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Acknowledgments

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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.

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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

## UNIT I - INTRODUCTION TO AGRICULTURE

### Lesson 1—Agriculture: What Is It?

| 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: A to Z Agricultural Careers | I-25 |
| AS 1.5: Cheeseburger, Fries, and Shake | I-27 |
| AS 1.6: Name That Career (Instructor) | I-29 |
| AS 1.8: Agriculture in My Community (Instructor) | I-31 |

### Lesson 2—Agriculture in the World

| 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 |

### Lesson 3—Agriculture in the United States

| TM 3.1: Map of United States | I-61 |
| 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 |

### Lesson 4—Agriculture in Missouri

| 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
Lesson 5—Advances in Agricultural Technology............................................................... I-93
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

Lesson 1—The Importance of Plants ................................................................................. II-1
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

Lesson 2—Plant Parts and Processes ............................................................................. II-13
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

Lesson 3—The Growing Medium ................................................................................. II-43
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

Lesson 4—Plant Care Requirements ............................................................................. II-63
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

Lesson 5—Technologies Used in Plant Agriculture ..................................................... II-75
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

Lesson 1—The Importance of Animals ........................................................................ III-1
TM 1.1: Livestock in Missouri........................................................................ III-5
TM 1.2: Animal Terminology........................................................................ III-7
AS 1.1: Animal Industry Terms .................................................................. III-9
UNIT IV - PRODUCTS FROM AGRICULTURE

Lesson 1—Agriculture in the Food Chain
TM 1.1: Simple Food Chain in the Natural Environment ................................IV-1
TM 1.2: Simple Food Chain in the Aquatic Environment ...................................IV-5
TM 1.3: Agricultural Food Chain ...............................................................................IV-7
AS 1.1: Student Chain (Instructor) ..........................................................................IV-9
AS 1.2: Food Web (Instructor) ................................................................................IV-11

Lesson 2—Food Products from Plants
TM 2.1: Cereal Food Label Ingredients .................................................................IV-15
TM 2.2: Key Parts of a Food Label ........................................................................IV-19
AS 2.1: Food Inventory .........................................................................................IV-21
AS 2.2: Do You Know Your Food Label? ..............................................................IV-23
AS 2.3: Compare Food Labels ...............................................................................IV-25

Lesson 3—Food Products from Animals
TM 3.1: Wholesale and Retail Cuts of Beef ..........................................................IV-27
TM 3.2: Meat Consumption Trends in the United States .......................................IV-29
TM 3.3: Know Your Meat Label ............................................................................IV-31
HO 3.1: Per Capita Consumption of Meat Products in the United States ............IV-35
HO 3.2: Beef Chart ..................................................................................................IV-37
HO 3.3: Pork Chart ..................................................................................................IV-39
HO 3.4: Lamb Chart ................................................................................................IV-41
HO 3.5: Meat Labels ...............................................................................................IV-43
AS 3.1: Identify the Most Popular Meat Product .......................................................IV-45
AS 3.2: Animal Food Products ...............................................................................IV-47
AS 3.3: Identifying per Capita Consumption Trends of Meat Products ...................IV-49
AS 3.4: Processing Whipped Cream and Butter .....................................................IV-51
AS 3.5: Reading a Meat Label ...............................................................................IV-53

Lesson 4—Food Processing and Food Safety
TM 4.1: Processing Food: From Producer to Consumer ........................................IV-55
TM 4.2: Recommended Safe Cooking Temperatures ..............................................IV-57
AS 4.1: Popcorn Processing (Instructor) ...............................................................IV-59
AS 4.1: Popcorn Processing (Student) .................................................................IV-61
AS 4.2: Soybean Processing (Instructor) ...............................................................IV-63
AS 4.3: Ice Cream Processing (Instructor) ............................................................IV-65
AS 4.3: Ice Cream Processing (Student) ...............................................................IV-67
AS 4.4: Food Safety Activities (Instructor) ............................................................IV-69

Lesson 5—Fiber Products from Agriculture
TM 5.1: Steps in Processing Wool .........................................................................IV-71
AS 5.1: Create a Sweater Pattern .........................................................................IV-73
AS 5.2: Clothing Labels .........................................................................................IV-75
AS 5.3: Scavenger Hunt for Fiber Trivia ................................................................IV-77

Lesson 6—Nonfood Products from Agriculture
TM 6.1: Corn Has Many Uses ...............................................................................IV-79

vii
### UNIT V - NATURAL RESOURCES AND CONSERVATION

**Lesson 1—Conservation of Natural Resources**  
- 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

**Lesson 2—Soil Conservation**  
- TM 2.1: U.S. Land Affected by Soil Erosion ..................................................... V-21  
- AS 2.1: How Does Mulch Prevent Soil Loss? (Instructor) ............................... V-23

**Lesson 3—Water Quality**  
- 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

**Lesson 4—Air Quality**  
- 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

**Lesson 5—Wildlife Management**  
- 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

**Lesson 6—Conservation Issues Affecting Agriculture**  
- AS 6.1: Conservation in Agriculture ............................................................... V-65

### UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

**Lesson 1—Developing Leadership Skills**  
- 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 ................................................ VII-13

**Lesson 2—Importance of Financial Records**  
- 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

**Lesson 1—Electricity**  
- 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

**Lesson 2—Common Measurements and Their Uses**  
- TM 2.1: Reading a Ruler .............................................................................. VII-21  
- TM 2.2: Measures of Length, Area, Volume, and Weight ............................. VII-23
Lesson 3—Common Tools and Their Uses

Lesson 4—Personal Safety Practices

Lesson 5—Safety and Maintenance Procedures for Lawn and Garden Equipment

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


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

   Food and Fiber Systems Literacy <http://food_fiber.okstate.edu/>.

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


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


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

Online Activities Population Count <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 46288-0960, 1996.


**Audiovisual**


**UNIT II - PLANT SCIENCE**

**Books, pamphlets, web sites**


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


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


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


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


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

Audiovisuals


UNIT III - ANIMALS IN SOCIETY

Books, pamphlets, web sites


UNIT IV - PRODUCTS FROM AGRICULTURE

Books, pamphlets, web sites


Food and Fiber Systems Literacy Online <http://food_fiber.okstate.edu>.

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


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

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

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


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


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


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


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.


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


UNIT VII - BASIC HOME AND FARMSTEAD SAFETY AND MAINTENANCE

Books, pamphlets, web sites


Audiovisuals


### Exploring Agriculture in America - Competency Crosswalk

<table>
<thead>
<tr>
<th>Duty Band &amp; Task Statement</th>
<th>SHOW-ME STANDARDS</th>
<th>CURRICULUM FRAMEWORKS FOR GRADES 5-8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge (Content)</td>
<td>Performance (Goals)</td>
</tr>
<tr>
<td>A-1</td>
<td>SC 8, SS 3, SS 4, SS 6</td>
<td>1.1, 1.3, 1.9, 1.10, 2.6, 4.8</td>
</tr>
<tr>
<td>A-2</td>
<td>CA 4, SC 4, SS 4, SS 7</td>
<td>1.1, 1.6</td>
</tr>
<tr>
<td>A-3</td>
<td>CA 3, CA 6, SC 8, SS 5, SS 6</td>
<td>1.1, 1.6, 1.8</td>
</tr>
<tr>
<td>A-4</td>
<td>CA 3, CA 6, SC 8, SS 5, SS 6</td>
<td>1.1, 1.6</td>
</tr>
<tr>
<td>A-5</td>
<td>CA 1, CA 3, SC 3, SS 4, SS 5, SS 6, SS 7</td>
<td>1.1, 1.2, 1.6, 1.7, 2.7, 3.8</td>
</tr>
<tr>
<td>B-1</td>
<td>CA 1, CA 3, SC 3, SS 4, SS 5, SS 6, SS 7</td>
<td>1.2, 1.3, 1.7, 1.8, 1.10</td>
</tr>
<tr>
<td>B-2</td>
<td>CA 1, CA 3, SC 3</td>
<td>1.1, 1.2, 1.3, 1.6</td>
</tr>
<tr>
<td>B-3</td>
<td>CA 1, CA 3, SC 3</td>
<td>1.1, 1.2, 1.3</td>
</tr>
<tr>
<td>B-4</td>
<td>CA 1, CA 3, SC 3</td>
<td>1.2, 1.3, 1.8, 2.1, 3.1</td>
</tr>
<tr>
<td>B-5</td>
<td>CA 1, CA 3, SC 3, SC 7, SC 8</td>
<td>1.1, 1.2, 1.3, 1.4, 2.7</td>
</tr>
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<td>SHOW-ME STANDARDS</td>
<td>CURRICULUM FRAMEWORKS FOR GRADES 5-8</td>
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<td>Performance (Goals)</td>
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<td>CA 1, CA 5, CA 6, SC 3, SC 4, SS 4, SS 6</td>
<td>2.2, 2.3</td>
</tr>
<tr>
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<td>CA 6, SC 3, SS 6</td>
<td>1.3, 1.4, 1.6, 2.3, 3.7, 3.8</td>
</tr>
<tr>
<td>C-3</td>
<td>CA 6, MA 1, SC 3, SS 6</td>
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<td>C-4</td>
<td>CA 1, CA 4, SC 3, SC 7, SC 8</td>
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<td>HP 2, SC 8, SS 6, SS 7</td>
<td>1.4, 2.7, 3.5</td>
</tr>
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<td>CA 3, SC 8, SS 4</td>
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<tr>
<td>Duty Band &amp; Task Statement</td>
<td>SHOW-ME STANDARDS</td>
<td>CURRICULUM FRAMEWORKS FOR GRADES 5-8</td>
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<tr>
<td></td>
<td>Knowledge (Content)</td>
<td>Performance (Goals)</td>
</tr>
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<td>CA 3, SC 4, SC 5, SS 5, SS 6</td>
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<td>1.1, 1.2, 1.3, 1.6, 1.8, 3.8</td>
</tr>
<tr>
<td>E-6</td>
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## Exploring Agriculture in America

### Teaching Calendar

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**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

<table>
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<th>A. Introduction to Agriculture</th>
<th>B. Plant Science</th>
<th>C. Animals in Society</th>
<th>D. Products from Agriculture</th>
<th>E. Natural Resources and Conservation</th>
<th>F. Leadership and Personal Development</th>
<th>G. Basic Home and Farmstead Safety and Maintenance</th>
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<tr>
<td>1. Define agriculture and identify career opportunities in agriculture.</td>
<td>2. Describe the role of agriculture in the world.</td>
<td>3. Describe the role of agriculture in the United States.</td>
<td>4. Describe the role of agriculture in Missouri.</td>
<td>5. Identify advances in agricultural technology and their implications.</td>
<td>Other: ____________________________</td>
<td>F. Identify important factors in developing leadership skills.</td>
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<td>1. Describe how plants affect our lives.</td>
<td>2. Describe the parts of a plant and major processes.</td>
<td>3. Describe the importance of the growing medium to plants.</td>
<td>4. Identify the important factors to consider in caring for plants.</td>
<td>5. Identify current and emerging technologies of plant agriculture.</td>
<td>Other: ____________________________</td>
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<td>2. Describe the responsibilities of animal ownership.</td>
<td>3. Identify factors in selecting an animal.</td>
<td>4. Identify current and emerging technology of animal agriculture.</td>
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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 technology 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.
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**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.
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.
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), houseplant, 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.
Average Annual Expenditures for Typical U.S. Family

- Housing: $11,713
- Transportation: $6,616
- Pensions & Life Insurance: $3,381
- Food at home: $2,780
- Food away from home: $2,030
- Health insurance and medical: $1,903
- Entertainment: $1,746
- Apparel: $1,674
- Other: $3,693

Total Expenditures = $35,536

Average Number in Family: 2.5
Average Number of Earners: 1.3
Disposable Income Spent for Food

Life Expectancy

Country

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.
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.
UNIT I - INTRODUCTION TO AGRICULTURE

Lesson 1: Agriculture: What Is It?

