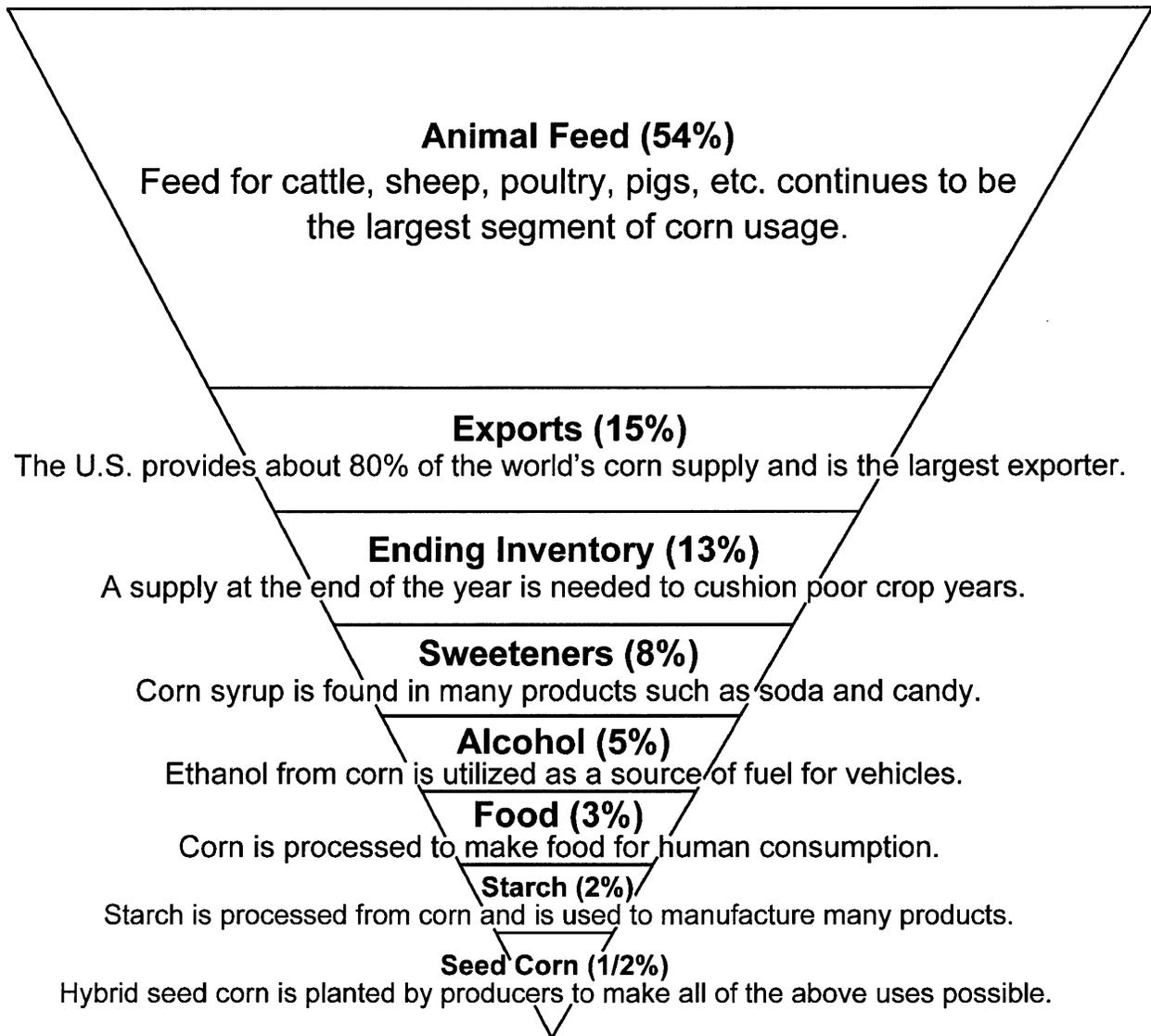
I. **Answers to Evaluation**

1. a
2. d
3. c
4. a
5. c
6. b
7. a
8. c
9. a
10. b
11. d
12. c
13. b
14. a
15. b
16. d
17. a
18. c
19. c
20. a
21. b
22. a
23. d
24. d
25. a
26. e
27. f
28. c
29. b
30. d
31. Whole milk has 5% cream or milkfat. Two % milk has 2% cream or milkfat. Skim milk has all cream removed.

32.
  - a. Clean – Wash hands for 20 seconds in hot, soapy water before preparing food.
  - b. Separate – Reduce cross-contamination by keeping raw meat products separate from ready-to-eat foods.
  - c. Cook – Select appropriate cooking temperatures and length of time to properly cook food.
  - d. Chill – Refrigerate or freeze leftovers within 2 hours or less.

# Corn Has Many Uses

Approximately 9 billion bushels of corn are produced each year





### **Biodegradable Plastic**

**Objective:** Students will create biodegradable plastic.

**Materials and Equipment:**

Cornstarch  
Water  
Tablespoon  
Microwave oven  
Corn oil  
Paper cup  
Stir stick  
Food coloring  
Eye dropper

**Procedure:**

1. Place 1 tablespoon of cornstarch in a paper cup.
2. Add 2 drops of corn oil to the cornstarch.
3. Add 1 tablespoon of water to the corn oil and cornstarch.
4. Stir the mixture.
5. Add 2 drops of your favorite food coloring to the mixture and stir well.
6. Microwave for 25 seconds on high.
7. When it is cool enough to handle, carefully remove the material from the cup.
8. Roll the material into a ball.



### **Cornstarch Activities**

**Objective:** Students will recognize some different uses of various materials that contain cornstarch.

**Materials and Equipment:**

Normal golf tee  
Biodegradable golf tee (one for each student or group)  
Jar  
Water  
Toothpick/straw  
6-oz. plastic cup (one for each student or group)  
Superabsorbent polymer  
Teaspoon

Note: Ordering information for the biodegradable golf tees and superabsorbent polymer is in the Supervised Study section of Lesson 1 of this unit.

Activity 1 - golf tee

**Procedure:**

Put a normal golf tee and a biodegradable golf tee in a jar of water. Observe it each week until the biodegradable golf tee begins to degrade.

Activity 2 - superabsorbent polymer

**Procedure:**

1. Give each student or group a 6-oz. plastic cup half full of water.
2. Add 2 teaspoons of superabsorbent polymer to the cup and mix with a toothpick or straw. In less than 1 minute, the mixture in the cup should turn to a gelatin or applesauce consistency. If this does not happen, experiment by adding more of the superabsorbent polymer or reducing the amount of water.



UNIT IV - PRODUCTS FROM AGRICULTURE

AS 6.3

Lesson 6: Nonfood Products from Agriculture

Instructor

**The Papermaking Kit**

**Objective:** Students will learn how to make paper.

This kit is an innovative, hands-on classroom project that involves students in the art of making paper. Each kit is capable of meeting the needs of a classroom of approximately 30 students. Instructions are provided with each kit.

Cost: \$8.00/kit

Order from the following address:

Minnesota Forest Industries  
902 Medical Arts Building  
324 West Superior Street  
Duluth, MN 55802  
(218) 722-5013  
<minntrees@aol.com>  
<<http://www.minnesotaforests.com>>

Note: Instructions for making paper can also be found in Boy Scout/Girl Scout publications.



**Nonfood Products from Cattle and Hogs**

**Objective:** Students will be able to identify nonfood products from cattle and hogs.

**Directions:** List at least two nonfood products in each of the categories that comes from cattle and hogs. Access the following Internet sites for research:

<<http://www.nppc.org/ForKids/byproducts.html>>

<[http://www.beef.org/library/publications/wow\\_that\\_cow/index.htm](http://www.beef.org/library/publications/wow_that_cow/index.htm)>

Category	Nonfood Products from Cattle	Nonfood Products from Hogs
Pharmaceuticals/Health Care		
Household Products		
Textiles/Clothing		
Transportation		



UNIT EVALUATION

**Circle the letter of the best answer.**

1. The four main parts of a food chain are \_\_\_\_\_.
  - a. Sun, producer, consumer, decomposer
  - b. Animals, plants, humans, grain
  - c. Sun, humans, recycler, bacteria
  - d. Sun, plants, herbivores, humans
  
2. In the agricultural food chain, the primary producers are \_\_\_\_\_.
  - a. Livestock
  - b. Sheep
  - c. Soybeans
  - d. Plants
  
3. \_\_\_\_\_ is an example of people manipulating the food chain.
  - a. Spider eating an insect
  - b. Fish in a river
  - c. Domestication of animals
  - d. Recycling paper
  
4. Which of the following products are processed from grain?
  - a. Flour, cereal, sweeteners
  - b. Soups, cereal, sweeteners
  - c. Pasta, snack chips, juices
  - d. Spices, jelly, tea
  
5. How are fruits and vegetables processed?
  - a. Fresh and packed in oils
  - b. Canned and cereals
  - c. Frozen and fresh
  - d. Dried and hermetically sealed
  
6. White bread is usually made from \_\_\_\_\_.
  - a. Rice
  - b. Wheat
  - c. Barley
  - d. Oats

7. Which of the following is an important product of plants grown in Missouri?
- Pecans
  - Chocolate
  - Maple syrup
  - Coffee
8. What is the term used for the meat from young cattle?
- Hamburger
  - Beef
  - Veal
  - Porterhouse
9. Which of the following products are from dairy animals?
- Milk, ice cream, yogurt
  - Veal, processed patties, lard
  - Butter, milk, eggs
  - Cheese, luncheon meat, dextrose
10. All of the following products are obtained from hogs except \_\_\_\_\_.
- Pork chops
  - Hamburger
  - Ham
  - Bacon
11. Which of the following is a freshwater fish?
- Shrimp
  - Scallops
  - Lobster
  - Catfish
12. Who cleans, separates, handles, and prepares food for the distributor?
- Harvester
  - Wholesaler
  - Processor
  - Producer
13. Which of the following is not a reason for processing foods?
- To improve taste
  - To decrease additives
  - To prevent spoilage
  - For the convenience of consumers
14. Which of the following describes the pasteurization process?
- Heating a dairy product to kill bacteria
  - Cooling a dairy product to kill bacteria
  - Removing the moisture content to kill bacteria
  - Removing fat from a dairy product to kill bacteria

15. Reducing the size of fat particles is a food process called \_\_\_\_\_.
- Fermentation
  - Homogenization
  - Emulsification
  - Extrusion
16. Forcing a food component through an opening under high pressure is a food process called \_\_\_\_\_.
- Fermentation
  - Homogenization
  - Emulsification
  - Extrusion
17. Where can consumers purchase food products directly from producers?
- Farmers' market
  - Grocery store
  - Wholesaler
  - Food warehouse
18. To safely store food in a refrigerator, the temperature should be maintained at \_\_\_\_\_°F or lower.
- 5
  - 20
  - 40
  - 47
19. Which of the following fibers is manufactured from cellulose from tree fibers?
- Cotton
  - Flax
  - Rayon
  - Mohair
20. Which of the following fibers can be used to make rope?
- Hemp
  - Acetate
  - Flax
  - Angora
21. Which of the following fibers is produced by a worm?
- Wool
  - Silk
  - Angora
  - Mohair

22. Which of the following is made from petroleum chemicals?

- a. Polyester
- b. Angora
- c. Rayon
- d. Burlap

23. Which of the following is a synthetic fiber?

- a. Wool
- b. Flax
- c. Silk
- d. Nylon

24. Gasohol is produced by blending gasoline with \_\_\_\_\_.

- a. 5% soy oil
- b. 10% dextrose from corn
- c. 10% STP
- d. 10% ethanol from corn

**Identify what plant, animal, or by-product from the right column can produce the by-products in the left column.**

25. \_\_\_\_\_ Packing peanuts

a. Cornstarch

26. \_\_\_\_\_ Printing ink

b. Ducks

27. \_\_\_\_\_ Charcoal

c. Pigs

28. \_\_\_\_\_ Insulin

d. Sheep wool

29. \_\_\_\_\_ Down comforters

e. Soybeans

30. \_\_\_\_\_ Lanolin in hand lotion

f. Trees

**Complete the following short answer questions.**

31. Explain the difference between whole milk, 2% milk, and skim milk.

32. Identify and briefly explain the four steps to keep our food safe from harmful bacteria.

a.

b.

c.

d.

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 1: Conservation of Natural Resources

**Competency/Objective:** Describe the importance of natural resources.

#### **Study Questions**

1. **What are natural resources?**
2. **What are the differences between inexhaustible and exhaustible resources?**
3. **Why is it important to conserve natural resources?**
4. **What is the difference between preservation and conservation?**
5. **What agencies monitor our natural resources?**
6. **What is pollution?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit V.
2. Transparency Master  
TM 1.1 Inexhaustible and Exhaustible Resources
3. Activity Sheets  
AS 1.1 Exhaustible vs. Inexhaustible Resources  
AS 1.2 Resources for the Future  
AS 1.3 Oil Pollution of Water

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 1: Conservation of Natural Resources

#### TEACHING PROCEDURES

##### A. **Introduction**

Natural resources are important to the welfare of all living things. Many of the products needed for survival rely on one or more natural resources. Conservation of precious natural resources is important for several reasons. This lesson will examine the importance of natural resource conservation.

##### B. **Motivation**

1. Natural resources include coal, oil, air, water, soil, trees, and wildlife. Acid rain, contaminated or polluted drinking water, clear cutting of forests, and wildlife poaching are conservation problems that need to be addressed. Identify and discuss natural resources that are important to society at this time.
2. Bring to class mounted specimens of fish or wildlife to initiate a discussion of hunting or fishing for recreation and population control.

##### C. **Assignment**

##### D. **Supervised Study**

To prepare for an activity in Lesson 5, obtain the board game "Oh My Deer" from Carolina Biological Supply Co., 2700 York Road, Burlington, NC 27215. You will need one game for every four to six participants.

#### **Discussion**

##### **Q1. What are natural resources?**

##### **A1. Natural resources can be defined as living things, including soil, water, air, etc., that people come in contact with that can be used to perform a useful function.**

Ask students to describe a natural resource. Write their answers on the board. Note that resources may include minerals, oil, trees, wildlife, fish, water, soil, air, and other materials found in nature.

##### **Q2. What are the differences between inexhaustible and exhaustible resources?**

##### **A2.**

- a) **An inexhaustible resource can last forever regardless of human use.**
  1. **They renew themselves continuously.**
  2. **They may, however, be limited.**
  3. **They can be damaged by human misuse.**
  4. **Inexhaustible resources can be replaced by human efforts.**
- b) **An exhaustible resource cannot be replaced or regenerated.**
  - 1) **They exist in finite quantities, and once gone they are gone forever.**
  - 2) **They can, however, be conserved wisely.**

Describe the difference between an exhaustible and an inexhaustible resource. Show TM 5.1 to generate a discussion on the importance of both exhaustible and inexhaustible resources. Have students complete AS 1.1. Ask students why they think it is important to know the difference between exhaustible and inexhaustible resources.

**Q3. Why is it important to conserve natural resources?**

**A3. Natural resources interact with each other and depend upon one another. When one natural resource is affected adversely, others may suffer.**

Discuss why it is important to conserve natural resources. Include a discussion about how resources interact and depend on each other for survival. Conduct AS 1.2 and discuss the impact conservation has on future generations.

**Q4. What is the difference between preservation and conservation?**

**A4.**

- a) **Preservation maintains natural resources that already exist by prohibiting their use and returning them to a natural state.**
- b) **Conservation is the careful use and management of resources to avoid wasting them for future generations.**

Explain the differences between preservation and conservation. Discuss the fact that most people involved in agriculture take great pains to **conserve** their natural resources, and because agriculture depends on the wise **use** of natural resources, **preservation** is not necessarily a feasible option. Divide the board into two categories (one for preservation and one for conservation) and have students list resources, items, or areas that are preserved or conserved.

**Q5. What agencies monitor our natural resources?**

**A5.**

- a) **Bureau of Land Management**
- b) **U.S. Fish and Wildlife**
- c) **National Park Service**
- d) **Environmental Protection Agency**
- e) **Forest Service**
- f) **Natural Resources Conservation Service**
- g) **National Scenic Riverways**
- h) **Missouri Department of Conservation**
- i) **Missouri Department of Natural Resources**

Each agency has its own responsibilities.

**Q6. What is pollution?**

**A6.**

- a) **Pollution is the presence of substances in water, soil, or air that affects its usefulness or makes it offensive.**
- b) **Pollution involves two forms.**
  - 1) **Point source can be traced to a specific point of discharge and is readily identifiable. One example of point source pollution is water pollution caused by industrial waste that is dumped directly into a nearby stream.**

- 2) **nearby stream.**  
**Nonpoint source occurs from sources that cannot be directly traced to a specific point of discharge. One example of this is air pollution and smog in large cities caused by emissions from thousands of vehicles.**

Have students complete AS 1.3 to become familiar with how pollution affects the water environment.

**F. Other Activities**

1. Students could research a recycling program in their community. Start research at pick-up points and follow the product's path to the recycling center or to the production of recycled products. Recycle the paper used in class for 1 week to calculate how much could be saved over a year's time.
2. Take the class on a field trip to a wastewater treatment plant or recycling facility.
3. Have students select one natural resource and provide information on the following.
  - a) Where is the resource geographically located?
  - b) What is the method used for retrieval for this resource (mining, drilling, etc.)?
  - c) What products are made from this resource?
  - d) What are the processing procedures of this resource?
  - e) How is it transported from area of retrieval to other parts of the region or world?
  - f) What are economic benefits to the country that possesses this resource?
4. View the video *Guarding Our Living Environment*, Ag Video 128, available from the Missouri Resource Center for Career & Technical Education (MRCCTE), University of Missouri-Columbia.
5. View the video *Soil Conservation Technician*, STW Video 27, available from MRCCTE, University of Missouri-Columbia. This video discusses career opportunities as well as the work a technician will perform.
6. Invite a forest service or conservation agent to speak to the class about the importance of conserving natural resources.
7. Give students trash bags containing both recyclable and nonrecyclable items. Customize the contents of each trash bag to the location of the classroom. Ask students to sort the contents of each bag into recyclable and nonrecyclable.

**G. Conclusion**

Practices to conserve natural resources should be implemented to preserve the natural condition of the land, air, water, and wildlife resources. Preservation of these resources will ensure their availability for future generations.

**H. Answers to Activity Sheets**

AS 1.1 Exhaustible vs. Inexhaustible Resources

1. I
2. E
3. E

5. I
6. I
7. E
8. I
9. E
10. E
11. The instructor should determine if answers are appropriate.

#### AS 1.2 Resources for the Future

Answers will vary.

#### AS 1.3 Oil Pollution of Water

Answers will vary.

### I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.



# **Inexhaustible vs. Exhaustible Resources**

## **Inexhaustible Resources**

Can be renewed or regenerated

Include:

- Water
- Air
- Wildlife
- Forests

## **Exhaustible Resources**

Cannot be replaced when used

Include:

- Crude oil
- Coal
- Minerals
  - Gold
  - Copper
  - Iron
- Soil



**Exhaustible vs. Inexhaustible Resources**

**Objective:** Students will differentiate between exhaustible and inexhaustible resources.

**Directions:** To the left of each natural resource listed below, identify the inexhaustible resources by writing an "I" in the blank and identify the exhaustible resources by writing an "E" in the blank.

1.    \_\_\_ Oak trees
2.    \_\_\_ Crude oil
3.    \_\_\_ Natural gas
4.    \_\_\_ Water
5.    \_\_\_ Air
6.    \_\_\_ Wildlife
7.    \_\_\_ Coal
8.    \_\_\_ Pine trees
9.    \_\_\_ Iron ore
10.   \_\_\_ Soil
11.   What steps can you take to conserve resources in your community?



**Resources for the Future**

**Objective:** Students will understand the importance of conserving resources for future generations.

**Materials and Equipment:**

Large container filled with peanuts

Lunch bag for each student

**Procedure:**

1. Divide the class into three equal groups. Name your own group.
2. The instructor will think of a number between 1 and 15. Each group tries to guess the number. The groups will proceed with the activity according to how close each group comes to guessing the correct number.
3. Everyone is given a lunch bag.
4. On the instructor's desk is a large bowl filled with peanuts. This bowl is labeled "The World's Supply of Peanuts."
5. The first group comes up to the bowl and everyone takes as many peanuts as desired.
6. When the first group is through, the second group takes whatever it wants. Finally, the third group takes as many peanuts as it can.
7. Within your group, designate someone to record responses to the following questions:
  - a. What does "exhaustible" mean? What are examples of exhaustible resources in your hometown?
  - b. How did the first group react when allowed to take the peanuts? How did you feel when you watched them take these resources?
  - c. What was the reaction of the last group when it had access to the peanuts?
  - d. If a fourth group could have some peanuts, how many would be available?
  - e. What will now happen to the world's supply of peanuts? What, if anything, could change this situation? What would you do to protect exhaustible resources?
8. Share your responses with the other groups.



**Oil Pollution of Water Environment**

**Objective:** Students will observe the effects of oil pollution on the water environment.

**Materials and Equipment:**

Water

Four 1-quart jars

1 quart motor oil

Table scraps

Dish soap

1 cup coffee grounds (used)

Algae

Microscope

Eight local/common water plants of varying types

Measuring cup

Labels

Eye dropper

Four slides and cover slips

**Procedure:**

1. Place 3 cups of water into each of the four 1-quart jars.
2. Label the jars as follows:
  - a) Jar 1 - fresh water - motor oil
  - b) Jar 2 - fresh water - dish soap
  - c) Jar 3 - coffee grounds
  - d) Jar 4 - table scraps
3. Add the algae and two water plants to the fresh water in each jar.
4. Use the dropper to add 8-10 drops each of oil to jar 1 and dish soap to jar 2.
5. Use the scoop to add a scoop of coffee grounds to jar 3 and table scraps to jar 4.
6. Every day, check the jars. Continue checking for 1 week. Record your daily findings in the chart found in step 9.
7. After 1 week, make a microscope slide from samples of each jar and observe the algae or plants. Record your findings in the chart shown in step 10.
8. Record your observations as you drop the oil in the water.

9. Record your daily observations in the chart below.

Day	Jar #			
	1	2	3	4
1				
2				
3				
4				
5				
6				
7				

10. Record your microscope observations in the chart below.

Jar #	Observation
1	
2	
3	
4	

**Key Questions:**

1. What change(s) occurred when the oil was placed in the water?
2. What happened to the algae or water plants when the oil was added?
3. What was the effect of dish soap on the algae and water plants?

