

Unit 2-H

**EXPLORING
CAREER CLUSTERS:**

MANUFACTURING



UNIT 2-H: EXPLORING CAREER CLUSTERS: Manufacturing *Suggestions for the Instructor*

Pg. 2H-13 - 14 -- What Do You Already Know? Job Titles in Manufacturing Science

In small groups, discuss each of the job titles in the **Manufacturing** career cluster. What do you think these workers do? What kind of environment do they work in? What tools and equipment do they use? What kind of skills do they need to have?

Pg. 2H-15 – 18 -- Manufacturing JOB TITLES: Research

In small groups, look up the job titles below on **MyCareerShines** (www.mycareershines.kuder.com) and write the definition on the lines on the handout. (Other websites or a dictionary may be used if this is not accessible.) ask students to discuss how their research compares with their prior knowledge.

Pg. 2H-19 -- Manufacturing Job Description Match-up

On this handout, have students match the letter of the job from this career cluster with the description of the job duties.

ANSWERS:

	Manufacturing Career Cluster		Description of Job Duties
<i>A</i>	Application Software Developer	C	Test, diagnose, and repair problems with production or processing machinery and equipment, including fabricating new parts according to specifications or blueprints when necessary.
<i>B</i>	Computer User Support Specialist	E	Design and implement robotic solutions for automation of tasks.
<i>C</i>	Industrial Machinery Mechanic	H	Design and integrate electrical components of mechanical equipment used in industrial production settings.
<i>D</i>	General Maintenance and Repair Worker	B	Guides users through setup of new computer equipment, and discusses problems with users in order to identify solutions.
<i>E</i>	Robotics Engineer	K	Use industrial machines to create specialized metal fixtures, tools, and parts to meet specifications in designs and blueprints.

<i>F</i>	Robotics Technician	O	Complete and analyze visual inspections and laboratory testing of finished products.
<i>G</i>	Electrical Engineering Technologist	A	Designs and creates application software using computer languages to meet user needs.
<i>H</i>	Electromechanical Engineering Technologist	J	Ensure that machines and equipment are operating appropriately and safety protocols are followed in biofuel, biomass, hydroelectric, or geothermal energy production plants.
<i>I</i>	Computer Numerically Controlled (CNC) Machine Programmer	L	Operate machines designed for cutting, bending, shaping and drilling metal parts to meet specifications in designs or blueprints.
<i>J</i>	Production Manager	D	Maintain and repair equipment such as water heaters, furnaces, or air conditioning units, as well as facilities including pipes and flooring.
<i>K</i>	Machinist	M	Use torches, chemicals, and various metals to construct pieces according to design blueprints.
<i>L</i>	Sheet metal worker	N	Work with employees to educate them on safety procedures as well as rights in the workplace, and monitor work sites for safety.
<i>M</i>	Welder or Solderer	F	Set up, test, and maintain robotic equipment on production lines.
<i>N</i>	Occupational Health and Safety Specialist	I	Programs automated machines to develop products by following blueprints or drawings to meet user needs.
<i>O</i>	Quality Control Analyst	G	Design and maintain electrical systems for industrial, residential, or commercial buildings, producing detailed schematics (plans).

Pg. 2H-20 -- Alphabetical Order

ANSWERS:

1. Application Software Developer
2. Computer User Support Specialist
3. Computer Numerically Controlled (CNC) Machine Programmer
4. Electrical Engineering Technologist
5. Electromechanical Engineering Technologist
6. General Maintenance and Repair Worker
7. Industrial Machinery Mechanic
8. Machinist
9. Occupational Health and Safety Specialist
10. Production Manager
11. Quality Control Analyst
12. Robotics Engineer
13. Robotics Technician
14. Sheet metal worker
15. Welder or Solderer

Pg. 2E-21 - 22 -- STRETCH your VOCABULARY

Have students make new words from the **Manufacturing Job Cluster** vocabulary. They may work in small groups to use their own knowledge and a dictionary to see how many forms of the words they can find. (They will not be able to fill in all the categories for some terms.) The first four are done for them.

Have them write a story about a day in the life of a person who works in the **Manufacturing** career cluster. Have them use at least ten of the words (in addition to the job titles!)

JOB TITLE	RELATED NOUN	Present-tense VERB	ADJECTIVE	ADVERB
Application Software Developer	Application Developer	Apply Develop	Applied Developed	
Computer User Support Specialist	Support	Support	Supportive Supported	Supportively
Industrial Machinery Mechanic	Mechanization	Mechanize	Mechanical	Mechanically
General Maintenance and Repair Worker	Maintenance	Maintain	Maintained	
Robotics Technician	Robot Robotics Technician		Robotic Technical	Technically
Electrical Engineering Technologist	Electricity Engineering Technology Technologist	Engineer	Electrically Engineered Technological	Technologically
Electromechanical Engineering Technologist	Electro-mechanics Engineering Technology Technologist	Engineer	Electrically Engineered Technological	Technologically
Computer Numerically Controlled (CNC) Machine Programmer	Computer Number Machine Programmer	Number Control Program	Computerized Numerical Controlled Programmed	Numerically

Robotics Engineer	Robot Robotics Engine Engineer Engineering	Engineer	Engineered	
Production Manager	Production Product Manager Management	Produce Manage	Produced Productive Managed	Productively
Machinist	Machinist Machine			
Sheet metal worker	Sheet-metal Worker	Work	Working	
Welder or Solderer	Welder Welding Solderer Soldering	Weld Solder	Welded Soldered	
Occupational Health and Safety Specialist	Occupation Health Safety Specialist	Occupy Specialize	Occupational Healthy Safe Specialized Special	Occupationally Healthfully Safely Specially
Quality Control Analyst	Quality Control Analyst	Qualify Control Analyze	Quality Controlled Analyzed	Qualitatively Analytically