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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population in Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1825</td>
<td>1.0</td>
</tr>
<tr>
<td>1925</td>
<td>2.0</td>
</tr>
<tr>
<td>1960</td>
<td>3.0</td>
</tr>
<tr>
<td>1975</td>
<td>4.0</td>
</tr>
<tr>
<td>1987</td>
<td>5.0</td>
</tr>
<tr>
<td>1999</td>
<td>6.0</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Minutes</th>
<th>Actual Time Listed at the Web Site</th>
<th>World Population</th>
<th>Population Change During the Last Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Increase in World Population During Previous 10 Minutes**
(Add values in the 4th column)

**Key Questions:**

1. Does the population change the same amount during each of the 10 minutes?

2. 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?
### 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.

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

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
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).

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

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

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

## U.S. Exports Purchased

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Units of Food Needed</th>
<th>Funds Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1</td>
<td>$50 billion</td>
</tr>
<tr>
<td>England</td>
<td>1</td>
<td>$10 billion</td>
</tr>
<tr>
<td>France</td>
<td>1</td>
<td>$10 billion</td>
</tr>
<tr>
<td>Australia</td>
<td>1</td>
<td>$10 billion</td>
</tr>
<tr>
<td>USSR</td>
<td>5</td>
<td>$20 billion</td>
</tr>
<tr>
<td>China</td>
<td>10</td>
<td>$10 billion</td>
</tr>
<tr>
<td>India</td>
<td>15</td>
<td>$10 billion</td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
<td>$30 billion</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>10</td>
<td>$5 billion</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>5</td>
<td>$40 billion</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Food Products</th>
<th>Food Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Products</td>
<td>Food Products</td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Products</td>
<td>Food Products</td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Products</td>
<td>Food Products</td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Products</td>
<td>Food Products</td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Products</td>
<td>Food Products</td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td>Other Product Coupons</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Automobiles</strong></td>
<td><strong>Crude Oil</strong></td>
</tr>
<tr>
<td>$2 Billion</td>
<td>$2 Billion</td>
</tr>
<tr>
<td><strong>Electronic Equipment</strong></td>
<td><strong>Military Aircraft</strong></td>
</tr>
<tr>
<td>$3 Billion</td>
<td>$3 Billion</td>
</tr>
<tr>
<td><strong>Medicine</strong></td>
<td><strong>Tractors</strong></td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td><strong>Lumber</strong></td>
<td><strong>Steel</strong></td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td><strong>Airplanes</strong></td>
<td><strong>Agricultural Equipment</strong></td>
</tr>
<tr>
<td>$3 Billion</td>
<td>$1 Billion</td>
</tr>
<tr>
<td><strong>Shoes</strong></td>
<td><strong>Clothing</strong></td>
</tr>
<tr>
<td>$1 Billion</td>
<td>$1 Billion</td>
</tr>
</tbody>
</table>
UNIT I - INTRODUCTION TO AGRICULTURE

Lesson 2: Agriculture in the World

Name__________________________

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 $ ____________________________

<table>
<thead>
<tr>
<th>Units Purchased</th>
<th>Funds Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ending Balance: $ ____________________________

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

<table>
<thead>
<tr>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
</tr>
<tr>
<td>Area (comparative)</td>
</tr>
<tr>
<td>Land Use</td>
</tr>
<tr>
<td>Environment (current issues)</td>
</tr>
<tr>
<td>Category</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
</tbody>
</table>
| Age Structure                    | 0-14 years  
15-64 years  
65 years and over                                                      |
| Literacy                         | definition  
total population                                                      |
| Population Growth Rate           |                                                                        |
| Life Expectancy At Birth         | total population  
male  
female                                                              |
| Languages                        | (official)                                                              |
| Population Below Poverty Line    |                                                                        |
| Unemployment Rate                |                                                                        |
| Agriculture                      | (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 x 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:

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

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)  
Africa (poor country)  
Africa (poor country)  
Africa (poor country)  
Asia (country with political power)  
Asia (rich country)  
Asia (rich country)  
Asia (rich country)  
Asia (poor country)  
Asia (poor country)  
Europe (rich country)  
Europe (poor country)  
North America (rich country)  
North America (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](http://www.nass.usda.gov/pa/annsum98/page88.htm).

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

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:

Exploring Agriculture in America, I-62
<table>
<thead>
<tr>
<th>Agricultural Product</th>
<th>Leading States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cows</td>
<td>Texas, Missouri, Nebraska, Oklahoma, South Dakota</td>
</tr>
<tr>
<td>Market beef</td>
<td>Texas, Kansas, Nebraska, Colorado, Iowa</td>
</tr>
<tr>
<td>Dairy cows/products</td>
<td>California, Wisconsin, New York, Pennsylvania, Minnesota</td>
</tr>
<tr>
<td>Market pigs</td>
<td>Iowa, North Carolina, Minnesota, Illinois, Indiana</td>
</tr>
<tr>
<td>Sheep and lambs</td>
<td>Colorado, Texas, Wyoming, California, South Dakota</td>
</tr>
<tr>
<td>Egg production (layers)</td>
<td>California, Ohio, Pennsylvania, Iowa, Indiana</td>
</tr>
<tr>
<td>Chickens (broilers)</td>
<td>Georgia, Arkansas, Alabama, North Carolina, Mississippi</td>
</tr>
<tr>
<td>Turkeys sold</td>
<td>North Carolina, Minnesota, Virginia, Arkansas, California</td>
</tr>
<tr>
<td>Corn</td>
<td>Iowa, Illinois, Nebraska, Minnesota, Indiana</td>
</tr>
<tr>
<td>Wheat</td>
<td>Kansas, North Dakota, Montana, Washington, Oklahoma</td>
</tr>
<tr>
<td>Soybeans</td>
<td>Iowa, Illinois, Minnesota, Indiana, Ohio</td>
</tr>
<tr>
<td>Cotton</td>
<td>Texas, California, Georgia, Mississippi, Arkansas</td>
</tr>
<tr>
<td>Peanuts</td>
<td>Georgia, Texas, Alabama, North Carolina, Florida</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Idaho, Washington, Wisconsin, Oregon, Colorado</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>California, Wisconsin, South Dakota, Nebraska, Idaho</td>
</tr>
<tr>
<td>Green peas</td>
<td>Minnesota, Wisconsin, Washington, Oregon, New York</td>
</tr>
<tr>
<td>Lettuce</td>
<td>California, Arizona, Florida, New Jersey, Colorado</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>Minnesota, Wisconsin, Washington, New York, Oregon</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>California, Florida, Ohio, Michigan, Indiana</td>
</tr>
<tr>
<td>Apples</td>
<td>Washington, Michigan, New York, California, Pennsylvania</td>
</tr>
<tr>
<td>Oranges</td>
<td>Florida, California, Texas, Arizona, Hawaii</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>Florida, California, Texas, Arizona, Hawaii</td>
</tr>
<tr>
<td>Pears</td>
<td>Washington, California, Oregon, New York, Michigan</td>
</tr>
<tr>
<td>Peaches</td>
<td>California, Georgia, South Carolina, New Jersey, Michigan</td>
</tr>
<tr>
<td>Pecans</td>
<td>Georgia, Texas, New Mexico, Arizona, Oklahoma</td>
</tr>
<tr>
<td>Strawberries</td>
<td>California, Florida, Oregon, Washington, Michigan</td>
</tr>
</tbody>
</table>

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.
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.

<table>
<thead>
<tr>
<th>Agricultural Product</th>
<th>Leading States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cows</td>
<td></td>
</tr>
<tr>
<td>Market beef</td>
<td></td>
</tr>
<tr>
<td>Dairy cows/products</td>
<td></td>
</tr>
<tr>
<td>Market pigs</td>
<td></td>
</tr>
<tr>
<td>Sheep and lambs</td>
<td></td>
</tr>
<tr>
<td>Egg production (layers)</td>
<td></td>
</tr>
<tr>
<td>Chickens (broilers)</td>
<td></td>
</tr>
<tr>
<td>Turkeys</td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td></td>
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<tr>
<td>Wheat</td>
<td></td>
</tr>
<tr>
<td>Soybeans</td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td></td>
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<tr>
<td>Peanuts</td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td></td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td></td>
</tr>
<tr>
<td>Green peas</td>
<td></td>
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<tr>
<td>Lettuce</td>
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<td>Sweet corn</td>
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<td>Grapefruit</td>
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<tr>
<td>Pears</td>
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<td>Peaches</td>
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<tr>
<td>Pecans</td>
<td></td>
</tr>
<tr>
<td>Strawberries</td>
<td></td>
</tr>
</tbody>
</table>
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.


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 - 2nd
2) Beef cows - 2nd
3) Grain sorghum - 4th
4) Hay (all types) - 4th
5) Turkeys raised - 5th
6) Concord grapes - 6th
7) Rice - 6th
8) Soybeans - 6th
9) Hogs and pigs - 7th
10) Cheese - 9th
11) Watermelons - 9th
12) Broilers - 10th
13) Corn - 10th
14) Winter wheat - 11th
15) Cotton - 12th
16) Ice cream - 12th
17) Tobacco - 12th
18) Eggs - 14th
19) Milk - 15th

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.

