

Missouri Center for Career Education  
Department of Career & Technology Education  
Central Missouri State University  
Warrensburg, Missouri

Division of Career Education  
Department of Elementary & Secondary Education  
Jefferson City, Missouri

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# *Exploring Careers in Manufacturing*

*Exploring Career Clusters*  
*Course A*  
*Architecture & Construction*  
*Science, Technology, Engineering, and Mathematics*  
*Manufacturing*

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## Manufacturing Student Competencies

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*The following competencies selected for this unit were taken directly from the Career Cluster Resources for Manufacturing ([www.Careerclusters.org](http://www.Careerclusters.org)).*

### **Cluster Knowledge and Skills**

Comprehend the use of reading strategies to learn meaning, technical concepts, vocabulary, and to bring together information needed for a particular situation.

Locate, organize, and document written information from various sources needed by coworkers and clients/participants.

Use correct grammar, punctuation, and terminology to write and edit documents.

Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.

Interpret verbal and nonverbal behaviors to enhance communication with co-workers and clients/participants.

Apply active listening skills to obtain and clarify information.

Interpret and use information in tables, charts, and figures to support written and oral communications.

Formulate solutions to problems using critical thinking skills while working independently and/or in teams.

Use Personal Information Management (PIM)/Productivity applications.

Demonstrate knowledge of how manufacturing businesses operate.

Demonstrate knowledge of how manufacturing businesses improve performance.

Demonstrate knowledge of safety, health, and environmental management systems.

Demonstrate leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

Demonstrate knowledge of and commitment to professional ethics and legal responsibilities.

Explain written organizational policies, rules and procedures to help employees perform their jobs.

Identify and demonstrate positive work behaviors and personal qualities.

Develop a personal career plan to meet career goals and objectives.

Demonstrate outstanding of the basic technical skills and knowledge required for career in manufacturing.

### **Pathway Knowledge and Skills**

Produce a product to satisfy customer desires.

Implement new manufacturing process.

Maintain a safe and productive workplace.

Maintain quality and implement continuous improvement processes.

Communicate with co-workers and/or external customers to ensure production meets business requirements.

Suggest and/or implement continuous improvement actions.

Improve production processes.

Correct processes to assure that products meet quality standards.

Maintain equipment, tools and workstations.

Maintain a safe and productive workplace.

Employ audits and inspections to maintain quality and continuous improvement processes.

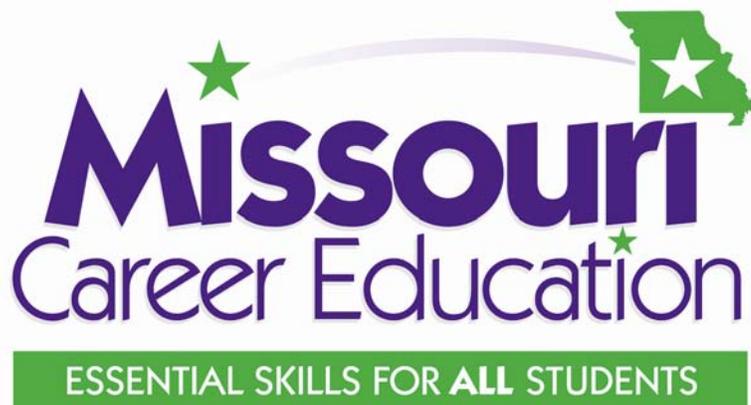
Communicate with co-workers and/or external customers to ensure production meets business requirements.

Coordinate work teams to produce product.

Ensure that equipment is being uses safely in the workplace.

Maintain a safe and productive workplace.

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# *Introducing the Manufacturing Cluster*

*Exploring Career Clusters*  
*Course A*  
*Architecture & Construction*  
*Science, Technology, Engineering, and Mathematics*  
*Manufacturing*

## Introducing the Manufacturing Cluster

The cluster of careers found in “*Manufacturing*” encompasses planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering. This Career Cluster can be divided into six distinct Pathways of *Production, Manufacturing Production Process Development, Maintenance, Installation & Repair, Quality Assurance, Logistics and Inventory Control, and Health, Safety and Environmental Assurance*.

Each Pathway has distinct knowledge and skill requirements as well as shared common knowledge and skill requirements. Students who understand these relationships will be prepared and able to make informed career decisions. Students should be given the opportunity to explore and investigate not only the traditional career options of *machine operator* and *engineer* but should be encouraged to touch on the many other related occupations found in this Career Cluster (See *Manufacturing Cluster Pathways chart in this section*).

### **Teacher Preparation**

The suggested scenario for this unit is the manufacture of a game board. You should review the whole project and decide on any alterations you want to make to the scenario. You may choose to use a scenario of your own design. If you do, you need to be sure and include as many occupations as time permits.

Introduce the unit with a short activity that helps students quickly grasp the breath and depth of this Career Cluster. Be sure to have every student engaged so they can begin the unit of study with the “big picture” of this career cluster.

Prepare a bulletin board display that illustrates the six Pathways (*Production, Manufacturing Production Process Development, Maintenance, Installation & Repair, Quality Assurance, Logistics and Inventory Control, and Health, Safety and Environmental Assurance*) found in the *Manufacturing Cluster*. Be sure to include photos/illustrations of non-typical careers such as *tool and die maker, purchasing agent, logistics engineer, and/or safety technician*. List under each category some of the key skills and knowledge needed. Remember, the use of bulletin boards, web searches, posters, and engaged projects will assist students in learning about and participating in various career experiences.

**Reference:** “Manufacturing Pathways”, “*Career Cluster Resources for Manufacturing, National Association of State Directors of Career Technical Education Consortium*” ( [www.Careerclusters.org](http://www.Careerclusters.org) )

Pathways:

- Production
- Manufacturing Production Process Development
- Maintenance, Installation & Repair
- Quality Assurance
- Logistics & Inventory Control
- Health, Safety & Environmental Assurance

**Handout:** *Manufacturing Cluster Pathways Chart*

This handout is for teacher reference for the student activity, *Pathway Matching* activity. It should not be given to students until after the completion of this activity.

### **Suggested Activities**

### **Introduction to the Cluster**

Use the following activity or design an appropriate activity that will allow students to comprehend the wide array of occupations involved in their built world.

#### *How Many Jobs?*

Using a Power Point presentation or photos & drawings showing the interior of a modern manufacturing plant and an exhaustive list of jobs, have students or teams of students match the job titles to the photos.

Upon completion of the activity, discuss with students the various occupations needed to complete the design, construction, and maintenance of the structure in question. Make a point of occupations that are not obvious.

### **Pathway Matching**

Have students match (even if they have to guess) random list of occupations to the three Career Pathways found in the Architecture & Construction Cluster. Discuss with students what makes up each Pathway (*See Pathway Matching activity*). This activity is designed to help students focus on the vast occupational opportunities available to them in this Career Cluster. It is not important at this point in the course they are able to recognize most of these occupations. It is important that they begin to see their possibilities. Discuss with students the differences between the three Career Pathways without listing the various occupations. Use the following activity or design an appropriate activity that will allow students to comprehend the wide array of occupations involved in their built world. You should review the list and become familiar with the occupations listed.

(Two sources: [www.stepfour.com/jobs](http://www.stepfour.com/jobs) and [www.collegeboard.com/csearch/majors\\_careers/profiles/](http://www.collegeboard.com/csearch/majors_careers/profiles/) )

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**Student Name:**

(PRINT)

**Date Assignment Due:**

**Date Assignment Submitted:**

Activity Satisfactorily Completed

Activity Not Completed (see notes below)

## Pathway Matching

The Manufacturing Career Cluster is divided into six Pathways according to the tasks of planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering. Our manufactured environment requires the services of engineers, machine operators, service technicians, quality control technicians and safety assurance personnel. Our manufactured environment includes all the manufactured products we use as well as food processed for eating and medicines processed for health concerns. All of these begin with design and end with the need for maintenance. However, without the involvement of the careers in this cluster, the quality, the quantity and the safety of these products would be severely limited.

The six Pathways for the Manufacturing Career Cluster are:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_

### Occupation – Pathway Matching

Given the list below, place the number of the pathway from the list above next to the occupation it matches. If you think an occupation could match with more than one Pathway, you may put more than one number. Be ready to say why you think the occupation matches the pathway or pathways you listed.

_____ <b>Assembler</b>	_____ <b>Environmental Engineer</b>
_____ <b>Communications, Transportation &amp; Utilities Managers</b>	_____ <b>Design Engineer</b>

_____ Calibration Technician	_____ Biomedical Equipment Technician
_____ Automated Manufacturing Technician	_____ Environmental Specialist
_____ Electrical & Electronic Technician/Technologists	_____ Dispatcher
_____ Boilermaker	_____ Inspector
_____ Health & Safety Representative	_____ Electronics Engineer
_____ Lab Technician	_____ Electromechanical Equipment Assembler
_____ Communication System Installer/Repairer	_____ Bookbinder
_____ Freight, Stock, & Material Mover	_____ Safety Coordinator
_____ Computer Installer/Repairer	_____ Electrical Installer/Repairer
_____ Engineering Technician	_____ Industrial Truck & Tractor Operator
_____ Extruding & Drawing Machine Setters/Set-up Operators	_____ Extrusion Machine Operator
_____ Facility Electrician	_____ Traffic, Shipping & Receiving Clerk
_____ Statistical Process Control Coordinator	_____ Meter Installer/Repairer
_____ Security System Installer/Repairer	_____ Foundry Worker
_____ Facilities Technician	_____ Welder

_____ <b>Engineering Technologist</b>	_____ <b>Grinding, Lapping &amp; Buffing Machine Operator</b>
_____ <b>Safety Engineer</b>	_____ <b>Logistical Engineer</b>
_____ <b>Industrial Engineer</b>	_____ <b>Computer Maintenance Technician</b>
_____ <b>Labor Relations Manager</b>	_____ <b>Hand Packers &amp; Packagers</b>
_____ <b>Manufacturing Engineer</b>	_____ <b>Hoist &amp; Winch Operator</b>
_____ <b>Logistician</b>	_____ <b>Industrial Electronic Installer/Repairer</b>
_____ <b>Process Control Technician</b>	_____ <b>Instrument Maker</b>
_____ <b>Large Printing Press Machine Setters &amp; Set-up Operator</b>	_____ <b>Material Associates</b>
_____ <b>Manufacturing Technician</b>	_____ <b>Power Generating &amp; Reactor Plant Operator</b>
_____ <b>Industrial Facilities Manager</b>	_____ <b>Industrial Machinery Mechanic</b>
_____ <b>Quality Control Technician</b>	_____ <b>Safety Team Leader</b>
_____ <b>Machine Operator</b>	_____ <b>Precision Inspector, Tester, &amp; Grader</b>
_____ <b>Industrial Maintenance Electrician</b>	_____ <b>Quality Engineer</b>
_____ <b>Material Handler</b>	_____ <b>Manager/Supervisor</b>
_____ <b>Millwright</b>	_____ <b>Industrial Maintenance Mechanic</b>
_____ <b>Operators, Tenders, Cutters/Brazers, Soldering, Machine Operation</b>	_____ <b>Medical Appliance Maker</b>

_____ <b>Instrument Calibration &amp; Repairer</b>	_____ <b>Safety Technician</b>
_____ <b>Material Mover</b>	_____ <b>Process Improvement Technician</b>
_____ <b>Painter</b>	_____ <b>Pattern &amp; Mold Maker</b>
_____ <b>Quality Control Technician</b>	_____ <b>Instrument Control Technician</b>
_____ <b>Precision Layout Worker</b>	_____ <b>Milling Machine Setter, Set-up Operator</b>
_____ <b>Job/Fixture Designer</b>	_____ <b>Production Manager</b>
_____ <b>Precision Optical Goods Worker</b>	_____ <b>Plumber, Pipe Fitter &amp; Steam Fitter</b>
_____ <b>Purchasing Agent</b>	_____ <b>Production Associate</b>
_____ <b>Laser Systems Technician</b>	_____ <b>Sheet Metal Worker</b>
_____ <b>Solderer &amp; Brazier</b>	_____ <b>Maintenance Repairer</b>
_____ <b>Major Appliance Repairer</b>	_____ <b>Tool &amp; Die Maker</b>

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## Exploring Careers in Manufacturing



**Student Name:** \_\_\_\_\_

(PRINT)

**Date Assignment Due:** \_\_\_\_\_

**Date Assignment Submitted:** \_\_\_\_\_

\_\_\_\_ Activity Satisfactorily Completed

\_\_\_\_ Activity Not Completed (see notes below)

### Pathway Matching

The Manufacturing Career Cluster is divided into six Pathways according to the tasks of planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering. Our manufactured environment requires the services of engineers, machine operators, service technicians, quality control technicians and safety assurance personnel. Our manufactured environment includes all the manufactured products we use as well as food processed for eating and medicines processed for health concerns. All of these begin with design and end with the need for maintenance. However, without the involvement of the careers in this cluster, the quality, the quantity and the safety of these products would be severely limited.