4. How was the water plant affected by the oil?
  
5. What effect did the dish soap have on the water plant?
  
6. Did the coffee grounds or table scraps affect the algae? In what way?
  
7. Did the coffee grounds or table scraps affect the water plant? In what way?
  
8. How can household wastes pollute the water?



## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 2: Soil Conservation

**Competency/Objective:** Describe the importance of soil conservation.

#### **Study Questions**

1. **What factors contribute to soil erosion?**
2. **How does soil erosion affect food production?**
3. **What is soil conservation?**
4. **What are soil conservation practices?**

#### **References**

1. Exploring Agriculture in America (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit V.
2. Transparency Master  
TM 2.1 U.S. Land Affected by Soil Erosion
3. Activity Sheet  
AS 2.1 How Does Mulch Prevent Soil Loss? (Instructor)

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 2: Soil Conservation

#### TEACHING PROCEDURES

##### A. **Review**

Lesson 1 discussed how natural resources are a precious commodity in the environment. Soil is a vital resource for the continued production of food and fiber crops. Each growing season, crops are planted and then harvested. Conservation practices to reduce soil erosion are important.

##### B. **Motivation**

1. Using different samples of soil, explain how plants get what they need from the soil. Pass around different types of soil samples for students to see and feel.
2. Ask students how many of them cross a creek to get to school. When a heavy rain comes, what color is the creek? Point out that the muddy color is actually soil in the water. Discuss how long it takes to replace 1 inch of topsoil. (It takes between 200 and 1,000 years.)
3. Take students on a walk on the school grounds. Identify erosion problem areas or potential areas. Discuss what could be done to control erosion in these areas.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### **Q1. What factors contribute to soil erosion?**

##### **A1.**

- a) **Human activity such as plowing or construction**
- b) **Water erosion**
  - 1) **Excess rainfall cannot be absorbed into the earth, so it runs off the surface and carries large amounts of soil with it.**
  - 2) **Raindrop splash causes soil particles to become separated and thrown about.**
- c) **Wind erosion - small particles of soil carried away by gusts of wind**
- d) **Natural events**
  - 1) **Earthquakes**
  - 2) **Floods**
  - 3) **Tornadoes**
  - 4) **Land slippage on wet, sloping land**

Discuss acreage that is affected by soil erosion and its impact on plant and animal life. Have students complete AS 2.1 to help them identify factors that affect soil erosion.

#### **Q2. How does soil erosion affect food production?**

##### **A2.**

- a) **Soils that have been eroded lose their nutrients and ability to hold water,**

- making plant life unable to thrive and grow.**
- b) **Plant nutrients are reduced and animals do not receive proper nutrients to grow and thrive.**

Explain to students how soil erosion impacts the food chain and how it affects overall food production.

**Q3. What is soil conservation?**

**A3. Soil conservation involves the protection, conservation, and improvement of the soil.**

Explain to students the concept of soil conservation. Remind them of the work done by the Natural Resources Conservation Service that was discussed in the previous lesson.

**Q4. What are soil conservation practices?**

**A4.**

- a) **Contour planting**
- b) **Crop rotation**
- c) **Terracing**
- d) **Grassed strips**
- e) **Diversion ditches**
- f) **Strip cropping**
- g) **Vegetative covers**

Show TM 2.1 to illustrate how land is affected by soil erosion. Refer to Figure 1 in the Student Reference for examples of soil conservation practices. Explain to students that this is just a sampling of the conservation practices being used in agriculture. Have the students research other ways in which conservation practices are being used in their local area.

**F. *Other Activities***

1. Gather pictures of areas that have been affected by soil erosion. Discuss the adverse effects.
2. On the board, list measures or techniques that can be used to prevent soil erosion.
3. View the video Stream Sense (Ag Video 123) available through the Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.
4. Invite a representative of the Natural Resources Conservation Service to discuss soil conservation.
5. Invite a representative from the highway department to class to discuss the various requirements during construction.

**G. *Conclusion***

Soil is a precious resource needed to sustain life. The movement of wind or water causes most soil erosion across the soil surface. Soil erosion removes fertile topsoil, leaving less fertile subsoil behind. Soil erosion is a problem that affects everyone. Farmers and others are using soil management practices to conserve soil resources.

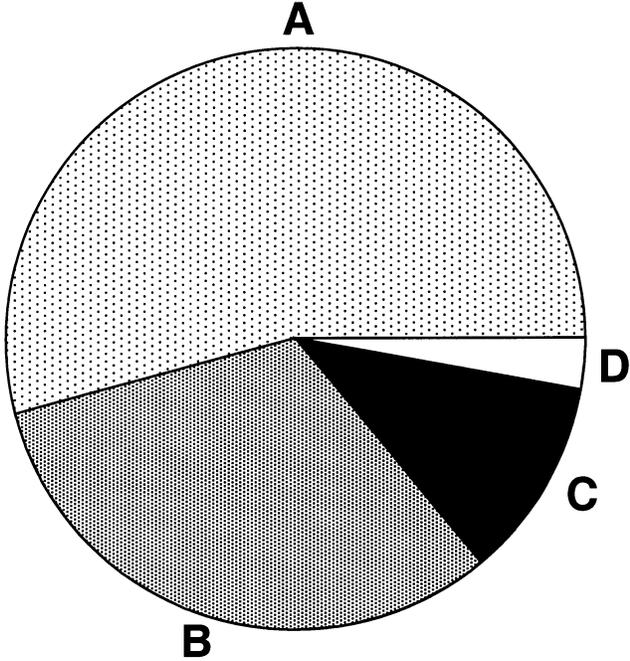
H. ***Answers to Activity Sheet***  
There are no answers for this activity.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# U.S. Land Affected by Soil Erosion

- A. 1.2 billion acres not affected by soil erosion
- B. 775 million acres eroded to some extent
- C. 280 million acres seriously damaged by soil erosion
- D. 25 million acres lost due to soil erosion



Total Land is 2.2 Billion Acres

Source: *Applied Environmental Science Book*, Lesson 3 page 57



### How Does Mulch Prevent Soil Loss?

**Objective:** Students will discover how mulch will prevent loss of soil through erosion.

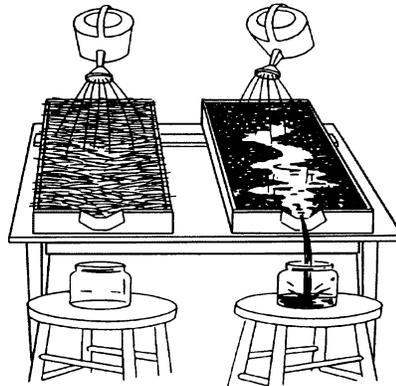
**Materials and Equipment:**

Two small boxes about 16 inches long, 12 inches wide, and 4 inches deep

Two quart-size flower sprinklers

Two half-gallon wide-mouth jars

Two sticks of wood about 1 inch thick



**Procedure:**

1. At one end of the box, cut a V-notch 1 to 1 ½ inches deep and fit with a tin spout to draw runoff water into a container (see drawing).
2. Fill the boxes with the same type of soil. Cover one box of soil with a thin layer of straw, grass, wood shavings, or sawdust. Leave the other box of soil bare.
3. Set the boxes on the table, placing sticks under one end to make a slope.
4. Put the empty jars on stools placed beneath the spouts.
5. Fill the two sprinklers with water and pour the water on both boxes at the same time. Pour steadily at the same rate for both boxes. Hold the sprinklers about the same height from the boxes. About a foot is satisfactory, although you can get various results with different heights.
6. Note how much and how fast the water runs off into each jar.
7. The water on the bare soil will rush off into the jars. The jar will contain muddy water. The water that flows over the mulch will take longer for the flow to start and it will continue longer. Also, not as much water will reach the jar. The water flowing into the jar should be fairly clean.
8. This demonstration illustrates how soil covered with mulch, or other protective coverings, reduces water runoff as opposed to soil that is bare.



## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 3: Water Quality

**Competency/Objective:** Describe the importance of water quality.

#### **Study Questions**

1. **What is the hydrologic cycle?**
2. **What is water quality?**
3. **What factors affect water quality?**
4. **What are some types of water pollution?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit V.
2. Transparency Master  
TM 3.1 The Hydrologic Cycle
3. Activity Sheets  
AS 3.1 Water's Going On?!  
AS 3.2 Edible Earth Parfaits

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 3: Water Quality

#### TEACHING PROCEDURES

##### A. **Review**

In the previous lesson, the importance of soil and soil conservation was discussed. Another important natural resource is water. Water is needed for human consumption, to produce food, and to aid in the production of manufactured products. This lesson explains the water cycle, water quality, and the factors that affect the quality of water.

##### B. **Motivation**

1. To illustrate how pollutants enter the water cycle, perform the following exercise. Using a dropper, drop dark food coloring on a slice of white bread (fresh or stale) that is held vertically. Mist the bread with water. Watch how the food coloring seeps through the bread. Compare the food coloring to a pollutant, the bread to soil, and the water to rain. Notice how the food coloring is dispersed throughout the bread as water is applied to it.
2. Using a Bunsen burner, boil a small amount of water to produce steam. Ask students what has happened to the water.
3. Use the board to chart where your city's or community's water supply comes from or where water in farm streams or ponds originated.
4. Show the video *Missouri Groundwater: The Hidden Resource* (Ag Video 124), available from the Missouri Resource Center for Career & Technical Education (MRCCTE), University of Missouri-Columbia.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### **Q1. What is the hydrologic cycle?**

**A1. Also called the water cycle, the hydrologic cycle is the process whereby water moves from bodies of water to the atmosphere, to the land, and back to the bodies of water.**

Use TM 3.1 to display the hydrologic cycle. Convey to students that this is the ongoing process whereby the earth is supplied with water necessary to sustain life. Have students complete AS 3.1 to demonstrate how the hydrologic cycle works. Have students complete AS 3.2 and discuss the amount of water used daily in the home. Discuss the importance of conserving water.

###### **Q2. What is water quality?**

**A2. Water quality is determined by assessing the condition of water for a particular use.**

It is important to understand that the end use of water will determine its level of quality. For instance, drinking water would be set to a higher standard of quality than water used for

industrial purposes.

**Q3. What factors affect water quality?**

**A3.**

- a) **Odor and taste**
- b) **Color**
- c) **pH**
- d) **Hardness**
- e) **Turbidity**
- f) **Heavy metals**
- g) **Chemical residues**
- h) **Bacteria**

Discuss and explain the factors that affect water quality. Explain the importance of testing the water quality to ensure it is safe for human consumption.

**Q4. What are some types of water pollution?**

**A4.**

- a) **Sediment**
- b) **Pathogens**
- c) **Organic wastes**
- d) **Inorganic materials**
- e) **Organic chemicals**
- f) **Thermal pollutants - water added to lakes or streams that was used for industrial purposes and is much warmer than normal**

Discuss factors that affect water quality. Note that there are water sources aboveground including lakes, rivers, and streams. In addition, there are many underground water storage reservoirs called aquifers. Pollution of water resources, either aboveground or underground, is a serious problem, affecting the quality of water throughout the world. Have students complete AS 3.3 and discuss how pollutants can enter drinking wells and contaminate drinking water.

**F. *Other Activities***

1. Have students take a water sample from a local stream, river, or pond. The instructor should have the results of an earlier test ready to discuss with the students.
2. Have students clip articles from local newspapers that deal with water pollution topics. Post the articles on the bulletin board.
3. Show the video *The Groundwater on the Move* (Ag Video 125), available from the Missouri Resource Center for Career & Technical Education (MRCCTE), University of Missouri-Columbia.
4. Tour a local water treatment plant for students to compare the quality of the water coming into the facility to the quality of water going out for public use. Investigate how water quality is measured.

**G. *Conclusion***

Water is a precious resource. Although water may be considered a renewable resource, it can be contaminated to the point that it is virtually unusable. Each individual can take part in protecting

water supplies. An awareness of the causes of pollution is vital in maintaining quality water resources.

H. ***Answers to Activity Sheets***

AS 3.1 Water's Going On?!

The instructor should determine if the answers are appropriate.

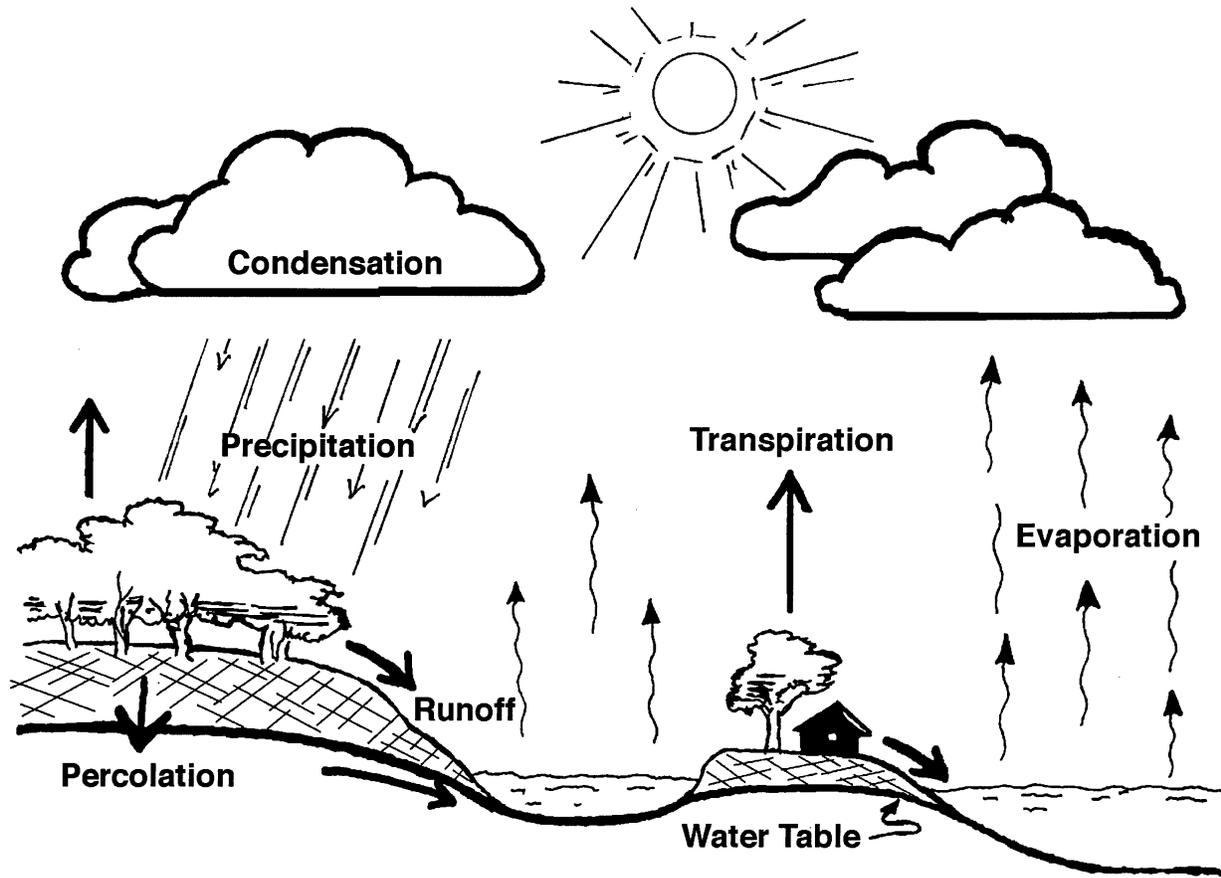
AS 3.2 Edible Earth Parfaits

There are no answers to this activity.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# The Hydrologic Cycle





Lesson 3: Water Quality

Name \_\_\_\_\_

**Water's Going On?!**

**Objective:** Students will assess amounts of water used in the home and illustrate the importance of water conservation.

**Directions:** Enter in Column C the number of times each situation occurs each day. Multiply Column B x Column C and enter total in Column D.

A	B	C	D
WHAT WE DO	HOW MUCH WATER IS USED	HOW OFTEN	DAILY WATER USE
Flushing a toilet	5-7 gallons		
Taking a bath with a tub full	30 gallons		
Taking a shower with water running	20 gallons		
Shaving with water running	15 gallons		
Brushing teeth with water running	5 gallons		
Washing hands or face with water running	2 gallons		
Drinking - running water to cool	1 gallon		
Cleaning vegetables with water running	3 gallons		
Dishwasher on full cycle	16 gallons		
Wash dishes by hand with water running	30 gallons		
Washing clothes on full cycle at top water level	60 gallons		
<i>Total Water Use</i>	<i>(add the numbers in Column D)</i>		

**Reference:** U.S. Department of Agriculture, Natural Resources Conservation Service



**Edible Earth Parfaits**

**Objective:** Students will understand how pollution can get into groundwater and how pumping can cause a decline in the water table.

**Materials and Equipment:**

Blue or red food coloring  
Vanilla ice cream  
Clear soda pop  
Crushed ice  
Assorted cake decoration sprinkles and sugars  
Drinking straws  
Clear plastic cups

**Procedure:**

1. Begin to construct your edible well by filling a clear plastic cup one-third full with crushed ice; this represents gravels and soils.
2. Add enough soda to just cover the ice.
3. Add a layer of ice cream to serve as a "confining layer" over the water-filled "well."
4. Add more crushed ice on top of the "confining layer."
5. Sprinkle colored sugars and sprinkles over the top to create the porous top layer, representing soils.
6. Add the food coloring to the soda. The food coloring represents contamination. Watch what happens when it is poured on the top of the well. Keep in mind that the same thing happens when contaminants are spilled on the earth's surface.
7. Using your straw, drill a well into the center of your aquifer.
8. Slowly begin to pump the well by sucking on the straw. Watch the decline in the water table.
9. Notice how the contaminants can get sucked into the well area and end up in the groundwater by leaking through the confining layer.
10. Now recharge your well by adding more soda, representing a rain shower.
11. Review what you have learned as you enjoy eating your edible well.

**Credit:** The Groundwater Foundation, P.O. Box 22558, Lincoln, NE 68542-2558 (402) 434-2740  
<<http://www.groundwater.org>>



## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 4: Air Quality

**Competency/Objective:** Describe the importance of air quality.

#### **Study Questions**

1. **What is air quality?**
2. **What types of pollution affect air quality?**
3. **What are the sources of air pollution?**
4. **Why is it important to maintain air quality?**
5. **What is being done to ensure air quality?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit V.
2. Transparency Master  
TM 4.1 Air Pollution in the Past
3. Activity Sheets  
AS 4.1 Factors Affecting Air Quality  
AS 4.2 Pollutants in the Home

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 4: Air Quality

#### TEACHING PROCEDURES

##### A. **Review**

Previous lessons discussed water quality and conservation. This lesson will discuss air quality. Fresh, clean air is necessary for life but frequently is taken for granted. Citizens should strive to keep air clean by recognizing and reducing causes of air pollution.

##### B. **Motivation**

1. Using an oxyacetylene torch, light the torch with only acetylene to show the soot that is formed. Ask students what happens to the soot in the air.
2. Using a white paper towel, hold it over the exhaust pipe of a car that is running. Repeat the experiment on a diesel car or truck. Were there any differences in the color of the exhaust emissions?
3. Show students an air filter from a furnace to show them how much dust and other matter is captured from the air people breathe.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### Q1. **What is air quality?**

###### A1. **Air quality is the purity of the air that is used by living organisms.**

High-quality air is free of pollution. Air with low quality contains materials that are toxic for living organisms to breathe. Have students brainstorm a list of possible ways that humans and other living things are affected by the quality of the air.

###### Q2. **What types of pollution affect air quality?**

###### A2.

- a) **Gaseous pollutants**
  - 1) **Carbon monoxide**
  - 2) **Nitrogen dioxide**
  - 3) **Sulfur dioxide**
  - 4) **Hydrocarbons**
- b) **Odor**
  - 1) **Factory odors**
  - 2) **Animal odors**
  - 3) **Waste treatment facilities**
- c) **Particulate matter**
  - 1) **Natural particles**
  - 2) **Human-generated particles**

Many factors contribute to the reduced quality of air in the environment. It is important to take steps to improve the quality of air in the environment. Complete AS 4.1 as a group and discuss possible ways humans contribute to the reduction of the quality of their air. Complete AS 4.2 and identify sources of air pollution in the home.

**Q3. What are the sources of air pollution?**

**A3.**

- a) **Human activities - burning, factories, automobiles, etc.**
- b) **Natural processes - fires, volcanic eruptions, decay, etc.**

Have students relate the types of pollution identified in study question 2 to their sources in this study question.

**Q4. Why is it important to maintain air quality?**

**A4.**

- a) **Human health**
- b) **Plant health**
- c) **Climate**
- d) **Maintain beauty of surroundings**
- e) **Reduce damage to property**

Air rich in chemicals, hazardous gases, and other pollutants affects the health of animals and plants. It damages property and causes a dingy, dirtier looking world in which to live. Discuss important reasons to maintain air quality.

**Q5. What is being done to maintain air quality?**

**A5.**

- a) **Motor vehicle emission controls on new cars**
- b) **Motor vehicle exhaust inspection**
- c) **Increased public transportation**
- d) **Use of ethanol and electric cars**
- e) **Use of alternate energy such as solar power, water power, and windmills**

Although progress has been made in controlling air pollution, more needs to be done. The public has become more conscious of the environment and is taking steps to maintain air quality. Each person should do his or her part to reduce air pollution and to maintain a healthy environment in which to live. Display TM 4.1 to demonstrate how pollution standards have developed and changed over history.

**F. *Other Activities***

1. Have students clip out newspaper articles on air pollution and write short critiques or summaries of these articles or have students to make a collage of magazine and newspaper pictures of air pollution sources.
2. Ask students to identify one source of air pollution and present to the class a way the source can be prevented or reduced.
3. Have students debate whether the air is cleaner now than it was 20 years ago. Encourage them to consider the current population and amount of industries in operation. What safeguards do we now have that were not enforced 20 years ago?

G. ***Conclusion***

H. ***Answers to Activity Sheets***

AS 4.1 Factors Affecting Air Quality

Answers will vary.

AS 4.2 Pollutants in the Home

Answers will vary.

I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## **Air Pollution in the Past**

- 1960** Studies are conducted on how carbon dioxide creates the greenhouse effect.
- 1963** About 300 people were killed and thousands of others were injured in New York City because of high concentrations of air pollutants that accumulated in air over the city. Other episodes in major cities led to much stronger air pollution control programs in the 1970s.
- 1963** Clean Air Act of 1963 authorized the U.S. Public Health Service to study air pollution and provided grants and training for states to control it.
- 1970** With the passage of the Clean Air Act Amendments of 1970, responsibility for controlling air pollution was assigned to the Environmental Protection Agency. Ambient air quality standards and performance standards for coal-fired power plants were established. These standards became known as the New Source Performance Standards.



## Air Pollution in the Past

**1987** CFC production is banned through a multinational treaty called Montreal Protocol.

**1990** Clean Air Act Amendments of 1990 targeted several specific areas:

Acid Rain: Reduce by half sulfur dioxides and nitrogen oxides.

Urban Smog: Establish targets for cities that do not meet limits on ozone (a key ingredient in smog.) These cities (non-attainment areas) have specific phased-in targets to be met.