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

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

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

Source: Missouri Farm Facts 1999
# How Has Missouri Agriculture Changed?

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

Source: Missouri Farm Facts 1999
1997 Cash Receipts

1997 Cash Receipts, Crops
By Counties

Top Ten Counties

STODDARD ........... $117,302,000
DUNKLIN ............ $108,634,000
NEW MADRID ........ $106,100,000
PEMISCOT ........... $85,273,000
MISSISSIPPI ......... $79,165,000
SALINE ................. $68,392,000
SCOTT ................. $59,543,000
LAFAYETTE ............ $57,833,000
ATCHISON ............. $55,759,000
BUTLER ................. $54,776,000

These top ten counties represent 34% of the State's total cash receipts for crops.

$35,000,000 and Above
$20,000,000 - $34,999,000
$10,000,000 - $19,999,000
Under $10,000,000

1997 Cash Receipts, Livestock
By Counties

Top Ten Counties

SULLIVAN ............ $176,258,000
McDONALD ........... $153,519,000
BARRY ................. $147,844,000
NEWTON .............. $117,404,000
LAWRENCE .......... $112,358,000
MORGAN ............... $85,579,000
PETTIS ................. $74,746,000
MILLER ................. $73,522,000
VERNON ............... $60,124,000
LAFAYETTE ........... $50,258,000

These top ten counties represent 34% of the State's total cash receipts for livestock.

$35,000,000 and Above
$20,000,000 - $34,999,000
$10,000,000 - $19,999,000
Under $10,000,000

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.

<table>
<thead>
<tr>
<th>Words</th>
<th>Words</th>
<th>Words</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>Pig</td>
<td>Lawn</td>
<td>DNA</td>
</tr>
<tr>
<td>Tractor</td>
<td>Cow</td>
<td>Flower</td>
<td>Cloning</td>
</tr>
<tr>
<td>Planter</td>
<td>Lamb</td>
<td>Greenhouse</td>
<td>Laboratory</td>
</tr>
<tr>
<td>Soil</td>
<td>Steak</td>
<td>Tree</td>
<td>Scientist</td>
</tr>
<tr>
<td>Weeds</td>
<td>Feed</td>
<td>Vegetable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concept</th>
<th>Concept</th>
<th>Concept</th>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomy</td>
<td>Livestock or Animals</td>
<td>Horticulture</td>
<td>Biotechnology</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
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<tr>
<td>Soybeans</td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td></td>
</tr>
<tr>
<td>Dairy cattle</td>
<td></td>
</tr>
<tr>
<td>Hogs and pigs</td>
<td></td>
</tr>
<tr>
<td>Beef cows</td>
<td></td>
</tr>
<tr>
<td>Sheep and lambs</td>
<td></td>
</tr>
<tr>
<td>Grain sorghum</td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td></td>
</tr>
</tbody>
</table>
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
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 timeline 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 I - INTRODUCTION TO AGRICULTURE

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.
   a. Central region
   b. Northwest region
   c. Northeast region
   d. Ozarks

16. One of the ways Missouri agriculture has changed is that the _______________________.
   a. Medium-size farms have increased
   b. Average age of producers has decreased
   c. Number of producers under the age of 35 has decreased
   d. Hiring in agribusinesses has declined

17. Which of the following choices is not a recent change in agriculture?
   a. Computer technology
   b. Embryo transfer
   c. Genetically-modified crops
   d. Commercial fertilizer

18. One of the predicted changes for agriculture is _______________________.
   a. Increased crop yields
   b. Machinery and animals will become obsolete
   c. Biotechnology will decrease production
   d. Precision farming will be phased out

19. Which of the following statements is not one of the implications of agricultural change?
   a. Crop yields will increase using the same amount of land.
   b. Global trade will become increasingly important.
   c. The United States will isolate itself from the world market.
   d. New career opportunities will be created.

20. 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
24. _____ Agricultural Journalist
25. _____ Agricultural Loan Officer (Banker)
26. _____ Beekeeper
27. _____ Farm Broadcaster
28. _____ Federal Meat Inspector
29. _____ Floral Designer
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.


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.

4. 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.

5. 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

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

## Major Areas of Floriculture Production by Commercial Growers

<table>
<thead>
<tr>
<th>Item</th>
<th>Wholesale Value (Millions of Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedding plants (flats) &amp; baskets</td>
<td>21</td>
</tr>
<tr>
<td>Indoor/patio plants</td>
<td>11</td>
</tr>
<tr>
<td>Cut flowers</td>
<td>.6</td>
</tr>
</tbody>
</table>

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.

- ____ Arborvitae
- ____ Ash, White
- ____ Barberry
- ____ Birch
- ____ Dogwood
- ____ Flowering Crabapple
- ____ Ginkgo
- ____ Honey Locust
- ____ Juniper
- ____ Linden
- ____ Maple
- ____ Oak
- ____ Pine
- ____ Spruce
- ____ Winged Euonymus
- ____ Yew

*Suggested publication: Effective Landscaping, Missouri Landscape and Nursery Association, 23750 State Route V, Clarksdale, MO 64430, 816-233-1481
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
   a. 
   b. 
2. Floral Designer
   a. 
   b. 
3. Landscape Designer or Landscape Artist
   a. 
   b. 
4. Greenhouse
   a. 
   b. 
5. Golf Course
   a. 
   b. 
6. Lawn Management
   a. 
   b. 
7. Tree Specialist or Arborist
   a. 
   b. 
8. Seed Store
   a. 
   b. 
9. Agronomist/Research
   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**

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 TM 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.


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

Flower

Leaves

Stem

Roots
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

Divisions

Layering

Budding

Tissue Culture
Methods of Taking Cuttings

Stem Cutting

Leaf and Bud Cutting

Root Cutting
Parts of a Complete Flower

- Petals
- Stigma
- Style
- Ovary
- Pistil - female part
- Stamen - male part
- Anther
- Filament
- Sepal
Can You Name an Annual or Perennial?

<table>
<thead>
<tr>
<th>Annual Vegetables:</th>
<th>Perennial Vegetable:</th>
<th>Perennial Fruit:</th>
<th>Perennial Flowers:</th>
<th>Perennial All trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumber</td>
<td>Asparagus</td>
<td>Strawberry</td>
<td>Chrysanthemum</td>
<td>Peony</td>
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<tr>
<td>Lettuce</td>
<td></td>
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<td>Hibiscus</td>
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<tr>
<td>Peas</td>
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<tr>
<td>Radish</td>
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<tr>
<td>Snap bean</td>
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<tr>
<td>Sweet corn</td>
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<td>Flowers:</td>
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<tr>
<td>Petunia</td>
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<tr>
<td>Geranium</td>
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<tr>
<td>Impatiens</td>
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<tr>
<td>Marigold</td>
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</tbody>
</table>

Monocot or Dicot?

MONOCOT (e.g. Corn)
- One cotyledon
- Leaves with parallel veins
- Fibrous root system

DICOT (e.g. Bean)
- Two cotyledons
- Leaves with network of veins
- Taproot system
Stages in Germination and Emergence of a Monocot

New Leaf
Leaves
Permanent Root System
Epicotyl
Radicle
First Internode
Temporary Root System
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.

![Flower Diagram]

Functions:

A. 

D. 

E. 

I. 
Effect of Light on Photosynthesis

Objective: Students will be able to describe the effect of light on photosynthesis.

Materials and Equipment:
- Two 2-liter empty soda bottles
- Knife or scissors
- Potting soil
- Two plants of equal size (tomatoes, cabbage, geranium, etc.)
- Water
- Black plastic bag with tie

Procedure:
1. Rinse out the soda bottles and allow them to dry.
2. Use the knife or scissors to cut off the top one-third of the bottle.
3. Put 2 inches of soil in the bottom of each soda bottle.
4. Carefully transplant one plant into each container.
5. Moisten the soil and replace the tops of the soda bottles.
6. Place one container in a window to receive good light.
7. Place the other container in a black plastic bag. Tie it securely so that it will not receive light.
8. Allow plants to grow for 2 weeks, being sure to water the plant when the soil is dry to the touch.
9. Examine the plants.

Key Questions:
1. Did the plants grow the same amount?
2. How did light or the lack of light affect photosynthesis?
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.
1. **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

- 45% Mineral Matter (sand, silt, clay)
- 25% Water
- 25% Air
- 5% Organic Matter
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**
- \( \frac{1}{4} \)” diameter or less pieces of fir, pine, or cedar bark
- Source of organic matter
Aquarium Hydroponic System

Plants in jiffy-peat pellets

Styrofoam

Aquarium pump for aeration

Cover sides of aquarium to help prevent algae growth

Nutrient solution
Examining Soil

Objective: Students will identify characteristics of soil.

Materials and Equipment:
Soil provided by instructor

Procedure:
1. Examine the soil and list as many items as possible that can be found in the soil. Provide a sample that represents each one.

2. List items that might be found in other soil, but not present in the soil provided by your instructor.

3. What are items in soil that cannot be seen?
UNIT II- PLANT SCIENCE

Lesson 3: The Growing Medium

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.

<table>
<thead>
<tr>
<th>SOIL</th>
<th>AMOUNT OF WATER COLLECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After 1 min.</td>
</tr>
<tr>
<td>Sand</td>
<td></td>
</tr>
<tr>
<td>Loam</td>
<td></td>
</tr>
<tr>
<td>Clay</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>WEIGHT OR PARTS</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>

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 drop in some species 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 under watering. 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?

"Faidley-Instant"
LIQUID PLANT FOOD
10 - 15 - 10

not for use with succulents,
on food products,
or other types of edible plants

Great for African Violets,
petite Rose bushes and other
small indoor plants

156
8ml
3.5 oz.

INDOOR SIZE

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.)


University Extension Bulletins: University of Missouri-Columbia.

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Light Needs</th>
<th>Water Needs</th>
<th>Fertilizer Needs</th>
<th>Type ofGrowing Medium</th>
<th>Common Pests</th>
<th>Other Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston Fern</td>
<td>partial sun</td>
<td>keep moist</td>
<td>feed lightly every 4 months</td>
<td>1-peat 2-sand 1-soil</td>
<td>mealy bugs</td>
<td>50-70°F temperature, mist often</td>
</tr>
</tbody>
</table>
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*).