The six Pathways for the Manufacturing Career Cluster are:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_

### Occupation – Pathway Matching

Given the list below, place the number of the pathway from the list above next to the occupation it matches. If you think an occupation could match with more than one Pathway, you may put more than one number. Be ready to say why you think the occupation matches the pathway or pathways you listed.

____ <b>Assembler</b>	____ <b>Environmental Engineer</b>
____ <b>Communications, Transportation &amp; Utilities Managers</b>	____ <b>Design Engineer</b>

Pathway Matching Continued	
<input type="checkbox"/> Calibration Technician	<input type="checkbox"/> Biomedical Equipment Technician
<input type="checkbox"/> Automated Manufacturing Technician	<input type="checkbox"/> Environmental Specialist
<input type="checkbox"/> Electrical & Electronic Technician/Technologists	<input type="checkbox"/> Dispatcher
<input type="checkbox"/> Boilermaker	<input type="checkbox"/> Inspector
<input type="checkbox"/> Health & Safety Representative	<input type="checkbox"/> Electronics Engineer
<input type="checkbox"/> Lab Technician	<input type="checkbox"/> Electromechanical Equipment Assembler
<input type="checkbox"/> Communication System Installer/Repairer	<input type="checkbox"/> Bookbinder
<input type="checkbox"/> Freight, Stock, & Material Mover	<input type="checkbox"/> Safety Coordinator
<input type="checkbox"/> Computer Installer/Repairer	<input type="checkbox"/> Electrical Installer/Repairer
<input type="checkbox"/> Engineering Technician	<input type="checkbox"/> Industrial Truck & Tractor Operator
<input type="checkbox"/> Extruding & Drawing Machine Setters/Set-up Operators	<input type="checkbox"/> Extrusion Machine Operator
<input type="checkbox"/> Facility Electrician	<input type="checkbox"/> Traffic, Shipping & Receiving Clerk
<input type="checkbox"/> Statistical Process Control Coordinator	<input type="checkbox"/> Meter Installer/Repairer
<input type="checkbox"/> Security System Installer/Repairer	<input type="checkbox"/> Foundry Worker
<input type="checkbox"/> Facilities Technician	<input type="checkbox"/> Welder

<input type="checkbox"/> <b>Engineering Technologist</b>	<input type="checkbox"/> <b>Grinding, Lapping &amp; Buffing Machine Operator</b>
<input type="checkbox"/> <b>Safety Engineer</b>	<input type="checkbox"/> <b>Logistical Engineer</b>
<input type="checkbox"/> <b>Industrial Engineer</b>	<input type="checkbox"/> <b>Computer Maintenance Technician</b>
<input type="checkbox"/> <b>Labor Relations Manager</b>	<input type="checkbox"/> <b>Hand Packers &amp; Packagers</b>
<input type="checkbox"/> <b>Manufacturing Engineer</b>	<input type="checkbox"/> <b>Hoist &amp; Winch Operator</b>
<input type="checkbox"/> <b>Logistician</b>	<input type="checkbox"/> <b>Industrial Electronic Installer/Repairer</b>
<input type="checkbox"/> <b>Process Control Technician</b>	<input type="checkbox"/> <b>Instrument Maker</b>
<input type="checkbox"/> <b>Large Printing Press Machine Setters &amp; Set-up Operator</b>	<input type="checkbox"/> <b>Material Associates</b>
<input type="checkbox"/> <b>Manufacturing Technician</b>	<input type="checkbox"/> <b>Power Generating &amp; Reactor Plant Operator</b>
<input type="checkbox"/> <b>Industrial Facilities Manager</b>	<input type="checkbox"/> <b>Industrial Machinery Mechanic</b>
<input type="checkbox"/> <b>Quality Control Technician</b>	<input type="checkbox"/> <b>Safety Team Leader</b>
<input type="checkbox"/> <b>Machine Operator</b>	<input type="checkbox"/> <b>Precision Inspector, Tester, &amp; Grader</b>
<input type="checkbox"/> <b>Industrial Maintenance Electrician</b>	<input type="checkbox"/> <b>Quality Engineer</b>
<input type="checkbox"/> <b>Material Handler</b>	<input type="checkbox"/> <b>Manager/Supervisor</b>
<input type="checkbox"/> <b>Millwright</b>	<input type="checkbox"/> <b>Industrial Maintenance Mechanic</b>
<input type="checkbox"/> <b>Operators, Tenders, Cutters/Brazers, Soldering, Machine Operation</b>	<input type="checkbox"/> <b>Medical Appliance Maker</b>
<input type="checkbox"/> <b>Instrument Calibration &amp; Repairer</b>	<input type="checkbox"/> <b>Safety Technician</b>

<b>___ Material Mover</b>	<b>___ Process Improvement Technician</b>
<b>___ Painter</b>	<b>___ Pattern &amp; Mold Maker</b>
<b>___ Quality Control Technician</b>	<b>___ Instrument Control Technician</b>
<b>___ Precision Layout Worker</b>	<b>___ Milling Machine Setter, Set-up Operator</b>
<b>___ Job/Fixture Designer</b>	<b>___ Production Manager</b>
<b>___ Precision Optical Goods Worker</b>	<b>___ Plumber, Pipe Fitter &amp; Steam Fitter</b>
<b>___ Purchasing Agent</b>	<b>___ Production Associate</b>
<b>___ Laser Systems Technician</b>	<b>___ Sheet Metal Worker</b>
<b>___ Solderer &amp; Brazier</b>	<b>___ Maintenance Repairer</b>
<b>___ Major Appliance Repairer</b>	<b>___ Tool &amp; Die Maker</b>

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## Manufacturing Cluster

**Planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.**

<b>Sample Career Specialties/Occupations</b>	<ul style="list-style-type: none"> <li>◆ Assemblers</li> <li>◆ Automated Manufacturing Technicians</li> <li>◆ Bookbinders</li> <li>◆ Calibration Technicians</li> <li>◆ Electrical Installers and Repairers</li> <li>◆ Electromechanical Equipment Assemblers</li> <li>◆ Extruding and Drawing Machine Setters/Set-Up Operators</li> <li>◆ Extrusion Machine Operators</li> <li>◆ Foundry Workers</li> <li>◆ Grinding, Lapping, and Buffing Machine Operators</li> <li>◆ Hand Packers and Packagers</li> <li>◆ Hoist and Winch Operators</li> <li>◆ Instrument Makers</li> <li>◆ Large Printing Press Machine Setters and Set-Up Operators</li> <li>◆ Machine Operators</li> <li>◆ Managers, Supervisors</li> <li>◆ Medical Appliance Makers</li> <li>◆ Milling Machine Setters, Set-Up Operators</li> <li>◆ Millwrights</li> <li>◆ Operators, Tenders, Cutters/Brazers, Soldering, Machine Operations</li> <li>◆ Painters</li> <li>◆ Pattern &amp; Model Makers</li> <li>◆ Precision Layout Workers</li> <li>◆ Precision Optical Goods Workers</li> <li>◆ Production Associates</li> <li>◆ Sheet Metal Workers</li> <li>◆ Solderers and Brazers</li> <li>◆ Tool and Die Makers</li> <li>◆ Welders</li> </ul>	<ul style="list-style-type: none"> <li>◆ Design Engineers</li> <li>◆ Electrical and Electronic Technicians and Technologists</li> <li>◆ Electronics Engineers</li> <li>◆ Engineering and Related Technicians and Technologists</li> <li>◆ Engineering Technicians</li> <li>◆ Industrial Engineers</li> <li>◆ Labor Relations Managers</li> <li>◆ Manufacturing Engineers</li> <li>◆ Manufacturing Technicians</li> <li>◆ Power Generating and Reactor Plant Operators</li> <li>◆ Precision Inspectors, Testers, and Graders</li> <li>◆ Process Improvement Technicians</li> <li>◆ Production Managers</li> <li>◆ Purchasing Agents</li> <li>◆ Supervisors</li> </ul>	<ul style="list-style-type: none"> <li>◆ Biomedical Equipment Technicians</li> <li>◆ Boilermakers</li> <li>◆ Communication System Installers/Repairers</li> <li>◆ Computer Installers/Repairers</li> <li>◆ Computer Maintenance Technicians</li> <li>◆ Electrical Equipment Installers/Repairers</li> <li>◆ Facility Electricians</li> <li>◆ Industrial Electronic Installers/Repairers</li> <li>◆ Industrial Facilities Managers</li> <li>◆ Industrial Machinery Mechanics</li> <li>◆ Industrial Maintenance Electricians</li> <li>◆ Industrial Maintenance Mechanics</li> <li>◆ Industrial Maintenance Technicians</li> <li>◆ Instrument Calibration and Repairers</li> <li>◆ Instrument Control Technicians</li> <li>◆ Job/Fixture Designers</li> <li>◆ Laser Systems Technicians</li> <li>◆ Maintenance Repairers</li> <li>◆ Major Appliance Repairers</li> <li>◆ Meter Installers/Repairers</li> <li>◆ Millwrights</li> <li>◆ Plumbers, Pipe Fitters and Steam Fitters</li> <li>◆ Security System Installers/Repairers</li> </ul>	<ul style="list-style-type: none"> <li>◆ Calibration Technicians</li> <li>◆ Inspectors</li> <li>◆ Lab Technicians</li> <li>◆ Process Control Technicians</li> <li>◆ Quality Control Technicians</li> <li>◆ Quality Engineers</li> <li>◆ SPC Coordinators</li> </ul>	<ul style="list-style-type: none"> <li>◆ Communications, Transportation and Utilities Managers</li> <li>◆ Dispatchers</li> <li>◆ Freight, Stock, and Material Movers</li> <li>◆ Industrial Truck and Tractor Operators</li> <li>◆ Logistical Engineers</li> <li>◆ Logisticians</li> <li>◆ Material Associates</li> <li>◆ Material Handlers</li> <li>◆ Material Movers</li> <li>◆ Process Improvement Technicians</li> <li>◆ Quality Control Technicians</li> <li>◆ Traffic Managers</li> <li>◆ Traffic, Shipping, and Receiving Clerks</li> </ul>	<ul style="list-style-type: none"> <li>◆ Environmental Engineers</li> <li>◆ Environmental Specialists</li> <li>◆ Health and Safety Representatives</li> <li>◆ Safety Coordinators</li> <li>◆ Safety Engineers</li> <li>◆ Safety Team Leaders</li> <li>◆ Safety Technicians</li> </ul>
	<b>Path ways</b>	<b>Production</b>	<b>Manufacturing Production Process Development</b>	<b>Maintenance, Installation &amp; Repair</b>	<b>Quality Assurance</b>	<b>Logistics &amp; Inventory Control</b>
<b>Cluster K &amp; S</b>	<p><b>Cluster Knowledge and Skills</b></p> <ul style="list-style-type: none"> <li>◆ Academic Foundations ◆ Communications ◆ Problem Solving and Critical Thinking ◆ Information Technology Applications ◆ Systems</li> <li>◆ Safety, Health and Environmental ◆ Leadership and Teamwork ◆ Ethics and Legal Responsibilities</li> <li>◆ Employability and Career Development ◆ Technical Skills</li> </ul>					

## Career Exploration

Students should begin this unit by getting a broad overview of the types of occupations they will find in this Career Cluster. They need to see the big picture first before exploring individual occupations.

### *Teacher Preparation*

Identify enough occupations so you will have no more than two or three students working at any one station. Set up stations around your classroom/lab with short activities that represent the six pathways of occupations which are: *Production; Manufacturing Production Process Development, Maintenance, Installation & Repair, Quality Assurance, Logistics & Inventory Control, and Health, Safety & Environmental Assurance*. Be sure to include occupations such as *Calibration Technician, Quality Control Technician, and Safety Engineer*, as well as typical occupations such as *Manufacturing Engineer, Machine Operator or Industrial Engineer*.