Pg. 2H-23 -- Manufacturing Job Cluster Crossword Puzzle

ANSWERS:

Across

- The programs that allow users to operate computer hardware and machines. **SOFTWARE**
- Responsible for writing computer software to control machines. **PROGRAMMER**
- Required upkeep. **MAINTENANCE**

Down

- Oversees the planning, installation, and implementation of new technology. **TECHNOLOGIST**
- A person who has extensive training in a given area. **SPECIALIST**
- Uses extreme heat and chemicals to fuse metal pieces together. **WELDER**
- Make automation possible. **ROBOTICS**
- Examine closely. **ANALYZE**

Pg. 2H-24 -- Manufacturing Job Cluster Word Search

ANSWERS:

Manufacturing Career Cluster Word Search

T S I N I H C A M Z B X V N P L R O W S
R S F H O A O M R X O G O K R A E Q Y I
S N I E N G I N E E R I N G O N G P K X
F C S G X S L V N V T V L G G O A Y T C
S N I S O A P V R A K T J D R I N A E U
F O Y T P L A E C G M F X P A T A A O D
N Z L X O N O I C A J T M K M A M J A L
F D M D Z B I N C T S D C P M P V X Y T
L I B O E P O H H Y A Z A K E U K T C M
S U I Q P R T H L C R L P Y R C N N B T
X Z W A A N G A V G E K I P L C O H X X
W E L D E R N C Y L E T G S M O W R W A
M I J R J A D T P O A X J X T F K T P Y
B L Y T B G L F O J I S X G D A H I J B
E A U S Q L E S L Z R U H M Q Z O L S C
O A W O X Z D J S W P S Q Q A T D R Q W
B E O B O M F O D B X P X H W U F Y N J
L O S U G G S T P S Z G P O I Z F Q P Z
L A C I N A H C E M O R T C E L E I C A
O E D O J U J U W X L O X B P P P V V L

ANALYST
ELECTROMECHANICAL
MACHINERY
MANAGER
PROGRAMMER
ROBOTICS
SPECIALIST
WELDER

APPLICATION
ENGINEERING
MACHINIST
OCCUPATIONAL
REPAIR
SOLDER
TECHNOLOGIST

**Pg. 2H-25 - 28 -- SCIENCE in the Manufacturing Career Cluster:
What is Electricity?**

Tell students that many words in the field of science have multiple meanings and are used in non-scientific ways. The words on the handout are key to understanding the science of electricity, but they have meaning in daily life as well.

In pairs or small groups, have students discuss what the words mean outside of the context of electricity, then write a sentence using that word. Then have them look up the definition of the word as it applies to the science of electricity and write it in the box. The first one is done for them.

Vocabulary word	Non-science definition and sentence	Science / electricity definition
<ul style="list-style-type: none"> circuit insulate / insulator conduct / conductor current series parallel resistor 	<i>noun -- a circular route</i> <i>I ran two circuits of the track at the high school.</i>	

Discuss with students how much of our world is electrified. Ask them to work individually or together to list ten examples of ways that electricity is used in daily life.

On the handout, students will read what electrical engineers do and will be introduced to the basic science of electricity. Have them read the handout aloud or in small groups, follow the directions about the pictures, then answer the comprehension questions:

ANSWERS:

1. Atoms are made up of protons, neutrons, and electrons.
2. Electricity is the flow of electrons from one atom to another.
3. A path that an electric current follows is a circuit.
4. A battery supplies energy to move electricity through a circuit.
5. Insulators are materials that electrical current cannot pass through.
6. Conductors are materials that electrical current can easily pass through.
7. A resistor is a material that cuts down the flow of current, but does not stop it.
8. In a series circuit, electrical current can follow only one path.
9. A parallel circuit is a circuit in which electrical current path to follow.
10. When a circuit is closed, it is complete and there is no break in the path that the charges must follow.
11. When a circuit is open, it is incomplete, and charges can't flow through.

Pg. 2H-29 -- What Does a Robotics Engineer Do? EDITING PRACTICE

Have students rewrite the paragraph on the handout. They will edit for complete sentences, correct subject / verb agreement, punctuation, and capitalization.

ANSWERS:

Have you ever wondered how a robot learns to complete complicated tasks such as assembling a car? It is truly amazing how many complicated processes are carried out every day by robots. However, it is a common misconception that robots learn these behaviors. In fact, it is more accurate to say that robots are given a complicated set of directions to follow, in the form of a computer program written using computer languages.

In order for robots to be effective, robotics engineers must work with a variety of other engineers, mechanics, technologists, welders and machine operators. Robotics engineers design have to consider not just the physical materials that make up the robot, but also the software that will guide the robot’s actions. They must also consider the space in which the robot will be functioning

Even when a robot is designed and built, the robotic engineer’s job is not complete. As with any mechanical equipment, sometimes things don’t go quite as planned. Robotics engineers are often responsible for diagnosing, or identifying, problems, and providing directions for technicians to complete. Engineers must then run tests to ensure that all equipment is operating as it is supposed to.

While many people assume that this sort of work must happen on a loud, crowded factory floor, robotics engineers actually work in a wide variety of environments. Sometimes, engineers are based primarily in a laboratory, where they can test different potential fixes and debug, or fix, computer software. Other times, they might be outside at a construction site helping to solve a design or mechanical problem. With so many possibilities, robotics engineering truly is an exciting field to work in!