Automobile Emissions: Set specific targets for reduction of tailpipe emissions of hydrocarbons. Require longer-lasting pollution control equipment on cars and cleaner kinds of gasoline (such as gasohol) in cities with the worst carbon monoxide problems. Mandate development of automobiles meeting even stricter standards in extremely pollution-prone cities like Los Angeles.



## Air Pollution in the Past

**1990** Toxic Air Pollutants: Expand the number of regulated toxic air pollutants from 7 to 189, set new safety standards for residents living near polluters, require polluters to install the best available pollution control equipment to reduce toxic emissions by 90% by the year 2003.

Depletion of the Ozone Layer: Phase out destruction of ozone-destroying chemicals throughout the 1990s, including CFCs, methyl chloroform, and carbon tetrachloride and establish rules for recycling and disposal of such chemicals.



Lesson 4: Air Quality

Name \_\_\_\_\_

**Factors Affecting Air Quality**

**Objective:** Students will identify sources affecting air quality.

**Directions:** Generate a list of sources contributing to reduced quality of air and list them to the right of each category.

Gaseous Pollutants

Odor

Particulate Matter



Lesson 4: Air Quality

Name \_\_\_\_\_

### **Pollutants in the Home**

**Objective:** Students will identify sources of pollution in the home.

**Directions:** Identify possible sources of pollution in your home, ways in which the pollutant could have harmful effects on people in the home, and possible ways in which the pollution could be reduced.

Sources of Pollution

Effects

Solutions



## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 5: Wildlife Management

**Competency/Objective:** Describe the importance of wildlife management.

#### **Study Questions**

1. **What is wildlife management?**
2. **What factors affect wildlife habitat?**
3. **What are agencies involved in wildlife management?**
4. **What are some wildlife management practices?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit V.
2. Transparency Masters  
TM 5.1 Economic Impacts of Recreation & Wildlife Watching in Missouri 1996  
TM 5.2 Wildlife Management Agencies
3. Activity Sheets  
AS 5.1 Maintaining Wildlife Habitats  
AS 5.2 Oh My Deer

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 5: Wildlife Management

#### TEACHING PROCEDURES

##### A. **Review**

In the previous lesson, the importance of maintaining air quality was discussed. This lesson will discuss wildlife management. Wildlife includes all animals that live in the natural environment without human assistance. Domestic animals require humans to survive and may not survive in nature.

##### B. **Motivation**

1. Ask students if they know of anyone who has tried to tame a wild animal and keep it for a pet. Have them describe the experiences this person had.
2. Have a Department of Conservation agent speak to the class about the goals of wildlife management.
3. Ask students if they can name any endangered wildlife in their state. Also ask students if they know what is being done in their state to protect these wildlife species.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **What is wildlife management?**

#### A1. **Wildlife management practices involve caring for wildlife and their environment to ensure the continuation of the species.**

Many wildlife management practices have been implemented to ensure the continuation of species nearly destroyed by human progress. Have students perform AS 5.1 and discuss when a wildlife habitat is destroyed, basic needs are endangered.

#### Q2. **What factors affect wildlife habitat?**

#### A2.

- a) **Urbanization**
- b) **Tilling the land for crops and pasture for livestock**
- c) **Manufacturing and industry**
- d) **Mining of land**
- c) **Cutting trees in forests**
- e) **Recreation areas**

Human advancement and habitation often come at the expense of wildlife habitats. It is important to develop methods for humans to advance society while maintaining natural habitats for wildlife. Complete AS 5.1 and discuss ways people can maintain wildlife environments. Wildlife is sustained to some degree through economics. Refer to TM 5.1 to demonstrate the financial impacts of recreation (fishing, hunting, and wildlife watching).

#### Q3. **What agencies are involved in wildlife management?**

**A3.**

- a) **U.S. Fish and Wildlife Service**
- b) **U.S. Department of Agriculture**
- c) **Bureau of Land Management**
- d) **Forest Service**
- e) **Missouri Department of Conservation**
- f) **Missouri Department of Natural Resources**

Wildlife management is a responsibility conducted on a federal, state, local, and even individual level. Use TM 5.2 to describe the organizations responsible for managing and protecting wildlife.

**Q4. What are some wildlife management practices?**

**A4.**

- a) **Managing habitat**
- b) **Controlling and preventing the spread of disease**
- c) **Hunting and hunting regulations**
- d) **Artificial stocking**
- e) **Managing funds**

Discuss wildlife management practices that have been implemented by federal and state agencies to ensure the health and growth of wildlife habitat and species. Conduct AS 5.2 to illustrate management practices for wildlife.

**F. *Other Activities***

1. Assign students to make posters on different types of wildlife by collecting pictures from magazines.
2. Ask students to clip newspaper articles on wildlife preservation or current events dealing with wildlife.
3. Have a panel debate the pros and cons of regulating hunting and fishing.
4. View one of the following videos available through the Missouri Resource Center for Career & Technical Education (MRCCTE), University of Missouri-Columbia.
  - a) *Guarding Our Living Environment* (Ag Video 128)
  - b) *Time Shadows: Encounters with the Whitetail* (Ag Video 127)
  - c) *Dedicated to Conservation II* (Ag Video 129)
  - d) *Back to the Wild* (Ag Video 250)
5. Take a field trip to a wildlife area.
6. Have students attend a hunter safety course or workshop.

**G. *Conclusion***

Wildlife management is an important part of wildlife protection. Everyone must recognize and take responsibility for protecting wildlife resources. Wildlife habitat is affected by several factors resulting from human habitation and advancement. There are several federal and state agencies dedicated to protecting wildlife. Wildlife management practices help ensure the continued health and growth of habitat and species.

**H. *Answers to Activity Sheets***

A.S 5.1 Maintaining Wildlife Habitats

Answers will vary.

AS 5.2 Oh My Deer

Answers will vary.

I ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## Economic Impacts of Recreation & Wildlife Watching in Missouri in 1996

Economic Impact	Anglers		Hunters	
	Residents (millions)	Nonresidents (millions)	Residents (millions)	Nonresidents (millions)
Expenditures	\$594.1	\$208.9	\$521.3	\$290.4
Total business-generated revenue	\$1,166.8	\$410.3	\$1,023.8	\$570.5
Earnings generated from expenditures	\$572.8	\$201.4	\$502.6	\$280.0
State sales tax generated	\$25.1	\$8.8	\$22.0	\$12.3
State income tax generated	\$13.3	\$4.7	\$11.6	\$6.5
Jobs supported	15,340	5,390	13,460	7,500

Economic Impact	Wildlife Watchers		Total		Grand Total All Spenders (Millions)
	Residents (millions)	Nonresidents (millions)	Residents (millions)	Nonresidents (millions)	
Expenditures	\$410.6	\$97.3	\$1,526.0	\$596.6	\$2,122.6
Total business-generated revenue	\$806.5	\$191.2	\$2,997.1	\$1,172.0	\$4169.1
Earnings generated from expenditures	\$395.9	\$93.8	\$1,471.3	\$575.2	\$2046.5
State sales tax generated	\$17.3	\$4.1	\$64.4	\$25.2	\$89.6
State income tax generated	\$9.2	\$2.2	\$34.1	\$13.4	\$47.5
Jobs supported	10,600	2,510	39,400	15,400	54,800



# **Wildlife Management Agencies**

## **Federal**

U.S. Fish and Wildlife Service

U.S. Department of Agriculture

Bureau of Land Management

Forest Service

## **State**

Missouri Department of Conservation

Missouri Department of Natural Resources



**Maintaining Wildlife Habitats**

**Objective:** Students will identify factors that contribute to the destruction of wildlife habitats.

**Directions:** Under each category that contributes to the destruction of wildlife habitats, name a specific practice that destroys the environment for wildlife. Then name a method in which this destruction could be reduced.

Urbanization

Manufacturing

Mining

Cutting trees

Tilling land for crops and pasture for livestock

Recreation



**Oh My Deer\***

**Objective:** Students will recognize features that affect the size and survival of a deer herd and will describe the influence of hunting and absence of hunting on a deer herd.

**Directions:** In this board game, participants are managing a deer herd for 6 years.

Note: The address for ordering the "Oh My Deer" board game is provided in Lesson 1 of this unit.

**Materials:**

Flip-chart paper  
Colored marking pens (one color for each team)  
One "Oh My Deer" board game for every four to six participants.

**Procedures:**

1. Divide into teams of four to five participants. Select someone to read the directions to the team. Be sure to note that only 14 deer can survive an average winter.
2. Stack the winter cards in each game to ensure that all teams have the same environmental conditions.
3. Use the flip chart to record the information from all teams.
4. Begin playing the game and play six rounds.
5. During the game, team members record the herd size at the end of each year. The final total of bucks and does is recorded in the harvest and nonharvest boxes.
6. Each group enters its data on the flip chart and then shares its results and management strategies with the other groups.
7. After the game is played, answer the following questions in the space provided.

**Key Questions:**

1. Which group was most successful in managing its deer herd?
2. Was it the group with the most deer?
3. Was it the group with the greatest number of harvested deer?

5. How do wildlife regulations affect wildlife?
  
6. How does winter carrying capacity affect long-run population numbers?
  
7. Why is it hard to survey herd size and condition?

\* This activity was adapted from "Oh My Deer," Investigating Your Environment Wildlife, U.S. Department of Agriculture Forest Service.

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 6: Conservation Issues

**Competency/Objective:** Describe how conservation issues affect agriculture.

#### **Study Questions**

1. **What are some agriculture-related conservation issues?**
2. **What conservation legislation affects agriculture?**
3. **How is agriculture working to maintain and conserve natural resources?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit V.
2. Activity Sheet  
AS 6.1 Conservation in Agriculture

## UNIT V - NATURAL RESOURCES AND CONSERVATION

### Lesson 6: Conservation Issues

#### TEACHING PROCEDURES

##### A. **Review**

The previous lesson discussed factors affecting wildlife habitats and management of wildlife habitats. This unit will discuss conservation issues as they relate to agricultural management practices.

##### B. **Motivation**

Present students with the following hypothetical situation. Congress is working to pass legislation that will completely outlaw chemicals used in crop production due to the pollutants created by such practices. Have students generate a list of ways in which this will affect the production of food in the United States as well as ways in which it will affect their daily lives.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. What are some agriculture-related conservation issues?

##### A1.

- a) **Maintaining soil productivity**
- b) **Controlling pollution**
- c) **Disposing of wastes**
- d) **Destruction of forests**

Divide the board into three sections: agriculture producers, consumers (or the general public), and natural resource conservationists. Have students list how each group would have different points of view on each of the above issues.

#### Q2. What conservation legislation affects agriculture?

##### A2.

- a) **1985 Farm Bill created the Conservation Reserve Program, which sets aside land to be maintained as natural vegetation for 10 years.**
- b) **1996 Federal Agriculture Improvement and Reform Act modified programs involved in natural resource conservation as directed by the Natural Resources Conservation Service.**
  - 1) **Environmental Quality Incentives**
  - 2) **Conservation Farm Option**
  - 3) **Flood Risk Reduction Program**
  - 4) **Conservation of Private Grazing Land**

Discuss ways in which legislation has helped agriculture to conserve natural resources.

#### Q3. How is agriculture working to maintain and conserve natural resources?

##### A3.

- a) **Precision farming**

- b) **Genetically altered crops**
- c) **Biological pest control**
- d) **Pesticide container reclaiming**
- e) **Minimum tillage or no-till cropping**
- f) **Rotational livestock grazing**
- g) **Set aside acreage**
- h) **Alternative power sources**

Have students complete AS 6.1 and discuss practices and methods that help make agriculture environment friendly.

F. ***Other Activity***

Have students debate the use of genetically altered crops as a form of reducing pesticide usage on crops.

G. ***Conclusion***

Agriculture has taken great strides in improving natural resources conservation. Legislation has educated producers in ways to improve their farming practices to reduce soil erosion and pollution and improve natural habitats for wildlife. New technology assists producers in reducing chemical use and developing alternative methods of production.

H. ***Answers to Assignment Sheet***

Answers will vary.

I. ***Answers to Evaluation***

1. a
2. a. E  
b. I  
c. E  
d. I  
e. E  
f. E
3. d
4. a
5. b
6. d
7. b.
8. d
9. a
10. d
11. a
12. c
13. d
14. a
15. d
16. b
17. They interact with and depend upon one another. When one is affected adversely, others may suffer.
18. Preservation maintains an existing natural resource. Conservation manages the use of natural resources to avoid wasting them

19. Any three of the following: Bureau of Land Management, Department of Fish and Wildlife, National Park Service, Environmental Protection Agency, Forest Service, Natural Resources Conservation Service
20. Any three of the following: human activities, water erosion, wind erosion, natural events (including earthquakes, floods, tornadoes), land slippage
21. Any three of the following: contour planting, crop rotation, terracing, grassed strips, diversion ditches, strip cropping, vegetative cover
22. Any three of the following: odor and taste, color, pH, hardness, turbidity, heavy metals, chemical residues, bacteria
23. Any three of the following: sediment, pathogens, organic wastes, inorganic wastes, organic chemicals, thermal pollutants
24. Any three of the following: human health, plant health, climate, maintain beauty of surroundings, reduce damage to property
25. Any two of the following: motor vehicle emission controls, motor vehicle exhaust inspection, increased public transportation, use of ethanol and electric cars, use of alternate energy
26. Any three of the following: Urbanization, tilling the land for crops and pasture for livestock, manufacturing and industry, mining of land, cutting trees in forests, recreation areas
27. Any three of the following: managing habitat, controlling and preventing disease, hunting and fishing regulations, artificial stocking, managing funds
28. Any three of the following: precision farming, genetically altered crops, biological pest control, minimum or no-till cropping, alternate power sources, pesticide container reclaiming

**Conservation in Agriculture**

**Objective:** Students will be able to identify agriculture-related conservation issues, the problems associated with each, and new practices that have been developed to improve conservation efforts.

**Directions:** Beside each agriculture-related conservation issue, list current developments that have improved conservation efforts.

Issue	Past Problems	Current Developments
Disposing of Wastes	No controls were placed on disposal of pesticide containers.	
Maintaining Soil Productivity	Soil erosion was drastic due to improper tillage procedures.	
Controlling Air Pollution	No controls were placed on vehicle emissions, and air was becoming polluted.	



UNIT EVALUATION

Circle the letter that corresponds to the best answer.

1. Natural resources are used by \_\_\_\_\_.
  - a. Plants
  - b. All living things
  - c. Humans
  - d. Animals
  
2. Place an "I" in front of the inexhaustible resources and an "E" in front of the exhaustible resources.
  - a. \_\_\_\_\_ Soil
  - b. \_\_\_\_\_ Water
  - c. \_\_\_\_\_ Oil
  - d. \_\_\_\_\_ Air
  - e. \_\_\_\_\_ Coal
  - f. \_\_\_\_\_ Natural gas
  
3. How do point source pollution and nonpoint solution differ?
  - a. Point of cleanup
  - b. Point of light
  - c. Point of effectiveness
  - d. Point of origin
  
4. How does soil erosion affect the production of food?
  - a. Decrease in crop and animal production
  - b. Decrease in mechanization
  - c. Decrease in human activity
  - d. Decrease in human population
  
5. Soil conservation is defined as \_\_\_\_\_.
  - a. Failure of crops growth due to soil erosion
  - b. Protection, preservation, and improvement of soil
  - c. Land overgrazed by livestock
  - d. Reducing human activity to conserve the soil
  
6. How is water purified naturally?
  - a. Condensation
  - b. Evaporation
  - c. Rain cycle
  - d. Hydrologic cycle

7. Determining the condition of water for a particular use is known as \_\_\_\_\_.
- a. Water safety
  - b. Water quality
  - c. Ecological quality
  - d. Environmental safety
8. The purity of the air used by living organisms is known as \_\_\_\_\_.
- a. Potability
  - b. Aerability
  - c. Oxygen quality
  - d. Air quality
9. What type of air pollutant is carbon monoxide?
- a. Gaseous
  - b. Chemical
  - c. Liquid
  - d. Invisible
10. What type of pollutant is soil in the air?
- a. Dirt matter
  - b. Fine matter
  - c. Soil-air matter
  - d. Particulate matter
11. What is the source of air pollution caused by factories?
- a. Human activity
  - b. Natural activity
  - c. Machine activity
  - d. Particle activity
12. Air pollution caused by a volcanic eruption would be the result of \_\_\_\_\_.
- a. Eruption activity
  - b. Particle activity
  - c. Natural processes
  - d. Human activity
13. The practices involved in caring for wildlife and its environment are known as \_\_\_\_\_.
- a. Wildlife quality
  - b. Environment management
  - c. Environment protection
  - d. Wildlife management
14. Which wildlife management organization protects and preserves endangered species?
- a. U.S. Fish and Wildlife Science
  - b. Forest Service
  - c. Bureau of Land Management
  - d. U.S. Department of Agriculture

15. Disposing of wastes and maintaining soil productivity are examples of \_\_\_\_\_ issues.
- a. Recreational
  - b. Air quality
  - c. Wildlife management
  - d. Agriculture-related conservation
16. How are the Federal Agriculture Improvement Reform Act and the Farm Bill similar?
- a. They outlawed farming.
  - b. They are conservation legislation affecting agriculture.
  - c. They are designed to eliminate conservation.
  - d. They fine farmers for spoiling the land.

**Complete the following short answer questions.**

17. Briefly explain the importance of conserving natural resources.
18. Explain the difference between preservation and conservation.
19. List three government agencies that monitor resource quality.
- a.
  - b.
  - c.
20. List three factors that could contribute to soil erosion.
- a.
  - b.
  - c.
21. List three agricultural soil conservation practices.
- a.
  - b.
  - c.

22. List three factors affecting water quality.
  - a.
  - b.
  - c.
23. List three sources of water pollution.
  - a.
  - b.
  - c.
24. List three reasons for maintaining air quality.
  - a.
  - b.
  - c.
25. Describe two practices that have been implemented to maintain air quality.
  - a.
  - b.
26. List three factors that could affect wildlife habitat.
  - a.
  - b.
  - c.
27. List three wildlife management practices.
  - a.
  - b.
  - c.
28. List three ways in which agriculture is working to maintain resources.
  - a.
  - b.
  - c.

## UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

### Lesson 1: Developing Leadership Skills

**Competency/Objective:** Identify important factors in developing leadership skills.

#### **Study Questions**

1. **How is personal leadership defined?**
2. **Why are leadership skills important?**
3. **Why is setting goals important?**
4. **Why are communications skills important?**
5. **How is knowledge of parliamentary procedure important to leadership?**
6. **How does the FFA Organization provide leadership opportunities?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VI.
2. *National FFA Manual*. The National FFA Organization.
3. Ricketts, Cliff. *Leadership: Personal Development and Career Success*. Albany, NY: Delmar, 1997.
4. Activity Sheets  
AS 1.1 Personal Leadership Qualities  
AS 1.2 Researching a Leader  
AS 1.3 Setting Goals  
AS 1.4 Verbal Communication Skills Checklist  
AS 1.5 The Parliamentary Procedure Game

## UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

### Lesson 1: Developing Leadership Skills

#### TEACHING PROCEDURES

##### A. ***Introduction***

This lesson defines leadership and includes the skills necessary to become an effective leader as well as skills on effective goal setting and communication. It concludes with a scope of the leadership opportunities provided by the National FFA Organization.

##### B. ***Motivation***

Have students generate a list of people they consider to be great leaders and list them on the board. Have them list the skills these people possessed that made them great leaders.

##### C. ***Assignment***

##### D. ***Supervised study***

##### E. ***Discussion***

#### **Q1. How is personal leadership defined?**

##### **A1. Personal leadership is the ability to motivate and organize oneself and others to achieve goals.**

Have students complete AS 1.1. Generate a discussion on leadership by having students write instances (good or bad) in which they were leaders. Discuss how people can lead in good ways and in bad ways. Also discuss how those who led poorly could have changed the situation to be good leaders.

#### **Q2. Why are leadership skills important?**

##### **A2.**

- a) **Improve confidence and acquire respect from others**
- b) **Help others and make a contribution to society**
- c) **Offer opportunity for unlimited success**

Discuss the importance of leadership and how being an effective leader can change someone's life in the ways stated above. Complete AS 1.2 to illustrate the impact a good leader can make.

#### **Q3. Why is setting goals important?**

##### **A3.**

- a) **Focuses energy on what is to be completed**
- b) **Motivates people to complete those tasks**

Discuss the three basic types of goals: short term, intermediate, and long term. Have students complete AS 1.3 to practice goal setting. Generate a classroom discussion about the importance of setting goals and the personal goals they would like to achieve.

#### **Q4. Why are communication skills important?**

A4.

- a) **Assist people in getting a job, a promotion, or a raise**
- b) **Create a strong personal image**
- c) **Build better relationships with people**

Have the students create a list of ways communication skills can help them succeed in their everyday lives. Relate each item to the three points listed above. Complete AS 1.4 Verbal Communication and discuss ways to improve communication skills.

Q5. **How is knowledge of parliamentary procedure important to leadership?**

A5.

- a) **Teaches leaders how to conduct fair and democratic meetings**
- b) **Improves communication and public speaking skills**
- c) **Improves decision making and respecting the rights of others**

Discuss the importance of parliamentary procedure. Optional: Consult *Robert's Rules of Order* for conducting an FFA meeting with the class and conduct AS1.5 in which students play a game about parliamentary procedure.

Q6. **How does the FFA Organization provide leadership opportunities?**

- A6. a) **Career Development Events - at the local, district, state, and national levels**
- b) **Supervised Agricultural Experience Programs - local, district, state, and national awards programs**
- c) **Leadership conferences, seminars, and camps - at local, state, and national levels**

Distribute *National FFA Manual* or *Student Handbook* to students and discuss opportunities for leadership activities in the National FFA Organization.

F. ***Other Activities***

1. Have a chapter or state FFA officer speak to the class on leadership opportunities in the National FFA Organization.
2. Have the class organize its own junior high FFA chapter, elect officers, and plan activities.
3. View the video *Leadership Qualities that Get Results*, R Video 87, available from the Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.

G. ***Conclusion***

Becoming an effective leader is important to success and satisfaction in life. Effective leaders inspire, motivate, and persuade others to achieve goals. Elements to leadership include setting goals and possessing good communication skills. Using parliamentary procedures ensures that meetings and decision making are fairly handled. The National FFA is a leadership organization that provides opportunities to achieve goals of leadership and communication.

H. ***Answers to Activity Sheets***

AS 1.1 Personal Leadership Qualities

The instructor should determine if the answers are appropriate.

AS 1.2 Researching a Leader

The instructor should determine if the answers are appropriate.

#### AS 1.3 Setting Goals

The instructor should determine if the answers are appropriate.

#### AS 1.4 Verbal Communication Skills Checklist

The instructor should determine if the answers are appropriate.

#### AS 1.5 The Parliamentary Procedure Game

The instructor should determine if the answers are appropriate.

### I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

Lesson 1: Developing Leadership Skills

Name \_\_\_\_\_

**Personal Leadership Qualities**

**Objective:** Students will be able to identify positive leadership skills and ways to improve negative leadership situations.