### *Suggested Activities*

#### *Round-Table Explorations Activity*

Have students rotate through each station (*See Round-Table Explorations activity*). On this worksheet, have the students select the level of education/ training and basic skills **they think** they would need to successfully work in that occupation (Area Career Center, Community College, or University). Students will research specific career occupations later in the unit of study. (*Print enough Round Table Exploration Information sheets and Worksheets for each student*)

#### *Round-Table Exploring Examples*

Mass Production Unit – Set up an area that displays a simple product being mass produced. Have students identify the various tasks that are required to produce the product. You may even have them calculate the amount of products produced in a set amount of time, then suggest what could be done to improve the speed of the system.

Quality Control System – Set up an area that displays a system demonstrating the process of checking for quality. Have students check the same dimension on several parts in different ways, such as measurement and go-no go gage methods. Have the students calculate the percentage of bad parts to good parts.

#### *Teacher: Class Discussion*

Discuss various academic and career preparation requirements for each of the stations explored by the students. Help students understand the differences between each educational level and occupational level of Technician, Technologist, and Professional. (*See Round-Table Exploration Information sheet in this section and Definitions of Three Levels of Occupations sheet in Career Search section of this unit*)

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## Round Table Explorations Information

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Every occupation requires a minimum amount of training and/or education and certain basic skills. As you rotate through each of the Occupation Stations, you will be asked to match the education and the skills **you think** are needed to enter that occupation.

Education: Different levels of education/training are required for different occupations. Below is a list with a brief description of each level. Use these definitions to determine the level needed for each occupation you examine.

### **REQUIRED EDUCATION LEVELS**

**No Schooling** – not completing high school or dropping out at an age allowed by law

**High School GEP** (General Education Program) – graduating from high school with a general education or college preparatory program

**High School CEP** (Career Education Program/Area Career Center) – graduating from high school with a program in one of the career education occupations

**On-the-Job Training/Apprenticeship** – learning a job while you are working in that job (may or may not require a high school diploma)

**Trade School** – school that teaches specialized skills for specific occupations (can be public schools, private schools, or trade unions)

**Military Training** – similar to trade schools in that you are taught specialized skills for a specific occupation in the military (requires a minimum of a high school diploma)

**Community College (2-year)** – two-year college education that leads to an associate's degree and may include specialized technical skills

**College/University (4-year)** – four-year college education that leads to a bachelor's degree and may include higher levels of specialized technical skills, engineering, science, and mathematics on a professional level

**College/University (graduate degree)** – education after a bachelor's degree in professional fields such as engineering, science, medicine, law, management or education

**REQUIRED SKILLS**

**Reading**

Ability to read and comprehend at a high school level

**Writing**

Ability to write simple and complex sentences with correct spelling, grammar and punctuation which allows for clear communication

**Calculating**

Ability to perform simple mathematical operations such as add, subtract, multiply and divide and comprehend simple geometric relationships (this may include reading and measuring with a ruler or tape measure)

**Computer Literacy**

Ability to perform basic computer operations such as save and retrieve files, word processing and spreadsheet operations

**Problem-Solving/Critical Thinking**

Ability to clearly identify and solve problems through a defined process

**Leadership/Teamwork**

Ability to successfully lead a group and work with a group to accomplish a task or solve a problem

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## Round Table Explorations

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**Student Name:**

(Print)

**Date Assignment Due:**

**Date Assignment Submitted:**

Activity Satisfactorily Completed

Activity Not Completed (see notes below)

*Fill in the required spaces below after you have completed the activity for each station.*

**OCCUPATION:**

Print the Name of the Occupation

**Check (✓) the minimum level of education you think would be needed for entry to this occupation:**

No School

High School (GEP)

High School (CEP)

On-the-Job Training

Trade School

Military Training

Community College (2 years)

College/University (4 years)

College/University (Graduate Degree)

**Check (✓) all the required skills you think would be needed for entry to this occupation:**

Reading

Writing

Calculating

Computer Literacy

Problem Solving/Critical Thinking

Leadership/Teamwork

**SEE BACK OF THIS PAGE FOR REFLECTIVE RESPONSES**

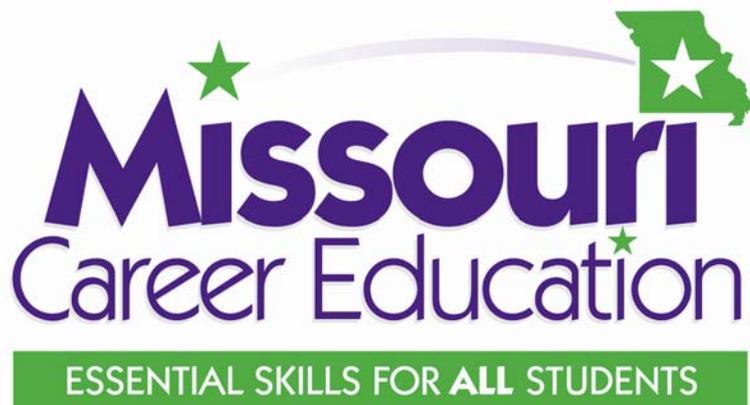
**Reflective Response:**

Use complete sentences, correct spelling and correct punctuation when completing the statements below. Be sure to read what you write to make sure it is clear to you and others.

1. I think this occupation would be fun to work in because

**OR**

1. I do not think this occupation would be fun to work in because
2. An example of how I might use problem solving in this occupation
3. An example of how I might have to use teamwork in this occupation
4. The reason I checked \_\_\_\_\_ as the minimum level of education needed for this occupation is
5. The reasons I checked these skills needed for this occupation are



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# Exploring Careers in *Manufacturing Process Development and Production*

*Exploring Career Clusters*  
*Course A*  
*Architecture & Construction*  
*Science, Technology, Engineering, and Mathematics*  
*Manufacturing*

Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic  
· Calibration Technician · Logistics Engineer · Safety Coordinator

## Manufacturing Process Development & Production

Consumer products, capital equipment, and tools all begin as an idea, a concept in someone's mind, usually based on the wants or needs of someone or some group. However, ideas or concepts are worthless unless they are turned into physical products. This is what the manufacturing process is all about, producing products in a way that is economical to the manufacturing company and to the consumer buying the product.

Manufacturing systems produce products in quantity. Manufacturing processes, a subset of a manufacturing system, include designing products, gathering resources, and using tools to separate, form, and combine materials. Servicing of products and systems are also considered an important part of manufacturing. Additional components of manufacturing are managing, labor relations, public relations, and financial affairs such as raising capital.

### *Teacher Preparation*

Prepare a bulletin board or other visual display that illustrates manufacturing systems and the various jobs involved. Be sure to include a mixture of gender and ethnicity in your displays. Have on hand several examples of manufactured products your students are familiar with. Display the various parts of a product to demonstrate the complexity of manufactured products.

Prepare to discuss and demonstrate the processes of manufacturing a product from natural resources to finished product. Be ready to help students recognize and experience the many occupations involved in manufacturing a product.

**Note: This unit can be very involved and complex. You will need to consider the time available, the number of students in the course and the facilities available when planning this unit. You may need to have a portion of the activities completed before your students begin the process. For example, you may have the jigs and fixtures already designed and set up. You can still discuss the need for and the design of jigs and fixtures, but to save time have them ready to go.**

This unit scenario is divided into three major activities based on the Pathways of this Career Cluster. The product for this scenario has already been designed even though product design is often considered part of manufacturing. Therefore, the first activity addresses pre-manufacturing development, that is pre-production planning and development. Through this scenario student teams as independent subcontractors (job-shop) will analyze the product to be manufactured in order to submit a bid to manufacture one or more product parts. Once the bid has been accepted, the student teams will enter into a contract with the parent company to produce the product parts.

The second activity addresses manufacturing production. Students will plan and set up an appropriate production system to fabricate the product part. (Note, this means that you may have multiple production systems running simultaneously.) The students should be assigned specific jobs during this phase. Remember, safety is a major concern and should be taken seriously.

The third activity deals with the assembly production phase of the scenario. Have your students reorganize themselves into one company to assemble the parts to produce the final product. This activity can also include the packaging of the product.

***Suggested Activity: Manufacturing Production Process Development***

1. *Product Analysis*

Prior to the manufacture of a product, the design plans must be analyzed to determine the most efficient processes and steps used to fabricate and assemble the product. This activity will allow students to experience the process manufacturing engineers must follow to establish the best manufacturing procedures. (See *Product Analysis activity*)

2. *Bid Process for Part Production*

Often manufacturing companies will *job-shop* one or more parts of a product which they cannot produce or is not economical for them to produce. The company calls for bids to produce a certain amount of the parts by a given date. In this activity students (companies) will select one of the parts of the product to be produced and estimate what it will cost to produce. (See *Bid Process form*)

3. *Processing Procedures*

In this activity students will plan the steps that need to be taken to produce the product part. Processes must be chosen to shape or form the part correctly. (See *Processing Procedures form*)

4. *Parts Contract*

When a company agrees to produce parts they will enter into a legal contract outlining the quantity and quality of the part and the timing for delivery. This activity will set the stage for the job-shop companies to produce the required parts. (See *Job-Shop Contract form*)

***Suggested Activity: Manufacturing Production***

1 *Production Run Set-up*

The following steps are needed to be ready to begin production of the part. All or some can be performed by the students, depending on the time available. However, students should learn about the occupations associated with this process and experience as many as time and facilities allow.

A. Production Assignments (See *Production Job Assignment form*)

- a. Production Manager
- b. Jigs & Fixtures Technologist/Technician
- c. Machine Operator Technologist/Technician
- d. Materials/Supplies Procurement Technologist/Technician
- e. Safety Technologist
- f. Packaging/Shipping Technologist/Technician
- g. Quality Control Technologist/Technician
- h. Maintenance Technologist/Technician

B. Design jigs and/or fixtures needed for process (See *Jig/Fixture Design form*)

C. Order/Purchase stock materials and supplies (See *Materials Order form*)

## 2 Safety Certification

Every manufacturing facility must be concerned about employee safety. Larger companies have *Safety Engineers* and/or *Safety Specialists* to manage their safety program. This activity will allow your students to understand the importance of safety in your lab/shop and in a manufacturing facility. (See *Safety Certification form*)

## 3 Production Run

This activity produces the part the company (student team) contracted to make. During production, safety of the *Machine Operators* should be monitored by the *Safety Technologist* and the quality of the parts produced should be monitored by the *Quality Control Technologist*. The *Packaging Technologist* ensures correct packing and records the accuracy of the number of parts made. (See *Inventory Accounts form*) The *Production Manager* monitors the process and makes sure the appropriate person takes care of any problem may arise. The *Maintenance Technologist/Technician* is responsible for proper functioning of machines, tool maintenance, and a work area clear of hazards. Students should complete the *Daily Work Report* form at the end of each work session.

### **Suggested Activity: Manufacturing Assembly Production**

#### 1. Assembly Production Run Set-up

The following steps are needed to begin assembly of the parts. All or some can be performed by the students, depending on the time available. However, students should learn about the occupations associated with this process and experience as many as time and facilities allow.

- A. Production Assembly Assignments (See *Assembly Job Assignment form*)
  - a. Production Manager
  - b. Jigs & Fixtures Technologist/Technician
  - c. Machine Operator Technologist/Technician
  - d. Materials/Supplies Procurement Technologist/Technician
  - e. Safety Technologist
  - f. Packaging/Shipping Technologist/Technician
  - g. Quality Control Technologist/Technician
  - h. Maintenance Technologist/Technician
- B. Design jigs and/or fixtures needed for process (See *Jig/Fixture Design form*)
- C. Order/Purchase stock materials and supplies (See *Materials Order form*)

#### 4 Assembly Production Run

This activity assembles all the parts for the final product. During assembly production, safety of the *Machine Operators* should be monitored by the *Safety Technologist*. The quality of the parts produced by the parts companies as well as the assembled products should be monitored by the *Quality Control Technologist*. The *Packaging Technologist* assures correct packing and records the accuracy of the number of final products made and packaged. (See *Inventory Accounts form*) The *Production Manager* monitors the process and makes sure the appropriate person takes care of any problem which may arise. The *Maintenance Technologist/Technician* is responsible for proper functioning of machines, tool maintenance, and a work area clear of hazards. Students should complete the *Daily Work Report* form at the end of each work session.