Pg. 2H-30 -- Talk About Jobs! Small Group Dialogue

Have students pick one of the jobs in the Manufacturing Career Cluster. In small groups, complete the dialogue on the handout, using at least ten of the words from the previous lessons. Have him write in such a way that the audience learns about the job duties, the work environment, and the qualities a person should possess who holds one of these jobs. Then they can perform the dialogue for the class.

Pg. 2H-31 - 33 -- A Day in the Life: Wanda Williams, Welder

ANSWERS:

1. What did Wanda do to prepare for her job as a welder?
She got her GED and enrolled in the welding program at the technical college and got certified.

2. What did you find most interesting about Wanda's story?
Answers will vary. Ask students to give specific examples from the passage.

3. What are some of the things that Wanda likes most about her job?
She likes to make sparks fly. She enjoys working by herself because working alone gives her time to think. She likes working outside.

4. What are some of the things that Wanda dislikes most about her job?
 - **Putting on welding gear which is very hot and heavy.**
 - **Fear of heights when working on girders.**
 - **The work is dangerous and you have to be careful not to get distracted.**

5. Why do you think Wanda feels proud of herself?
Answers might include:
 - **Getting her GED**
 - **Getting her welding certification**
 - **Providing for her son**
 - **Being the first woman welder her company has hired**

6. What is Wanda considering doing in her future?
She wonders if she'd want to be an underwater welder. If she got that certification, she knows she could make even more money.

Pg. 2H-34 - 35 -- A Day in the Life: Lonnie Love, Robotics Engineer

ANSWER KEY

1. What did Lonnie do to prepare for his job as a robotics engineer?

Tinkered as a kid, went to school (PhD)

2. What did you find most surprising about Lonnie’s story?

Answers will vary. (Push students to refer to specific examples from the text.)

3. What other workers in the Manufacturing Career Cluster does Lonnie work with as part of his job?

Machinists, NC programmers, software developers, robotics technicians, electromechanical technologists.

4. What are some of the things that Lonnie likes most about his job?

- **Solving problems**
- **Helping people**
- **Working with others (ask students to defend their inferences with examples from the text).**
-

5. What parts of Lonnie’s job as a robotics engineer do you think you would enjoy? Which would you find challenging?

Answers will vary. (Ask students to refer to specific examples from the text.)

6. What qualities or skills do you think Lonnie has that make him an effective robotics engineer?

leadership skills

mechanical expertise

ability to make decisions

artistic ability

knowledge of equipment and supplies

financial skills

communication skills

planning & organizational skills

responsibility

medical skills

Pg. 2H-36 -- Career Cluster Research

Ask students to use three resources to research and complete the information pertaining to job titles in the career cluster they have chosen to explore. (For example: MyCareer Shines: <https://mycareershines.kuder.com>, another on-line resource, an interview with a career counselor.)

Pg. 2H-37 - 38 -- Post-Secondary Catalogue Exploration & Presentation

For this activity, students will choose a program at one of the local educational or vocational institutions that interests them, based on what they have learned about their interests, skills and talents as well as what they now know about post-secondary options. (For example: they might select a certificate program from the local technical center, an Associate of Arts degree program, a community college certificate program or Associate of Science degree, or a four-year college degree.) They will go to the website of the institution which offers a program that interests them to answer the following questions. If they do not have internet access, if possible bring in print catalogues from the local college and vocational / technical center. Have students then prepare to present their information to the class.

Pg. 2H-39 - 41 -- Manufacturing Occupation Presentation

Have students study the occupational vocabulary on the handout. Then they can use MyCareer Shines (<https://mycareershines.kuder.com>) and the **Occupational Outlook Handbook** (http://o*netonline.com) to explore in greater depth one of the jobs in the Manufacturing Career Cluster and prepare to present the information to the class.

Image from www.commonswiki.org/wiki/File:Manufacturing_equipment_104.jpg

Unit 2-H

EXPLORING

CAREER CLUSTERS:

MANUFACTURING



Student Activities

WHAT DO YOU KNOW?

JOB TITLES IN MANUFACTURING

In small groups, discuss each of the job titles in the Manufacturing career cluster. What do you think these workers do? What kind of environment do they work in? What tools and equipment do they use? What kind of skills do they need to have?

Application Software Developer _____

Computer User Support Specialist _____

Industrial Machinery Mechanic _____

General Maintenance and Repair Worker _____

Robotics Engineer _____

Robotics Technician _____

Electrical Engineering Technologist _____

Electromechanical Engineering Technologist _____

Computer Numerically Controlled (CNC) Machine Programmer _____

Production Manager _____

Machinist _____

Sheet Metal Worker _____

Welder or Solderer _____

Occupational Health and Safety Specialist _____

Quality Control Analyst _____

MANUFACTURING

JOB TITLES: Research

In small groups, look up the job titles below on MyCareerShines (www.mycareershines.kuder.com) and write the definition on the lines below. (Other websites or a dictionary may be used if this is not accessible.) How does your research compare with your prior knowledge?

APPLICATION SOFTWARE DEVELOPER

COMPUTER USER SUPPORT SPECIALIST

INDUSTRIAL MACHINERY MECHANIC

GENERAL MAINTENANCE AND REPAIR WORKER

ROBOTICS ENGINEER

ELECTRICAL ENGINEERING TECHNOLOGIST

ELECTROMECHANICAL ENGINEERING TECHNOLOGIST

COMPUTER NUMERICALLY CONTROLLED (CNC) MACHINE PROGRAMMER

PRODUCTION MANAGER

MACHINIST

SHEET METAL WORKER

WELDER OR SOLDERER

OCCUPATIONAL HEALTH AND SAFETY SPECIALIST

QUALITY CONTROL ANALYST

ROBOTICS TECHNICIAN

MANUFACTURING

JOB DESCRIPTION MATCH-UP

Match the letter of the job from this career cluster with the description of the job duties.