**Directions:** In the appropriate spaces below, list situations in which you showed positive leadership skills and negative leadership skills. Then write ways in which you could have turned your negative leadership situations into positive ones under the new positive leadership roles. Finally, list some ways in which you could be a positive leader in the future.

Positive Leadership Situations

1.

2.

3.

4.

5.

New Positive Leadership Role

1.

2.

3.

4.

5.

Negative Leadership Situations

1.

2.

3.

4.

5.

Good Leadership in the Future

1.

2.

3.

4.

5.











Lesson 1: Developing Leadership Skills

Name \_\_\_\_\_

**Verbal Communication Skills Checklist**

**Objective:** Students will identify and assess areas of improvement in verbal communication.

**Directions:** Check all the speaking situations that apply to you now or that will apply to you in the future. Then rate your level of satisfaction for each area.

√	CATEGORY	NEEDS SIGNIFICANT IMPROVEMENT	NEEDS SOME IMPROVEMENT	PRETTY GOOD	EXCELLENT
	Formal stand-up speech				
	Lead meetings				
	Participate in meetings				
	Speak on the telephone				
	Give demonstrations				
	Act in a play				
	Motivate a sports team				
	Raise funds for an organization				
	Give a report in class				
	Speak in a small group activity				



Lesson 1: Developing Leadership Skills

Name \_\_\_\_\_

### The Parliamentary Procedure Game

**Objective:** Students will understand and use basic parliamentary procedure skills.

**Directions:** Participate in the following "Parliamentary Procedure" game in class. Be sure to review the basic motions listed in *Robert's Rules of Order*.

**Procedures:**

1. Stand with your classmates in line in the classroom as you would for a spelling bee.
2. The teacher will name one of the motions discussed in *Robert's Rules of Order*.
3. The first person must state whether the motion requires a second.
4. The next person states whether or not that motion is debatable.
5. The third person states what vote it requires.
6. The fourth person states what other motion is directly above it in the order of precedence. If it is an incidental motion, the correct response is "incidental."
7. If a student answers incorrectly, he or she must be seated.
8. The teacher continues asking questions about motions until only the winner remains standing.

Adapted from *Robert's Rules of Order Revised*. < <http://www.constitution.org/rror/rror--00.htm> > 11 May 2000.



## UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

### Lesson 2: Importance of Financial Records

**Competency/Objective:** Explain the importance of keeping financial records.

#### **Study Questions:**

1. **Why should individuals save for the future?**
2. **How is interest calculated?**
3. **What is the difference between an expense and a receipt?**
4. **Why is it important to keep personal financial records?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VI.
2. Board games such as "We Mean Business! An Adventure in Entrepreneurship" or "Rich Farmer - Poor Farmer." Order from NASCO, 1-800-558-9595.
3. Transparency Masters  
TM 2.1 A Million Dollars or a Penny?  
TM 2.2 Two Ways to Become a Millionaire  
TM 2.3 Rule of 72  
TM 2.4 Calculating Simple Interest
4. Handout  
HO 2.1 Two Ways to Become a Millionaire
5. Activity Sheets  
AS 2.1 Time Value of Money and Rule of 72  
AS 2.2 Calculating Simple Interest  
AS 2.3 Tips on Saving Money

## UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

### Lesson 2: Importance of Financial Records

#### TEACHING PROCEDURES

##### A. **Review**

In the previous lesson, we learned about the important factors in developing leadership skills. One of the important concepts was how setting goals is an important factor in leadership development. In this lesson, the concept of goal setting will be applied to financial management.

##### B. **Motivation**

1. Explain the following scenario to students: You have just won the lottery and will receive \$100,000 today. What will you do with the money? After giving students time to develop their plan, have them share it with another student. Have them identify similarities and differences in what they would do with the money by categories. Discuss categories with the class and list on the white board. Is "put in savings" a category?
2. Ask students if they would rather have a penny that doubles in amount each day for a month or a million dollars in one lump sum. Use TM 2.1 to illustrate what will happen.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. Why should individuals save for the future?

##### A1.

- a) **To have enough money for key times in life**
  - 1) **Living expenses when moving away from home can be considerable.**
  - 2) **College expenses may range from \$2,000 to \$3,000 or even as high as \$15,000-\$20,000, depending on various factors.**
  - 3) **Major purchases - Making large purchases such as a car, house, land, machinery, or business requires a significant amount of money.**
  - 4) **Retirement - When an individual no longer has a salaried job, savings and other retirement accounts are needed to provide the needed funds.**
- b) **To let the effect of interest rates and time work for them**

Show TM 2.1 (or review if used in the Motivation). Show TM 2.2 to illustrate savings and interest with two different scenarios and then distribute HO 2.1, which provides the breakdown of payments for each scenario. Briefly discuss what Tax-Sheltered Annuity provides an individual. Without getting too complex, help students to understand the similarities and differences between a savings account and a TSA. A TSA can be thought of as a savings account that usually earns a higher rate of return. Unlike a savings account, the money contributed to a TSA stays there until needed at retirement. Then show TM 2.3, which illustrates how to calculate rate of return, and have students complete AS 2.1 for an exercise in how to figure interest rates and savings accrued.

#### Q2. How is interest calculated?

**A2. Simple interest, interest charged for only the time the money is used, is equal to (principal) x (rate) x (time).**

Show TM 2.4, which displays how to calculate simple interest. Have students complete AS 2.2 to solve problems involving simple interest.

**Q3. What is the difference between an expense and a receipt?**

**A3.**

- a) **Expense - An expense is a financial outlay or cost.**
- b) **Receipt - A receipt is revenue or income.**

Use board games such as "We Mean Business! An Adventure in Entrepreneurship" or "Rich Farmer - Poor Farmer" to help students better understand financial concepts.

**Q4. Why is it important to keep personal financial records?**

**A4.**

- a) **It enables an individual to monitor income and spending.**
- b) **It can help an individual accomplish his or her goals.**

Conduct AS 2.3 as a concluding activity on how to budget and save money. Have students share their lists and summarize the information.

**F. *Other Activities***

1. Invite a banker or financial planner to class to present information on financial management.
2. Utilize web sites such as <<http://www.bankrate.com/brm/popcalc2.asp>> that have amortization programs and loan calculators.

**G. *Conclusion***

A financial plan can help an individual manage his or her money so that personal and financial goals can be reached. It is important to begin this process early so that time and interest work for you. Monitoring the plan, especially in regard to saving and spending will help individuals reach their goals.

**H. *Answers to Activity Sheets***

AS 2.1 A Million Dollars or a Penny?

1. 18 years
2. 13 years
3. 7 years
4. 40,000
5. a. \$1,600  
b. \$16,000

Breakdown:

	a.	b.
Age	Savings Account Value	
14	\$100	\$1000
28	\$200	\$2000
42	\$400	\$4000
56	\$800	\$8000
70	\$1,600	\$16,000

#### AS 2.2 Two Ways to Become a Millionaire

1.  $SI = (2000)(.08)(1) = \$160$
2.  $SI = (25000)(.07)(2) = \$3500$
3.  $SI = (15000) (.08) (3/12) = \$225$
4.  $SI = (300) (.075) (9/12) = \$16.88$
5.  $SI = (10)(.14)(20/365) = \$.08$

#### AS 2.3 Tips on Saving Money

Answers will vary.

#### I. **Answers to Evaluation**

1. c
2. b
3. a
4. b
5. b
6. a
7. d
8. a
9. The ability to motivate oneself and others to achieve goals
10. Answer should include three of the following: motivating yourself and others, good character, communicating effectively with others, working well in teams, confident in abilities, goal oriented and motivated.
11. Answer should include one of the following: getting a job, strong personal image, building better relationships with people.
12. Simple interest = principal x rate x time
13. Savings accounts, certificates of deposits, retirement accounts.
14. Answers will vary.

## **A Million Dollars or a Penny?**

Would you take \$1,000,000?

or

1¢ and each day double this amount for a month? (1¢, 2¢, 4¢, 8¢, 16¢, etc.)

At the end of the month, the original penny will be worth \$10,737,418.

Let time and interest work for you!



## Two Ways to Become a Millionaire

At age 21:

You open a TSA by investing \$2,000 a year for 6 years and then stop.

or

Spend \$2,000 on yourself for 6 years and then open a TSA by investing \$2,000 a year for 36 years until you retire at age 62.

At age 62:

Using an interest rate of 12%, both ways will result in approximately the same amount of money . . . a million dollars!

Which way will you select?

Start saving early to become a millionaire!  
Let time and interest work for you.



## Rule of 72

$72 \div \text{Rate of Return} =$   
Number of years for your money to double

Example - You deposit \$100 in a savings account that earns 6% interest. How many years will it take for your money to double?

$$72 \div 6 = 12 \text{ years}$$

In 12 years from the day you deposited your money, you will have \$200.

How much money will you have in 24 years?

\$400



## Calculating Simple Interest

Simple Interest = (Principal) (Rate) (Time)

Terms of the loan:

\$3,000 borrowed

12% interest rate

1 year to pay

Simple Interest = (3000) (.12) (1) = \$360

---

Terms of the loan:

\$2,000 borrowed

9% interest rate

4 months to pay

Simple Interest = (2000) (.09) (4/12) = \$60



## Lesson 2: Importance of Financial Records

**Two Ways to Become a Millionaire**

Individual A opened a Tax sheltered Annuity (TSA) at 12% interest and invested \$2,000 a year for 6 years and then stopped. Individual B spent \$2,000 a year on himself/herself for 6 years and then opened a TSA at 12% interest, investing \$2,000 a year for the next 38 years. Look at age 62. Individual A, who only deposited \$12,000, has accumulated nearly as much as Individual B, who deposited \$74,000. Start early - let time work for you!

Age	Individual A		Individual B	
	Payment	Accumulation End of Year	Payment	Accumulation End of Year
21	\$2,000	\$2,240	0	0
22	2,000	4,479	0	0
23	2,000	7,559	0	0
24	2,000	10,706	0	0
25	2,000	14,230	0	0
26	2,000	18,178	0	0
27	0	20,359	\$2,000	\$2,240
28	0	22,803	2,000	4,479
29	0	25,539	2,000	7,559
30	0	28,603	2,000	10,706
31	0	32,036	2,000	14,230
32	0	35,880	2,000	18,178
33	0	40,186	2,000	22,559
34	0	45,008	2,000	27,551
35	0	50,409	2,000	33,097
36	0	56,458	2,000	39,309
37	0	63,233	2,000	46,266
38	0	70,821	2,000	54,058
39	0	79,320	2,000	62,785
40	0	88,838	2,000	72,559
41	0	99,499	2,000	83,507
42	0	111,438	2,000	95,767
43	0	124,811	2,000	109,499
44	0	139,788	2,000	124,879
45	0	156,563	2,000	142,105
46	0	175,351	2,000	161,397
47	0	196,393	2,000	183,005
48	0	219,960	2,000	207,206
49	0	246,355	2,000	234,310
50	0	275,917	2,000	264,668
51	0	309,028	2,000	298,668
52	0	346,111	2,000	336,748
53	0	387,644	2,000	379,398
54	0	434,161	2,000	427,166
55	0	486,261	2,000	480,665
56	0	544,612	2,000	540,585
57	0	609,966	2,000	607,695
58	0	683,162	2,000	682,859
59	0	765,141	2,000	767,042
60	0	856,958	2,000	861,327
61	0	959,793	2,000	966,926
62	0	1,074,968	2,000	1,082,959



Lesson 2: Importance of Financial Records

Name \_\_\_\_\_

**Time Value of Money and Rule of 72****Objective:** Students will figure interest rates and how savings can be accrued.**Directions:** Complete the following problems. Show your work.

1. How many years are required for \$50 to double if it is earning 4% interest?  
\_\_\_\_\_ years
  
2. How many years will it take for \$1,000 to double if it is earning 5.5% interest?  
\_\_\_\_\_ years
  
3. Your TSA has been earning 10.3% interest. You have \$2,000 in the account. Without adding any more money to the TSA and assuming you can earn 10.3%, your \$2,000 will be worth \$4,000 in \_\_\_\_\_ years.
  
4. You have \$10,000 in your savings account earning 4.8% interest. How much money will you have in your savings account in 30 years? \$\_\_\_\_\_
  
5. Julie Carver, a 14-year-old, opens a saving account that earns 5.14% interest.
  - a. If she puts \$100 in the account and there is no change in the interest, it will be worth \$\_\_\_\_\_ at age 70.
  - b. What would the savings account value be at age 70 if Julie started with \$1,000?  
\$\_\_\_\_\_



Lesson 2: Importance of Financial Records

Name \_\_\_\_\_

**Calculating Simple Interest****Objective:** Students will compute simple interest.**Directions:** Complete the following problems. Show your work.

1. I.M. Rich borrows \$2,000 for 1 year at 8% interest. \$\_\_\_\_\_ is the simple interest that has accumulated at the end of the year.
  
2. Your horticultural business Plants and More must borrow \$25,000 for a new greenhouse. Banker Brad loans you the money for 2 years at 7% interest. How much simple interest will be due at the end of the 2 years? \$\_\_\_\_\_
  
3. BBBB (Brad's Best Buy Bank) loans Dr. Doug Holmes \$15,000 for medicine and other supplies. Dr. Holmes must repay the loan in 3 months with 6% interest charges. \$\_\_\_\_\_ in simple interest will be due at the end of 3 months.
  
4. Mickey Alottamoney borrows \$300 to buy a new lawnmower for his business Mickey's Mowing. He must repay the loan in 9 months with 7.5% interest charged. What is the simple interest that will be due at the end of 9 months? \$\_\_\_\_\_
  
5. You loan your classmate \$10 for 20 days and charge 14% interest. How much simple interest will be due at the end of the 20 days? \$\_\_\_\_\_



**Tips on Saving Money**

**Objective:** Students will identify ways to budget and save money.

**Procedure:**

1. Access web sites to find information about saving money. Following are several web sites:

Savvy Student            <http://www.savvystudent.com>  
Personal Budgeting    <http://www.personalbudgeting.com>

2. From these or other sources, identify at least two ways you can save money and two ways your family might be able to save money.

You

1.

2.

Your family

1.

2.



## UNIT EVALUATION

Circle the letter that corresponds to the best answer.

1. Select the correct bonus to possessing leadership skills.
  - a. Winning the lottery
  - b. Front row parking
  - c. Respect, confidence, and success
  - d. Growth of investments
  
2. Select the three types of goals.
  - a. Small, medium, large
  - b. Short-term, intermediate, long-term
  - c. Short-range, mid-range, long-range
  - d. Lower, mid-level, upper
  
3. Select the appropriate reason for setting goals as a leader.
  - a. Goals focus and motivate people to complete tasks.
  - b. Goals lead to increased salaries.
  - c. Goals are required for job interviews.
  - d. Goals are always achieved in 1 to 2 days.
  
4. Choose the premier leadership organization for youth in agricultural education.
  - a. FAF
  - b. National FFA
  - c. FHA
  - d. FMHA
  
5. I.M. Rich put \$2,000 into a certificate of deposit at 9% interest. It will be worth \$4,000 in \_\_\_\_\_ years.
  - a. 5
  - b. 8
  - c. 12
  - d. 18
  
6. Plants And More borrows \$7,000 for new greenhouse benches. The loan will be paid back in 1 year with 6.5% interest charges. \$\_\_\_\_\_ simple interest will be due at the end of the year.
  - a. 455
  - b. 550
  - c. 910
  - d. 955

7. Principal is defined as \_\_\_\_\_.
- a. PRT
  - b. The interest rate
  - c. The part of the year the money is used
  - d. The amount of money borrowed
8. Operating costs would be considered a/an \_\_\_\_\_.
- a. Expense
  - b. Receipt
  - c. Income
  - d. Revenue

**Complete the following short answer questions.**

9. Define personal leadership.
10. List three important leadership skills.
- a.
  - b.
  - c.
11. Describe one way in which communication skills are important as a leader.
12. What is the formula for determining simple interest?
13. List three ways that money can be saved to provide financial security for retirement.
- a.
  - b.
  - c.
14. Identify a goal you have that involves financial planning. Explain how your financial plan will allow you to reach this goal.

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

Lesson 1: Electricity

**Competency/Objective:** Understand electricity and explain precautions for the safe use of electricity.

### **Study Questions**

1. **What is electricity?**
2. **How is electricity generated and transported?**
3. **How is electricity measured?**
4. **What is the difference between a fuse and a circuit breaker?**
5. **What are hot, neutral, and ground wires?**
6. **What are the different types of lightbulbs?**
7. **What hazards are associated with the use of electricity in the farm and home?**

### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Bergwall Productions, Inc. *Working Safely With Electricity*, (T&I Video Kit I). Chadds Ford, PA, 1997. Available from Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.
3. Transparency Masters  
TM 1.1 Reading an Electric Meter  
TM 1.2 Fuses and Circuit Breakers
5. Activity Sheets  
AS 1.1 Daily Use of Electricity in My Home  
AS 1.2 Electrical Safety Checklist

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 1: Electricity

#### TEACHING PROCEDURES

##### A. **Introduction**

Electricity has so many uses, it is difficult to imagine life without it. Electrical energy improves the quality of life in our homes, on the farm, in agricultural industry, and nearly everywhere else. It is important for all people to gain an understanding of electricity and safety precautions associated with its use around the house as well as the farm.

##### B. **Motivation**

1. Begin the lesson by asking students to write all of the ways in which they use electricity in a typical day. Challenge them to think of an instance in their daily lives in which they don't use electricity either directly or indirectly. Have students describe how their daily lives would change if they did not have electricity. Discuss and stress the importance of electricity in improving quality of life.
2. Begin the lesson by asking students to define electricity in their own words. Ask leading questions and generate thoughts on subjects such as:

What is electricity?

Is lightning a form of electricity?

Is static electricity really electricity?

Why can someone "shock" you after dragging his/her feet across the carpet?

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

###### Q1. **What is electricity?**

**A1. Electricity is a form of energy created by the flow of negatively charged particles in a circuit through a conductor.**

Explain an electric conductor and circuit and the flow of electrons. Compare it to water flowing in a river or stream.

###### Q2. **How is electricity generated and transported?**

###### A2.

a) **Electricity is generated by mechanically passing coils of wire through a magnetic field.**

1) **Water power is created by flowing water from a higher level to a lower level to turn the generator.**

2) **Steam power is created by heated water, which causes steam that turns the generator. Ways to heat water include the following.**

(a) **Burning fossil fuels - burning coal, oil, and natural gas**

(b) **Nuclear fission - splitting atoms**

(c) **Geothermal - steam rising from cracks in the earth**

(d) **Burning waste - burning solid waste products**

- 3) **Wind power uses air currents to turn the generator.**
- 4) **Solar power uses solar cells to convert sunlight to electricity.**
- b) **Electricity is transported from the power plant where it was generated through power lines to the local electric company. It then travels through distribution lines to the customer.**

Discuss the positive and negative aspects of each energy form used to generate electricity.

- Water power requires a water source so it would not be effective in a desert.
- Steam power creates a great deal of energy. The burning process may create air pollution. Burning solid wastes may be an effective way to create energy from waste products as well as dispose of wastes.
- Wind and solar power are effective ways of using natural sources of energy; however, both require a steady supply of wind and/or sunlight.

**Q3. How is electricity measured?**

**A3. Electricity is measured in units of watt-hours called kilowatt-hours.**

If possible, locate a meter within walking distance of the classroom to show what it looks like. Discuss how the kilowatt-hours are read from the meter. Electrical use is computed by multiplying the pressure times the flow (i.e., volts times amps), which yields watts. Kilowatt-hours are the amount of kilowatts of electricity used over time. One kilowatt-hour represents the use of 1,000 watts of electricity over a 1-hour time period. Use TM 1.1 to illustrate how to read an electric meter. Distribute AS 1.1 and direct students to do a daily meter reading over a 1-week or a 2-week time period. Discuss home usage of electricity at the conclusion of the activity.

**Q4. What is the difference between a fuse and a circuit breaker?**

**A4.**

- a) **A fuse is a short piece of metal that will melt at a predetermined number of amps. It is a disposable device designed to be replaced when blown.**
- b) **A circuit breaker is a switch that trips when excess current passes through it. When a circuit breaker is tripped, it only needs to be reset.**
- c) **Both devices are designed to limit the amount of current passing through them.**

Provide examples or pictures of fuses and circuit breakers. Show TM 1.2 to show students the difference between fuses and circuit breakers. Explain to the class that the purpose of a fuse and a circuit breaker is to protect a wiring system. If there is an overload or short in a circuit, the fuse or circuit breaker will keep the wiring system from overheating.

**Q5. What are hot, neutral, and ground wires?**

**A5. Electricity travels from its source to electrical tools and appliances through a series of wires.**

- a) **Hot wires - These are the positive wires that conduct the electrical power to the appliance or tool. They are usually coated with red or black plastic.**
- b) **Neutral wires - These wires help to complete the electrical circuit by carrying the electrical current from the appliance or tool back to its source. Neutral wires are usually coated with gray or white plastic.**
- c) **Ground wires - These wires, usually coated in green plastic, serve as a connection from the electrical appliance or tool to the earth. If that**

**electricity travels outside its normal path, ground wires help provide an alternate path for the electricity back to its source.**

Provide examples or pictures of hot wires, neutral wires, and ground wires. Explain their purpose and color coding.

**Q6. What are the different types of lightbulbs?**

**A6.**

- a) **Incandescent - a filament wire heated inside the bulb**
- b) **Fluorescent - light radiated from a gas contained in the bulb after electricity has passed through it**
- c) **Halogen - gases inside the bulb forming a very bright hot light**
- d) **Mercury vapor - an inner bulb with a tube containing sodium with a mixture of argon and neon gas**
- e) **Metal halide - compounds of metal and halogen with a basic two-bulb design**
- f) **Sodium - an arc tube made of aluminum oxide containing a solid mixture of sodium and mercury**

Have each type of lightbulb available for the class and discuss uses of each. Discuss which bulbs are the safest and most energy efficient. Emphasize the importance of choosing the appropriate bulb for a task while considering safety hazards and energy costs of each bulb.

**Q7. What hazards are associated with the use of electricity in the farm and home?**

**A7. The main source of injuries associated with electricity occurs from fire or electrical shock. The following situations can create some of these electrical hazards.**

- a) **Installation hazards - Always turn off the main power source and follow all instructions and codes when working with electricity.**
- b) **Overuse of extension cords - Extension cords should be used only for short periods when cords on equipment will not reach an outlet. They should never be used permanently due to a lack of wall outlets.**
- c) **Misuse of fuses and circuit breakers - A blown fuse or a tripped circuit breaker indicates a problem in an electrical circuit. Always attempt to find the source of the problem before replacing a fuse or resetting the breaker.**
- d) **Using electricity in wet areas - Water is an excellent conductor of electricity and can cause electrical shock. Never work with electrical items near wet or damp areas.**

Discuss safe practices for electricity usage. Distribute AS 1.2 for students to complete to emphasize safety in handling electricity. View T&I videos 1 and 4 in *Working Safely With Electricity* (available from Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia) and discuss the dangers involved with electricity.