## Reference:

- ITEA, *Standards for Technological Literacy, Content for the Study of Technology*, 2000, Reston Virginia
- Mid-America Vocational Curriculum Consortium, *Exploring Manufacturing Technology*, 1988, Stillwater, OK
- Wright, Thomas R., *Manufacturing and Automation Technology*, 2004, The Goodheart-Willcox Company, Inc., Tenley Park, IL

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Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic · Calibration Technician · Logistics Engineer · Safety Coordinator

# Manufacturing Process Development & Production

New Games Industries (NGI) has developed a new game to be mass produced. This manufacturing company is not equipped to produce all the parts of this game. They specialize in assembling the parts and packaging the final product.

You or your team has been requested by NGI to submit a *bid* to produce one of the parts of the game. You or your team will need to examine the part and determine the cost to produce the total number of parts required by NGI. If your bid is accepted, you or your team will enter into a contractual agreement with NGI to produce the required parts by a specific date.

Upon successful completion of the above job, you will be employed by NGI to help set up and operate a manufacturing assembly line to produce the packaged game.

### Learning Objectives:

Upon successful completion of these assignments, you will be able to:

1. List the steps/procedures in producing a product.
2. Identify and safely use hand and power tools associated with the manufacture of a product.
3. Match occupation titles to occupation descriptions.
4. Explain the need for planning in the process of manufacturing a product.

### Complete the following tasks for each segment of the manufacturing process:

#### Pre-Manufacturing Process Tasks:

1. *Product Analysis*: Examine the shop drawings for the new game. Determine what is needed to produce the product parts and assemble them for the final product (*See Product Analysis form*).
2. *Bid Process*: Using the information from *Product Analysis*, complete the *Bid Process* form (*See Bid Process form*).
3. *Parts Contract*: Once your bid has been accepted by NGI, complete the *Job-Shop Contract* between you or your team and NGI (*See Job-Shop Contract form*).
4. *Processing Procedures*: Determine the materials, supplies, equipment/tools and the steps needed to produce the product part (*See Processing Procedures form*).

#### Manufacturing Process (Parts Production) Tasks:

1. *Production Run Set-up*: You or your team will assign production jobs, design jigs and fixtures, and order materials and supplies for the production of the product part (*See Production Job Assignment form, Jig/Fixture Design form, and Materials Order form*).
2. *Safety Certification*: After determining what equipment and tools you or your team will need to produce the product part, obtain the appropriate training and pass a safety test for each tool/machine. Complete the Safety Certification before beginning the production process (*See Safety Certification form*).

3. *Production Run*: Produce the product part. Each member of the team should perform his/her assigned task and complete the required forms (*See Inventory Accounts form and Daily Work Report*).

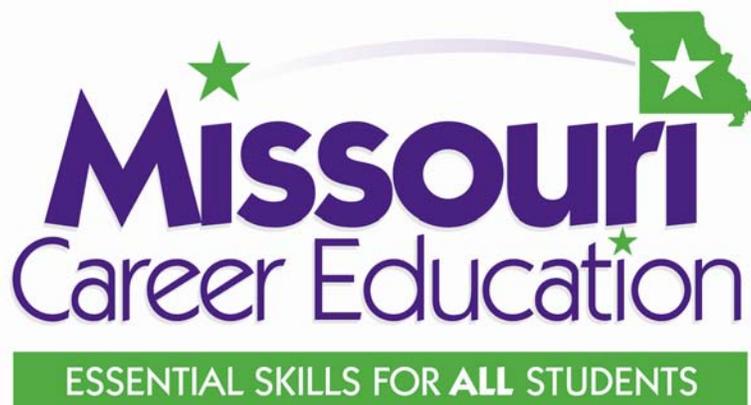
**Manufacturing Process (Assembly Production) Tasks:**

1. *Assembly Production Run Set-up*: You or your team will need to assign assembly production jobs, design jigs and fixtures, and set up the assembly line to assemble the game (*See Production Job Assignment form, Jig/Fixture Design form, and Materials Order form*)
2. *Safety Certification*: After determining what equipment and tools you or your team will need to assemble the product parts, obtain the appropriate training and pass the required safety test for each tool/machine. Complete the *Safety Certification* before beginning the assembly process unless this has already been done. If so, Safety Certification forms only need be checked and confirmed by the *Safety Technologist* (*See Safety Certification form*).
3. *Assembly Production Run*: Assemble the product parts. Each member of the team should perform his/her assigned tasks and complete the required forms (*See Inventory Accounts form and Daily Work Report*).

**Safety Reminder:**

Before you begin your job, be sure you are familiar with all safety rules and have all required safety exams successfully completed and on record with the Safety Technologist (or teacher).

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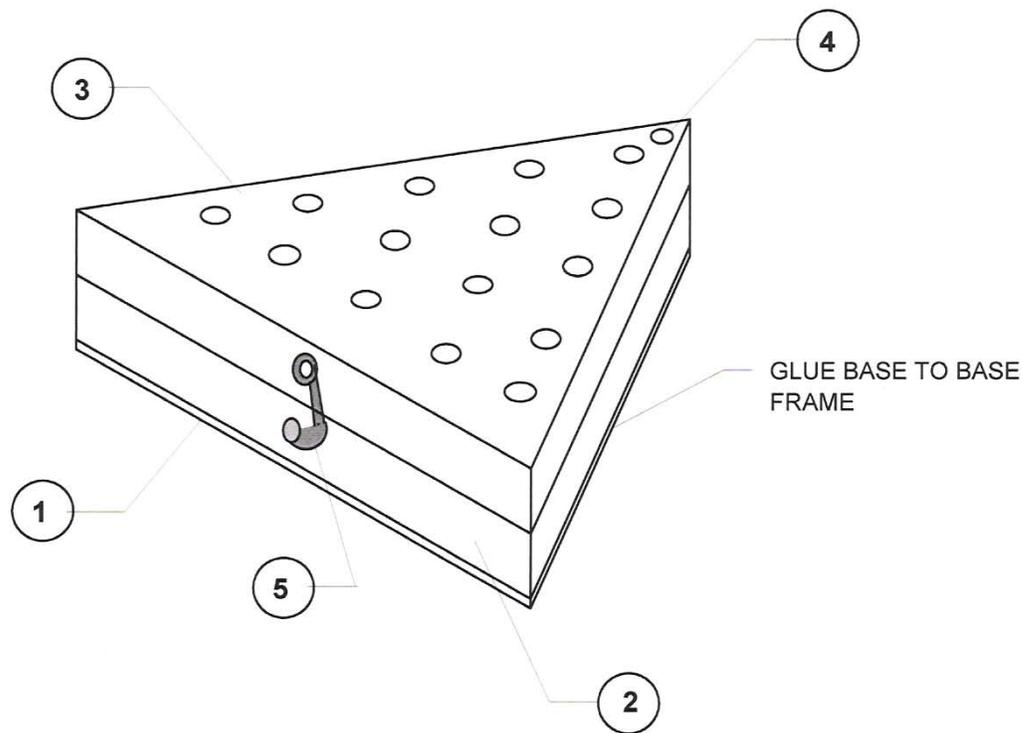
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# Exploring Careers

## *Game Board*

## *Shop Drawings*

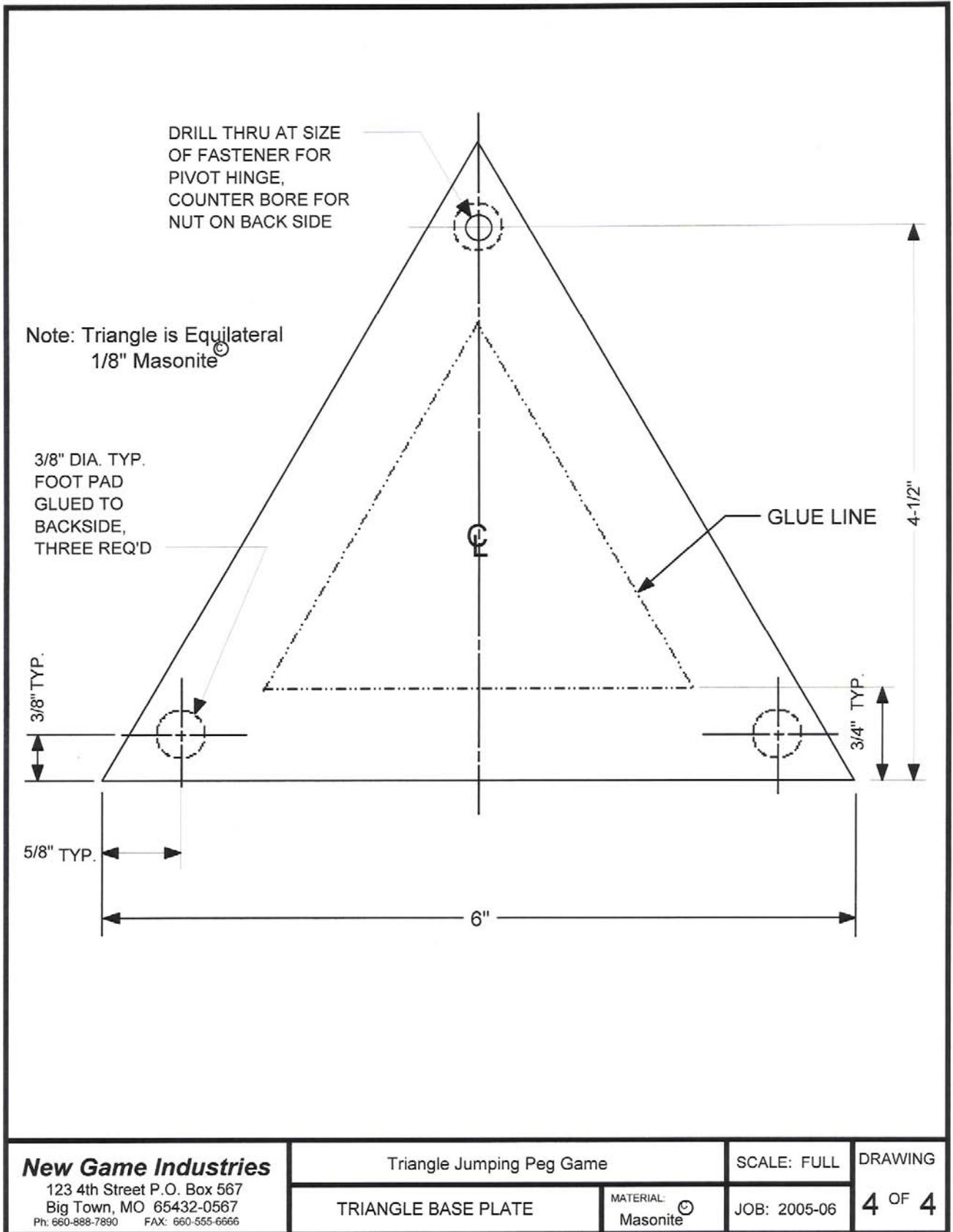
*Exploring Career Clusters*  
*Course A*  
*Architecture & Construction*  
*Science, Technology, Engineering, and Mathematics*  
*Manufacturing*