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) Pharmaceutical - 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 sh
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. Farmaceuticals
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

<table>
<thead>
<tr>
<th>4 ½ Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>90-ACRE FIELD</td>
</tr>
</tbody>
</table>

TM 5.1
One Acre Is About the Size of a Football Field

Approx. 1 acre

300 feet

160 feet
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.

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

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.
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.
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral or Unsure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

2. Genetically modified foods sold in a grocery store should carry a label that states they are genetically modified.
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral or Unsure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

3. As foods are processed, it may be impossible to keep genetically modified foods separate from nongenetically modified foods.
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral or Unsure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

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?
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral or Unsure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

5. I feel that all genetically modified plants should be banned from agriculture.
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral or Unsure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

6. I feel that accidents in the environment may result from growing genetically modified plants.
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral or Unsure</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>
7. Genetically modifying plants is ethically wrong.

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

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

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

9. Biotechnology will improve the profits of producers.

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

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

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

Additional comments on biotechnology: 

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
UNIT II - PLANT SCIENCE

Name _______________________
Date _______________________

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 ____________________________.
   a. Growing plants in soil without water
   b. Growing plants in water (nutrient solution)
   c. Raising fish
   d. A new propagation method

17. Which item below is not important for plant growth?
   a. wind
   b. humidity
   c. light
   d. gases

18. N-P-K are ____________________________.
   a. Herbicides
   b. Micronutrients
   c. Primary macronutrients
   d. Pesticides

19. A key watering principle for indoor plants is ____________________________.
   a. Water once per month
   b. Water the same amount each time
   c. Water thoroughly at each watering
   d. Prune when watering

20. Outdoor plants usually require ____________________________.
   a. shade
   b. regular watering during dry periods
   c. full sun
   d. daily pruning

21. GPS was developed by ____________________________.
   a. The Extension Service
   b. The U.S. Department of Defense
   c. The U.S. Department of Agriculture
   d. The U.S. Aviation Association

22. GPS uses ____________________________ to determine exact locations.
   a. 24 satellites orbiting the earth
   b. The Internet
   c. Four laser beam systems
   d. 80 acres as subfields

23. An example of a GMO is ____________________________.
   a. Nitrogen fertilizer
   b. Fish grown through aquaculture
   c. Round-down wheat
   d. 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.

a) Food  
b) Clothing  
c) By-products  
d) Medicine/medical research  
e) Recreation/companionship  
f) 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.

a) Beef cattle  
b) Dairy cattle  
c) Sheep  
d) Swine  
e) Poultry  
f) 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.
<table>
<thead>
<tr>
<th>Animal</th>
<th>Use</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>Food</td>
<td>Beef</td>
</tr>
<tr>
<td>Dairy</td>
<td>Food</td>
<td>Milk, cheese</td>
</tr>
<tr>
<td>Swine</td>
<td>Food</td>
<td>Pork</td>
</tr>
<tr>
<td>Sheep</td>
<td>Product</td>
<td>Wool</td>
</tr>
<tr>
<td>Poultry</td>
<td>Food</td>
<td>Eggs, chicken, turkey</td>
</tr>
<tr>
<td>Goats</td>
<td>Food</td>
<td>Goat milk, goat cheese</td>
</tr>
<tr>
<td>Bison</td>
<td>Food</td>
<td>Bison meat</td>
</tr>
<tr>
<td>Ostrich</td>
<td>Food</td>
<td>Ostrich meat</td>
</tr>
<tr>
<td>Fish</td>
<td>Food</td>
<td>Fish meat, fish oils</td>
</tr>
<tr>
<td>Bees</td>
<td>Product</td>
<td>Beeswax, honey</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Livestock in Missouri (1999 Value)</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Cattle and Calves</td>
<td>$2,420,000,000</td>
</tr>
<tr>
<td>All Hogs and Pigs</td>
<td>$158,400,000</td>
</tr>
<tr>
<td>All Sheep and Lambs</td>
<td>$7,650,000</td>
</tr>
</tbody>
</table>

Source: 1999 Missouri Farm Facts, Missouri Agricultural Statistics Service
## Animal Terminology

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CATTLE</th>
<th>SHEEP</th>
<th>SWINE</th>
<th>CHICKEN</th>
<th>TURKEY</th>
<th>HORSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature male</td>
<td>Bull</td>
<td>Ram</td>
<td>Boar</td>
<td>Rooster</td>
<td>Tom</td>
<td>Stallion</td>
</tr>
<tr>
<td>Mature female</td>
<td>Cow</td>
<td>Ewe</td>
<td>Sow</td>
<td>Hen</td>
<td>Hen</td>
<td>Mare</td>
</tr>
<tr>
<td>Young male</td>
<td>Bull</td>
<td>Ram Lamb</td>
<td>Shoat</td>
<td>Cockerel</td>
<td>Poul</td>
<td>Colt</td>
</tr>
<tr>
<td>Young female</td>
<td>Heifer</td>
<td>Ewe Lamb</td>
<td>Gilt</td>
<td>Pullet</td>
<td>Hen Poult</td>
<td>Filly</td>
</tr>
<tr>
<td>Castrated male</td>
<td>Steer</td>
<td>Wether</td>
<td>Barrow</td>
<td>Capon</td>
<td>Capon</td>
<td>Gelding</td>
</tr>
<tr>
<td>Group</td>
<td>Herd</td>
<td>Flock</td>
<td>Herd</td>
<td>Flock</td>
<td>Flock</td>
<td>Herd</td>
</tr>
<tr>
<td>Young Animal</td>
<td>Calf</td>
<td>Lamb</td>
<td>Pig</td>
<td>Chick</td>
<td>Poult</td>
<td>Foal</td>
</tr>
</tbody>
</table>
UNIT III - ANIMALS IN SOCIETY

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.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Use</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Swine</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
<td>Product</td>
</tr>
<tr>
<td>Poultry</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Goats</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Bison</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Ostrich</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>Bees</td>
<td></td>
<td>Product</td>
</tr>
</tbody>
</table>
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 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.

<table>
<thead>
<tr>
<th>FOOD</th>
<th>SHELTER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEALTH CARE</th>
<th>KNOWLEDGE OF PURCHASE AND MAINTENANCE NEEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Day</th>
<th>FOOD</th>
<th>WATER</th>
<th>EXERCISE &amp; PLAY</th>
<th>CLEANING, BRUSHING, BATHING, OR CLEANING PEN</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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:

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

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?
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__________

<table>
<thead>
<tr>
<th>START-UP COSTS ($)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase price</td>
<td></td>
</tr>
<tr>
<td>Registration</td>
<td></td>
</tr>
<tr>
<td>Neutering</td>
<td></td>
</tr>
<tr>
<td>Vaccinations</td>
<td></td>
</tr>
<tr>
<td>House/shelter</td>
<td></td>
</tr>
<tr>
<td>Lot/pasture</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td>Toys/leash</td>
<td></td>
</tr>
<tr>
<td>Bath supplies</td>
<td></td>
</tr>
<tr>
<td>1 bag of food</td>
<td></td>
</tr>
<tr>
<td>Vitamins</td>
<td></td>
</tr>
<tr>
<td>Dishes</td>
<td></td>
</tr>
<tr>
<td>Fencing</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
</tr>
</tbody>
</table>

Ongoing Expenses:

Bag food $____ x ____ bags/month x 12 months/year = A.__________

Supplements $____ x ____/month x 12 months/year = B.__________

Registration Fees or Annual Dues C.__________

Yearly Vaccination/ Veterinarian Fees D.__________

Monthly Cleaning $____ x 12 months/year = E._______

Monthly lot rent $____ x 12 months/year = F._______

Other H._______

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.

<table>
<thead>
<tr>
<th>Source</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Shelter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breeders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet Stores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper Ads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Livestock Concerns

Objective: Students will select livestock to raise, explain why this animal was chosen, and describe what the animal will need.

Directions: Assume that you have a choice between raising beef cattle, dairy cattle, goats, poultry, swine, bison, bees, or ostriches. Research the following questions and write your answers in the space provided.

Key Questions:

1. Which animal would you like to raise? Why?

2. What kind of equipment/food is needed to care for the animal?

3. How much space will be needed to raise the animal?

4. For what purpose will you raise the animal?

5. Considering where you live and your personal resources, can you realistically care for this animal? Why or why not?

6. Select three different types of animals and compare their needs and your ability to care for them.
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
Alternative Reproduction Technologies

Objective: Students will investigate an alternative reproduction technology.

Directions: Choose an alternative reproduction technology – artificial insemination, cloning, embryo transfer, or genetic engineering. Research the technology and answer the following questions.

Technology________________

1. What are the advantages of this technology?

2. What are the disadvantages of this technology?

3. How has this technology advanced agriculture?

4. How has this technology helped consumers?
UNIT III - ANIMALS IN SOCIETY

Name ________________________

Date ________________________

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

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

1. Algae
2. Water Insects
3. Minnows
4. Hawk

Food energy flow
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.

   Tree
   Leaves

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.

   Tree
   Leaves
   Raking
   Part-time job

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.

   ![Food Web Diagram]

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**


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

#### Nutrition Facts

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>1 cup (30g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servings Per Container</td>
<td>about 14</td>
</tr>
<tr>
<td>Cereal with 1/2 cup Vitamins A &amp; D Skim Milk</td>
<td></td>
</tr>
<tr>
<td>Amount Per Serving</td>
<td>Cereal</td>
</tr>
<tr>
<td>Calories</td>
<td>110</td>
</tr>
<tr>
<td>Calories from Fat</td>
<td>0</td>
</tr>
<tr>
<td>Total Fat</td>
<td>0g*</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>0g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>120mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>35mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>26g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>2g</td>
</tr>
<tr>
<td>Sugars</td>
<td>15g</td>
</tr>
<tr>
<td>Other Carbohydrate</td>
<td>9g</td>
</tr>
<tr>
<td>Protein</td>
<td>2g</td>
</tr>
</tbody>
</table>

#### Percent Daily Values

- Vitamin A: 25% 30%
- Vitamin C: 25% 25%
- Calcium: 0% 15%
- Iron: 25% 25%
- Vitamin D: 10% 25%
- Thiamin: 25% 30%
- Riboflavin: 25% 35%
- Niacin: 25% 25%
- Vitamin B6: 25% 25%
- Folate: 25% 25%
- Phosphorus: 2% 15%
- Magnesium: 2% 6%
- Zinc: 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
- Total Fat: Less than 65g 80g
- Saturated Fat: Less than 20g 25g
- Cholesterol: Less than 300mg 300mg
- Sodium: Less than 2,400mg 2,400mg
- Potassium: Less than 3,500mg 3,500mg
- Total Carbohydrate: 300g 375g
- Dietary Fiber: 25g 30g

#### 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, NIACIN AMIDE, REDUCED IRON, CALCIUM PANTOTHENATE, BHT (A PRESERVATIVE), VITAMIN A PALMATE, THIAMIN MONONITRATE (VITAMIN B1), PYRIDOXINE HYDROCHLORIDE (VITAMIN B6), RIBOFLAVIN (VITAMIN B2), FOLIC ACID, VITAMIN B12, AND VITAMIN D.
UNIT IV - PRODUCTS FROM AGRICULTURE

Lesson 2: Food Products from Plants

Name ________________

**Food Inventory**

**Objective:** Students will be able to identify food products made from grains, vegetables, fruits, and other plants.

**Directions:** Look on the kitchen shelves at home or at the grocery store. Identify 10 food products in each of the following categories.