**F. *Other Activities***

1. Refer to the Alliance to Save Energy web site for educators at <[www.ase.org/educators](http://www.ase.org/educators)> for an activity titled "Making Choices." This activity will expand on the first motivation listed at the beginning of this lesson where students are challenged to evaluate the impact that electricity has on their daily lives.
2. Visit a local power plant to show students the generation and transport of electricity in their areas.

3. Invite various guest speakers including electricians and utility company employees to discuss how to handle minor electrical emergencies at home and on the farm.
4. Ask a local Rural Electric Cooperative representative to visit and speak with the class.

G. ***Conclusion***

Conclude the lesson by having students provide answers to the questions they generated from the first motivation. Electricity is created by a flow of electrons. There are many sources of electrical power. It is measured in kilowatt-hours. Safe use of electric power requires precautions to avoid shock and fire hazards.

H. ***Answers to Activity Sheets***

AS 1.1 Daily Use of Electricity in My Home

The instructor should determine if the answers are appropriate.

AS 1.2 Electrical Safety Checklist

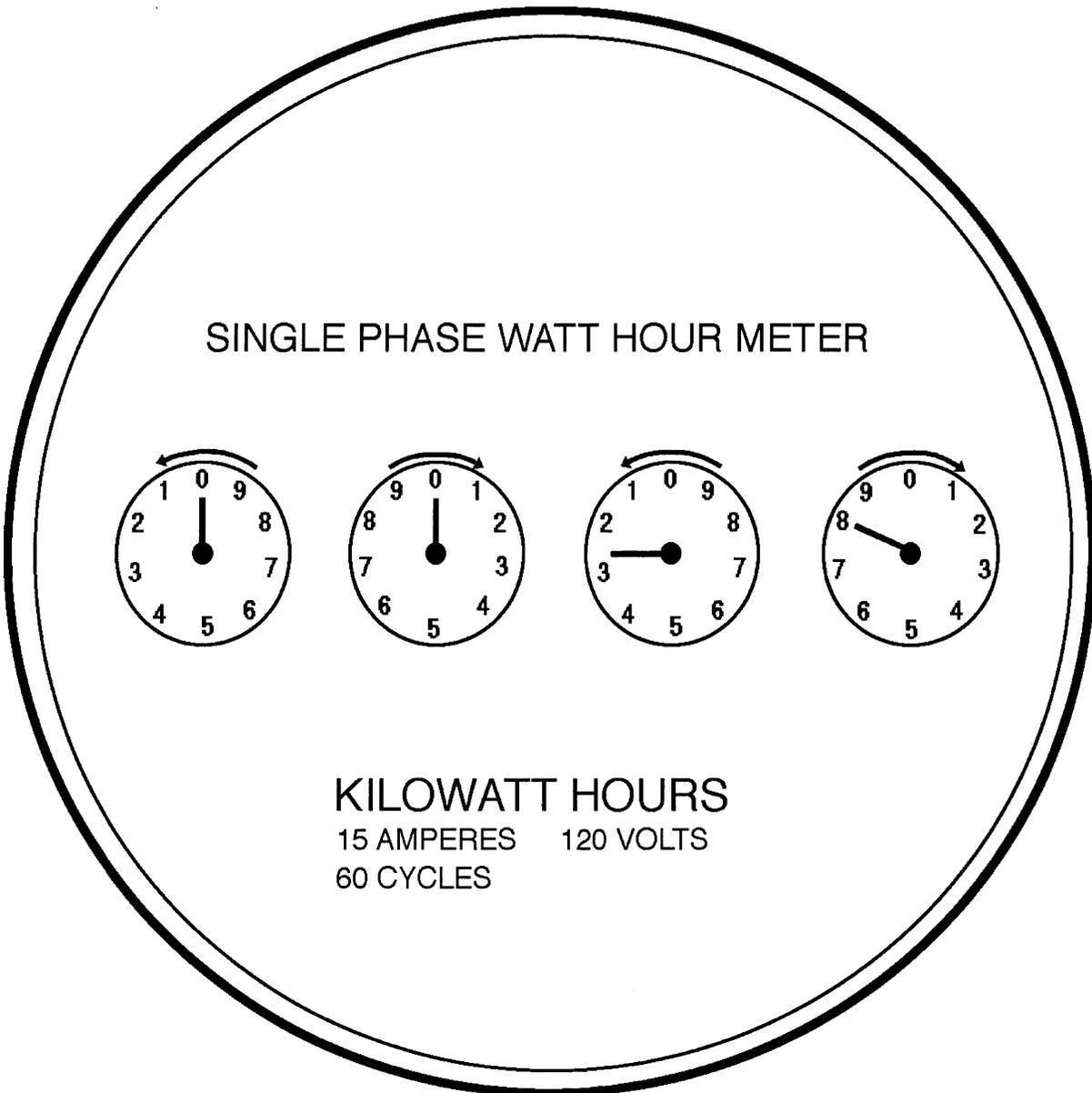
The instructor should determine if the answers are appropriate.

I. ***Answers to Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.



# Reading an Electric Meter

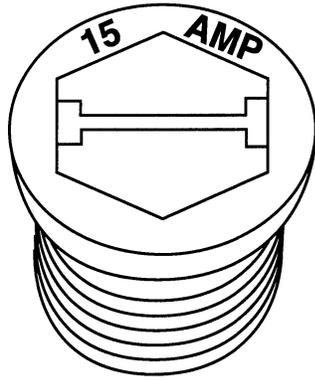


**Reading = 0028**

Note: The arrow denotes the rotation of the hands on each dial.



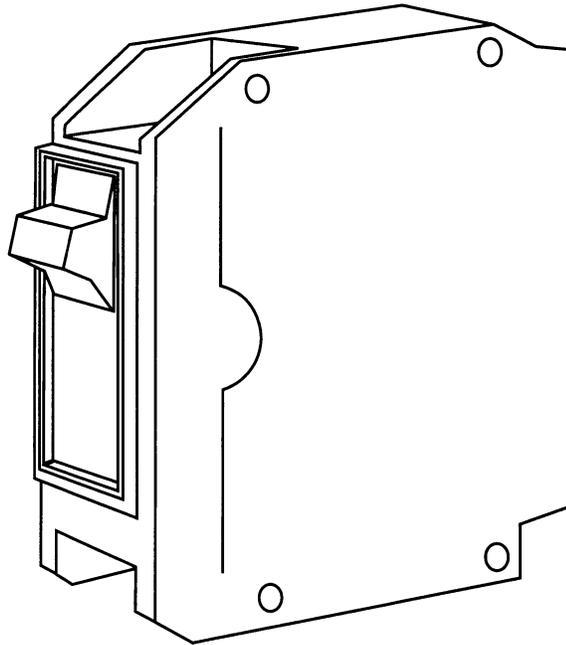
# Fuses and Circuit Breakers



**Edison - Base Plug Fuse**



**Cartridge Fuse**



**Single Pole Circuit Breaker**



Lesson 1: Electricity

Name \_\_\_\_\_

**Daily Use of Electricity in My Home**

**Objective:** Students will determine daily and weekly usage of electricity in their homes.

**Directions:** To analyze your family's electricity use, read your meter daily for 2 weeks at approximately the same time each day. Record the readings on the following table. By subtracting the previous day's reading from the current reading each day, you get the number of kilowatt-hours used during that 24-hour period. By adding the daily figures into a weekly total, you can see how much and when your family used electric power. If there are large variances during a day or week, consider what additional electricity may have been used that contributed to the differences.

DATE	TIME	READING	kWh USED DAILY
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
<b>WEEKLY TOTAL</b>			
Day 8			
Day 9			
Day 10			
Day 11			
Day 12			
Day 13			
Day 14			
<b>WEEKLY TOTAL</b>			



Lesson 1: Electricity

Name \_\_\_\_\_

**Electrical Safety Checklist**

**Objective:** Students will identify potential electrical hazards in the home.

**Directions:** Survey your home using the following list of safety precautions to identify potential electrical hazards. Place a check mark in the blank before each statement properly observed in the home.

- \_\_\_ 1. Do not tamper with or bypass safety features on electrical tools and/or appliances.
- \_\_\_ 2. Do not touch electrical tools or appliances with wet hands or feet.
- \_\_\_ 3. Do not remove the third prong (ground prong) on a three-prong plug.
- \_\_\_ 4. Do not use extension cords that are worn, frayed, or get warm during use.
- \_\_\_ 5. Do not place extension cords under a rug or carpet.
- \_\_\_ 6. Use only double-insulated or three-prong (grounded) cord power tools and appliances.
- \_\_\_ 7. Correct problem before resetting circuit breaker or replacing fuse.
- \_\_\_ 8. Use the appropriate size fuse or circuit breaker for each circuit.
- \_\_\_ 9. Do not leave heat-producing appliances unattended while operating (e.g., toaster, iron, hair dryer).
- \_\_\_ 10. Keep heaters and lamps away from combustible materials.
- \_\_\_ 11. Keep electric motors well lubricated and free of dirt and grease buildup.
- \_\_\_ 12. Keep electric appliances and tools dry to avoid shock hazards.
- \_\_\_ 13. Replace switches, outlets, fixtures, or extension cords that are cracked or damaged.
- \_\_\_ 14. Do not operate electrical equipment in wet conditions.
- \_\_\_ 15. Use caution when handling long objects (e.g., ladders, pipe, lumber) to avoid overhead power lines.
- \_\_\_ 16. Use caution when digging in areas where power lines may be buried.
- \_\_\_ 17. Avoid the use of multiple plug adapters in electrical outlets.

What electrical hazards did you identify? How were they corrected?



## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 2: Common Measurements and Their Uses

**Competency/Objective:** Identify common measurements and give examples of their uses.

#### **Study Questions**

1. **What are common linear measurements and their uses?**
2. **What are common area measurements and their uses?**
3. **What are common volume measurements and their uses?**
4. **What are common weight measurements and their uses?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Transparency Masters  
TM 2.1 Reading a Ruler  
TM 2.2 Measures of Length, Area, Volume, and Weight
3. Activity Sheets  
AS 2.1 Reading a Ruler  
AS 2.2 Area Calculations  
AS 2.3 Volume Calculations  
AS 2.4 Calculating Board Feet  
AS 2.5 Weight Calculations

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 2: Common Measurements and Their Uses

#### TEACHING PROCEDURES

##### A. **Review**

Performing accurate measurements and converting from one unit of measure to another are important in the study of agricultural mechanics. There are two common systems used today. The English system of measurement is the most commonly used in the United States. However, the metric system is used widely around the world and its practices are becoming more prevalent in the United States, namely, in the automotive industry.

##### B. **Motivation**

1. Begin the lesson with the following problem. "This weekend, the maintenance department will be putting new commercial tile on the classroom floor. However, it has requested that this class figure out how many boxes will be needed to cover the floor. They have told us that the local home improvement store sells the tiles we need. Each tile is 1 square foot, and they are packaged 25 to a box. How many tiles will we need in the classroom?"

Let the students work through this problem for a few minutes.

On the board, write the students' questions about what they would need to know in order to solve the problem:

- a) How long is the room?
- b) How wide is the room?
- c) How do I read a tape measure (or ruler)?
- d) What is a square foot?
- e) What is area?

Explain to the students that the questions they have posed in this discussion will be the kinds of questions they will learn to answer in the lesson. Students should leave the discussion with the understanding that once they are able to answer the general questions they have posed, they will (1) have a solid understanding of the lesson and (2) be able to solve this word problem and similar problems in their daily lives dealing with measurements.

2. Begin discussion by bringing an extension cord, a carpet sample, a soda bottle, and a pound of hamburger to class. Have students identify the units in which they would buy these products in a store. They should be feet, square yards, liters, and pounds, respectively. Point out that in this example, there are four different ways to measure units of each product. These correspond with the four different types of measurements they will study in this lesson: linear, area, volume, and weight. In addition, there are differences between the systems of measurement. Two different systems are English and metric. See if students can point out which is the metric system in the product examples. (It should be the soda bottle - liter.)

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

**Q1. What are common linear measurements and their uses?**

**A1.**

- a) **Common English linear measurements**
  - 1) **Inches**
  - 2) **Feet**
  - 3) **Yards**
- b) **Common metric linear measurements**
  - 1) **Millimeters**
  - 2) **Centimeters**
  - 3) **Meters**
  - 4) **Kilometers**

Explain to students that linear measurement is straight-line measurement. Have students identify items in the room that would be measured in a linear fashion. Display TM 2.1 and instruct class on ruler reading while they look at the ruler on AS 2.1. Have students complete the activity sheet and check answers to be sure they have a good understanding of this process. Display TM 2.2 and explain English equivalents and metric equivalents. Be sure that students understand that the metric system is used around the world and is important to understand.

**Q2. What are common area measurements and their uses?**

**A2. Common area measurements include square feet and square yards.**

Area is calculated by multiplying the length of an object by the width of the object. Display TM 2.2 and explain the calculation of area equals length times width ( $A=L \times W$ ). Give students AS 2.2 and allow them to work alone or in partners to solve the area problems. Discuss the answers in a class forum. Include in the discussion the uses of area measurements.

**Q3. What are common volume measurements and their uses?**

**A3. Common volume measurements include board feet, cubic yards, and cubic feet.**

Volume is calculated by multiplying the length of an object times the width of an object times the object's thickness ( $V=L \times W \times T$ ). Display TM 2.2. Explain that cubic feet and cubic yards are directly related to one another. Board feet is a special calculation that deals with calculating a volume of wood. Have students complete AS 2.3 and discuss answers. When students are comfortable with the concept of volume, have them complete AS 2.4 and discuss the answers. Board feet is calculated by multiplying the length of a board in feet times the width of a board in feet times the thickness of a board in inches. If you have more than one board, multiply the board feet by the number of boards to get total board feet.

**Q4. What are common weight measurements and their uses?**

**A4.**

- a) **Common measurements of weight in the English system are ounces and pounds.**
- b) **Common measurements of weight in the metric system are grams and kilograms.**

Explain that there are 16 ounces in 1 pound and there are 1,000 grams in 1 kilogram. Display TM 2.2 and distribute AS.2.5. Have students practice converting weights in metric and English. Discuss results as a class.

F. **Other Activities**

1. Set up 10 to 15 stations around the room or laboratory. Place a different item at each station to be measured in one of the four ways discussed. Have students alone or in pairs rotate from station to station measuring and calculating their answers, e.g., put a 2x4 at one station and have students calculate the board feet.
2. Set up English and metric scales and have students practice measuring small objects in grams-kilograms or in ounces-pounds. For further comprehension, have students practice converting ounces and pounds or grams and kilograms.
3. Have students bring different types of food packages from home to examine how different types of food are measured and what units of measure they are packaged and sold in. For further practice, have them convert the unit on the package to the other unit discussed.
4. Reread the tile problem that was introduced in the motivation. See how quickly students can calculate this problem.

G. **Conclusion**

Calculating and converting measurements are important skills in agricultural mechanics as well as in everyday life. Construction projects such as the one discussed in the Motivation, gardening projects, and even grocery shopping involve some degree of measurement and the ability to convert one type of measurement into another.

H. **Answers to Activity Sheets**

AS 2.1 Reading a Ruler

- a.  $1/16$
- b.  $1/8$  ( $2/16$ )
- c.  $3/16$
- d.  $1/4$  ( $4/16$ )
- e.  $5/16$
- f.  $3/8$  ( $6/16$ )
- g.  $7/16$
- h.  $1/2$  ( $8/16$ )
- i.  $9/16$
- j.  $5/8$  ( $10/16$ )
- k.  $11/16$
- l.  $3/4$  ( $12/16$ )
- m.  $13/16$
- n.  $7/8$  ( $14/16$ )
- o.  $15/16$
- p. 1
- q.  $1 \frac{3}{8}$
- r.  $2 \frac{5}{16}$

AS 2.2 Area Calculations

1.
  - a.  $8 \text{ ft.} \times 16 \text{ ft.} = 128 \text{ sq. ft.}$  x 2 walls = 256 sq. ft.  
 $8 \text{ ft.} \times 12 \text{ ft.} = 96 \text{ sq. ft.}$  x 2 walls = 192 sq. ft.  
 $256 \text{ sq. ft.} + 192 \text{ sq. ft.} = 448 \text{ sq. ft.}$  of surface
  - b. door area:  $3 \text{ ft.} \times 6 \text{ ft.} = 18 \text{ sq. ft.}$   
window area:  $2 \text{ ft.} \times 3 \text{ ft.} = 6 \text{ sq. ft.}$   
 $448 \text{ sq. ft.} - (18 \text{ sq. ft.} + 6 \text{ sq. ft.}) = 424 \text{ sq. ft.}$  of surface to paint
  - c.  $424 \text{ sq. ft.}$  divided by  $200 \text{ sq. ft./gallon} = 2.12$  gallons of paint  
You would need to purchase 2 gallons and 1 quart of paint.

2.
  - a.  $18 \text{ ft.} \times 20 \text{ ft.} = 360 \text{ sq. ft.}$   
 $360 \text{ sq. ft.} \text{ divide by } 9 \text{ sq.ft. /sq. yd} = 40 \text{ sq. yd. of carpet}$
  - b.  $18 \text{ ft.} \times 20 \text{ ft.} = 360 \text{ sq. ft.}$   
 $360 \text{ sq. ft.} \text{ divide by } 9 \text{ sq. ft/ sq. yd.} = 40 \text{ sq. yd. of padding}$
  - c. carpet:  $40 \text{ sq. yd.} \times \$6.00/\text{sq.yd.} = \$240.00$   
padding:  $40 \text{ sq. yd.} \times \$1.00/\text{sq.yd.} = \$40.00$   
 $\$240.00 + \$40.00 = \$280.00 \text{ total cost}$
3.
  - a.  $10 \text{ ft.} \times 8 \text{ ft.} = 80 \text{ sq. ft. for one wall}$   
 $15 \text{ ft.} \times 8 \text{ ft.} = 120 \text{ sq. ft. for second wall}$   
 $80 \text{ sq. ft.} + 120 \text{ sq. ft.} = 200 \text{ sq. ft. to be covered with paneling}$
  - b. area of sheet of paneling:  $8 \text{ ft.} \times 4 \text{ ft.} = 32 \text{ sq. ft.}$   
 $200 \text{ sq. ft.} \text{ divided by } 32 \text{ sq. ft./sheet} = 6.25 \text{ sheets of paneling}$   
You would need to buy 7 sheets of paneling to complete this job.
  - c.  $\$9.00/\text{ sheet} \times 7 \text{ sheets} = \$63.00$

### AS 2.3 Volume Calculations

1.  $5 \text{ ft.} \times 3 \text{ ft.} \times 1 \text{ ft.} = 15 \text{ cu. ft.}$
2.  $1 \text{ cu. yd.} = 27 \text{ cu. ft.}, 150 \text{ cu. ft.}/27 = 5.5 \text{ cu. yd.}$   
 $5.5 \text{ cu. yd.} \text{ divide by } 2 \text{ cu. yd./bag} = 2.7 \text{ bags}$   
You will need to buy 3 bags.
3. Home supply =  $\$4.99$  for 3 cu. yd.  
Discount =  $\$ 6.50$  for  $(81 \text{cu. Ft}/27) = 3 \text{ cu. yd.}$   
Home Supply is cheaper.
4.  $3 \text{ ft.} = 1 \text{ yd.}$   
 $5 \text{ yd.} \times 2 \text{ yd.} \times 1 \text{ yd.} = 10 \text{ cu. yd.}$
5. Steve:  $20 \text{ cu. yd.}$   
Andy:  $(500 \text{ cu. ft.}/27) = 18.5 \text{ cu. yd.}$   
Steve used more mulch.