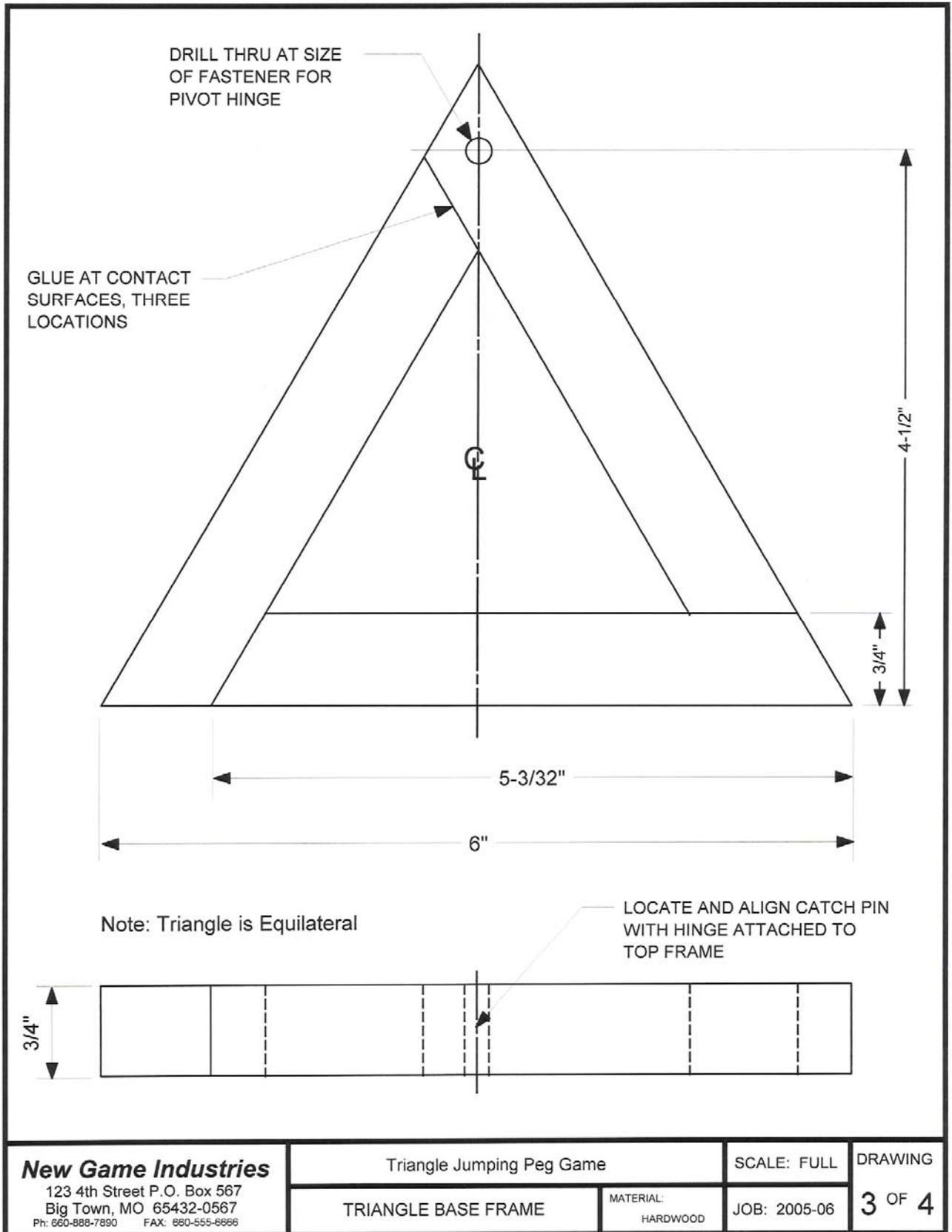


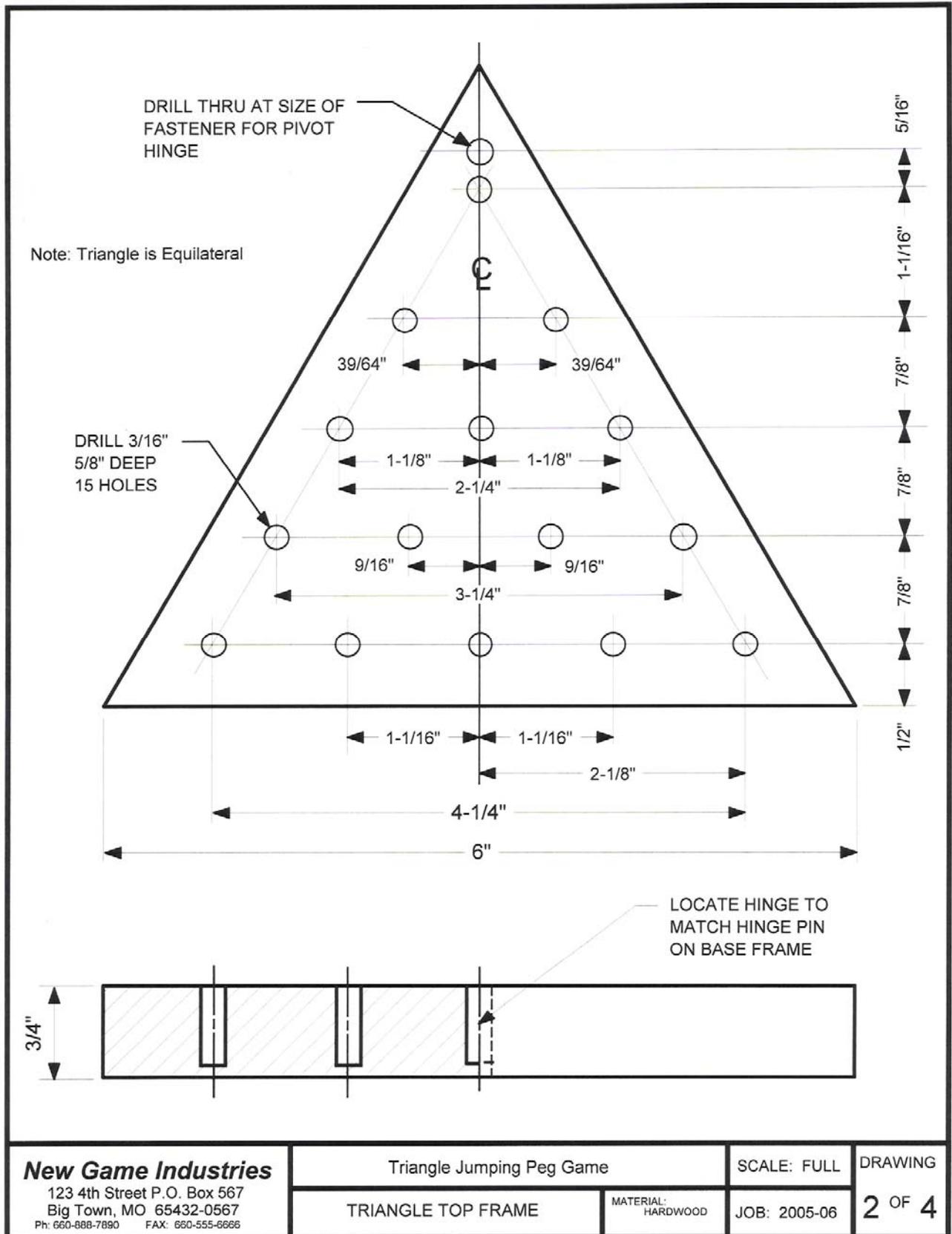
PARTS

- 1 BASE PLATE
- 2 BASE FRAME
- 3 TOP FRAME
- 4 PIVOT FASTENER
- 5 HINGE
- 6 FOOT PAD (NOT SHOWN)
- 7 STANDARD GOLF TEE (14 COUNT, NOT SHOWN)

<b>New Game Industries</b> 123 4th Street P.O. Box 567 Big Town, MO 65432-0567 Ph: 660-888-7890 FAX: 660-555-6666	Triangle Jumping Peg Game		SCALE: HALF	DRAWING
	ASSEMBLY	MATERIAL:	JOB: 2005-06	1 OF 4









## Exploring Careers in Manufacturing



Possible Careers: Automated Manufacturing Technician • Design Engineer • Machine Operator • Industrial Maintenance Mechanic • Calibration Technician • Logistics Engineer • Safety Coordinator

### Product Analysis Information

Before those who are going to product a product can actually begin work, an analysis (breakdown into individual parts) of the product and the parts of the product must be conducted. To begin the analysis you should identify all the parts that make up the product. Below is a list of steps and questions to consider:

1. Review and become familiar with the shop drawings.
2. Make a list of each part. Be very specific on the correct name for each part. Identify the material each part is made of. If the part is something you might purchase from a store like a screw, it is referred to an “off-the-shelf part.”
3. Make a note of the quantity needed of each part like four screws.
4. Try to determine what production processing procedures would be used to make the part. See the *Parts Analysis* form for information on processes. You will want to identify which processes need to be completed. Your teacher can provide you with more information on production processes.
5. Off-the-shelf parts will not need to be produced, but they still need to be counted.
6. Use the information collected from Steps 1 – 5 to complete the *Product Analysis* form.

END OF DOCUMENT



## Exploring Careers in Manufacturing



# New Games Industries

1234th Street PO Box 567, Big Town, Missouri 65432-0567

Possible Careers: Automated Manufacturing Technician • Design Engineer • Machine Operator • Industrial Maintenance Mechanic • Calibration Technician • Logistics Engineer • Safety Coordinator

Name: \_\_\_\_\_ Apprv'd By: \_\_\_\_\_

## Product Part Analysis

**Product Name:** \_\_\_\_\_

Part No.	Part Name	Quantity Needed	Part Material	Processes	Tools/Equipment

**Secondary Processes:** Operations that use the industrial materials produced by primary production processes to make finished products.

**Separating Process** - Removing excess material to produce a desired size, shape, or finish  
 Sawing - Shearing - Turning - Abrading - Milling - Shaping - Drilling

**Forming Process** - Changing the size and shape of a material, but not the volume  
 Rolling - Bending - Extruding - Pressing - Drawing - Forging - Blow Molding - Thermoforming

**Casting Process:** Pouring liquid material (hot or cold) into molds by free-flow or pressure injection  
 Slip Casting - Permanent Mold Casting - Sand Casting - Injection Molding - Dip Casting - Rotation Molding -

**Conditioning Process:** Operations that establish mechanical properties and determine the internal structure.  
 Thermal - Chemical - Mechanical

**Assembling Process:** Holding materials together.  
 Mechanical Fastening - Bonding (Cohesive or Adhesive)

**Finishing Process:** Operations that prepare the surface of a material with the desired characteristics such as smoothness.  
 Sand Blasting - Wire Brushing - Buffing - Abrasive Etching - Knurling - Peening - Embossing - Plainishing - Cast Finish - Bleaching - Burning -  
 Painting - Electroplating - Flocking - Electrostatic Finishing - Glazing

Resource: Mid-America Vocational Curriculum Consortium, Exploring Manufacturing Technology, 1988, Stillwater, OK



## Exploring Careers in Manufacturing



Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic · Calibration Technician · Logistics Engineer · Safety Coordinator

### Bid Process

The *Bid* is usually a formal legal document that states what someone is willing to produce or perform under certain conditions for a set amount of money or for a set amount of money per hour, day, or month. In most cases bids are binding on both parties when they are accepted. They are the bases for developing legal contracts.

When a company prepares a bid for any type of job, certain information must be gathered. In the case of manufacturing a product the following are some such needed items of information:

1. What materials will the product be made from?
2. What will the stock materials cost?
3. What will the off-the-shelf parts cost?
4. How many parts will be required to be made (the more parts you make, the less each part will cost).
5. What will energy (electricity, natural gas, etc.) cost?
6. What will it cost to run equipment?
7. What will labor cost (plus health insurance, retirement funds, Workman's Compensation)?
8. If you have to ship the manufactured parts, what will it cost?
9. What level of quality will you have to meet (usually measured in percent of reject parts).
10. Will you have to purchase new tools/equipment?
11. What are the processing procedures and in what order should they run?

These are a few of the questions a *cost estimator* must find answers to. With your teacher's help complete the Processing Procedures form. With this information and the information you collected when you completed the *Product Analysis form*, complete the *Product Parts Bid form*.

Once your bid has been accepted, you or your team will need to complete

END OF DOCUMENT





# Exploring Careers in Manufacturing



Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic  
Calibration Technician · Logistics Engineer · Safety Coordinator

## Product Parts Bid

This Product Parts Bid is made and submitted by *Student Product Industries*, known as "Contractor," whose address is

\_\_\_\_\_ Street (PO Box) \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ ZIP Code

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_,

To \_\_\_\_\_

known as "Owner," whose address is

\_\_\_\_\_ Street (PO Box) \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ ZIP Code

The Contractor shall furnish all labor, materials, and services to fabricate

\_\_\_\_\_ in the quantity of \_\_\_\_\_ with \_\_\_\_\_ %  
Print Part Name (No. of Parts to be supplied)

error/defect free of defects to the Owner at

\_\_\_\_\_ Street (PO Box) \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ ZIP Code

Parts will be packaged in lots of \_\_\_\_\_ and secured from possible damage in shipping.  
for the amount of \$ \_\_\_\_\_ per part and a total amount of \$ \_\_\_\_\_,  
net due in 30 days, upon delivery.

All changes requested by the Owner, the Contractor, or their agents, will require a Change Order prior to the change and may constitute additional charges. This bid is submitted in good faith and will remain in effect for 30 days from the date of this bid.