<table>
<thead>
<tr>
<th>Grains</th>
<th>Vegetables</th>
<th>Fruits</th>
<th>Other Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
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. ____________________________

---

**Nutrition Facts**

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>1 oz (28g/about 10 chips)</th>
<th>Servings Per Container</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Per Serving</td>
<td>Calories 150</td>
<td>Calories from Fat 70</td>
<td>% Daily Value*</td>
</tr>
<tr>
<td>Total Fat 8g</td>
<td>12%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturated Fat 1.5g</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium 170mg</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate 18g</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber 1g</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugars 0g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein 2g</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Calories:</th>
<th>2,000</th>
<th>2,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>Less than 65g</td>
<td>60g</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>Less than 20g</td>
<td>25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2,400mg</td>
<td>2,400mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>300g</td>
<td>375g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>25g</td>
<td>90g</td>
</tr>
</tbody>
</table>

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.
**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.

<table>
<thead>
<tr>
<th>Name of Product</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving Size</td>
<td></td>
</tr>
<tr>
<td>Servings per Container</td>
<td></td>
</tr>
<tr>
<td>Calories per Serving</td>
<td></td>
</tr>
<tr>
<td>Calories from Fat</td>
<td></td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td></td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td></td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td></td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td></td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate (g)</td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber (g)</td>
<td></td>
</tr>
<tr>
<td>Sugars (g)</td>
<td></td>
</tr>
<tr>
<td>Protein (g)</td>
<td></td>
</tr>
<tr>
<td>Vitamin A (%)</td>
<td></td>
</tr>
<tr>
<td>Vitamin C (%)</td>
<td></td>
</tr>
<tr>
<td>Iron (%)</td>
<td></td>
</tr>
<tr>
<td>Calcium (%)</td>
<td></td>
</tr>
<tr>
<td>Wt. of Total Package</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td></td>
</tr>
<tr>
<td>Price/Serving (price ÷ servings per container)</td>
<td></td>
</tr>
</tbody>
</table>
Key Questions:

1. Based on a comparison of the two labels, which product is more nutritious to eat? Explain why.

2. Based on the nutritional information, price, and taste, which product do you recommend? Explain your answer.
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

<table>
<thead>
<tr>
<th>CUT OF MEAT</th>
<th>TYPE OF MEAT ANIMAL</th>
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<tr>
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<td>3. T-bone steak</td>
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<td>4. Lamb chops</td>
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<td>15. Ham slice</td>
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<td>20. Blade steak</td>
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</table>

## 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.
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

### 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_1/

1/ Boneless, trimmed equivalent.

Know Your Meat Label

Greiman Angus Meats
FOOD GIANT STORES
Columbia, Missouri

Species → BEEF RIB RIB STEAK
Wholesale cut → RIBEYE
"Sell by" date → SELL BY 06-04-00
Total price → TOTAL PRICE $4.76
Net weight → NET WT/CT 0.75 lb.
Unit price → UNIT PRICE $6.35
# Per Capita Consumption of Meat Products in the United States 1/

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<th>Pork</th>
<th>Lamb</th>
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<th>Chicken 4/ &amp; 5/</th>
<th>Turkey</th>
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**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.

Pork Chart

RETAIL CUTS OF PORK — WHERE THEY COME FROM AND HOW TO COOK THEM

BOSTON SHOULDER
- Blade Steak
- Boneless Blade Boston Roast
- Lard
- Fat Back

CLEAR PLATE
- Pork Cubes
- Cubed Steak
- Blade Chop
- Loin Chop
- Rib Chop
- Pork Cutlet

FAT BACK
- Ground Pork
- Arm Roast
- Smoked Arm Picnic
- Fresh Arm Picnic
- Pork Skin

LEG (FRESH OR SMOKED HAM)
- Sliced Cooked "Boiled" Ham
- Sliced Smoked Ham
- Center Smoked Ham Slice
- Smoked Ham, Shank Portion
- Smoked Ham, Rump (Butt) Portion
- Rump (Butt), Breast, Shank Portion

LOIN
- Roast
- Boneless Top Loin Roast
- Boneless Top Loin Roast (Doublet)
- Back Ribs
- Country-Style Ribs
- Cuban Ham

BONELESS BOSTON ROAST
- Roast
- Roast (Bake)

JOVEL
- Smoked Jowl
- Cook in Liquid, Broil, Panbraised, Pantry
- Pig's Feet
- Cook in Liquid, Broil

PICNIC SHOULDER
- Fresh Hock
- Smoked Hock
- Sausage
- Arm Steaks
- Link
- Roll
- Hock Bones

SPARERIBS
- Spareribs
- Pork Rib

BACON (SIDE PORK)
- Salt Pork
- Sliced Bacon

Source: Uniform Retail Meat Identity Standards, National Live Stock and Meat Board
IV-31

This chart approved by
National Live Stock and Meat Board
Lamb Chart

RETAIL CUTS OF LAMB — WHERE THEY COME FROM AND HOW TO COOK THEM

SHOULDER
1. Cubes for Kabobs
2. Boneless Bladed Chops (Sanctua)
3. Blade Chop
4. Boneless Shoulder
5. Arm Chop
6. Cushing Shoulder
7. Square Shoulder
8. Neck Slices

NECK
9. Rib Chops
10. Crown Roast
11. Rib Roast

RIB
12. Frenched Rib Chops
13. Loin Chops
14. Boneless Double Loin Chops
15. Boneless Rib Roast
16. Loin Roast

LOIN
17. Leg Chop (Skinless)
18. Combination Leg
19. Center Leg
20. Sirloin Chop
21. Sirloin Half of Leg
22. Boneless Sirloin Roast
23. Sirloin Roast
24. Sirloin of Leg

SIRLOIN
25. Rolled Leg
26. Shank Half of Leg
27. French-Style Leg
28. French-Style Leg, Sirloin Off

LEG
29. achievement Chop
30. Rolled Leg
31. Shank Half of Leg
32. French-Style Leg
33. French-Style Leg, Sirloin Off

FORE SHANK
34. Fore Shank
35. Breast
36. Rolled Breast
37. Stuffed Breast
38. Ribs
39. Boneless Ribs
40. Spereids
41. Stuffed Chops

BREAST
42. Breast, Cook in Liquid
43. Roast, Brine
44. (Large Pieces) Lamb for Stew
45. (Small Pieces)

HIND SHANK
46. Hind Shank
47. Hind Shank
48. Boneless Hind Shank
49. Stuffed Hind Shank

GROUND OR CUBED LAMB *
50. Ground Lamb
51. Lamb Patties
52. Cubed Steak

* Lamb for shoes or grinding may be made from any cut.
** Ribs or boneless cuts may be made from any inch half piece of boneless lamb.

This chart approved by National Live Stock and Meat Board

Source: Uniform Retail Meat Identity Standards, National Live Stock and Meat Board

IV-33
Meat Labels

**Greiman Meats**

Columbia, Missouri

### 1.06lb. $1.29
**N/Wt.** **Pkg.**
**GROUND BEEF**
**NOT LESS THAN 70% LEAN**

**TOTAL PRICE** 
$1.37

DEC 12

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 1.45lb. $3.69
**N/Wt.** **Pkg.**
**BONELESS & SKINLESS**
**CHICKEN BREAST**

**TOTAL PRICE** 
$5.35

DEC 16

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 3.30lb. $1.59
**N/Wt.** **Pkg.**
**GROUND BEEF**
**NOT LESS THAN 95% LEAN**

**TOTAL PRICE** 
$5.21

DEC 20

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 0.65lb. $6.49
**N/Wt.** **Pkg.**
**BEEF RIB RIB EYE STEAK**
**USDA CHOICE**

**TOTAL PRICE** 
$4.22

SEP 11

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 1.00lb. $1.79
**N/Wt.** **Pkg.**
**GROUND BEEF**
**NOT LESS THAN 85% LEAN**

**TOTAL PRICE** 
$1.79

DEC 12

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 4.19lb. $1.99
**N/Wt.** **Pkg.**
**BEEF CHUCK**
**T-BONE POT ROAST**
**USDA CHOICE**

**TOTAL PRICE** 
$7.92

DEC 14

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 1.16lb. $2.19
**N/Wt.** **Pkg.**
**GROUND BEEF**
**NOT LESS THAN 90% LEAN**

**TOTAL PRICE** 
$2.54

DEC 12

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 1.70lb. $1.49
**N/Wt.** **Pkg.**
**FRESH PORK LOIN**
**ASSORTED CHOPS**

**TOTAL PRICE** 
$2.53

DEC 14

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 0.59lb. $1.99
**N/Wt.** **Pkg.**
**BEEF CHUCK SHOULDER**
**BONELESS CHARCOAL STRIP**
**USDA CHOICE**

**TOTAL PRICE** 
$0.85

SEP 12

STORE NO. KEPT REFRIGERATED PURCHASE BY

### 0.39lb. $2.19
**N/Wt.** **Pkg.**
**FRESH PORK LOIN**
**SIRLOIN CHOPS BONELESS**

**TOTAL PRICE** 
$0.85

DEC 14

STORE NO. KEPT 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.

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</table>
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.