### AS 2.4 Calculating Board Feet

1.  $2 \text{ in.} \times .67 \text{ ft.} \times 14 \text{ ft.} = 18.76 \text{ bd. ft.}$   
 $18.76 \text{ bd. ft.} \times 2 \text{ pieces} = 37.52 \text{ bd. ft. total}$
  2.  $2 \text{ in.} \times .5 \text{ ft.} \times 8 \text{ ft.} = 8 \text{ bd. ft.}$   
 $8 \text{ bd. ft.} \times 8 \text{ pieces} = 64 \text{ bd. ft. total}$
  3.  $2 \text{ in.} \times .3 \text{ ft.} \times 14 \text{ ft.} = 8.4 \text{ bd. ft.}$   
 $8.4 \text{ bd. ft.} \times 2 \text{ pieces} = 16.8 \text{ bd. ft. total}$
  4.  $1 \text{ in.} \times .5 \text{ ft.} \times 14 \text{ ft.} = 7 \text{ bd. ft.}$   
 $7 \text{ bd. ft.} \times 16 \text{ pieces} = 112 \text{ bd. ft. total}$
  5.  $2 \text{ in.} \times .3 \text{ ft.} \times 6 \text{ ft.} = 3.6 \text{ bd. ft.}$   
 $3.6 \text{ bd. ft.} \times 4 \text{ pieces} = 14.4 \text{ bd. ft. total}$
  6.  $2 \text{ in.} \times .3 \text{ ft.} \times 5 \text{ ft.} = 3 \text{ bd. ft.}$   
 $3 \text{ bd. ft.} \times 4 \text{ pieces} = 12 \text{ bd. ft. total}$
  7.  $1 \text{ in.} \times .5 \text{ ft.} \times 8 \text{ ft.} = 4 \text{ bd. ft.}$   
 $4 \text{ bd. ft.} \times 10 \text{ pieces} = 40 \text{ bd. ft. total}$
  8.  $1 \text{ in.} \times .5 \text{ ft.} \times 6 \text{ ft.} = 3 \text{ bd. ft.}$   
 $3 \text{ bd. ft.} \times 4 \text{ pieces} = 12 \text{ bd. ft. total}$
- Board feet each:  $18.76 + 8 + 8.4 + 7 + 3.6 + 3 + 4 + 3 = 55.76 \text{ bd. ft.}$   
Total board feet:  $37.52 + 64 + 16.8 + 112 + 14.4 + 12 + 40 + 12 = 308.72 \text{ bd. ft. total}$

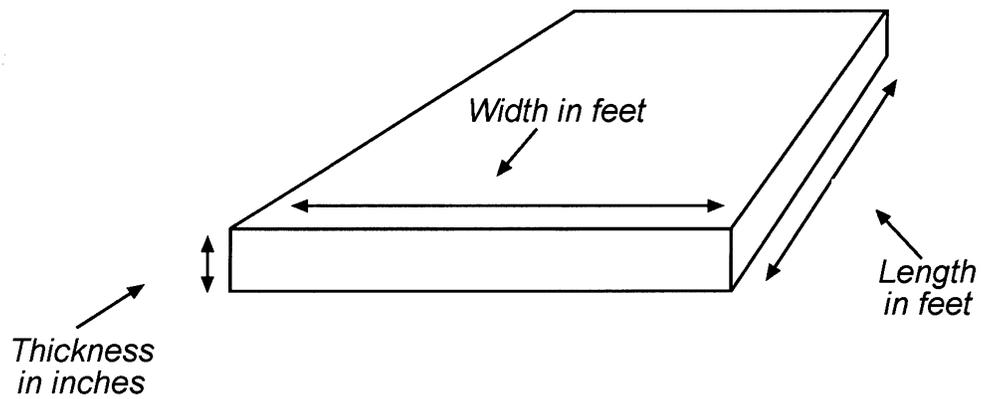
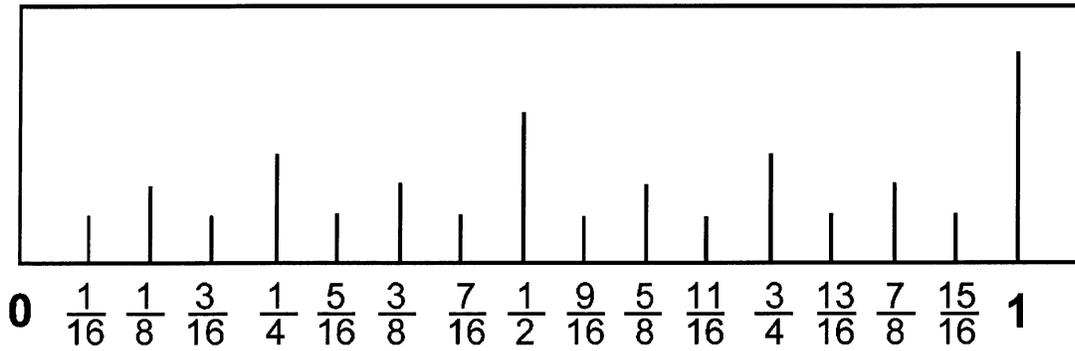
### AS 2.5 Weight Calculations

1.  $2 \text{ lb.} \times 16 \text{ oz./lb} = 32 \text{ oz.}$
2.  $55 \text{ oz}/16 \text{ oz. per lb} = 3.4 \text{ lb of cat food} \times \$1.50/\text{lb.} = \$5.10$
3.  $\$.25/\text{oz.} \times 16 \text{ oz./lb.} = \$4.00/\text{lb.}$  The store uptown is cheaper.
4.  $6.5 \text{ lb} \times 16 \text{ oz./lb.} = 104 \text{ oz.}$  Divide by  $8 \text{ oz./bag} = 13 \text{ bags}$
5.  $1.5 \text{ kg} \times 1000 \text{ g/kg} = 1500$

I. ***Answers to Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

# Reading a Ruler



$$L' \times W' \times T'' = \text{Bd. Ft.}$$



# Measures of Length, Area, Volume, and Weight

## ENGLISH

### Measures of Length

12 in.	= 1 ft.
3 ft.	= 1 yd.
5 ½ yd	= 1 rod
320 rods	= 1 mile
5,280 ft.	= 1 mile
1,760 yd.	= 1 mile
6,080 ft.	= 1 knot

### Measures of Area

144 sq. in.	= 1 sq. ft.
9 sq. ft.	= 1 sq. yd.
30 ¼ sq. yd	= 1 sq. rod
160 sq. rods	= 1 acre

### Measures of Volume

#### *(solids)*

1,728 cu. in	= 1 cu. ft.
27 cu. ft	= 1 cu. yd.
128 cu. ft.	= 1 cord

#### *(liquids)*

16 fluid oz.	= 1 pt.
2 pt.	= 1 qt.
32 fl. oz.	= 1 qt.
4 qt.	= 1 gal.
31 ½ gal.	= 1 bbl.
231 cu. in	= 1 gal.
7 ½ gal.	= 1 cu. ft.

### Measures of Weight

7,000 grains (gr.)	= 1 lb.
16 oz.	= 1 lb.
100 lbs.	= 1 cwt.
2,000 lbs.	= 1 short ton
2,240 lbs.	= 1 long ton

## METRIC

### Measures of Length

10 millimeters	= 1 centimeter
10 centimeters	= 1 decimeter
100 centimeters	= 1 meter
1000 meter	= 1 kilometer

### Measures of Volume

100 cubic centimeters	= 1 liter
100 liters	= 1 hectoliter

### Measures of Weight

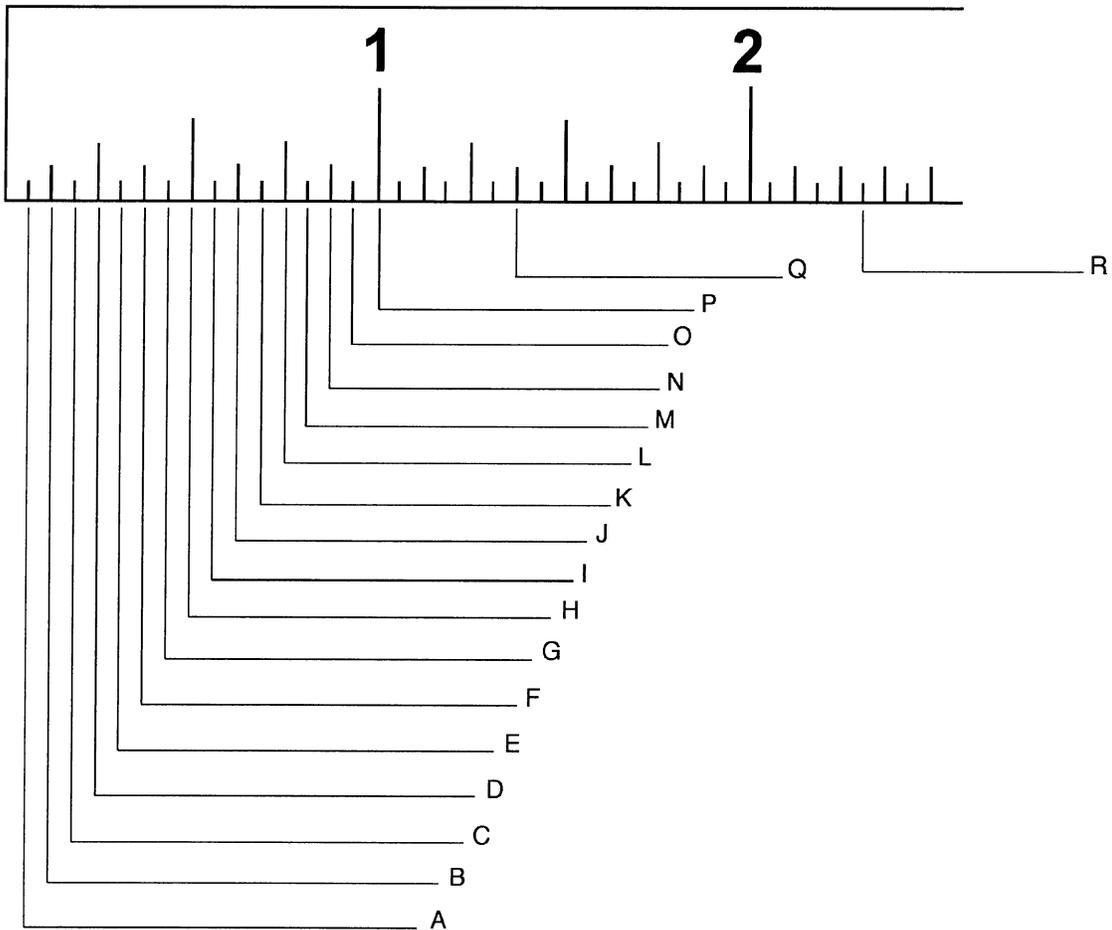
100 milligrams	= 1 gram
1000 grams	= 1 kilogram
1000 kilograms	= 1 metric ton



### Reading a Ruler

**Objective:** Students will practice reading an English ruler.

**Directions:** Fill in the blanks on the accompanying figure with the correct inch readings in the simplest terms.





**Area Calculations**

**Objective:** Students will calculate areas to determine the amount of materials needed.

**Directions:** Correctly calculate each problem. (Show your work.)

When purchasing materials to complete a home maintenance project, the exact amount of materials cannot always be purchased because of the way materials are packaged. Therefore accurate calculations are important in order to purchase enough materials without purchasing too much. The following information is provided:

Floor area = length x width

Wall area = length x height

9 sq. ft. = 1 sq. yd.

1. If 1 gallon of paint covers 200 sq. ft., how many gallons of paint will you need to purchase to completely cover a room that has two walls that measure 8 feet tall by 16 feet long and two walls that measure 8 feet tall by 12 feet long? There is one window that measures 2 feet by 3 feet and one door that measures 3 feet by 6 feet that will not need painting.
  - a. Total square feet of wall space =
  - b. Total square feet to be painted =
  - c. Total gallons of paint required =
2. You have decided to carpet the living room. The room measures 18 feet wide by 20 feet long. You will need padding and carpet. The padding costs \$1.00 per square yard and the carpet costs \$6.00 per square yard.
  - a. How many square yards of carpet will be needed?
  - b. How many square yards of padding will be needed?
  - c. How much will the materials cost?
3. You want to panel two walls in a room in your house. One wall measures 10 feet long by 8 feet tall. The other wall measures 15 feet long by 8 feet tall. Your paneling comes in sheets 4 feet by 8 feet and costs \$9.00 per sheet.
  - a. How many square feet have to be covered by paneling?
  - b. How many sheets of paneling would you need to purchase to cover these areas?
  - c. What is the cost for the paneling only?



**Volume Calculations**

**Objective:** Students will calculate volume.

**Directions:** Calculate the following problems.

1. If a flower bed is 5 feet long, 3 feet wide, and 1 foot thick, how many cubic feet of potting soil must be purchased to fill the bed?
2. You are doing a landscaping project and have calculated that you need 150 cubic feet of topsoil to complete the project. The local supplier sells topsoil in bags with 2 cubic yards of soil per bag. How many bags will you need?
3. The home supply store is having a sale on cedar mulch for \$4.99 a bag with 3 cubic yards. The discount store is also selling cedar mulch for \$6.50 for a bag with 81 cubic feet. Who has the best buy on cedar mulch?
4. When mulching a garden that is 5 yards long, 2 yards wide, and 3 feet deep, how many cubic yards of mulch would you need to buy?
5. Steve used 20 cubic yards of mulch on Garden A and Andy used 500 cubic feet of mulch on Garden B. Who used the most mulch?



Lesson 2: Common Measurements and Their Uses

Name \_\_\_\_\_

**Calculating Board Feet****Objective:** Students will accurately calculate board feet.**Directions:** Calculate the number of board feet in the following list of lumber materials for a hayrack.

ITEM	NUMBER	SIZE	BD. FT. EACH	TOTAL BD. FT.
Sills	2	14' x .67' x 2"		
Joists	8	8' x .5' x 2"		
Side rails	2	14' x .33' x 2"		
Floor	16	14' x .5' x 1"		
Standards	4	6' x .33' x 2"		
Standards	4	5' x .33' x 2"		
Ends	10	8' x .5' x 1"		
Braces	4	6' x .5' x 1"		
<b>TOTAL BOARD FEET</b>				



**Weight Calculations**

**Objective:** Students will apply and understand weight calculations.

**Directions:** Calculate the following problems.

1. If you buy 2 pounds of chicken from the store, how many ounces of chicken would you have?
2. Susan purchased 55 ounces of cat food at the local pet store. This cat food sold for \$1.50/pound. How many dollars' worth of cat food did she buy?
3. The local grocery store is selling shrimp for \$5 per pound. Another store uptown had a special on shrimp that ran \$0.25 per ounce. Which store offered the better buy on shrimp?
4. Vikki needed 6.5 pounds of chocolate chips for a recipe she was making. The store sold chocolate chips in 8-ounce bags. How many bags of chocolate chips must Vikki buy?
5. If the local Super Discount Warehouse sells mega bags of chips with 1.5 kilograms per bag, how many grams of chips are in each bag?



## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 3: Common Tools and Their Uses

**Competency/Objective:** Identify common tools and their uses.

#### **Study Questions**

1. **What are common hand tools and their uses?**
2. **What are common power tools and their uses?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Transparency Masters  
TM 3.1 Common Hand Tools  
TM 3.2 Common Power Tools
3. Activity Sheets  
AS 3.1 Common Hand Tools  
AS 3.2 Common Power Tools

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 3: Common Tools and Their Uses

#### TEACHING PROCEDURES

##### A. **Review**

The previous lesson discussed units of measure and their uses. In this lesson common hand tools, common power tools, and the uses of each will be presented.

##### B. **Motivation**

Display a variety of hand tools on the tables in the classroom. Divide the students into small groups. Award bonus points or give a prize to the group that identifies the name and uses of the most tools.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. What are common hand tools and their uses?

##### A1.

- a) **Hammers - driving and removing nails or shaping another object**
  - 1) **Ball peen**
  - 2) **Ripping claw**
  - 3) **Curved claw**
- b) **Pliers - gripping and/or turning objects**
  - 1) **Needle-nose**
  - 2) **Slip-joint**
- c) **Screwdrivers – turning bolts or screws**
  - 1) **Flat head**
  - 2) **Phillips head**
- d) **Handsaws - cutting wood, metal, or plastic materials**
  - 1) **Hacksaw**
  - 2) **Common handsaw**
  - 3) **Backsaw**
- e) **Wrenches - tighten and loosen bolts and nuts**
  - 1) **Combination wrenches**
  - 2) **Socket wrenches**
  - 3) **Adjustable wrenches**
- f) **Measuring tools - determine dimensions of specific areas**
  - 1) **Retractable steel tape**
  - 2) **Folding wooden rule**
  - 3) **Steel tape**
- g) **Squares - used to lay out a 90° corner**
  - 1) **Combination square**
  - 2) **Carpenter's square**
- h) **Levels - gauge the straightness or levelness of a line or object**
- i) **Wood chisels - cutting tools used to cut, shave, or carve wood**
- j) **Hand drills - used to drill holes in surfaces**
  - 1) **Hand drill**

- 2) **Push drill**
- 3) **Bit brace**

Use TM 3.1 or display the actual tool when explaining the identification and use of each tool. Explain that each tool is designed for a specific job and should only be used for its intended purpose. Using tools for purposes other than for what they were intended may cause personal injury or damage to the tool. Have students complete AS 3.1.

**Q2. What are common power tools and their uses?**

**A2.**

- a) **Portable drill - used to drill holes or drive screws into or out of materials**
- b) **Router - used to create a groove or cut in wood**
- c) **Jig saw - used to cut curved lines in wood**
- d) **Band saw - used to cut straight or curved lines in different types of materials**
- e) **Drill press - used to cut or drill holes in different types of materials**
- f) **Circular saw- used to rip or cross-cut boards**

Use TM 3.2 or the actual tool to describe the identification and use of each power tool. Careful instruction on the operation and safety procedures is essential before operating any power tool. Have students complete AS 3.2.

**F. *Other Activities***

1. Build a small wood project such as a toolbox or a sawhorse with hand tools. Note: Do not begin this project until the safety unit has been addressed and students have passed any required safety evaluations.
2. Display different hand tools at numbered stations around the lab. Have students identify the appropriate tool and its use at each station.
3. Display different power tools at numbered stations around the lab. Have students identify the appropriate tool and its use at each station.

**G. *Conclusion***

Knowing how to operate and use various hand and power tools is essential for mechanic and repair operations around the home and farm. It is important for the operator to know the proper use and safety procedures for each tool to avoid injury or damage to the tool.

**H. *Answers to Activity Sheets***

**AS 3.1 Common Hand Tools**

1. Hacksaw - used to cut wood, metal, or plastic materials
2. Combination square - used to lay out a 90° corner
3. Curved claw hammer - used to drive and remove nails or shape another object
4. Bit brace - used to drill holes in surfaces
5. Adjustable wrench - used to tighten and loosen bolts and nuts
6. Combination wrench - used to tighten and loosen bolts and nuts
7. Needle-nose pliers - used to grip and/or turn objects
8. Level - used to gauge the straightness or levelness of a line or object
9. Phillips head screwdriver - used to turn bolts or screws
10. Push drill - used to drill holes in surfaces

### AS 3.2 Common Power Tools

1. Band saw - used to cut straight or curved lines in different types of materials
2. Jig saw - used to cut curved lines in wood
3. Router - Used to create a groove or cut in wood
4. Drill press - used to cut or drill holes in different types of materials
5. Portable drill - used to drill holes or drive screws into or out of materials

#### I. ***Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

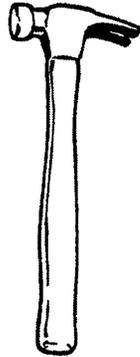
# Common Hand Tools



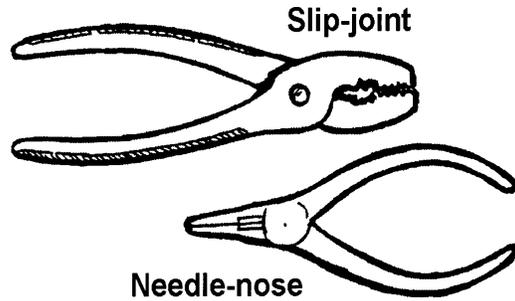
Ball peen



Curved claw

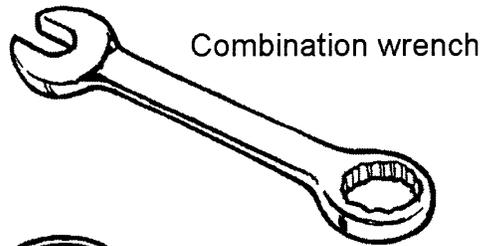


Ripping claw

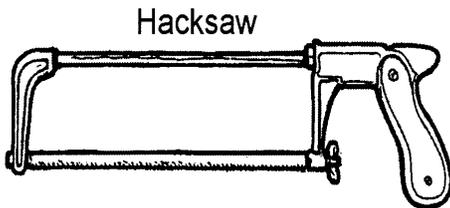


Slip-joint

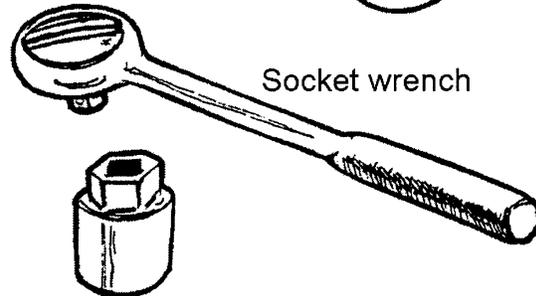
Needle-nose



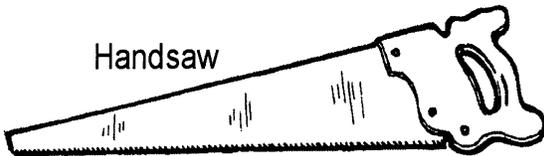
Combination wrench



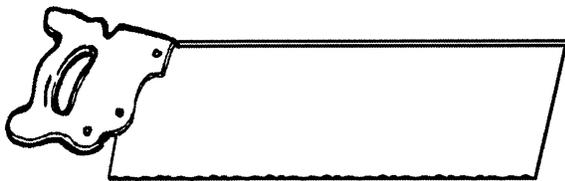
Hacksaw



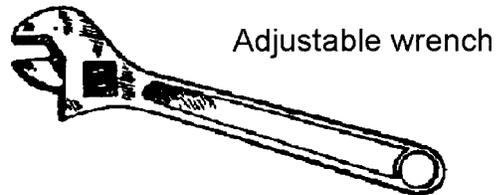
Socket wrench



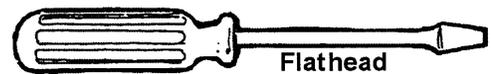
Handsaw



Backsaw



Adjustable wrench



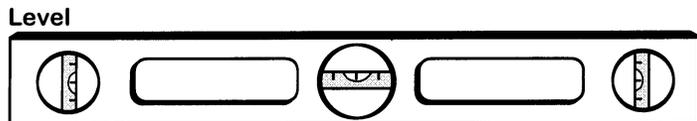
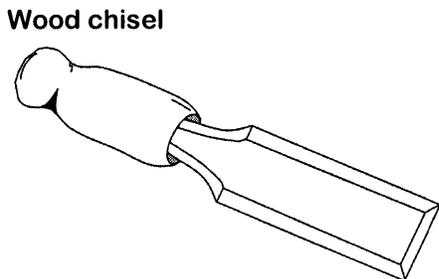
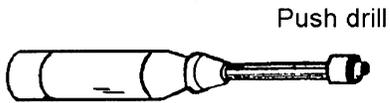
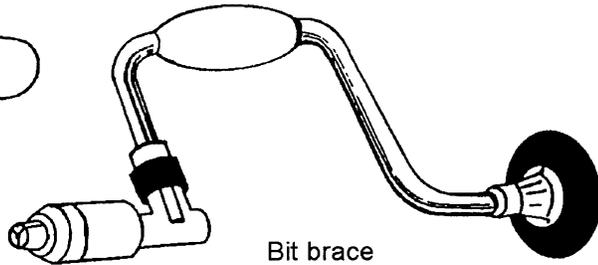
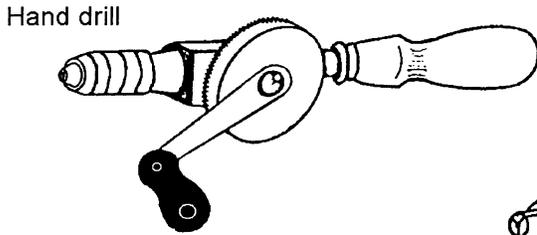
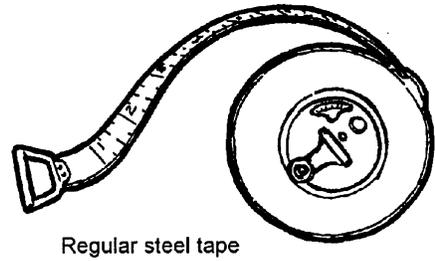
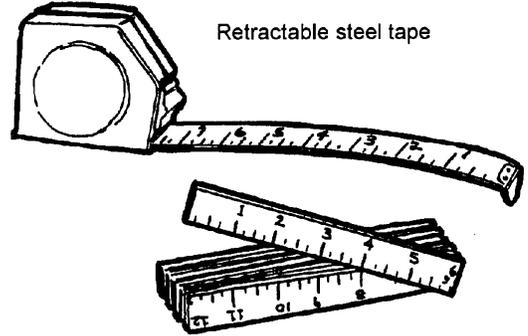
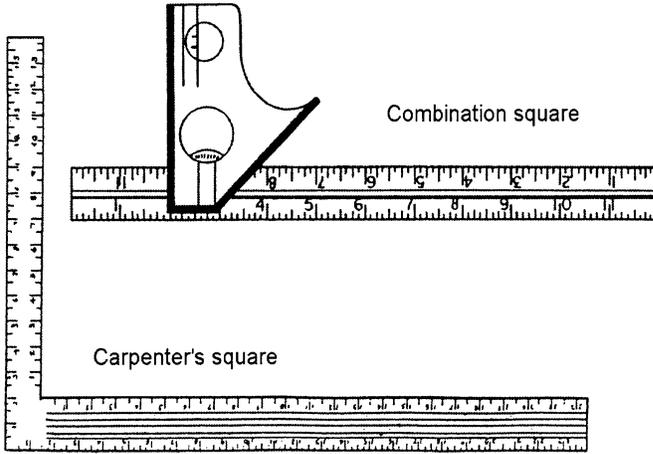
Flathead



Phillips Head

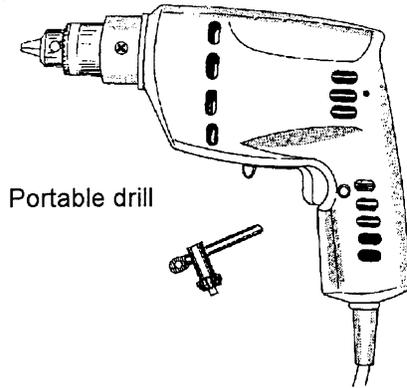


TM 3.1 (Cont.)