	Manufacturing Career Cluster		Description of Job Duties
A	<i>Application Software Developer</i>		<i>Test, diagnose, and repair problems with production or processing machinery and equipment, including fabricating new parts according to specifications or blueprints when necessary.</i>
B	<i>Computer User Support Specialist</i>		<i>Design and implement robotic solutions for automation of tasks.</i>
C	<i>Industrial Machinery Mechanic</i>		<i>Design and integrate electrical components of mechanical equipment used in industrial production settings.</i>
D	<i>General Maintenance and Repair Worker</i>		<i>Guides users through setup of new computer equipment, and discusses problems with users in order to identify solutions.</i>
E	<i>Robotics Engineer</i>		<i>Use industrial machines to create specialized metal fixtures, tools, and parts to meet specifications in designs and blueprints.</i>
F	<i>Robotics Technician</i>		<i>Complete and analyze visual inspections and laboratory testing of finished products.</i>
G	<i>Electrical Engineering Technologist</i>		<i>Designs and creates application software using computer languages to meet user needs.</i>
H	<i>Electromechanical Engineering Technologist</i>		<i>Ensure that machines and equipment are operating appropriately and safety protocols are followed in biofuel, biomass, hydroelectric, or geothermal energy production plants.</i>
I	<i>Computer Numerically Controlled (CNC) Machine Programmer</i>		<i>Operate machines designed for cutting, bending, shaping and drilling metal parts to meet specifications in designs or blueprints.</i>
J	<i>Production Manager</i>		<i>Maintain and repair equipment such as water heaters, furnaces, or air conditioning units, as well as facilities including pipes and flooring.</i>
K	<i>Machinist</i>		<i>Use torches, chemicals, and various metals to construct pieces according to design blueprints.</i>
L	<i>Sheet metal worker</i>		<i>Work with employees to educate them on safety procedures as well as rights in the workplace, and monitor work sites for safety.</i>
M	<i>Welder or Solderer</i>		<i>Set up, test, and maintain robotic equipment on production lines.</i>
N	<i>Occupational Health and Safety Specialist</i>		<i>Programs automated machines to develop products by following blueprints or drawings to meet user needs.</i>
O	<i>Quality Control Analyst</i>		<i>Design and maintain electrical systems for industrial, residential, or commercial buildings, producing detailed schematics (plans).</i>

ALPHABETICAL ORDER

Put the following Manufacturing job titles in alphabetical order.

Application Software Developer	Computer User Support Specialist
Industrial Machinery Mechanic	Robotics Engineer
Sheet metal Worker	Robotics Technician
Production Manager	Welder or Solderer
Quality Control Analyst	Machinist
Electrical Engineering Technologist	
General Maintenance and Repair Worker	
Electromechanical Engineering Technologist	
Computer Numerically Controlled (CNC) Machine Programmer	
Occupational Health and Safety Specialist	

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

STRETCH YOUR VOCABULARY

Make new words from the **Manufacturing Career Cluster** vocabulary. Work in small groups to use your own knowledge and a dictionary to see how many forms of the words below you can find. (You will not be able to fill in all the categories for some terms.) The first four are done for you.

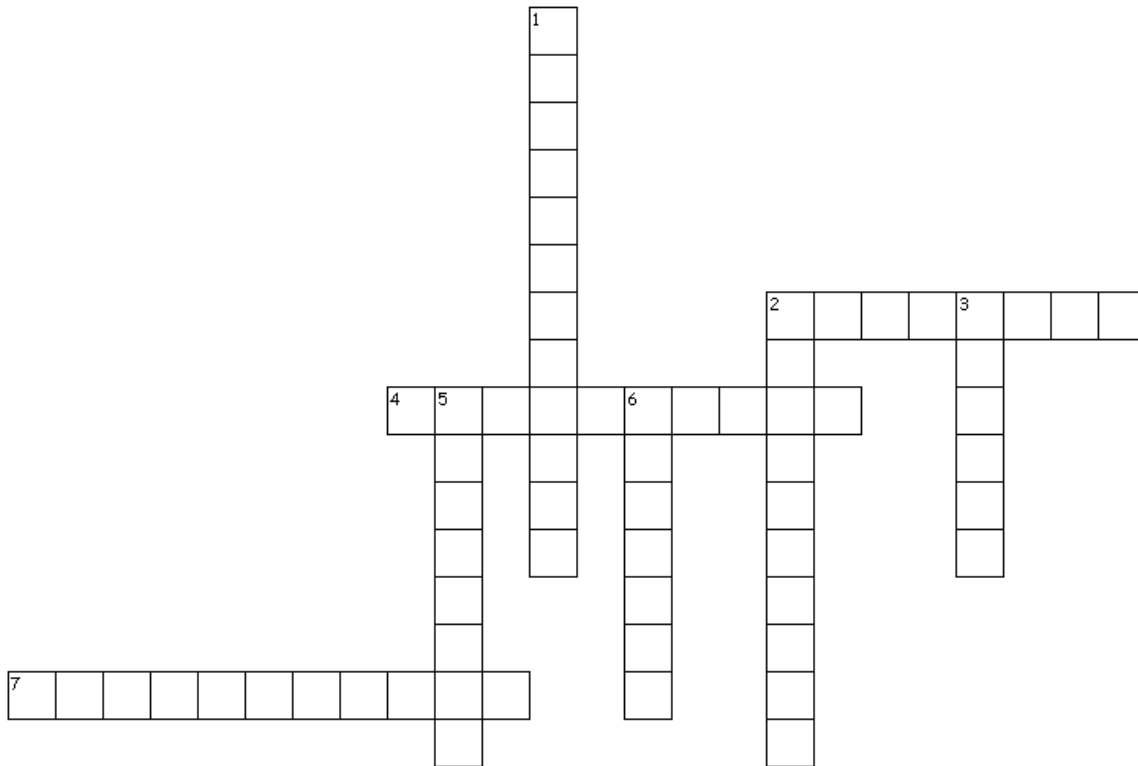
JOB TITLE	RELATED NOUN	Present-tense VERB	ADJECTIVE	ADVERB
<i>Application Software Developer</i>	Application Developer	Apply Develop	Applied Applicable Developed	
<i>Computer User Support Specialist</i>	Support	Support	Supportive Supported	Supportively
<i>Industrial Machinery Mechanic</i>	Mechanization	Mechanize	Mechanical	Mechanically
<i>General Maintenance and Repair Worker</i>	Maintenance	Maintain	Maintained	
<i>Robotics Technician</i>				
<i>Electrical Engineering Technologist</i>				
<i>Electromechanical Engineering Technologist</i>				
<i>Computer Numerically Controlled (CNC) Machine Programmer</i>				
<i>Robotics Engineer</i>				
<i>Production Manager</i>				