<table>
<thead>
<tr>
<th>CUT OF MEAT</th>
<th>TYPE OF MEAT ANIMAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEEF</td>
</tr>
<tr>
<td>1. Bacon</td>
<td></td>
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<tr>
<td>2. Sirloin steak</td>
<td></td>
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<tr>
<td>3. T-bone steak</td>
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<tr>
<td>4. Lamb chops</td>
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<tr>
<td>5. Filet mignon</td>
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<td>6. Loin chop</td>
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<td>7. Kabobs</td>
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<td>8. Flank steak</td>
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<tr>
<td>9. Rump roast</td>
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<td>10. Sausage</td>
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<tr>
<td>11. Rib steak</td>
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<tr>
<td>12. Fresh arm picnic</td>
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<tr>
<td>13. Tenderloin</td>
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<tr>
<td>14. Round steak</td>
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<tr>
<td>15. Ham slice</td>
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<tr>
<td>16. Loin roast</td>
<td></td>
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<tr>
<td>17. Shoulder steak</td>
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<tr>
<td>18. Leg of lamb</td>
<td></td>
</tr>
<tr>
<td>19. Short ribs</td>
<td></td>
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<tr>
<td>20. Blade steak</td>
<td></td>
</tr>
</tbody>
</table>
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**


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, wiener, 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 been washed, sorted, and destemmed before freezing. Wheat has to be cleaned, dried, weighed, and milled 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)
   b) Food and Drug Administration (FDA)
   c) U.S. Department of Agriculture (USDA)
   d) 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°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

Producer

↓

Harvesting

↓

Processing

↓

Distributing

↓

Wholesaling

↓

Retailing

↓

Consumer
Recommended Safe Cooking Temperatures

F

180° Whole Poultry
170° Poultry Parts (leg, thigh, breasts)
165° Beef Roasts & Steaks (well done)
160° Ground Poultry - Reheat Leftovers

Ground Meat (beef, pork, lamb)
Pork
Beef Roasts & Steaks (medium rare)

145° Beef & Lamb Roasts and Steaks
140° (medium rare)

Danger Zone - Bacteria grow most rapidly in this temperature range

40° Refrigerator Temperature

0° Freezer Temperature

Reference - The Partnership for Food Safety Education
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.
Lesson 4: Food Processing and Food Safety

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!

<table>
<thead>
<tr>
<th>Popcorn</th>
<th>Did the sample pop?</th>
<th>Why or why not?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #1</td>
<td></td>
<td></td>
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<tr>
<td>Sample #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample #3</td>
<td></td>
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</tbody>
</table>

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°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.
Ice Cream Processing

Objective: Students will process ice cream.

Materials and Equipment (group of four):  
- 1 cup 2% milk
- 1 cup whipping cream or half and half
- ¼ cup sugar (4 tablespoons)
- ½ teaspoon vanilla
- 1 cup rock salt
- 1-quart freezer bag
- 1-gallon freezer bag
- Measuring spoon and measuring cup
- Duct tape
- Four 8-oz. sundae cups
- Four spoons

Class Materials:  
- Ice supply
- Various toppings for ice cream
- Towels, hot/cold mitts or old gloves
- Scissors

Procedure:

1. Each group adds 1 cup of milk, 1 cup of whipping cream or Half and Half, ¼ cup of sugar (4 tablespoons), and ½ teaspoon vanilla to a quart freezer bag. Use duct tape to seal the open end of the bag, keeping some air in the bag.

2. Place the quart freezer bag inside a 1-gallon freezer bag. Pack ice around the quart bag and add 1 cup of rock salt and ¾ cup of water. The gallon bag should then be tightly sealed using the duct tape.

3. Students should take turns shaking the bag until the ice cream is frozen, which usually takes 10-15 minutes. Towels, hot/cold mitts, or old gloves can be used to protect your hands from the cold.

4. Carefully cut open the gallon freezer bag and discard the ice and rock salt. Rinse the quart bag containing the ice cream. Cut a corner of the bag with clean scissors and squeeze out the ice cream.

5. Eat the ice cream plain or add your favorite toppings.

Key Questions:

1. Why is rock salt added to the ice?

2. How does the amount of milk fat affect ice cream?
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 dying. 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 woven 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.


G. **Conclusion**

Many fiber materials are processed from agricultural products. Cotton and wool are produced in the United States to illustrate the process of making 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

Step 1
Shearing
A skillful shearer can clip a sheep in about 5 minutes and keep the wool in one piece, called the fleece.

Step 2
Scouring
The fleece is washed to remove dirt, grease (unrefined lanolin), and other impurities.

Step 3
Carding
The clean wool passes through a system of wire rollers to straighten the fibers.

Step 4
Spinning
Wool is spun into yarn, making it suitable for weaving and knitting.

Step 5
Knitting or Weaving
By interlacing two or more sets of yarn, knitted or woven fabrics are produced.

Step 6
Finishing
The fabric undergoes a controlled shrinkage process. In addition, a chemical finish may be applied to the wool that will allow it to be machine washed and dried.
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.

<table>
<thead>
<tr>
<th>Name of Clothing Item</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
UNIT IV - PRODUCTS FROM AGRICULTURE

Lesson 5: Fiber Products from Agriculture

Name __________________

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://ipm.ces.ncsu.edu/cottonpickin>

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 **AS 6.1**, which students create biodegradable plastics, 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
   - Nuclear
   Using 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

<table>
<thead>
<tr>
<th>Category</th>
<th>Nonfood Products from Cattle</th>
<th>Nonfood Products from Hogs</th>
</tr>
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<tbody>
<tr>
<td>Pharmaceuticals/Health Care</td>
<td>Blood factor Collagen Heparin Insulin Thrombin</td>
<td>Heart valves Insulin Skin</td>
</tr>
<tr>
<td>Category</td>
<td>Nonfood Products from Cattle</td>
<td>Nonfood Products from Hogs</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Household Products</td>
<td>Candles, Ceramics, Deodorants, Detergents, Floor wax, Insulation</td>
<td>Linoleum, Mouthwash, Paints, Plastic, Soups, Toothpaste</td>
</tr>
<tr>
<td>Textiles/Clothing</td>
<td>Shoes, Boots, Belts, Wallets, Gloves, Luggage</td>
<td>Fabric dye</td>
</tr>
<tr>
<td>Travel</td>
<td>Antifreeze, Asphalt, Lubricants, Tires</td>
<td>Antifreeze, Tires</td>
</tr>
</tbody>
</table>

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

Animal Feed (54%)
Feed for cattle, sheep, poultry, pigs, etc. continues to be the largest segment of corn usage.

Exports (15%)
The U.S. provides about 80% of the world's corn supply and is the largest exporter.

Ending Inventory (13%)
A supply at the end of the year is needed to cushion poor crop years.

Sweeteners (8%)
Corn syrup is found in many products such as soda and candy.

Alcohol (5%)
Ethanol from corn is utilized as a source of fuel for vehicles.

Food (3%)
Corn is processed to make food for human consumption.

Starch (2%)
Starch is processed from corn and is used to manufacture many products.

Seed Corn (1/2%)
Hybrid seed corn is planted by producers to make all of the above uses possible.
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.
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 come 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>

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</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNIT IV - PRODUCTS FROM AGRICULTURE

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?
   a. Pecans
   b. Chocolate
   c. Maple syrup
   d. Coffee

8. What is the term used for the meat from young cattle?
   a. Hamburger
   b. Beef
   c. Veal
   d. Porterhouse

9. Which of the following products are from dairy animals?
   a. Milk, ice cream, yogurt
   b. Veal, processed patties, lard
   c. Butter, milk, eggs
   d. Cheese, luncheon meat, dextrose

10. All of the following products are obtained from hogs except ____________________________.
    a. Pork chops
    b. Hamburger
    c. Ham
    d. Bacon

11. Which of the following is a freshwater fish?
    a. Shrimp
    b. Scallops
    c. Lobster
    d. Catfish

12. Who cleans, separates, handles, and prepares food for the distributor?
    a. Harvester
    b. Wholesaler
    c. Processor
    d. Producer

13. Which of the following is not a reason for processing foods?
    a. To improve taste
    b. To decrease additives
    c. To prevent spoilage
    d. For the convenience of consumers

14. Which of the following describes the pasteurization process?
    a. Heating a dairy product to kill bacteria
    b. Cooling a dairy product to kill bacteria
    c. Removing the moisture content to kill bacteria
    d. Removing fat from a dairy product to kill bacteria
15. Reducing the size of fat particles is a food process called ________________________.
   a. Fermentation
   b. Homogenization
   c. Emulsification
   d. Extrusion

16. Forcing a food component through an opening under high pressure is a food process called ________________________.
   a. Fermentation
   b. Homogenization
   c. Emulsification
   d. Extrusion

17. Where can consumers purchase food products directly from producers?
   a. Farmers' market
   b. Grocery store
   c. Wholesaler
   d. Food warehouse

18. To safely store food in a refrigerator, the temperature should be maintained at _____°F or lower.
   a. 5
   b. 20
   c. 40
   d. 47

19. Which of the following fibers is manufactured from cellulose from tree fibers?
   a. Cotton
   b. Flax
   c. Rayon
   d. Mohair

20. Which of the following fibers can be used to make rope?
   a. Hemp
   b. Acetate
   c. Flax
   d. Angora

21. Which of the following fibers is produced by a worm?
   a. Wool
   b. Silk
   c. Angora
   d. 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) 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?


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?
Lesson 1: Conservation of Natural Resources

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.

<table>
<thead>
<tr>
<th>Day</th>
<th>Jar #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
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<td>5</td>
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<tr>
<td>6</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Record your microscope observations in the chart below.

<table>
<thead>
<tr>
<th>Jar #</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**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
**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.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHAT WE DO</td>
<td>HOW MUCH WATER IS USED</td>
<td>HOW OFTEN</td>
<td>DAILY WATER USE</td>
</tr>
<tr>
<td>Flushing a toilet</td>
<td>5-7 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking a bath with a tub full</td>
<td>30 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking a shower with water running</td>
<td>20 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaving with water running</td>
<td>15 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brushing teeth with water running</td>
<td>5 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing hands or face with water running</td>
<td>2 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking - running water to cool</td>
<td>1 gallon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning vegetables with water running</td>
<td>3 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dishwasher on full cycle</td>
<td>16 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wash dishes by hand with water running</td>
<td>30 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing clothes on full cycle at top water level</td>
<td>60 gallons</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Water Use** *(add the numbers in Column D)*

**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.
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
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.