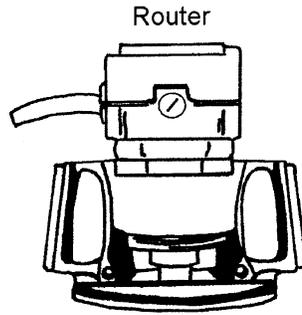




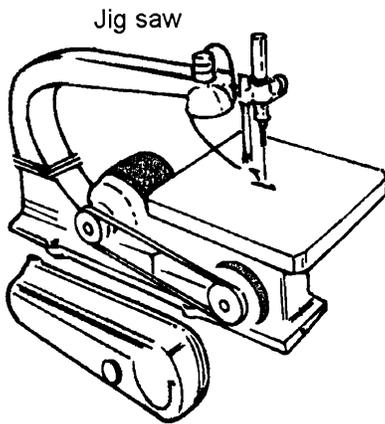
# Common Power Tools



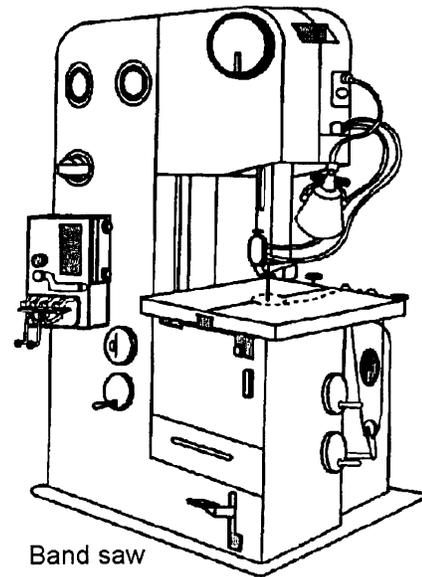
Portable drill



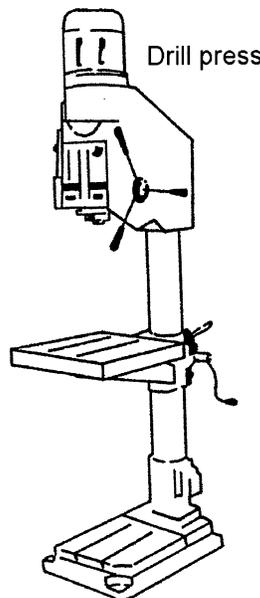
Router



Jig saw



Band saw



Drill press



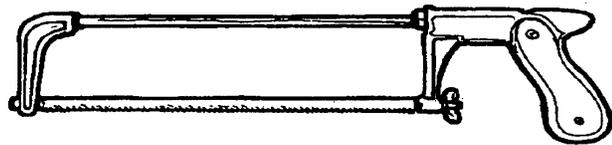
**Common Hand Tools**

**Objective:** Students will identify common hand tools used on the farm or in the home and explain how each is used.

**Directions:** Identify each numbered tool and explain one use for each tool.

- 1. \_\_\_\_\_  
\_\_\_\_\_
- 2. \_\_\_\_\_  
\_\_\_\_\_
- 3. \_\_\_\_\_  
\_\_\_\_\_
- 4. \_\_\_\_\_  
\_\_\_\_\_
- 5. \_\_\_\_\_  
\_\_\_\_\_
- 6. \_\_\_\_\_  
\_\_\_\_\_
- 7. \_\_\_\_\_  
\_\_\_\_\_
- 8. \_\_\_\_\_  
\_\_\_\_\_
- 9. \_\_\_\_\_  
\_\_\_\_\_
- 10. \_\_\_\_\_  
\_\_\_\_\_

1.



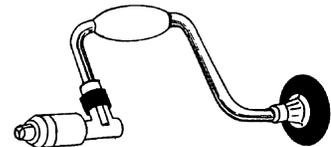
2.



3.



4.



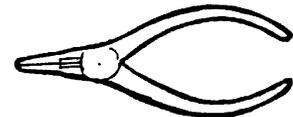
5.



6.



7.



8.



9.



10.



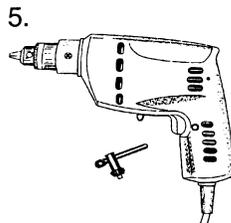
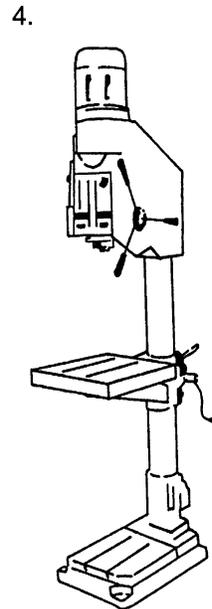
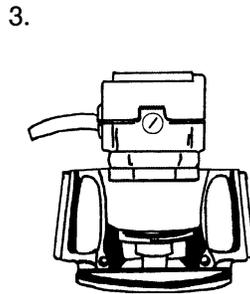
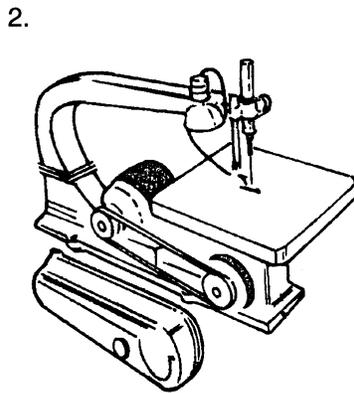
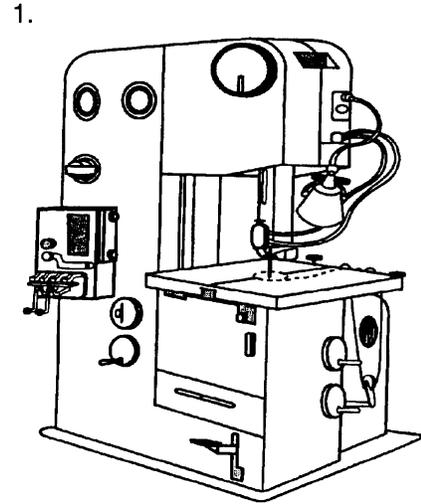


**Common Power Tools**

**Objective:** Students will identify common power tools used on the farm or in the home and explain how each is used.

**Directions:** Identify each numbered tool and explain one use for each tool.

- 1. \_\_\_\_\_  
\_\_\_\_\_
- 2. \_\_\_\_\_  
\_\_\_\_\_
- 3. \_\_\_\_\_  
\_\_\_\_\_
- 4. \_\_\_\_\_  
\_\_\_\_\_
- 5. \_\_\_\_\_  
\_\_\_\_\_





## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 4: Personal Safety Practices

**Competency/Objective:** Identify personal safety practices when using hand and power tools.

#### **Study Questions**

1. How do I protect my eyes?
2. What must be worn to be safe?
3. Why is cleanliness important to safety?
4. How do I use hand tools safely?
5. How do I use power tools safely?

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. *Safety First: Wood Shop Safety* (T&I Video 149). Missouri Resource Center for Career & Technical Education, University of Missouri-Columbia.

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 4: Personal Safety Practices

#### TEACHING PROCEDURES

##### A. **Review**

Review the previous lesson, identifying common tools and their uses. Students should be able to identify a tool and describe the appropriate use for that tool. The next step in becoming familiar with hand and power tools is to become familiar with safe tool use and personal safety practices. Tools are ineffective and dangerous if not used in a safe and proper manner.

##### B. **Motivation**

Begin by viewing the safety video entitled *Safety First: Wood Shop Safety* (T&I Video 149) and discuss the importance of using hand and power tools safely. Ask students to share examples of people that they know who have been injured in accidents involving hand or power tools. Discuss how they think these accidents could have been prevented.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. **How do I protect my eyes?**

#### A1. **Safety glasses/goggles should be used. These should have side shields to protect the eyes from debris that could enter from the side.**

Explain to the students that safety glasses/goggles should be used. Ask students to predict what would occur without these safety glasses/goggles.

#### Q2. **What must be worn to be safe?**

#### A2.

- a) **Clothing must fit well and be free from tears. Loose, baggy, or frayed clothing is a safety hazard.**
- b) **Protective clothing such as coveralls, shop aprons, or shop coats are highly recommended to protect clothing from damage.**
- c) **If hair is long, hair restraints must be worn to keep hair out of the way of machines that have moving parts.**
- d) **Leather shoes with steel toes and high tops are recommended to protect feet from injury.**
- c) **Face masks should be worn when working around fumes or dust.**

Ask students to describe clothing of professionals in various machine shops. What do they have in common.

#### Q3. **Why is cleanliness important to safety?**

#### A3. **Cleanliness is important to safety for a number of reasons.**

- a) **Materials strewn about a shop are obstacles.**
- b) **People risk falling over tools or materials on the floor.**
- c) **Debris can be a fire hazard.**

Ask students why cleanliness is important to safety. List their responses on the board.

**Q4. How do I use hand tools safely?**

**A4.**

- a) **Protect eyes and clothing.**
- b) **Be certain that the operator is using the correct tool for the job.**
- c) **Before using a hand tool, be certain that the tool is not damaged in any way.**
- d) **Understand the operation of the tool and conduct the operation correctly and carefully.**
- e) **Store hand tools in their proper place after use to keep the shop clear from hazards.**
- f) **Be sure that the tool is clean and undamaged before storage. A damaged tool should be repaired, not put away for the unsuspecting person to use later.**

Ask students to restate the major points they observed in the video shown during the Motivation about using hand tools safely.

**Q5. How do I use power tools safely?**

**A5.**

- a) **Obtain permission from the instructor before using any power tool.**
- b) **Conduct an inspection of the tool to meet the following standards:**
  - 1) **The blade or cutter is clean and sharp.**
  - 2) **The power cord and switch are in good condition.**
  - 3) **All guards are in place.**
- c) **Protect eyes and clothing properly.**
- d) **The operator should use a power tool only after obtaining instruction in and mastering a safety test on the proper use of the tool.**
- e) **Be sure to let others in the shop know when a tool is in use.**
- f) **Make any adjustments to a power tool when the switch is off and the tool is unplugged.**
- g) **After use, power tools should be properly cleaned and stored.**

Ask students to restate the major points they observed in the video shown during the Motivation about using power tools safely.

**F. *Other Activities***

1. Instruct students in the proper and safe use of each of the hand and power tools mentioned in the previous lesson.
2. Administer a general safety test, a hand tool safety test, and a safety test on the power tools mentioned in the previous lesson. Have students retake the test to 100% competency.
3. Have a guest speaker from a local machine shop, agri-business, or Cooperative Extension office speak on shop safety.
4. Have students create general, hand tool, or power tool safety posters to display around the classroom and shop.

**G. *Conclusion***

Once students have attained knowledge of hand and power tools, it is essential that they know the safety practices associated with working with or around such types of tools. Safety not only

prevents injury to the operator, it also prevents injury to others in the area and extends the life of the equipment.

H. ***Answers to Activity Sheets***

I. ***Answers to Evaluation***

A unit test is provided at the end of this unit. If a lesson quiz is needed, use questions pertaining to this lesson from the unit test.

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 5: Safety and Maintenance Procedures for Lawn and Garden Equipment

**Competency/Objective:** Identify safety and maintenance procedures for lawn and garden equipment.

#### **Study Questions**

1. **What are common lawn and garden hand tools?**
2. **What are examples of common power lawn and garden equipment?**
3. **What is the difference between a two- and four-stroke engine?**
4. **What safety guidelines should be followed when using hand lawn equipment?**
5. **What safety guidelines should be followed when using power lawn equipment?**
6. **What are maintenance procedures for hand lawn equipment?**
7. **What are maintenance procedures for power lawn equipment?**

#### **References**

1. *Exploring Agriculture in America* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Activity Sheets
  - AS 5.1 Hand Lawn Tool Identification
  - AS 5.2 Power Lawn Tool Identification
  - AS 5.3 Two- vs. Four-Stroke Engines
  - AS 5.4 Mower Safety Demonstration (Instructor)
  - AS 5.5 Mowing Obstacle Course (Instructor)
  - AS 5.6 Lawn Mower Safety Guidelines

## UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

### Lesson 5: Safety and Maintenance Procedures for Power Lawn and Garden Equipment

#### TEACHING PROCEDURES

##### A. **Review**

Review the previous lesson and inform students that safety applications are crucial in many operations around the home and farm. This lesson stresses proper safety procedures used when working with hand and power lawn and garden equipment.

##### B. **Motivation**

Bring several different types of hand and power lawn tools to the classroom. Divide students into groups. Have each group identify as many tools as they can and describe the use for each tool. Reward the group with the most correct answers.

##### C. **Assignment**

##### D. **Supervised Study**

##### E. **Discussion**

#### Q1. What are common lawn and garden hand tools?

##### A1.

- a) Turf edger
- b) Weed cutter
- c) Garden hoe
- d) Push hoe
- e) Lawn or leaf rake
- f) Garden rake
- g) Pitchfork
- h) Spading fork
- i) Cultivators
- j) Pruning shears
- k) Hedge shears
- l) Hand trowel
- m) Round-pointed shovel
- n) Wheelbarrow
- o) Sod roller

Refer to the drawings in the Student Reference. Explain to students that hand tools work well where large power tools cannot fit. Stress the importance of keeping hand tools clean and well maintained to ensure the safety of the operator and the longevity of the tool. Have students complete AS 5.1 to identify hand lawn tools.

#### Q2. What are examples of common power lawn and garden equipment?

##### A2.

- a) Walk-behind mower
- b) Riding mower
- c) Leaf blower
- d) String trimmer
- e) Hedge trimmer

**g) Tiller**

Refer to the drawings in the Student Reference and describe the various types of power lawn and garden equipment. Ask students which types they have at home and which types they have personally operated. Have students complete AS 5.2 to identify power lawn tools.

**Q3. What is the difference between a two- and four-stroke engine?**

**A3. The two-stroke engine requires an oil-fuel mixture directly in the fuel chamber whereas the four-stroke engine strictly requires fuel in the fuel tank and oil in the oil reservoir.**

Refer to Table 5.1 in the Student Reference, which displays the differences between a two- and four-stroke engine. Discuss the differences, making it clear that one is not necessarily better than another. They are both extremely useful for different power requirements. Be sure that students clearly understand that two- and four-stroke engines have extremely different fuel requirements. Regular fuel cannot be used in a weed-eater, and conversely, fuel-oil mixture for a weed-eater cannot be used in a riding lawn mower. Demonstrate the correct mixing of a two-stroke fuel-oil mixture. Have students complete AS 5.3 to identify differences between two- and four-stroke engines.

**Q4. What safety guidelines should be followed when using hand lawn equipment?**

**A4.**

- a) Use the appropriate tool for the job.**
- b) Avoid baggy, loose-fitting clothing.**
- c) Wear safety glasses, particularly when sharpening tools.**
- d) Wear gloves to protect the hands.**
- e) Inspect the tool to ensure that it is sharp and in good working condition.**
- f) Be conscious of others' locations before swinging sharp tools to avoid injuring others.**

Review the safety guidelines and express the importance of safety. Explain that even though the equipment is not power equipment, it can still be dangerous.

**Q5. What safety guidelines should be followed when using power lawn equipment?**

**A5.**

- a) Carefully read the instructions and operating procedures in the owner's manual before attempting to operate any power lawn tool.**
- b) Avoid loose or baggy clothing because it may become entangled in moving parts of the equipment.**
- c) Wear safety goggles to protect the eyes.**
- d) Inspect tools before use to be sure they are sharp and in good working condition.**
- e) Alert others that a power tool is in use.**
- f) Keep hands and feet away from all moving parts.**
- g) Remove debris and large objects from areas where mowers and trimmers will be operated.**
- h) Never smoke or attempt to refill the fuel tank while the tool is running.**
- i) Keep all safety shields in their proper places.**
- j) Use caution when mowing on slopes to avoid falling or overturning equipment.**
- k) Mow only dry grass and cut grass 1 1/2 to 3 inches depending upon time of year and type of grass.**

Review the safety guidelines and discuss the importance of safe operations for power lawn equipment. Perform AS 5.4, the mower safety demonstration and AS 5.5, the mower obstacle course. When questions are answered and students have mastered safety, have them complete AS 5.6 to identify mower safety guidelines.

**Q6. What are maintenance procedures for hand lawn equipment?**

**A6.**

- a) **Clean and inspect hand tools for any damage after each use.**
- b) **Restore rough, dry, and splintered wooden handles by sanding and rubbing with linseed oil.**
- c) **Prevent rusting by keeping all metal surfaces dry.**
- d) **Remove existing rust by wire brushing metal surfaces and then shining with light oil.**
- e) **Sharpen blades with files, stones, or grinders.**

Discuss maintenance procedures for hand-operated lawn equipment. Continue to emphasize the use of safe handling while maintaining the tools.

**Q7. What are maintenance procedures for power lawn equipment?**

**A7.**

- a) **Check air cleaners and filters every 25 hours of operation or sooner when working in extremely dusty conditions.**
- b) **Check oil in four-stroke engines before each use and change oil every 25 hours of use.**
- c) **Always use the correct fuel-oil mixture in a two-stroke engine.**
- d) **Check spark plugs frequently and change after 100 hours of use.**
- e) **Follow proper procedures when storing power tools for long periods of time.**
  - 1) **Drain the fuel tank.**
  - 2) **Change oil and filters.**
  - 3) **Clean and lubricate the exterior and chains.**
  - 4) **Loosen the belts.**

Discuss maintenance procedures for power lawn equipment. Always consult the owner's manual. If equipment is available, illustrate the necessary procedures to the students. After procedures have been explained and they understand safety precautions to be followed, have them perform the procedures.

**F. *Other Activities***

1. Have students perform a general power lawn maintenance procedure whereby they clean an air filter, clean a spark plug, and change the oil.
2. Demonstrate to students how to correctly mix fuel for a particular two-stroke tool such as a weed eater.
3. Invite a guest speaker from a local lawn and garden dealership to speak about different types of lawn equipment and their safety.
4. Have students create lawn safety posters to display in the shop, around the school, or at various locations throughout the community.

**G. *Conclusion***

It is very important as a homeowner to know the proper use, maintenance, and safety procedures for lawn and garden equipment. Appropriate practices will help ensure the safety of the operator, the ease of operation, and the longevity of the tool.

H. **Answers to Activity Sheets**

AS 5.1 Hand Lawn Tool Identification

1. c
2. f
3. h
4. d
5. a
6. m
7. b
8. l
9. k
10. i
11. n
12. o
13. j
14. e
15. g

AS 5.2 Power Lawn Tool Identification

1. c
2. b
3. d
4. e
5. a

AS 5.3 Two- vs. Four-Stroke Engines

	Four-Cycle Engine (equal hp) One Cylinder	Two-Cycle (equal hp) One Cylinder
Number of moving parts	Nine	Three
Running	Cooler running	Hotter running
Overall	Larger	Smaller
Engine	Heavier construction	Lighter in weight
Fuel and Oil	No mixture required	Must be premixed
Fuel Consumption	Fewer gallons per hour	More gallons per hour
Oil Consumption	Oil recirculates and stays in engine	Oil is burned with fuel
Sound	Generally quiet	Louder in operation
Operation	Smoother	More erratic
Acceleration	Slower	Very quick
General maintenance	Greater	Less
Initial Cost	Greater	Less
Versatility of operation	Limited slope operation (Receives less lubrication when tilted)	Lubrication not affected at any angle of operation

AS 5.4 Mower Safety Demonstration

There are no answers to this exercise.

### AS 5.5 Mowing Obstacle Course

There are no answers to this exercise.

### AS 5.6 Lawn Mower Safety Guidelines

1.    a)    No loose/baggy clothing  
      b)    Safety goggles
2.    a)    Inspect for sharpness/good condition  
      b)    Alert others  
      c)    Remove debris from the area  
      d)    Read instructions/owner's manual
3.    a)    Keep hands and feet away from moving parts.  
      b)    Use caution on slopes  
      c)    Mow dry grass and cut 1 ½ to 3 inches  
      d)    Keep safety shields in place
4.    a)    Don't smoke.  
      b)    Turn off engine.

### I. ***Answers to Evaluation***

1.    b
2.    c
3.    a
4.    d
5.    b
6.    b
7.    a
8.    c
9.    d
10.   b
11.   c
12.   c
13.   b
14.   a
15.   d
16.   a
17.   d
18.   d
19.   b
20.   a
21.   a
22.   c
23.   c
24.   a
25.   d
26.   b
27.   e
28.   e
29.   c
30.   a
31.   b
32.   d
33.   a
34.   d
35.   e

36. c
37. b
38. a
39. d
40. e
41. c
42. b
43. Any two of the following:
- a. Protect eyes and clothes.
  - b. Use right tool for the job.
  - c. Inspect tool for damages.
  - d. Know how to use correctly.
  - e. Store in proper place after use.
  - f. Be sure tool is clean and undamaged before storing.
44. Any two of the following:
- a. Get permission.
  - b. Inspect tool.
  - c. Protect eyes and clothes.
  - d. Master the safety and operating techniques.
  - e. Let others know.
  - f. Make adjustments with the tool unplugged.
  - g. Clean and store after use.
45. Any three of the following:
- a. Do not wear loose, baggy clothing.
  - b. Wear safety glasses.
  - c. Wear gloves.
  - d. Inspect tool before use.
  - e. Be aware of others when using sharp tools.
46. Any three of the following:
- a. Do not wear baggy clothes.
  - b. Wear safety goggles.
  - c. Inspect tool for sharpness and condition.
  - d. Alert others.
  - e. Hands away from moving parts.
  - f. Remove debris from area to be mowed.
  - g. Never smoke when fueling a running engine.
  - h. Keep safety shields in place.
  - i. Know owner's manual operating procedures.
  - j. Use caution on slopes.
  - k. Mow dry grass only.
47. One of the following:
- a. Clean after each use and inspect for damage.
  - b. Rub linseed oil on rough, dry handles.
  - c. Remove rust on metal surfaces with a wire brush and apply oil.
  - d. Keep tools dry to prevent rust.
  - e. Sharpen blades with files, stones, or grinders.
48. Any two of the following:
- a. Check air filters every 25 hours of use or after very dusty conditions.
  - b. Check oil in 4-stroke engines before each use and change oil every 25 hours of use.
  - c. Use correct fuel-oil mix in a 2-stroke engine.
  - d. Check spark plugs frequently and change every 100 hours of use.
  - e. Follow correct steps for winter storage of power tools.