<i>Machinist</i>				
<i>Sheet metal worker</i>				
<i>Welder or Solderer</i>				
<i>Occupational Health and Safety Specialist</i>				
<i>Quality Control Analyst</i>				

SMALL GROUP STORY

*Now write a story about a day in the life of a person who works in the career cluster of **Manufacturing**. Use at least ten of the words above (in addition to the job titles!)*

Manufacturing Career Cluster Crossword Puzzle



Across

2. The programs that allow users to operate computer hardware and machines.
4. Responsible for writing computer software to control machines.
7. Required upkeep.

Down

1. Oversees the planning, installation, and implementation of new technology.
2. A person who has extensive training in a given area.
3. Uses extreme heat and chemicals to fuse metal pieces together.
5. Make automation possible.
6. Examine closely.

Manufacturing Career Cluster Word Search

T S I N I H C A M Z B X V N P L R O W S
R S F H O A O M R X Q G O K R A E Q Y I
S N I E N G I N E E R I N G O N G P K X
F C S G X S L V N V T V L G G O A Y T C
S N I S O A P V R A K T J D R I N A E U
F O Y T P L A E C G M F X P A T A A O D
N Z L X O N O I C A J T M K M A M J A L
F D M D Z B L N C I S D C P M P V X Y T
L I B O E P O H H Y A Z A K E U K T C M
S U I Q P R I R L C R L P Y R C N N B T
X Z W A A N G A V G E K I P L C O H X X
W E L D E R N C Y L P T G S M O W R W A
M I J R J A D T P O A X J X T F K T P Y
B L Y T B G L F O J I S X G D A H I J B
E A U S Q L E S L Z R U H M Q Z O L S C
O A W O X Z D J S W P S Q Q A T D R Q W
B E O B O M F O D B X P X H W U F Y N J
L O S U G G S T P S Z G P O J Z F Q P Z
L A C I N A H C E M O R T C E L E I C A
O E D O J U J U W X L O X B P P P V V L

ANALYST
ELECTROMECHANICAL
MACHINERY
MANAGER
PROGRAMMER
ROBOTICS
SPECIALIST
WELDER

APPLICATION
ENGINEERING
MACHINIST
OCCUPATIONAL
REPAIR
SOLDER
TECHNOLOGIST

SCIENCE in the Manufacturing Career Cluster

What is Electricity?

Many words in the field of science have multiple meanings and are used in non-scientific ways. The words below are key to understanding the science of electricity, but they have meaning in daily life as well.

In pairs or small groups, discuss what the words mean outside of the context of electricity, then write a sentence using that word. Then look up the definition of the word as it applies to the science of electricity and write it in the box. The first one is done for you.

Vocabulary word	Non-science definition and sentence	Science / electricity definition
circuit	<i>noun -- a circular route</i> <i>I ran two circuits of the track at the high school.</i>	
insulate /insulator		
conduct /conductor		
current		
series		
parallel		
resistor		

SCIENCE in the Manufacturing Career Cluster: What is Electricity?, cont.

Electrification of our world happened between the 1880s to the 1960s. Before the 1880s, people lit homes and streets with candles, oil lamps, and gas lamps. Now, of course, electricity is everywhere. It's part of our day-to-day lives.

List ten examples of ways that electricity is used in daily life.

How Do Electrical Engineers Do?

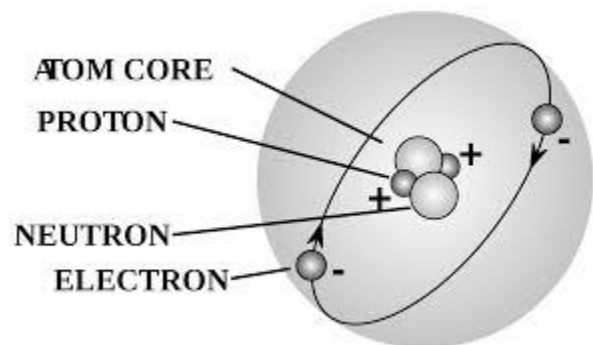
Electrical engineers use the science of electricity to solve real-world problems. They design and develop new electrical equipment, solve problems and test equipment. They work with all kinds of electronic devices, from the smallest pocket devices to large supercomputers.