**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

<table>
<thead>
<tr>
<th>Economic Impact</th>
<th>Anglers</th>
<th>Hunters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Residents (millions)</td>
<td>Nonresidents (millions)</td>
</tr>
<tr>
<td>Expenditures</td>
<td>$594.1</td>
<td>$208.9</td>
</tr>
<tr>
<td>Total business-generated revenue</td>
<td>$1,166.8</td>
<td>$410.3</td>
</tr>
<tr>
<td>Earnings generated from expenditures</td>
<td>$572.8</td>
<td>$201.4</td>
</tr>
<tr>
<td>State sales tax generated</td>
<td>$25.1</td>
<td>$8.8</td>
</tr>
<tr>
<td>State income tax generated</td>
<td>$13.3</td>
<td>$4.7</td>
</tr>
<tr>
<td>Jobs supported</td>
<td>15,340</td>
<td>5,390</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic Impact</th>
<th>Wildlife Watchers</th>
<th>Total</th>
<th>Grand Total All Spenders (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Residents (millions)</td>
<td>Nonresidents (millions)</td>
<td>Residents (millions)</td>
</tr>
<tr>
<td>Expenditures</td>
<td>$410.6</td>
<td>$97.3</td>
<td>$1,526.0</td>
</tr>
<tr>
<td>Total business-generated revenue</td>
<td>$806.5</td>
<td>$191.2</td>
<td>$2,997.1</td>
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<tr>
<td>Earnings generated from expenditures</td>
<td>$395.9</td>
<td>$93.8</td>
<td>$1,471.3</td>
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<tr>
<td>State sales tax generated</td>
<td>$17.3</td>
<td>$4.1</td>
<td>$64.4</td>
</tr>
<tr>
<td>State income tax generated</td>
<td>$9.2</td>
<td>$2.2</td>
<td>$34.1</td>
</tr>
<tr>
<td>Jobs supported</td>
<td>10,600</td>
<td>2,510</td>
<td>39,400</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Past Problems</th>
<th>Current Developments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposing of Wastes</td>
<td>No controls were placed on disposal of pesticide containers.</td>
<td></td>
</tr>
<tr>
<td>Maintaining Soil Productivity</td>
<td>Soil erosion was drastic due to improper tillage procedures.</td>
<td></td>
</tr>
<tr>
<td>Controlling Air Pollution</td>
<td>No controls were placed on vehicle emissions, and air was becoming polluted.</td>
<td></td>
</tr>
</tbody>
</table>
UNIT V - NATURAL RESOURCES AND CONSERVATION

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 Service
    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.
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.

<table>
<thead>
<tr>
<th>Positive Leadership Situations</th>
<th>New Positive Leadership Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
<td>5.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negative Leadership Situations</th>
<th>Good Leadership in the Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
<td>5.</td>
</tr>
</tbody>
</table>
Lesson 1: Developing Leadership Skills

Researcuhing a Leader

Objective: Students will identify personal qualities necessary for good leaders.

Directions: Identify a person in your school or community whom you consider to be a great leader. Follow the guidelines below.

1. Write a short biographical sketch of your leader.

2. Identify ways in which this person leads others.

3. Identify qualities that make this person a good leader.
Lesson 1: Developing Leadership Skills

Setting Goals

Objective: Students will identify short-, intermediate, and long-term goals.

Directions: Complete the questions below.

1. List three short-term goals you would like to achieve. (These are goals you could achieve this school year.)

2. List three intermediate goals for yourself. (These goals could be completed within the next 3 years.)

3. List three long-term goals. (Long-term goals could be completed 5-10 years from now.)
**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.

<table>
<thead>
<tr>
<th>√</th>
<th>CATEGORY</th>
<th>NEEDS SIGNIFICANT IMPROVEMENT</th>
<th>NEEDS SOME IMPROVEMENT</th>
<th>PRETTY GOOD</th>
<th>EXCELLENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Formal stand-up speech</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lead meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participate in meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speak on the telephone</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Give demonstrations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Act in a play</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motivate a sports team</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Raise funds for an organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Give a report in class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speak in a small group activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNIT VI - LEADERSHIP AND PERSONAL DEVELOPMENT

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.

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:

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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 ÷ 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 ÷ 6 = 12 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
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!

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Lesson 2: Importance of Financial Records

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? $__________
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 VI - LEADERSHIP AND PERSONAL DEVELOPMENT

Name__________________________

Date__________________________

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.
3. Transparency Masters
   - TM 1.1 Reading an Electric Meter
   - TM 1.2 Fuses and Circuit Breakers
4. 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> 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

SINGLE PHASE WATT HOUR METER

KILOWATT HOURS
15 AMPERES  120 VOLTS
60 CYCLES

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
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.

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>READING</th>
<th>kWh USED DAILY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Day 3</td>
<td></td>
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<td></td>
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<tr>
<td>Day 4</td>
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<td></td>
<td></td>
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<tr>
<td>Day 5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Day 6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Day 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEKLY TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 8</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Day 9</td>
<td></td>
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<td></td>
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<tr>
<td>Day 10</td>
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<td></td>
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<tr>
<td>Day 11</td>
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<td></td>
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<tr>
<td>Day 12</td>
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<td></td>
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<tr>
<td>Day 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEKLY TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**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

<table>
<thead>
<tr>
<th>a.</th>
<th>1/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>b.</td>
<td>1/8  (2/16)</td>
</tr>
<tr>
<td>c.</td>
<td>3/16</td>
</tr>
<tr>
<td>d.</td>
<td>¼ (4/16)</td>
</tr>
<tr>
<td>e.</td>
<td>5/16</td>
</tr>
<tr>
<td>f.</td>
<td>3/8  (6/16)</td>
</tr>
<tr>
<td>g.</td>
<td>7/16</td>
</tr>
<tr>
<td>h.</td>
<td>½ (8/16)</td>
</tr>
<tr>
<td>i.</td>
<td>9/16</td>
</tr>
<tr>
<td>j.</td>
<td>5/8  (10/16)</td>
</tr>
<tr>
<td>k.</td>
<td>11/16</td>
</tr>
<tr>
<td>l.</td>
<td>¾ (12/16)</td>
</tr>
<tr>
<td>m.</td>
<td>13/16</td>
</tr>
<tr>
<td>n.</td>
<td>7/8  (14/16)</td>
</tr>
<tr>
<td>o.</td>
<td>15/16</td>
</tr>
<tr>
<td>p.</td>
<td>1</td>
</tr>
<tr>
<td>q.</td>
<td>1 3/8</td>
</tr>
<tr>
<td>r.</td>
<td>2 5/16</td>
</tr>
</tbody>
</table>

AS 2.2 Area Calculations

1. a. 8 ft. x 16 ft. = 128 sq. ft. x 2 walls = 256 sq. ft.
   8 ft. x 12 ft. = 96 sq. ft. x 2 walls = 192 sq. ft.
   256 sq. ft. + 192 sq. ft. = 448 sq. ft. of surface

   b. door area: 3 ft. x 6 ft. = 18 sq. ft.
      window area: 2 ft. x 3 ft. = 6 sq. ft.
      448 sq. ft. – (18 sq. ft. + 6 sq. ft.) = 424 sq. ft. of surface to paint

   c. 424 sq. ft. divided by 200 sq. ft./gallon = 2.12 gallons of paint
      You would need to purchase 2 gallons and 1 quart of paint.
2. a. 18 ft x 20 ft. = 360 sq. ft.  
   360 sq. ft divide by 9 sq. ft./sq. yd. = 40 sq. yd. of carpet  
   b. 18 ft x 20 ft. = 360 sq. ft  
   360 sq. ft divide by 9 sq. ft/sq. yd. = 40 sq. yd. of padding  
   c. carpet: 40 sq. yd. X $6.00/sq.yd. = $240.00  
      padding: 40 sq. yd. x $1.00/sq.yd. = $40.00  
      $240.00 + $40.00 = $280.00 total cost  

3. a. 10 ft x 8 ft. = 80 sq. ft. for one wall  
   15 ft. x 8 ft. = 120 sq. ft. for second wall  
   80 sq. ft. + 120 sq. ft. = 200 sq. ft. to be covered with paneling  
   b. area of sheet of paneling: 8 ft. x 4 ft. = 32 sq. ft.  
      200 sq. ft. divided by 32 sq. ft./sheet = 6.25 sheets of paneling  
      You would need to buy 7 sheets of paneling to complete this job.  
   c. $9.00/ sheet x 7 sheets = $63.00

AS 2.3 Volume Calculations

1. 5 ft. x 3 ft. x 1 ft. = 15 cu. ft.  
2. 1 cu. yd. = 27 cu. ft., 150 cu. ft./27 = 5.5 cu. yd.  
   5.5 cu. yd. divide by 2 cu. yd./bag = 2.7 bags  
   You will need to buy 3 bags.  
   Discount = $6.50 for (81cu. Ft/27) = 3 cu. yd.  
   Home Supply is cheaper.  

4. 3 ft. = 1 yd.  
   5 yd. x 2 yd. X 1 yd. = 10 cu. yd.  
5. Steve: 20 cu. yd.  
   Andy: (500 cu. ft./27) = 18.5 cu. yd.  
   Steve used more mulch.