Lesson 5: Safety and Maintenance Procedures for Lawn and Garden Equipment

Name \_\_\_\_\_

### Hand Lawn Tool Identification

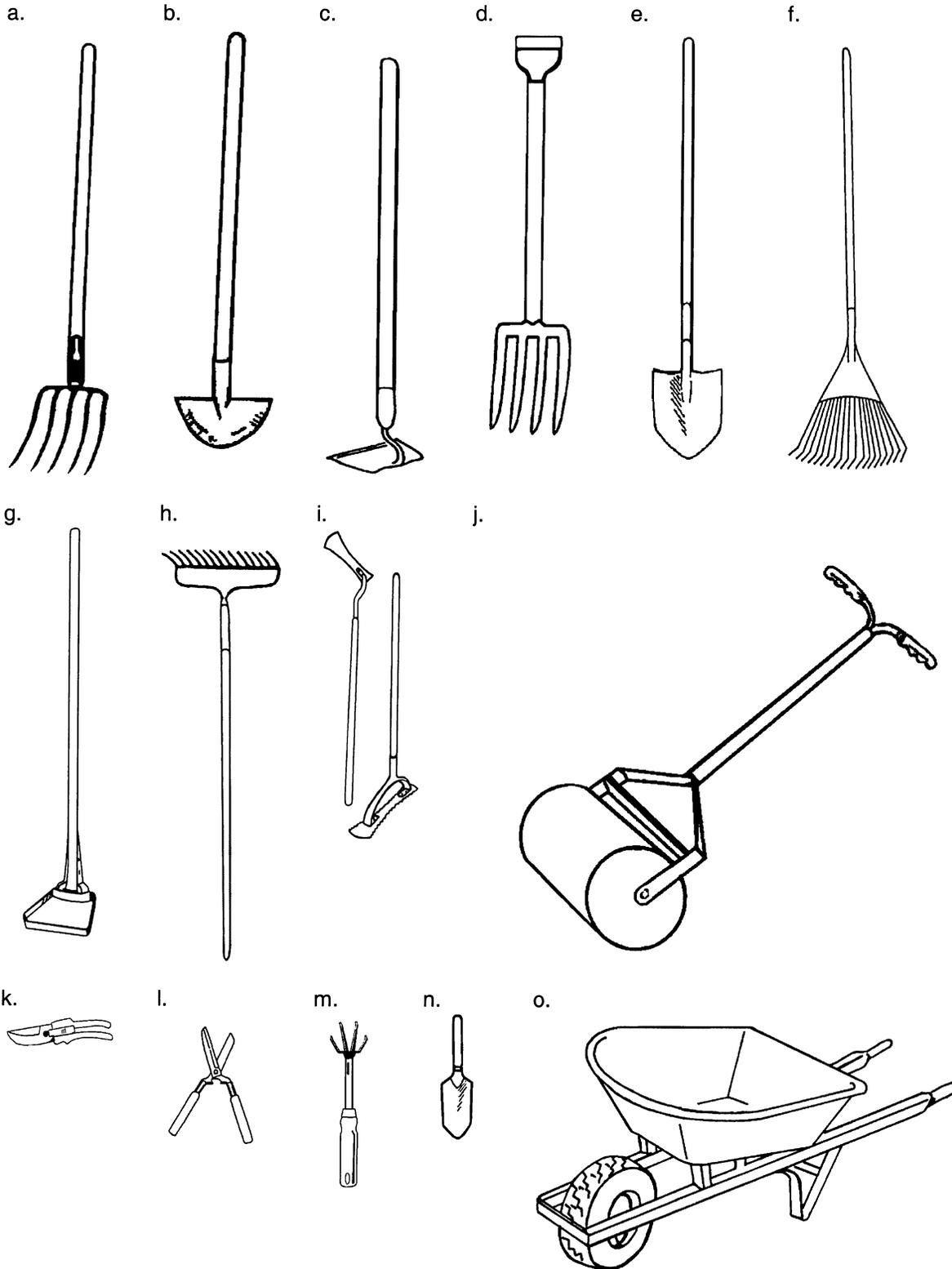
**Objective:** Students will identify common lawn and garden hand tools.

**Directions:** Match the correct hand lawn tool with the correct picture on the following page.

- \_\_\_\_\_ 1. Garden hoe
- \_\_\_\_\_ 2. Lawn or leaf rake
- \_\_\_\_\_ 3. Garden rake
- \_\_\_\_\_ 4. Spading fork
- \_\_\_\_\_ 5. Pitchfork
- \_\_\_\_\_ 6. Cultivator
- \_\_\_\_\_ 7. Turf edger
- \_\_\_\_\_ 8. Hedge shears
- \_\_\_\_\_ 9. Scissor-type pruning shears
- \_\_\_\_\_ 10. Weed cutters
- \_\_\_\_\_ 11. Hand trowel
- \_\_\_\_\_ 12. Wheelbarrow
- \_\_\_\_\_ 13. Sod roller
- \_\_\_\_\_ 14. Round-pointed shovel
- \_\_\_\_\_ 15. Push hoe



Lesson 5: Safety and Maintenance Procedures for Lawn and Garden Equipment





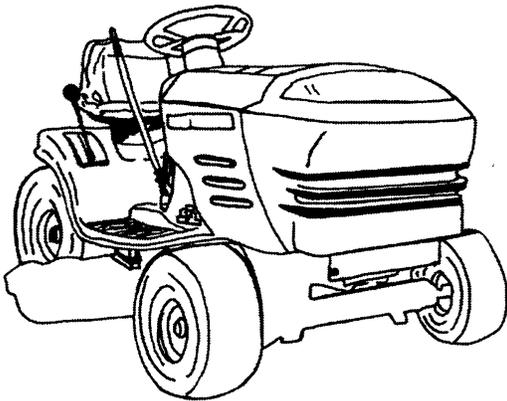
**Power Lawn Tool Identification**

**Objective:** Students will identify common power lawn equipment.

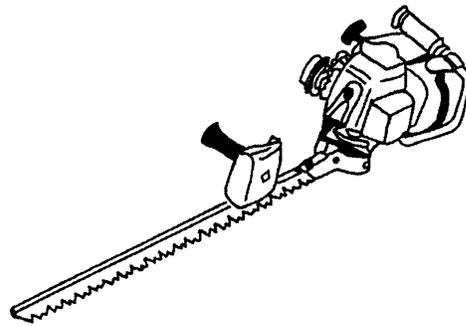
**Directions:** Match the correct power lawn equipment with the correct picture.

- \_\_\_\_\_ 1. Walk-behind mower
- \_\_\_\_\_ 2. Hedge trimmer
- \_\_\_\_\_ 3. Line or string trimmer
- \_\_\_\_\_ 4. Leaf blower
- \_\_\_\_\_ 5. Riding lawn mower

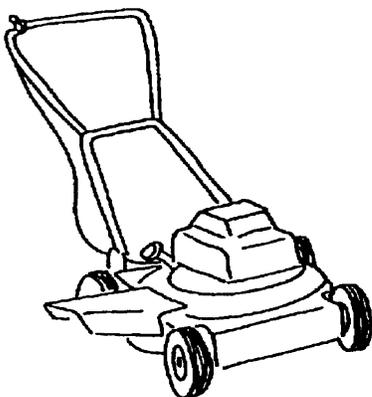
a.



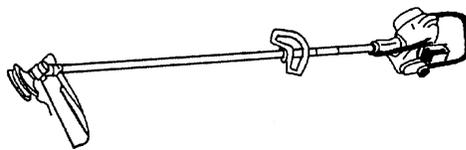
b.



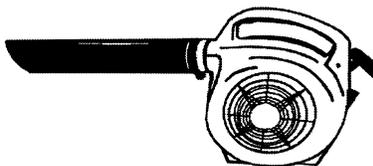
c.



d.



e.





Lesson 5: Safety and Maintenance Procedures for Lawn and Garden Equipment

Name \_\_\_\_\_

**Two- vs. Four-Stroke Engines**

**Objective:** Students will identify differences between two- and four-stroke engines.

**Directions:** Place the appropriate characteristic in the appropriate blank.

	<b>FOUR-CYCLE ENGINE (EQUAL HP) ONE CYLINDER</b>	<b>TWO-CYCLE (EQUAL HP) ONE CYLINDER</b>
Number of moving parts		
Running		
Overall		
Engine		
Fuel and oil		
Fuel consumption		
Oil consumption		
Sound		
Operation		
Acceleration		
General maintenance		
Initial cost		
Versatility of operation		



## Lesson 5: Safety and Maintenance Procedures for Lawn and Garden Equipment

Instructor

**Mower Safety Demonstration**

**Objective:** Students will observe why safety features are so important on lawn mowers.

**Directions:** Use a lawn mower equipped with the four safety features, including the rear guard, to demonstrate how objects can be thrown from a lawn mower.

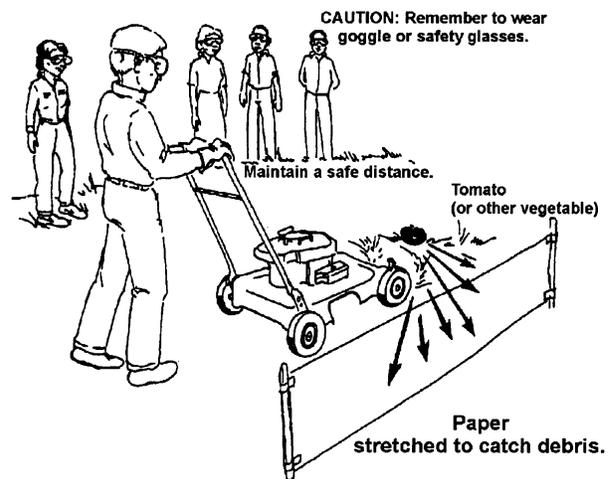
**Materials and Equipment:**

Lawn mower  
Safety goggles or safety glasses (for all students and the instructor)  
2 stakes  
6' of paper  
Soft vegetable or fruit (tomato)

**Procedure:**

CAUTION: Emphasize to students that they should not try this at home. This is only a demonstration.

1. The instructor and students should wear goggles to prevent injury.
2. Students should be a safe distance away from the demonstration and on the opposite side of the discharge chute.
3. Using two stakes set 6 feet apart, stretch paper across alongside the mowing area to emphasize the effect of the thrown object.
4. Use a soft vegetable or fruit such as a tomato as the object to be run over.
5. Adjust the mower deck at a low setting. (Make sure the mower is off when adjusting.)
6. Mow over the vegetable or fruit.
7. Discuss what would happen if the object had been a rock, stick, or toy.
8. Discuss what would happen to a foot or hand that was accidentally run over.





Lesson 5: Safety and Maintenance Procedures for Lawn  
and Garden Equipment

Instructor

### **Mowing Obstacle Course**

**Objective:** Students will be able to put the mower through a mowing obstacle course.

**Directions:** Set up a mowing obstacle course to enable students to know how to properly use a lawn mower. The instructor needs to determine if students will go through the course with the mower running. If students go through the course without the mower running, explain starting and stopping procedures instead of doing them. The course should not be timed.

The obstacle course should include:

1. Adjusting mower height
2. Clearing the mowing area of people and objects
3. Starting the mower
4. Mowing around trees or posts
5. Mowing around a curved bed
6. Stopping the mower



Lesson 5: Safety and Maintenance Procedures for Lawn and Garden Equipment

Name \_\_\_\_\_

**Lawn Mower Safety Guidelines**

**Objective:** Students will be able to identify mower safety guidelines.

**Directions:** Use owner manuals and basic lawn mower books to help find the following information. Describe safety guidelines that should be followed for each of the following power mower operations.

PROCEDURE	SAFETY GUIDELINES
Selecting proper attire	a. b.
Pre-operational procedures	a. b. c. d.
Operational procedures	a. b. c. d.
Refueling	a. b.
PROCEDURE	MAINTENANCE GUIDELINES
Changing oil	a. b.
Sharpening blades	a. b.
Check spark plug	a. b.
Lubricating parts	a. b.



UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

Name \_\_\_\_\_

Date \_\_\_\_\_

UNIT EVALUATION

**Circle the letter that corresponds to the best answer.**

1. Select the correct definition of electricity.
  - a. An uncontrolled burst of energy
  - b. The flow of negatively charged atoms
  - c. Lightning
  - d. The flow of a substance under pressure
  
2. Which of the following is a form of power used to generate electricity?
  - a. Battery power
  - b. Horse power
  - c. Steam power
  - d. Human power
  
3. Select the unit of measurement commonly used to measure electricity usage.
  - a. Kilowatt-hour
  - b. Kilogram
  - c. Amperage
  - d. Ohms
  
4. Select the statement that best describes the difference between a fuse and a circuit breaker.
  - a. A blown fuse indicates a problem in a circuit whereas a tripped circuit can be ignored.
  - b. Fuses can be replaced with a fuse of any amperage whereas circuits are exact.
  - c. Circuits must be replaced on a regular basis whereas fuses last permanently.
  - d. A fuse is replaced when blown whereas a circuit is switched to the "on" position when tripped.
  
5. Select the common hazard associated with the uses of electricity.
  - a. Drowning
  - b. Electric shock
  - c. Electric stroke
  - d. Electric hazard
  
6. What piece of safety equipment must be worn to protect the eyes while working?
  - a. Gloves
  - b. Safety glasses or goggles
  - c. Contacts
  - d. Safety shield
  
7. Identify the safety equipment worn for protection from dust and fumes.
  - a. Face mask
  - b. Safety goggles
  - c. Safety shield
  - d. Dust buster

8. Identify the type of shoe that provides the best protection from injury.
  - a. Moccasins
  - b. High-topped sneakers
  - c. High-topped leather, steel-toed boots
  - d. Cowboy boots
  
9. What method is safest for wearing long hair in a shop or work area?
  - a. Braided
  - b. Left long
  - c. Teased
  - d. Pulled back and tied up
  
10. Tools strewn about on the floor \_\_\_\_\_ .
  - a. Can be stolen.
  - b. Create a safety hazard.
  - c. Will not work.
  - d. Can be easily located.
  
11. Select the answer that best describes the difference between a two-stroke and a four-stroke engine.
  - a. The two-stroke engine is a battery and the four-stroke is a motor.
  - b. The two-stroke is fast and the four-stroke is slow.
  - c. The two-stroke uses a fuel-oil mixture and the four-stroke has separate compartments for fuel and oil.
  - d. The four-stroke engine does not require oil and the two-stroke relies on diesel.

**Match the light bulb to its appropriate description.**

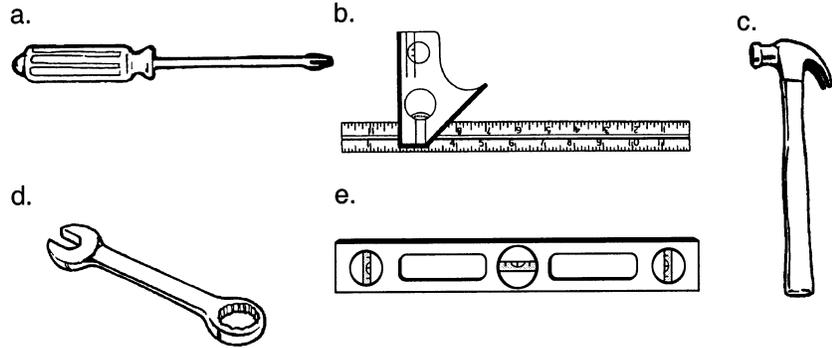
- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>12. _____ Fluorescent</li> <li>13. _____ Halogen</li> <li>14. _____ Metal-halide</li> <li>15. _____ Sodium</li> </ol> | <ol style="list-style-type: none"> <li>a. Contains compounds of metal and halogen with a basic two-bulb design.</li> <li>b. A mixture of gases inside the bulb forms a very bright, hot light.</li> <li>c. Radiates light from a gas inside the bulb, commonly used in greenhouses.</li> <li>d. Composed of an aluminum oxide arc tube containing a mixture of sodium and mercury.</li> </ol> |
|--|---|

**Match each type of measurement with the appropriate category.**

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>16. _____ Inch</li> <li>17. _____ Gram</li> <li>18. _____ Ounce</li> <li>19. _____ Square foot</li> <li>20. _____ Yard</li> <li>21. _____ Meter</li> <li>22. _____ Board feet</li> </ol> | <ol style="list-style-type: none"> <li>a. Linear</li> <li>b. Area</li> <li>c. Volume</li> <li>d. Weight</li> </ol> |
|---|--|

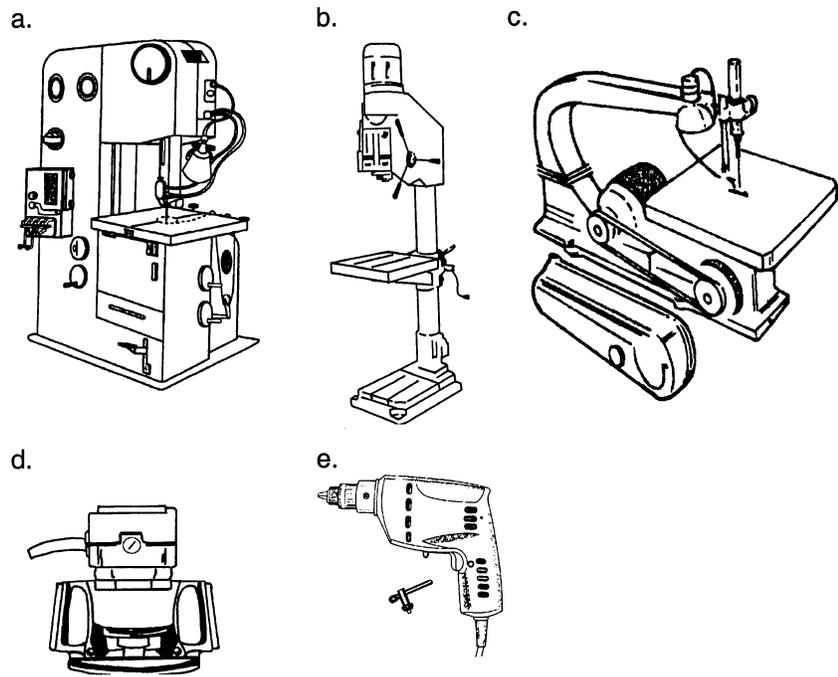
**Match the name with the correct hand tool.**

- 23. \_\_\_\_\_ Curved claw hammer
- 24. \_\_\_\_\_ Phillips screwdriver
- 25. \_\_\_\_\_ Combination wrench
- 26. \_\_\_\_\_ Combination square
- 27. \_\_\_\_\_ Level



**Match the name with the correct power tool.**

- 28. \_\_\_\_\_ Portable drill
- 29. \_\_\_\_\_ Jig saw
- 30. \_\_\_\_\_ Band saw
- 31. \_\_\_\_\_ Drill press
- 32. \_\_\_\_\_ Router



**Match the name with the correct lawn tool.**

33. \_\_\_\_\_ Garden hoe

a.

b.

c.

d.

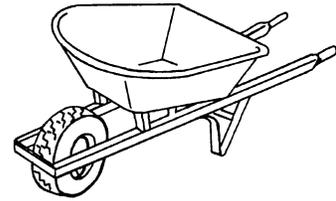
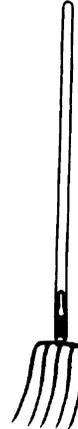
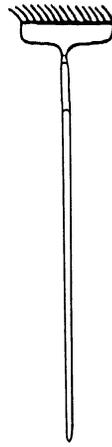
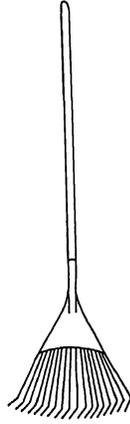
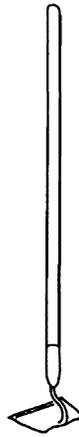
e.

34. \_\_\_\_\_ Pitchfork

35. \_\_\_\_\_ Wheelbarrow

36. \_\_\_\_\_ Garden rake

37. \_\_\_\_\_ Lawn rake



**Match the name with the correct power lawn equipment.**

38. \_\_\_\_\_ Riding mower

a.

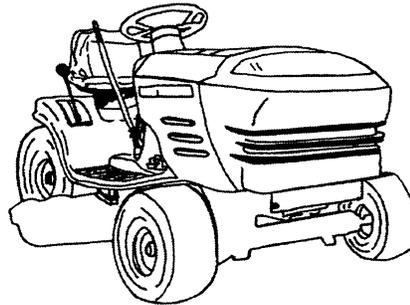
b.

39. \_\_\_\_\_ Leaf blower

40. \_\_\_\_\_ String trimmer

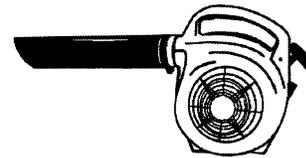
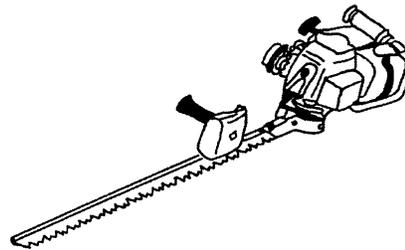
41. \_\_\_\_\_ Hedge trimmer

42. \_\_\_\_\_ Walk-behind mower

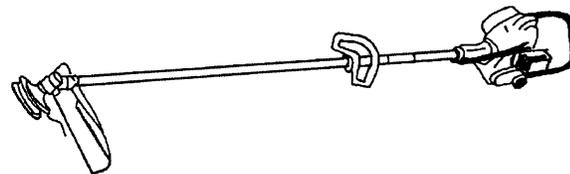


c.

d.



e.



**Complete the following short answer questions.**

43. List two important safety tips for using hand tools.
  - a.
  - b.
  
44. List two important safety tips for the use of power tools.
  - a.
  - b.
  
45. List three safety guidelines for lawn and garden hand tools.
  - a.
  - b.
  - c.
  
46. List three safety guidelines for power lawn and garden tools.
  - a.
  - b.
  - c.
  
47. List one proper maintenance procedure for hand lawn equipment.
  
  
48. List two maintenance procedures for power lawn equipment.
  - a.
  - b.