Electrical engineers work with electricity, electro-magnetism and electronics. They work to solve problems that relate to the manufacture of the electrical energy grid, air and space travel, cell phones, computer software, and radio and television broadcasting.

The electricity used to power a radio or run a washing machine or refrigerator is generated at power plants long distances away from where it is used. Engineers use power lines and transformers to move the electricity created at the power plant to the places it is used, like homes, hospitals, schools, and stores. Electrical engineers control the flow of electrical energy in all of these places through circuits.

How Does Electricity Work?

Electricity is made of **atoms**. Atoms are the smallest unit of matter, impossible to see with the eye. In the center of every atom is a **nucleus**, and inside of the nucleus are **protons** and **neutrons**. **Electrons** orbit around the nucleus. .



SCIENCE in the Manufacturing Career Cluster: What is Electricity?, cont.

Electricity is the flow of electrons from one atom to another. The flow of electrons is called **electric current**.

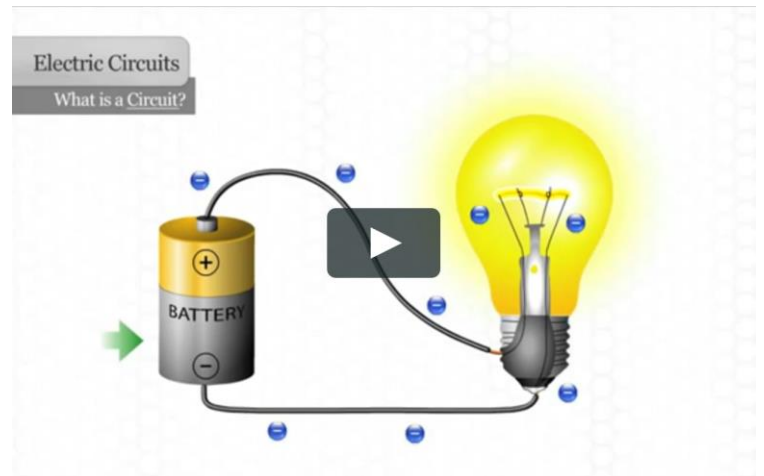
The type of electricity that is used to power things is called **current electricity**.

Current electricity is electricity that flows through wires. The path that electricity follows is called a **circuit**.

The picture shows a **circuit**.

Electricity flows from the negative side of a battery (indicated by a minus sign [-]), through the wires, and lights the bulb.

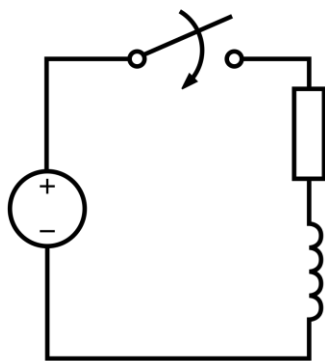
The electricity continues to travel around to the positive side of the battery (indicated by a plus sign [+]).



Draw arrows on the picture (→ or ←) to show the path of the electricity.

Something that uses some of the electricity in a circuit is called a **resistor**. Resistors could also be things like motors, light bulbs, or speakers.

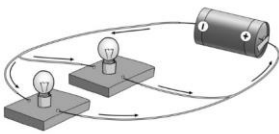
Circle the resistors in the circuit above.



A circuit can be **open** or **closed**.

When a circuit is closed, it is complete and there is no break in the path that the charges must follow. When a circuit is open, it is incomplete and charges can't flow through.

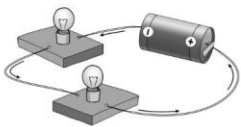
SCIENCE in the Manufacturing Career Cluster: What is Electricity?, cont.



In a **parallel circuit**, electricity follows more than one path.

In a **series circuit**, electricity follows only one path.

Insulators are materials that electrical current cannot pass through. Plastic and glass are both examples of insulators.



Conductors are materials that electrical current can easily pass through. Silver and copper are both examples of conductors.

Check Your Understanding

1. Atoms are made up of _____, _____, and _____.
2. Electricity is the flow of _____ from one atom to another.
3. A path that an electric current follows is a _____.
4. A _____ supplies energy to move electricity through a circuit.
5. _____ are materials that electrical current cannot pass through.
6. _____ are materials that electrical current can easily pass through.
7. A _____ is a material that cuts down the flow of current, but does not stop it.
8. In a _____ circuit, electrical current can follow only one path.
9. A _____ circuit is a circuit in which electrical current has more than one path to follow.
10. When a circuit is _____, it is complete and there is no break in the path that the charges must follow.
11. When a circuit is open, it is _____, and charges can't flow through.

*Images from www.commonswikimedia.org/wiki/File:Atom-struct.svg,
Creative Commons www.vimeo.com/213483724,
www.commonswikimedia.org/wiki/File:RL_Series_Open-Closed.svg,
www.flickr.com/photos/121935927@N06/13580443433*

What does a Robotics Engineer do?

EDITING PRACTICE

Adapted from www.sokanu.com

Rewrite the paragraph below. Edit for spelling, complete sentences, correct subject / verb agreement, punctuation, and capitalization.

have you ever wondered how a robot learns to complete complicated tasks such as assembling a car. it is truly amazing how many complicated processes are carried out every day by robots. However, it is a common misconception that robot's *learn* these behaviors. In fact, it is more accurate too say that robots are given a complicated set of directions to follow, in the form of a computer program writing using computer languages.