AS 2.4 Calculating Board Feet

1. 2 in. x .67 ft. x 14 ft. = 18.76 bd. ft.  
   18.76 bd. ft. x 2 pieces = 37.52 bd. ft. total  
2. 2 in. x .5 ft. x 8 ft. = 8 bd. ft.  
   8 bd. ft. x 8 pieces = 64 bd. ft. total  
3. 2 in. x .3 ft. x 14 ft. = 8.4 bd. ft.  
   8.4 bd. ft. x 2 pieces = 16.8 bd. ft. total  
4. 1 in. x .5 ft. x 14 ft. = 7 bd. ft.  
   7 bd. ft. x 16 pieces = 112 bd. ft. total  
5. 2 in. x .3 ft. x 6 ft. = 3.6 bd. ft.  
   3.6 bd. ft. x 4 pieces = 14.4 bd. ft. total  
6. 2 in. x .3 ft. x 5 ft. = 3 bd. ft.  
   3 bd. ft. x 4 pieces = 12 bd. ft. total  
7. 1 in. x .5 ft. x 8 ft. = 4 bd. ft.  
   4 bd. ft. x 10 pieces = 40 bd. ft. total  
8. 1 in. x .5 ft. x 6 ft. = 3 bd. ft.  
   3 bd. ft. x 4 pieces = 12 bd. ft. total  

Board feet each: 18.76 + 8 + 8.4 + 7 + 3.6 + 3 + 4 + 3 = 55.76 bd. ft.  
Total board feet: 37.52 + 64 + 16.8 + 112 + 14.4 + 12 + 40 + 12 = 308.72 bd. ft. total

AS 2.5 Weight Calculations

1. 2 lb. x 16 oz./lb = 32 oz.  
2. 55 oz/16 oz. per lb = 3.4 lb of cat food x $1.50/lb. = $5.10  
3. $.25/oz. x 16 oz./lb = $4.00/lb. The store uptown is cheaper.  
4. 6.5 lb x 16 oz./lb. = 104 oz. Divide by 8 oz./bag = 13 bags  
5. 1.5 kg x 1000 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' x W' x T'' = Bd. Ft.
# Measures of Length, Area, Volume, and Weight

## ENGLISH Measures of Length

<table>
<thead>
<tr>
<th>English Measure</th>
<th>Metric Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 in.</td>
<td>1 ft.</td>
</tr>
<tr>
<td>3 ft.</td>
<td>1 yd.</td>
</tr>
<tr>
<td>5 1/2 yd</td>
<td>1 rod.</td>
</tr>
<tr>
<td>320 rods</td>
<td>1 mile</td>
</tr>
<tr>
<td>5,280 ft.</td>
<td>1 mile</td>
</tr>
<tr>
<td>1,760 yd.</td>
<td>1 mile</td>
</tr>
<tr>
<td>6,080 ft.</td>
<td>1 knot</td>
</tr>
</tbody>
</table>

## METRIC Measures of Length

<table>
<thead>
<tr>
<th>Metric Measure</th>
<th>English Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 millimeters</td>
<td>1 centimeter</td>
</tr>
<tr>
<td>10 centimeters</td>
<td>1 decimeter</td>
</tr>
<tr>
<td>100 centimeters</td>
<td>1 meter</td>
</tr>
<tr>
<td>1000 meter</td>
<td>1 kilometer</td>
</tr>
</tbody>
</table>

## Measures of Area

<table>
<thead>
<tr>
<th>English Measure</th>
<th>Metric Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>144 sq. in.</td>
<td>1 sq. ft.</td>
</tr>
<tr>
<td>9 sq. ft.</td>
<td>1 sq. yd.</td>
</tr>
<tr>
<td>30 1/4 sq. yd</td>
<td>1 sq. rod.</td>
</tr>
<tr>
<td>160 sq. rods</td>
<td>1 acre</td>
</tr>
</tbody>
</table>

## Measures of Volume

### (solids)

<table>
<thead>
<tr>
<th>English Measure</th>
<th>Metric Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,728 cu. in.</td>
<td>1 cu. ft.</td>
</tr>
<tr>
<td>27 cu. ft.</td>
<td>1 cu. yd.</td>
</tr>
<tr>
<td>128 cu. ft.</td>
<td>1 cord</td>
</tr>
</tbody>
</table>

### (liquids)

<table>
<thead>
<tr>
<th>English Measure</th>
<th>Metric Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 fluid oz.</td>
<td>1 pt.</td>
</tr>
<tr>
<td>2 pt.</td>
<td>1 qt.</td>
</tr>
<tr>
<td>32 fl. oz.</td>
<td>1 qt.</td>
</tr>
<tr>
<td>4 qt.</td>
<td>1 gal.</td>
</tr>
<tr>
<td>31 1/2 gal.</td>
<td>1 bbl.</td>
</tr>
<tr>
<td>231 cu. in.</td>
<td>1 gal.</td>
</tr>
<tr>
<td>7 1/2 gal.</td>
<td>1 cu. ft.</td>
</tr>
</tbody>
</table>

## Measures of Weight

<table>
<thead>
<tr>
<th>English Measure</th>
<th>Metric Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,000 grains (gr.)</td>
<td>1 lb.</td>
</tr>
<tr>
<td>16 oz.</td>
<td>1 lb.</td>
</tr>
<tr>
<td>100 lbs.</td>
<td>1 cwt.</td>
</tr>
<tr>
<td>2,000 lbs.</td>
<td>1 short ton</td>
</tr>
<tr>
<td>2,240 lbs.</td>
<td>1 long ton</td>
</tr>
</tbody>
</table>

## Measures of Volume

<table>
<thead>
<tr>
<th>Metric Measure</th>
<th>English Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 cubic centimeters</td>
<td>1 liter</td>
</tr>
<tr>
<td>100 liters</td>
<td>1 hectoliter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric Measure</th>
<th>English Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 milligrams</td>
<td>1 gram</td>
</tr>
<tr>
<td>1000 grams</td>
<td>1 kilogram</td>
</tr>
<tr>
<td>1000 kilograms</td>
<td>1 metric ton</td>
</tr>
</tbody>
</table>
Lesson 2: Common Measurements and Their Uses

Name ____________________________

**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?
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.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NUMBER</th>
<th>SIZE</th>
<th>BD. FT. EACH</th>
<th>TOTAL BD. FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sills</td>
<td>2</td>
<td>14' x .67' x 2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joists</td>
<td>8</td>
<td>8' x .5' x 2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side rails</td>
<td>2</td>
<td>14' x .33' x 2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td>16</td>
<td>14' x .5' x 1&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standards</td>
<td>4</td>
<td>6' x .33' x 2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standards</td>
<td>4</td>
<td>5' x .33' x 2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ends</td>
<td>10</td>
<td>8' x .5' x 1&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braces</td>
<td>4</td>
<td>6' x .5' x 1&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL BOARD FEET**
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
- Socket wrench
- Adjustable wrench
- Hacksaw
- Handsaw
- Backsaw
- Flathead
- Phillips Head
Common Power Tools

Portable drill

Router

Jig saw

Drill press

Band saw
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. _______________________________________________________________________
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. 

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.
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

<table>
<thead>
<tr>
<th></th>
<th>Four-Cycle Engine (equal hp) One Cylinder</th>
<th>Two-Cycle (equal hp) One Cylinder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of moving parts</td>
<td>Nine</td>
<td>Three</td>
</tr>
<tr>
<td>Running</td>
<td>Cooler running</td>
<td>Hotter running</td>
</tr>
<tr>
<td>Overall</td>
<td>Larger</td>
<td>Smaller</td>
</tr>
<tr>
<td>Engine</td>
<td>Heavier construction</td>
<td>Lighter in weight</td>
</tr>
<tr>
<td>Fuel and Oil</td>
<td>No mixture required</td>
<td>Must be premixed</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>Fewer gallons per hour</td>
<td>More gallons per hour</td>
</tr>
<tr>
<td>Oil Consumption</td>
<td>Oil recirculates and stays in engine</td>
<td>Oil is burned with fuel</td>
</tr>
<tr>
<td>Sound</td>
<td>Generally quiet</td>
<td>Louder in operation</td>
</tr>
<tr>
<td>Operation</td>
<td>Smoother</td>
<td>More erratic</td>
</tr>
<tr>
<td>Acceleration</td>
<td>Slower</td>
<td>Very quick</td>
</tr>
<tr>
<td>General maintenance</td>
<td>Greater</td>
<td>Less</td>
</tr>
<tr>
<td>Initial Cost</td>
<td>Greater</td>
<td>Less</td>
</tr>
<tr>
<td>Versatility of operation</td>
<td>Limited slope operation (Receives less lubrication when tilted)</td>
<td>Lubrication not affected at any angle of operation</td>
</tr>
</tbody>
</table>

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
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.
   f. Hands away from moving parts.
   g. Remove debris from area to be mowed.
   h. Keep safety shields in place.
   i. Know owner's manual operating procedures.
   j. Use caution on slopes.
   k. Mow dry grass only.

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. Rub linseed oil on rough, dry handles.
   g. Remove rust on metal surfaces with a wire brush and apply oil.
   h. Keep tools dry to prevent rust.
   i. Sharpen blades with files, stones, or grinders.

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.
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
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.
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.

<table>
<thead>
<tr>
<th></th>
<th>FOUR-CYCLE ENGINE (EQUAL HP) ONE CYLINDER</th>
<th>TWO-CYCLE (EQUAL HP) ONE CYLINDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of moving parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Running</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel and oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceleration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Versatility of operation</td>
<td></td>
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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.
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
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.

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>SAFETY GUIDELINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selecting proper attire</td>
<td>a.</td>
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<td></td>
<td>b.</td>
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<tr>
<td>Pre-operational procedures</td>
<td>a.</td>
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<tr>
<td></td>
<td>b.</td>
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<td>c.</td>
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<td>d.</td>
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<td>Operational procedures</td>
<td>a.</td>
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<td></td>
<td>b.</td>
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<td></td>
<td>c.</td>
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<td></td>
<td>d.</td>
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<tr>
<td>Refueling</td>
<td>a.</td>
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<td></td>
<td>b.</td>
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<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>MAINTENANCE GUIDELINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing oil</td>
<td>a.</td>
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<tr>
<td></td>
<td>b.</td>
</tr>
<tr>
<td>Sharpening blades</td>
<td>a.</td>
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<td></td>
<td>b.</td>
</tr>
<tr>
<td>Check spark plug</td>
<td>a.</td>
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<td></td>
<td>b.</td>
</tr>
<tr>
<td>Lubricating parts</td>
<td>a.</td>
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<tr>
<td></td>
<td>b.</td>
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</table>
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.**

12. _____ Fluorescent a. Contains compounds of metal and halogen with a basic two-bulb design.
13. _____ Halogen b. A mixture of gases inside the bulb forms a very bright, hot light.
14. _____ Metal-halide c. Radiates light from a gas inside the bulb, commonly used in greenhouses.
15. _____ Sodium d. Composed of an aluminum oxide arc tube containing a mixture of sodium and mercury.

**Match each type of measurement with the appropriate category.**

16. _____ Inch a. Linear
17. _____ Gram b. Area
18. _____ Ounce c. Volume
19. _____ Square foot d. Weight
20. _____ Yard
21. _____ Meter
22. _____ Board feet
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.  
34. _____ Pitchfork  b.  
35. _____ Wheelbarrow  c.  
36. _____ Garden rake  d.  
37. _____ Lawn rake  e.  

Match the name with the correct power lawn equipment.

38. _____ Riding mower  a.  
39. _____ Leaf blower  b.  
40. _____ String trimmer  c.  
41. _____ Hedge trimmer  d.  
42. _____ Walk-behind mower  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. 