\_\_\_\_\_  
Contractor's Signature

\_\_\_\_\_  
Print Name

END OF DOCUMENT



# Exploring Careers in Manufacturing



Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic · Calibration Technician · Logistics Engineer · Safety Coordinator

## Job-Shop Contract

This Contract made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_,

between \_\_\_\_\_, called "Owner,"  
Print Company Name

whose address is \_\_\_\_\_  
Street Address City State Zip Code

and Student Product Industries, called "Contractor" whose address is \_\_\_\_\_  
Street Address City State Zip Code

Both parties hereby agree:

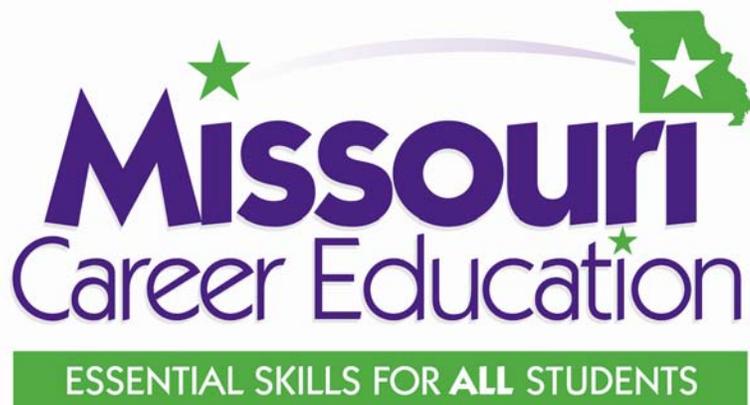
- 1. Work to be Completed:** Contractor shall furnish all labor, materials, and services to fabricate \_\_\_\_\_, hence referred to as "product part" to the specifications described in attached shop drawing(s).  
Product Part Name
- 2. Quantity:** Contractor agrees to deliver \_\_\_\_\_ product parts on or before \_\_\_\_\_.  
Delivery Date
- 3. Quality:** Contractor agrees product parts to be free of errors/defects with a rejection rate of no more than \_\_\_\_\_% and Contractor will replace any defective parts within 24 hours of notification of defective part(s).
- 5. Labor:** Contractor shall perform all work and shall not pass on or relegate work to any other sub-contractor (student) in side or out side of class.
- 6. Tools & Equipment:** Contractor shall be responsible for all tools and/or equipment used by Contractor to complete the contract.
- 7. Materials & Supplies:** Contractor shall be responsible for ordering and obtaining all necessary materials and supplies to fabricate the aforementioned product part.
- 8. Safety:** Contractor agrees to be responsible for knowing and following all general and specific safety rules while working on the product part. Contractor shall keep work area at manufacturing site clear of all clutter and/or hazards at all times during the production. Contractor shall have on file with Owner (instructor) all required records of successful completion of safety exams completed by Contractor prior to beginning production.

\_\_\_\_\_  
OWNER SIGNATURE

\_\_\_\_\_  
CONTRACTOR SIGNATURE

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name



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Jefferson City, Missouri

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# Exploring Careers in *Manufacturing Production*

***Exploring Career Clusters***  
***Course A***  
***Architecture & Construction***  
***Science, Technology, Engineering, and Mathematics***  
***Manufacturing***





# Exploring Careers in Manufacturing



Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic · Calibration Technician · Logistics Engineer · Safety Coordinator

## Safety Certification

Date Filed:

Certificate No:

This is to certify that \_\_\_\_\_ has successfully  
Print Student Name

completed the required safety exams listed below for the job of

Print Job Title

and has said exams on record with the Safety Technologist:

- |   |  |   |
|---|--|---|
| <input type="checkbox"/> General Hand Tools | <input type="checkbox"/> General Shop Safety | <input type="checkbox"/> Electric Drill |
| <input type="checkbox"/> Circular Saw       | <input type="checkbox"/> Drill Press         | <input type="checkbox"/> Band Saw       |
| <input type="checkbox"/> Scroll Saw         | <input type="checkbox"/> Reciprocating Saw   | <input type="checkbox"/> Miter Saw      |
| <input type="checkbox"/> Jig Saw            | <input type="checkbox"/> Sharps              | <input type="checkbox"/> Clean-up       |
| <input type="checkbox"/>                    | <input type="checkbox"/>                     | <input type="checkbox"/>                |
| <input type="checkbox"/>                    | <input type="checkbox"/>                     | <input type="checkbox"/>                |

The above mentioned person accepts responsibility to follow all safety rules and regulations in force on the job site (on or off school campus) and agrees to report any safety violation and/or concern to the officials in charge.

\_\_\_\_\_  
Official (Instructor) Signature

\_\_\_\_\_  
Student Signature

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

END OF DOCUMENT



# Exploring Careers in Manufacturing



## New Games Industries

1234th Street PO Box 567, Big Town, Missouri 65432-0567

Possible Careers: Automated Manufacturing Technician • Design Engineer • Machine Operator • Industrial Maintenance Mechanic • Calibration Technician • Logistics Engineer Safety Coordinator

Name: \_\_\_\_\_ Appr'd By: \_\_\_\_\_

### Parts Jig/Fixture Design Needs

**Product Name:** \_\_\_\_\_

Part No.	Part Name	Quantity	Part Material	Processes	Tools/Equipment

Sketch Jig or Fixture design below. Indicate by dashed lines the outline of the product part. Use solid lines for the Jig or Fixture.



# Exploring Careers in Manufacturing



## New Games Industries

1234th Street PO Box 567, Big Town, Missouri 65432-0567

Possible Careers: Automated Manufacturing Technician • Design Engineer • Machine Operator • Industrial Maintenance Mechanic • Calibration Technician  
Logistics Engineer • Safety Coordinator

Name: \_\_\_\_\_

Appr'd By: \_\_\_\_\_

### Materials Order Form

**Product Name:**

Complete the chart below to request stock materials and tools/equipment needed for next working day.

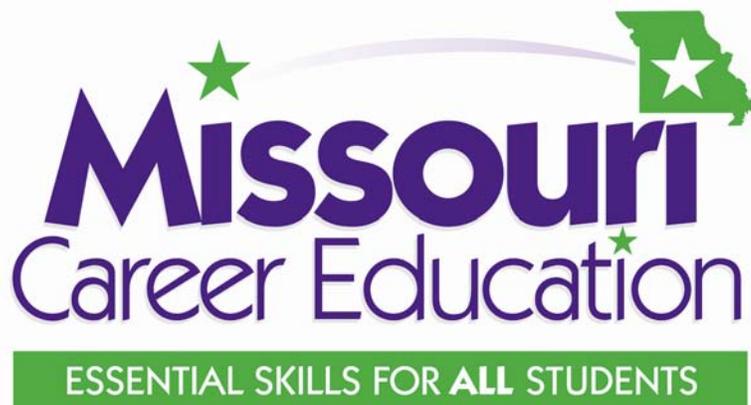
Item No.	Stock Material	Quantity	Part Name Material is for

Item No.	Tools/Equipment	Safety Certified	Part Name Tools/Equipment is for

**NOTES:**







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Division of Career Education  
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Jefferson City, Missouri

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# Exploring Careers in *Manufacturing* *Assembly Process*

*Exploring Career Clusters*  
*Course A*  
*Architecture & Construction*  
*Science, Technology, Engineering, and Mathematics*  
*Manufacturing*

Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic · Calibration Technician · Logistics Engineer · Safety Coordinator

## Manufacturing Assembly Process

Most products people buy are made up of two or more parts. Some are very simple, like an axe that has a handle and an axe head. Other products are much more complicated, such as automobiles or manufactured houses. This means that at some point in the production of a product it has to be *assembled*. The process of combining individual parts to make one product is called the *Assembly Process*.

There are two fundamental types of assembly processes. One is mechanical fastening and the other is bonding. Mechanical fastening can attach two or more parts temporarily or permanently. Bonding usually fastens parts permanently with the use of a bonding agent, through heat and/or pressure.

Examples of mechanical fastening are nails, rivets, sewing (with different types of thread), threaded fasteners (screws, bolts & nuts), staples, clips, cotter pins, and mechanical seams (in sheet metal or plastics). Examples of fastening by bonding are different types of welding, melting parts together, brazing, soldering, chemical reaction bonding, and adhesives such as various tapes or glues.

Selecting the correct assembly process or processes is very important. Here are some factors designers and engineers consider when deciding on fastening processes to use:

1. Strength needed
  - a. How much movement will there be?
  - b. Will there be low/high impact or no impact at all?
  - c. Will the product be under pressure?
2. Length of time
  - a. How long is the product expected to function/last?
  - b. How many times will the product need to operate without failure within a given amount of time?
3. Cost
  - a. How much will the fastener(s) cost compared to how much the company can earn from the sale of the product?
  - b. How much will the process or processes cost compared to how much the company can earn from the sale of the product?

Finally, production engineers and technologists must plan the most efficient way to assemble the parts of a product. This would include such factors or considerations as the order in which the parts are assembled, the level of skill needed to perform a particular assembly, the possibility of automating the processes and the packaging plan for the assembled products at the end of the assembly line (that is, are they packaged individually, multiples in one box, or not packaged at all?).

Reference:

Wright, Thomas R., *Manufacturing and Automation Technology*, 2004, The Goodheart-Willcox Company, Inc., Tenley Park, IL

Possible Careers: Automated Manufacturing Technician · Design Engineer · Machine Operator · Industrial Maintenance Mechanic · Calibration Technician · Logistics Engineer · Safety Coordinator

## Product Assembly Analysis Information

Before people who are going to assemble a product can actually begin work, an analysis (breakdown into individual processes) of the product and how the parts of the product go together must be conducted. To begin a similar analysis you should identify all of the parts that make up your product. Below is a list of steps and questions to consider:

1. Review each part and how all the parts fit together.
2. Make a list of all parts. Be very specific on the correct name for each part.
3. Identify the fastening materials to be used.
4. Determine the sequence for performing the processes. See the *Product Assembly Analysis* form for information on fastening processes. Your teacher will provide you with more information on fastening processes.
5. Determine what jigs or fixtures, if any, you will need to make the assembly process more efficient and safe.
6. Use the information collected in Steps 1 – 5 to complete the *Product Assembly Analysis* form.

END OF DOCUMENT



## Exploring Careers in Manufacturing



# New Games Industries

1234th Street PO Box 567, Big Town, Missouri 65432-0567

Possible Careers: Automated Manufacturing Technician • Design Engineer • Machine Operator • Industrial Maintenance Mechanic • Calibration Technician • Logistics Engineer • Safety Coordinator

Name: \_\_\_\_\_ Appr'd By: \_\_\_\_\_

## Product Assembly Analysis

**Product Name:** \_\_\_\_\_

Part No.	Part Name	Attached To (Part Name)	Fastening Process to be Used (Check All That Apply)				Fastening Material to be Used
			Mechanical Fastener	Mechanical Force	Adhesive Bonding	Cohesive Bonding	

**Mechanical Assembly:** Fastening that temporarily or permanently holds parts together with mechanical parts or mechanical force. These are divided into two groups: *Mechanical Fasteners* and *Mechanical Force*.

**Examples of Mechanical Fasteners:** Wing Nut, Clip, Cotter Pin, Staple, Screw, Bolt, Nail, Thread (Sewing), and Rivet.

**Examples of Mechanical Force:** Force Fit of two parts (Interference Fit, Press Fit, Shrink Fit), Seaming.

**Bonding Assembly:** Fastening two or more parts together, which is usually permanent, using a process of *Adhesive* or *Cohesive Bonding*. *Adhesive Bonding* requires a tacky or sticky material to be applied between two parts. *Cohesive Bonding* requires two or more materials to be "melted" together to form a solid part. This process occurs at the molecular level where molecules bond together.