In order for robots to be effective, robotics engineers must work with a variety of other engineers mechanics technologists, welder and machine operators. Robotics engineers design have to consider not just the fysical materials that make up the robot, but also the software that will guide the robots actions. they must also consider the space in which the robot will be functioning

even when a robot is designed and built, the robotic engineers job is not complete. as with any mechanical equipment, sometimes things dont go quite as planned robotics Engineers are often responsible for diagnosing, or identifying, problems, and providing directions four technicians to complete engineers must then run tests to ensure that all equipment is operating as it is supposed to.

while many people assume that this sort of work must happen on a loud crowded factorie floor, robotics engineers actually work inn a wide variety of environments Sometimes, engineer's are based primarily in a laboratory, where they can test different potential fixes and debug, or fix, computer software. Other times, they might be outside at a construshun site helping too solve a design or mechanical problem. With sew many possibilities, robotics engineering truly is an exciting field to work in?

Talk About Jobs!

Small Group Dialogue

*Pick one of the jobs in the **Manufacturing** Career Cluster. In small groups, complete the dialogue below, using at least ten of the words from the previous lessons. Write in such a way that the audience learns about the job duties, the work environment, and the qualities a person should possess who holds one of these jobs. Then perform the dialogue for the class.*

Joe: I love being a _____

Sarena: Me, too! My favorite part of this job is _____

Joe: Really? My favorite part is _____

Sarena: I got my training for the job _____

Joe: I got my training _____

Sarena: I love the tools! I love the fact that every day I get to use _____

Joe: And the environment is so _____

Sarena: And you have to be a special sort of person to do this! You have to be _____

Joe: _____

Sarena: _____

A Day in the Life: Wanda Williams, Welder

Adapted from <https://www.shmoop.com/careers/welder/typical-day.html>

Wanda Williams wakes at 5:30 am, ready for another day on a job she'd always wanted. She always wanted to work with her hands. The day in high school in auto shop that she fired up a welding torch for the first time, she knew she'd found the career for her. She loved to make sparks fly! She left high school when she got pregnant and her mother got sick, then got her GED a few years later. And because she wanted to make good money to support her son, she enrolled in the welding program at the technical college. And after a year, she was certified! Working with a manufacturing firm for the past three years had been a dream job.

She drinks a cup of coffee and feeds herself and her son Bobby a hearty breakfast. She's going to need a lot of energy for the busy, physical day ahead. She drives Bobby to daycare, then rushes off.

She drives to the welding site, a shipyard, arriving at 7:00 am, to meet with her supervisor, Jack Johnson. He hands Wanda a blueprint.

The blueprint calls for a lot of complex welds...and a lot of grinding and cutting. Wanda sighs. She'll be doing that same thing over and over and over again today.



By 7:15, she's strapped on the safety gear. Putting on welding gear is important, but it is very hot and heavy. It's the part of the job she likes the least. The respirator snaps over her face, snug and moist. She pulls on boots so thick they feel like winter galoshes, even though it's summer. She straps on thick glasses, a visor, and heavy gloves.

It takes another half hour to set up her welding equipment. It's mostly TIG (tungsten inert gas) welding today, so the setup is shorter than usual. Next she crawls, deep, deep into the dark tunnel of the ship hull. And then she welds.

Welding is highly technical, but it's often the same thing over and over again. Her welder lights up. Sparks fly. Metal solders to metal. She inspects the weld. It's hot.

In the distance she hears a sharp yell as someone burns himself with sparks. She looks into the darkness in the direction of the noise. *Ow!* The sparks fly a little too close. She has to be careful not to get distracted because this is dangerous work.

As the hours pass, her back starts to ache. She enjoys working by herself, building a ship one metal plate at a time, because working alone gives her time to think. She wonders if she'd want to be an underwater welder. If she got that certification, she knows she could make even more money. She likes the ocean and she's a good swimmer, but she's never gotten certified as a scuba diver. She decides to research it more this weekend.

She breaks for lunch, eats a sandwich and jokes with the guys. They like and accept her now, but they were resistant and standoffish at first. She's the first female welder the company has ever hired, and she's proud of that.

In the afternoon Wanda's assignment involves climbing high up on a girder. At first it's good to be outside, but it's also scary. She continues to weld while facing the constant dread that she could fall forty feet and break her legs or worse.

At the end of the day, she climbs off the girder, packs up her equipment, and de-gears. She gets in her car and goes to pick up her son. She looks forward to taking him to the playground and telling him about her day, then getting ready for another day at the shipyard tomorrow.

Image from Creative Commons www.tinker.af.mil/News/Article-Display/Article/845408/womens-history-month-feature-ledford-forges-strong-bonds-as-elite-welder/

A Day in the Life: Wanda Williams, Welder

QUESTIONS

1. What did Wanda do to prepare for her job as a welder?
2. What did you find most interesting about Wanda's story?
3. What are some of the things that Wanda likes most about her job?
4. What are some of the things that Wanda dislikes most about her job?
5. Why do you think Wanda feels proud of herself?
6. What is Wanda considering doing in her future?

A Day in the Life: Lonnie Love, Robotics Engineer

(Adapted from energy.gov)

When I was a kid, I loved to figure out how things worked. One memory that's vivid is taking apart my dad's lawn mower and not being able to get it back together before he got home. His response was "You should be an engineer." I was young enough that I didn't know what that was. But, if I could take apart someone's stuff and not get in trouble...that was the job for me!

Later, as an undergraduate, I had an opportunity to work in a controls lab. It was my first exposure to robotics. This led to an internship at NASA Langley which was a springboard for my Ph.D. and career with ORNL's Robotics Group.

Day to day, I work at a national laboratory, where my work focuses on making hydraulic systems more smaller, lighter, and more efficient. The products my team has worked on have been used in not just robots, but prosthetics and wearable robotic applications as well.

Because I work in a large laboratory, I am always working alongside and in partnership with other engineers and scientists. Often, this makes great breakthroughs possible. Believe it or not, one of my solar energy products would not have been possible without the bacteria produced by another scientist at my laboratory! (It's a long story!) Aside from coffee, my coworkers really are what keep me going.

Other times, my work takes me outside of the lab, too. Recently I helped a local school start a robotics club. We used their 3D printer to create a real, working robot.

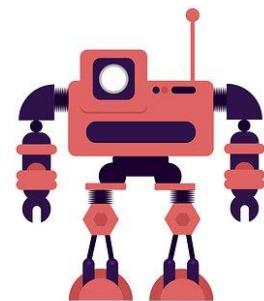


Image from Creative Commons www.pixabay.com/en/robot-illustration-technology-3124412/

A Day in the Life: Lonnie Love, Robotics Engineer

QUESTIONS

1. What did Lonnie do to prepare for his job as a robotics engineer?
2. What did you find most surprising about Lonnie's story?
3. What other workers in the Manufacturing Career Cluster does Lonnie work with as part of his job?
4. What are some of the things that Lonnie likes most about his job?
5. What parts of Lonnie's job as a robotics engineer do you think you would enjoy? Which would you find challenging?
6. What qualities or skills do you think Lonnie has that make him an effective robotics engineer?

___ leadership skills	___ mechanical expertise
___ ability to make decisions	___ artistic ability
___ knowledge of equipment and supplies	___ financial skills
___ communication skills	___ planning and organizational skills
___ responsibility	___ medical skills

Career Cluster Research

Use three resources to research and complete the information pertaining to job titles in the career cluster you have chosen to explore.
 (For example: MyCareer Shines: <https://mycareershines.kuder.com>, another on-line resource, an interview with a career counselor.)

Name of career cluster: _____

Job Title			
Educational level needed: (On-the-job training, apprenticeship, 2-year technical school or community college, 4-year college/university?)			
Salary/Wages: (Beginning, Median, Experienced?)			
Environment: (Outdoors / indoors, school, office, hospital, business?)			
Qualities needed to be successful in this occupation: (Special skills, personal qualities, etc.)			

Post-Secondary Catalogue Exploration & Presentation

Based on what you have learned about your interests, skills and talents as well as what you now know about post-secondary options, choose a program at one of the local institutions that interests you (for example: you might select a certificate program from Lively Technical Center, a TCC Associate of Arts degree program, TCC certificate program, or a FAMU four-year degree.) Go to the website of the institution which offers a program that interests you to answer the following questions. If you do not have internet access, use the print catalogues from the local college and vocational / technical center. Prepare to present your information to the class.

1. What is the name of the website? _____

2. What is the name of the program of study that interests you? _____

3. How many credit hours or clock hours is the program? _____

4. How long will it take in weeks, months or years to complete the program? _____

5. What does the program cost? _____

6. Does the program accept financial aid? _____

7. What are the entrance requirements of the program? (TABE scores? GED? ACT or SAT? Other tests or requirements?)

8. What are some of the classes you will have to take in this program?

9. What do graduates of this program typically earn? _____

10. What questions would you ask of a student who is currently involved in this program?

11. What questions would you ask of a counselor in student services about this program?

12. If this program is right for you, what do you need to do to prepare for it so that you can be successful? (Be specific: what do you need to accomplish academically, financially and personally before you apply?)

MANUFACTURING

OCCUPATION PRESENTATION

Study the occupational vocabulary below. Then use **MyCareer Shines** (<https://mycareershines.kuder.com>) and the **Occupational Outlook Handbook** (http://o*netonline.com) to explore in greater depth one of the jobs in the Architecture and Construction Career Cluster. Prepare to present the information to the class.

DEFINITIONS:

- ❖ **occupational outlook:** the chance you have of getting a job in a certain field in the current economy. Occupational outlook is related to how many jobs are available in this field and how many workers are needed.
- ❖ **occupational hazards:** working conditions that can lead to illness or death. Often, but not always, people in high-risk jobs are paid more than similar but less risky jobs to compensate for the danger involved.
- ❖ **certification:** evidence that an individual has acquired the skills and knowledge needed to do a job, given by a school or authority after an evaluation or test
- ❖ **mandatory:** required or commanded by authority; obligatory
- ❖ **job prospects:** the range of career opportunities available to a person having a particular combination of skills, knowledge, qualifications, etc.
- ❖ **median earnings:** the middle salary out of all the people in a group (often used to describe people doing a similar job), half having incomes above the median, half having incomes below the median

Occupation _____

1. What are the typical job duties of this occupation?

2. What is the typical environment where this work takes place?

3. What are the typical hours worked by a person doing this job?

4. Are there occupational hazards? What are they?

5. What education and / or training are required to enter this occupation?

6. What licenses or certifications are mandatory for this occupation?

7. What skills should a person in this occupation possess?

8. What is the total number of jobs in this occupation today?

9. What is the projected change in the number of jobs in this occupation?

10. What are the job prospects for this occupation in Florida?

11. What are the median earnings for workers in this field?

12. In your opinion, what are the major advantages of this occupation?

13. In your opinion, what are the major disadvantages of this occupation?

14. Does this job suit you and your talents and interests? How?

15. If you decided to pursue work in this occupation, what steps would you need to take?