**Examples of Adhesive Bonding:** White Glue, Contact Cement, Epoxy, Liquid Solder

**Examples of Cohesive Bonding:** Arc & Gas Welding, Brazing, Soldering, Spot Welding, Cold Bonding (high pressure)








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Possible Careers: Automated Manufacturing Technician • Design Engineer • Machine Operator • Industrial Maintenance Mechanic • Calibration Technician • Logistics Engineer • Safety Coordinator

Name: \_\_\_\_\_ Appr'd By: \_\_\_\_\_

### Assembly Jig/Fixture Design Needs

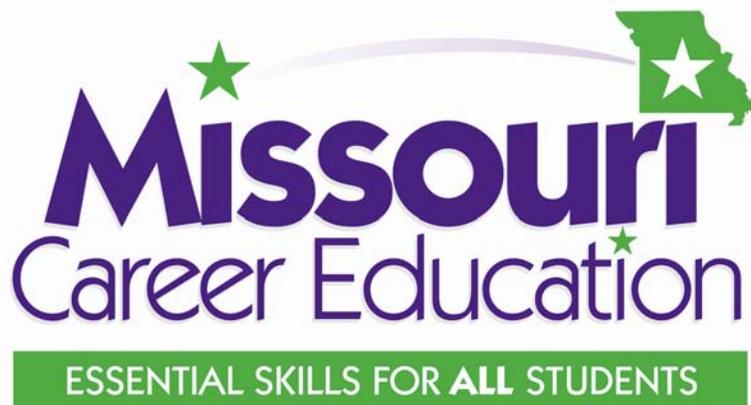
**Product Name:** \_\_\_\_\_

Part No.	Part Name	Quantity	Part Material	Processes	Tools/Equipment

Sketch Jig or Fixture design below. Indicate by dashed lines the outline of the product part. Use solid lines for the Jig or Fixture.







Missouri Center for Career Education  
Department of Career & Technology Education  
Central Missouri State University  
Warrensburg, Missouri

Division of Career Education  
Department of Elementary & Secondary Education  
Jefferson City, Missouri

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# *Manufacturing Career Search*

## *Exploring Career Clusters* *Course A* *Architecture & Construction* *Science, Technology, Engineering, and Mathematics* *Manufacturing*

## Introduction to Career Search

Your students have spent the last few weeks in hands-on experiences within this Career Cluster gaining an understanding of and an appreciation for various occupations. They should have also gained some understanding of the knowledge and skills needed to enter these occupations. This unit of study is intended to help the student gain more detailed information about specific occupations that interest them. Before attempting the search, your students should take an interest survey to give them insight and direction. Your students will then be ready to select their occupations of interest and complete the career search. Remember, a major objective of this course is for your students to have an educated understanding of career options within specific clusters.

### *Teacher Preparation*

There are several references available for teachers and students. You will want to view these references before finalizing your lessons and before your students begin their career search. You should visit with your guidance counselor(s) at the beginning of this course and coordinate your efforts and arrange time for the counselor to help. You should also contact your Area Career Center to arrange class presentations and/or a tour of the center facilities and programs.

**Note:** Your enthusiasm for this unit will be a huge encouragement for your students. Help them understand that good planning now will save them time and money later. You will also want to express the fact that plans can change and what they select now can be altered at any point in their high school and/or college life. Additionally, encourage your students to share their findings with their parents or guardians.

Although there are many resources available in print and online which you and your students can use, Missouri Kuder (<http://mo.kuder.com/>) is the official college and career planning program recognized by Missouri Guidance & Placement Services of the Department of Elementary and Secondary Education, Career and Technical Education Division. Your guidance counselor will be able to help you access the web site if you have not done so.

Prepare a bulletin board that displays various educational options after high school in this Career Cluster. Be sure to include both local and distant schools as well as low to high costs schools.

### Resources:

- Missouri Kuder, <http://mo.kuder.com/>
- Missouri Guidance and Placement Services,
- [http://dese.mo.gov/divcareered/career\\_plan.htm](http://dese.mo.gov/divcareered/career_plan.htm)
- Explore Careers, <http://www.iseek.org/sv/10000.jsp>
- Gettech, <http://gettech.org/default2.asp>
- Vocational Information Center, <http://www.khake.com/>
- Technology Careers, <http://www.pathwaystotechnology.org/>
- Career Voyages, US Government, <http://www.careervoyages.gov>

## *Suggested Activities*

### 1. *Interest Assessment* (if not taken before)

(This activity will only need to be completed once in the semester.) Take the interest assessment (Kuder® Career Search with Person Match), the skills inventory (Kuder Skills Assessment), and print out the Composite Report from these two. If possible, enlist the help of your guidance counselor. Go to <http://mo.kuder.com/> to find the assessment documents.

### 2. *Career Search Identity*

You will want to make sure your students have the *Manufacturing Pathways* chart available so they can select occupations relevant to this Career Cluster search. You will need to decide how many searches you want your students to complete. It is suggested that they complete one search for each of the occupational levels: Technician, Technologist, and Professional. You may have them complete more if time permits.

#### Handout: *Definitions of the Three Levels of Occupations*

This handout will give the students a brief description the three levels of occupations students might find in any Career Pathway. This is a way of recognizing different levels of education and skills needed for an occupation.

#### Handout: *MLA Citation Style Information*

Your students will be asked to cite their sources of information. This handout will give them the correct format for citing different sources. It is suggested you review this with them. You may also want to check with your English teachers and/or librarian to confirm the style(s) being taught in your building

### 3. *Career Center Presentation* (if not done already)

Contact your career center director or guidance counselor and make arrangements for a tour of the center facilities and a presentation of the programs the center offers. If it is not possible to tour the facilities, arrange for presentations by career center faculty in your classroom or lab. Make sure the presentations include photos. If possible, make a video tour of the center with interviews by faculty and students.

Handout: *Career Center Information* (teacher designed) Design an information sheet with appropriate questions about the various programs offered by your career center in the *Manufacturing Cluster*. Include such topics as the type of activities for students, certifications available, types of jobs after the program, transferability to college, characteristics students should have to be successful in each program, etc.

### 4. *Four-Year High School Plan*

Enlist the assistance of your guidance counselor. You will want your students to identify courses that will prepare them for post high school employment and/or higher education programs. Use *Missouri Kuder* and the *Missouri Educational Career Plan* (Manufacturing) form found at [http://dese.mo.gov/divcareered/career\\_plan.htm](http://dese.mo.gov/divcareered/career_plan.htm).

END OF DOCUMENT

## Definitions of the Three Levels of Occupations



### ***TECHNICIAN***

Technicians typically build, repair, maintain, and/or operate specialized, complex, technical equipment and systems. A technician receives technical training through an apprenticeship program (on-the-job), a technical certification program, or a two-year associate degree college program.



### ***TECHNOLOGIST***

Technologists typically work as technical managers and must be able to understand theories and apply the principles and concepts of mathematics, science, and applications of computer fundamentals. Generally, a technologist is college educated with a four-year degree, which includes general education, technical specializations, and technical management.



### ***PROFESSIONAL***

A professional is a person who has an occupation requiring training in the liberal arts or the sciences and usually advanced study (course work after the bachelor's degree or a master's degree) in a specialized field such as, but not limited to, architects, engineers, upper level managers, certified accountants, and educators.

END OF DOCUMENT

## Occupational Levels

<b>Manufacturing</b>		
<b><u>Technician</u></b>	<b><u>Technologist</u></b>	<b><u>Professional</u></b>
Assembler	Communications, Transportation & Utilities Managers	SPC Coordinator
Automated Manufacturing Technician	Design Engineer	
Biomedical Equipment Technician	Electrical & Electronic Technologists	
Boilermaker	Electronics Engineer	
Bookbinder	Engineering Technologist	
Calibration Technician	Environmental Engineer	
Communication System Installer/Repairer	Environmental Specialist	
Computer Installer/Repairer	Industrial Engineer	
Computer Maintenance Technician	Industrial Facilities Manager	
Dispatcher	Labor Relations Manager	
Electrical & Electronic Technician	Logistical Engineer	
Electrical Installer/Repairer	Manager/Supervisor	
Electromechanical Equipment Assembler	Manufacturing Engineer	
Engineering Technician	Production Manager	
Extruding & Drawing Machine Setters/Set-up Operators	Purchasing Agent	
Extrusion Machine Operator	Quality Engineer	
Facilities Technician	Safety Coordinator	
Facility Electrician	Safety Engineer	
Foundry Worker		
Freight, Stock, & Material Mover		
Grinding, Lapping & Buffing Machine Operator		
Hand Packers & Packagers		
Hoist & Winch Operator		
Industrial Electronic Installer/Repairer		
Industrial Machinery Mechanic		
Industrial Maintenance Electrician		

Note: The above information is referenced from various internet searches.  
It is based solely on the interpretation of the author and may be altered at the teacher's discretion.

<b>Manufacturing con't</b>		
<b><u>Technician</u></b>	<b><u>Technologist</u></b>	<b><u>Professional</u></b>
Industrial Maintenance Mechanic		
Industrial Truck & Tractor Operator		
Inspector		
Instrument Calibration & Repairer		
Instrument Control Technician		
Lab Technician		
Laser Systems Technician		
Maintenance Repairer		
Major Appliance Repairer		
Manufacturing Technician		
Material Handler		
Material Mover		
Meter Installer/Repairer		
Milling Machine Setter, Set-up Operator		
Millwright		
Operators, Tenders, Cutters/Brazers, Soldering, Machine Operation		
Painter		
Pattern & Mold Maker		
Plumber, Pipe Fitter & Steam Fitter		
Power Generating & Reactor Plant Operator		
Precision Inspector, Tester, & Grader		
Precision Optical Goods Worker		
Process Control Technician		
Process Improvement Technician		
Production Associate		
Quality Control Technician		
Safety Technician		
Security System Installer/Repairer		
Sheet Metal Worker		
Solderer & Brazer		
Tool & Die Maker		
Traffic, Shipping & Receiving Clerk		
Welder		

Note: The above information is referenced from various internet searches.  
It is based solely on the interpretation of the author and may be altered at the teacher's discretion.



## Exploring Careers in Manufacturing



Career Pathways: Production • Manufacturing Production Process Development • Maintenance, Installation & Repair Quality Assurance  
Logistics & Inventory Control • Health, Safety and Environmental Assurance

### Career Search Identity

**Student Name:**

**Graduation Year:**

Your career search is designed to help you gain understanding and knowledge about career possibilities within your interest of the *Manufacturing Career Cluster*. Based on your recent experiences in this class and the interest assessment you took in Kuder, you will choose at least one occupational Pathway and an occupation from each of the three levels of occupations: Technician, Technologist, and Professional. When you have completed your search, you will:

1. know what level of education you must have.
2. know what technical skills you must have.
3. know what academic skills you must have.
4. know what the working conditions will be.
5. know what the average wage/salary will be.
6. know what the outlook for jobs will be.
7. know where the jobs will be found.

You should select your occupations from the Manufacturing Pathways chart. Within each Pathway, occupations can be divided into three levels: 1. Technician, 2. Technologist, and 3. Professional. Select one occupation from each of the occupational levels which may be from one Pathway or all three Pathways. Complete the following information:

Occupations I will research:

	<b>Technician:</b>	
Pathway		Occupation
	<b>Technologist:</b>	
Pathway		Occupation
	<b>Professional:</b>	
Pathway		Occupation

END OF DOCUMENT



## Exploring Careers in Manufacturing



Career Pathways: Production • Manufacturing Production Process Development • Maintenance, Installation & Repair Quality Assurance  
Logistics & Inventory Control • Health, Safety and Environmental Assurance

### Pathway:

---

**Activity Completed:**

Date

**Activity Assessment:**

**Student Name:**

**Graduation Year:**

**Occupation:**

Level:  Technician  Technologist  Professional  
Check One Above

**Sources of Information** - Refer to Bibliographic Style Sheet for correct format to cite references:

**Work Activities** - Provide at least four activities this person would do on the job:

- 1.
- 2.
- 3.
- 4.

**Work Conditions** - List at least three physical conditions you would work under and if you would be required to work with other people:

- 1.
- 2.
- 3.
4. Are you required to work with other people?  Yes  No

**Skills, Abilities & Knowledge** - List the required skills, abilities & knowledge in each of the areas listed below:

Communication:

Math Level:

Science Knowledge:

Technical Knowledge:

Tool/Equipment Skill:

**Preparation** - Check all education or training you need to enter this occupation:

High School Diploma  GED  On-The-Job Training/Apprenticeship  Technical  University

**Wages** - List the hourly wage and the annual expected income:

Amount per Hour:                      Amount per Month:                      Amount per Year:

**Outlook** (Will there be jobs available in this occupation in the future?)

Number of Jobs now available:                      Number of Jobs available in  
5 Years                      10 Years

**Major Employers** - What type of companies will hire you?

- |    |    |
|----|----|
| 1. | 4. |
| 2. | 5. |
| 3. | 6. |

END OF DOCUMENT

# Educational Career Plan

**Career Path:** Industrial & Engineering Technology

**Career Cluster:** Manufacturing

**Career Pathway:**

**Graduation Year:**

**Date:** \_\_\_\_\_

**Student Name:** \_\_\_\_\_

**Student Signature:** \_\_\_\_\_

**Advisor Signature:** \_\_\_\_\_

**Parent/Guardian Signature (if required):** \_\_\_\_\_

<b>High School</b>	9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade*
	English I	English II	English III	English IV
	Algebra I or Geometry	Geometry or Algebra II	Algebra II or Trigonometry	Trigonometry or Pre-Calculus
	Physical Science or Biology I	Biology I or Chemistry I	Chemistry or Physics	Physics or Environmental Science
	Geography/State History	World History	American History	Economics/Government
	PE/Health or Fine Arts	PE/Health or Fine Arts		Personal Finance
				Practical Art (if needed)
	<b>Career Major Elective(s)</b> Agriscience I Foundations Course (PLTW) Technology Education	<b>Career Major Electiv(e)s</b> Agriscience II Foundations Course (PLTW) Technology Education	<b>Career Major Coursework:</b> Electronics **Engineering Design & Development Industrial Maintenance Introduction to Engineering Plastic Manufacturing Precision Machining Principles of Ag. Technology Principles of Engineering Welding	
	<b>Additional Coursework</b> Foreign Language or Computer Technology	<b>Additional Coursework</b> Foreign Language or Computer Technology	**Aerospace Engineering Agriculture Power & Technology **Biotechnical Engineering **Civil Engineering and Architecture **Computer Integrated Manufacturing Computer Numerical Control Drafting and CAD Drafting and Design	
<b>Postsecondary</b>	Area Career Center	Community College	College/University	Other
	<input type="checkbox"/> Automated Manufacturing Technology <input type="checkbox"/> Drafting and CAD <input type="checkbox"/> Electronics <input type="checkbox"/> Industrial Maintenance <input type="checkbox"/> Manufacturing Engineering Technology <input type="checkbox"/> Plastic Manufacturing <input type="checkbox"/> Precision Machining <input type="checkbox"/> Welding	<input type="checkbox"/> Agriculture Engineering <input type="checkbox"/> Apprenticeships <input type="checkbox"/> Automated Aerospace Manufacturing Technology <input type="checkbox"/> Engineering Technology <input type="checkbox"/> Industrial Drafting <input type="checkbox"/> Industrial Electronics <input type="checkbox"/> Industrial Maintenance <input type="checkbox"/> Machining <input type="checkbox"/> Manufacturing Technology <input type="checkbox"/> Pre-Engineering <input type="checkbox"/> Precision Production Trades <input type="checkbox"/> Tool & Die Making	<input type="checkbox"/> Education <input type="checkbox"/> Engineering Technology <input type="checkbox"/> Industrial Technology <input type="checkbox"/> Mechanical Engineering <input type="checkbox"/> Mechanical Engineering Technology	<input type="checkbox"/> Apprenticeship <input type="checkbox"/> Military <input type="checkbox"/> On-the-Job Training

<b>Career Enhancement Options</b>	<b>Work-based Learning Opportunities</b>	<b>Relevant High School Intra-Curricular/Co-Curricular Experiences</b>	<b>Graduation Exams</b>
	After School Employment Cooperative Occupational Experience Internship/Mentorship Job-Shadowing On-The-Job Training Service Learning	Career and Technical Student Organization:  SkillsUSA  Technology Students of America (TSA)  Other high school activities:	___ U.S. Constitution    ___ MO Constitution

Adapted from National Career Cluster

\* 12<sup>th</sup> grade year should include at least 3 academic courses including college prep math or science.

\*\* These courses are part of the Project Lead The Way curriculum. More information is available at [www.pltw.org](http://www.pltw.org).

*Note: All Career and Technical Education courses count as a practical arts credit.*



# MLA Citation Style

This guide provides a basic introduction to the MLA citation style. It is based on the 6th edition of the MLA Handbook for Writers of Research Papers published by the Modern Language Association in 2003.

Copies are available at the Vanier Library Reference Desk, in the Webster Library Reference Collection and on 3-hour Reserve (Webster). The call number for the handbook is LB 2369 G53 2003.

The MLA Handbook is generally used for academic writing in the humanities. The handbook itself covers many aspects of research writing including selecting a topic, evaluating sources, taking notes, plagiarism, the mechanics of writing, the format of the research paper as well as the way to cite sources.

This guide provides basic explanations and examples for the most common types of citations used by students. For additional information and examples, refer to the MLA Handbook.

## *Parenthetical references in the text*

---

Parenthetical documentation allows you to acknowledge a source within your text by providing a reference to exactly where in that source you found the information. The reader can then follow up on the complete reference listed on the Works Cited page at the end of your paper.

- ◆ In most cases, providing the author's last name and a page number are sufficient:

In response to rapid metropolitan expansion, urban renewal projects sought “an order in which more significant kinds of conflict, more complex and intellectually stimulating kinds of disharmony, may take place” (Mumford 485).

- ◆ If there are two or three authors, include the last name of each:

(Winks and Kaiser 176)

(Choko, Bourassa, and Baril 258-263)

- ◆ If there are more than three authors, include the last name of the first author followed by “et al.” without any intervening punctuation:

(Baldwin et al. 306)

- ◆ If the author is mentioned in the text, only the page reference needs to be inserted:

According to Postman, broadcast news influences the decision-making process (51-63).

*Parenthetical documentation is not used for electronic or web documents if there is no pagination.*

Further examples and explanations are available in Chapter 6 of the MLA Handbook.

## *Works Cited*

---

The alphabetical list of works cited that appears at the end of your paper contains more information about all of the sources you've cited allowing readers to refer to them, as needed. The main characteristics are:

- ◆ The list of Works Cited must be on a new page at the end of your text
- ◆ Entries are arranged alphabetically by the author's last name or by the title if there is no author
- ◆ Titles are underlined (not *italicized*) and all important words should be capitalized
- ◆ Entries are double-spaced (for the purposes of this handout, single-spacing is used)

Below are some examples of the most common types of sources including online sources (web and databases).

### **Book with one author**

Mumford, Lewis. The Culture of Cities. New York: Harcourt, 1938.

### **Book with two or three authors**

Francis, R. Douglas, Richard Jones, and Donald B. Smith. Destinies: Canadian History Since Confederation. Toronto: Harcourt, 2000.

### **Book with more than three authors**

Baldwin, Richard et al. Economic Geography and Public Policy. Princeton: Princeton UP, 2003.

### **Two or more books by the same author**

*Replace the author's name by three hyphens and arrange alphabetically by the book's title*

Postman, Neil. Amusing Ourselves to Death: Public Discourse in the Age of Show Business. New York: Viking, 1985.

---. The Disappearance of Childhood. New York: Vintage, 1994.

### **Anthology or compilation**

Abate, Corinne S., ed. Privacy, Domesticity, and Women in Early Modern England. Burlington, VT: Ashgate, 2003.

### **Work in an anthology or an essay in a book**

Naremore, James. "Hitchcock at the Margins of Noir." Alfred Hitchcock: Centenary Essays. Eds. Richard Allen and S. Ishii-Gonzalès. London: BFI, 1999.

### **Book by a corporate author**

*Associations, corporations, agencies and organizations are considered authors when there is no single author*

Organisation for Economic Co-operation and Development. Action Against Climate Change: The Kyoto Protocol and Beyond. Paris: OECD, 1999.

### **Article in a reference book or an entry in an encyclopedia**

*If the article/entry is signed, include the author's name; if unsigned, begin with the title of the entry*

Guignon, Charles B. "Existentialism." Routledge Encyclopedia of Philosophy. Ed. Edward Craig. 10 vols. London: Routledge, 1998.

### **A translation**

Kafka, Franz. The Metamorphosis. Trans. and Ed. Stanley Corngold. New York: Bantam, 1972.

### **A government publication**

Canada. Dept. of Foreign Affairs and International Trade. Freedom From Fear: Canada's Foreign Policy for Human Security. Ottawa: DFAIT, 2002.

United Nations. Dept. of Economic and Social Affairs. Population Division. Charting the Progress of Populations. New York: UN, 2000.

### **Book in a series**

Bloom, Harold, ed. André Malraux. Modern Critical Views. New York: Chelsea House, 1988.

### **Article in a journal**

Ferrer, Ada. "Cuba 1898: Rethinking Race, Nation, and Empire." Radical History Review 73 (1999): 22-49.

Man, Glenn K. S. "The Third Man: Pulp Fiction and Art Film." Literature Film Quarterly 21.3 (1993): 171-178.

### **Article in a newspaper or magazine**

Semenak, Susan. "Feeling Right at Home: Government Residence Eschews Traditional Rules." Montreal Gazette 28 Dec. 1995, Final Ed.: A4.

Driedger, Sharon Doyle. "After Divorce." Maclean's 20 Apr. 1998: 38-43.

### **A review**

Kirn, Walter. "The Wages of Righteousness." Rev. of Cloudsplitter, by Russell Banks. New York Times Book Review 22 Feb. 1998: 9.

Kauffmann, Stanley. "A New Spielberg." Rev of Schindler's List, dir. Steven Spielberg. New Republic 13 Dec. 1993: 30.

### Television or radio program

"Scandal of the Century." Narr. Linden MacIntyre. The Fifth Estate. CBC Television. 23 Jan. 2002.

### Sound recording

Ellington, Duke. "Black and Tan Fantasy." Music is My Mistress. Musicmasters, 1989.

### Film, video recording or DVD

The Shining. Dir. Stanley Kubrick. Perf. Jack Nicholson, Shelley Duvall. Warner Bros., 1980.

Macbeth. Dir. Roman Polanski. Perf. Jon Finch, Francesca Annis, and Nicholas Selby. 1971. DVD. Columbia, 2002.

### Musical composition, published score

Beethoven, Ludwig van. Symphony no. 4 in B-flat major, op. 60. Mineola, NY: Dover, 2001.

### Work of art, photographed, in a book

Cassatt, Mary. Mother and Child. 1890. Wichita Art Museum, Wichita. American Painting: 15601913. By John Pearce. New York: McGraw, 1964. Slide 22.

### • Article from a database

*Provide the same information as you would for a printed journal article and add the name of the database, the platform of the database (if applicable), the access provider (Concordia University Libraries), the date of access and the general URL for the database*

*NOTE - If the article is in HTML only, pagination is not required. However, you can include the start page followed by a hyphen, a space and then a period. If a PDF version is available, provide pagination.*

Brennan, Katherine Stern. "Culture in the Cities: Provincial Academies During the Early Years of Louis XIV's Reign." Canadian Journal of History 38.1 (2003): 19-42. CBCA Complete. ProQuest. Concordia University Libraries. 29 Mar. 2004 <<http://www.proquest.com>>.

Dussault, Marc and Bruce G. Barnett. "Peer-assisted Leadership: Reducing Educational Managers' Professional Isolation." Journal of Educational Administration 34.3 (1996): 5- . ABI/INFORM Global. ProQuest. Concordia University Libraries. 29 Mar. 2004 <<http://www.proquest.com>>.

Heming, Li, Paul Waley, and Phil Rees. "Reservoir Resettlement in China: Past Experience and the Three Gorges Dam." The Geographical Journal 167.3 (2001): 195-212. Academic Search Premier. EBSCOhost. Concordia University Libraries. 29 Mar. 2004 <<http://search.epnet.com>>.

### • Web page

"Joyce Wieland." Celebrating Women's Achievements: Women Artists in Canada. 2000. National Library of Canada. 29 Mar. 2004. <<http://www.nlc-bnc.ca/women/h12-523-e.html>>.

### • Internet site

Legends of our Times: Native Ranching and Rodeo Life on the Plains and Plateau. 22 Jan. 1999. Canadian Museum of Civilization. 29 Mar. 2004. <<http://www.civilisations.ca/aborig/rodeo/rodeo00e.html>>.

### • Article in online periodical

Sehmy, Dalbir S. "Wrestling and Popular Culture." CCLWeb: Comparative Literature and Culture 4.1 (2002). 29 Mar. 2004 <<http://clwebjournal.lib.purdue.edu/clweb02-1/sehmy02.html>>.

*Revised: March 2004*