Quarter 3
Careers
6-8

Creative Communication
Activity: Creative Communication

Engineering & Manufacturing
Activity: Manufacturing Products: Design an Assembly Line

Agriculture, Food, Natural Resources
Activity: Planting with Precision

Natural Resources
Activity: Food Webs in the Ecosystem

Health Science
Activity: Cell City Models

Art, Information & Communication Technology
Activity: Build a Website!

Art, Information & Communication Technology
Activity: Build a Website!

Art, Information & Communication
Activity: Make a STEM Video

Art, Information & Communication
Activity: Make a STEM Video

Note: This middle school STEM curriculum is aligned to Next Generation Science Standards (NGSS) and serves students in grades 6-8.

STOP!
Please Read First: 5-8 Minutes
Before you begin the activity, please hand out the pre-test to each student. The pre-test has two different grade levels, make sure to use the correct one for your age group. The pre-test will help us evaluate how effective this unit is on teaching kids about the engineering method. At the end of the quarter the same test will be administered again to see how much knowledge students have gained.
Write and/or explain the 8 steps in the Scientific Inquiry Process.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

3. ____________________________________________________________
   ____________________________________________________________

4. ____________________________________________________________
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5. ____________________________________________________________
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7. ____________________________________________________________
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8. ____________________________________________________________
   ____________________________________________________________
## Quarter 3: Careers

### Creative Communication

**WEEK 1**

*Creative Communication*

### Next Generation Science Standards (NGSS):

- ODE ENP01.01 - Use effective communication skills with a variety of audiences
- ODE ENP06.01 - Use teamwork, critical thinking, and problem solving skills to address complex problems in engineering.
- ODE ENP09.01 - Understand the impact personal characteristics such as creativity, resourcefulness, the ability to visualize and the ability to think abstractly have on engineers and their ability to design.

### Supporting Materials

- Careers Information Logbook and examples

### Prep:

- Collect materials and have stations ready

### Background Information:

STEM is short for Science, Technology, Engineering, and Math. People who work in a STEM career are people who use one or more of these subjects every day to do their jobs. Car mechanics, astronauts, doctors, farmers and video game designers all have STEM Careers.

Engineering is designing and building solutions to problems. Engineers create all kinds of things, from tiny parts to giant cities. To do these jobs, engineers often work in groups in order to design and test their ideas. Communication is very important, because it takes so many people to make the things you use every day.

### Setting the Stage:

None
**Objective:**
Understand STEM fields with a focus on engineering. Practice communication through writing. Explore hands-on engineering, prototype development, testing, and production.

**Materials:**
- Recycled Materials
- Paper
- Masking Tape
- Ruler
- Scissors
- Scissors
- Timer

**Activity Instructions:**
1. Explain that it takes a team to move through design, development, testing and production of new things. Teams may be far apart, in different buildings or different countries. It is very important to communicate clearly.

2. Divide into teams of three or so students. Try to give teams separate areas to work in. Each team will have 15 minutes to build a prototype object out of the provided materials. Each team must also use their time to write a description of their object and how to make it. They will then put their object inside of a paper bag.

3. Ask teams to trade descriptions and try to build a ‘production’ recreation of the prototype object in 10 minutes without looking in the bag.

4. Students may divide the labor among members of their team in any way they choose. If they are able to write their directions in more than one language (which may include a drawing), then they will receive one extra minute for each additional language when they are making their reproductions.

5. At the end, lead a group discussion: What was easy? What was hard? How might you have done this differently if you had been able to plan?

**Extension:**
Have one person take 3 minutes to build an object. With the object hidden, have them sit back to back with another student, who has materials in front of them. The “designer” will describe verbally how to build the object, and the “builder” will have 5 minutes to build it from their directions. Afterword, ask the same questions as above.
ENGINEERING & MANUFACTURING

WEEK 2 - activity 1
Assemble a Building Block

Quarter 3: Careers

Next Generation Science Standards (NGSS):

ODE MNZ05.02 – Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production

6-8
Supporting Materials:
Manufacturing Worksheets (Building Blocks)

Background Information:
This lesson shows students the kinds of thinking and skills that go into manufacturing. Students work in teams to design, construct, test, and redesign an assembly line to manufacture a product as quickly and efficiently as possible to meet the quality control criteria.

Setting the Stage:
None
Assemble a Building Block

**Objectives:**
During this lesson, students will first assemble a product individually that meets the quality control criteria. Then they will design an assembly line process to assemble a product as quickly and efficiently as possible while meeting the quality control criteria. Then teams will construct an assembly line, test and redesign the assembly line process, and compare the difference between assembling a product individually versus with an assembly line.

**Materials:**
- 2 Brown Paper Bags
- 5 pieces of Recycled Paper
- 1 set of Markers
- 1 Ruler
- 1 copy of Building Blocks worksheet
- Sample Color Brick (only need 1 to show class)
- 2 Cups of different sizes or other objects that can be traced to make circles.

**Activity Instructions:**
1. Pass out the Build a Building Block Worksheet
2. Introduce the design challenge scenario.
3. Share the sample Building Block.
4. Discuss each criterion and the tools needed to assemble the product correctly.
5. Provide each student with the materials and tools needed to make one Building Block.
6. Once the task is clear and questions have been answered, set the timer and students can begin to assemble their Building Block making sure to meet the criteria while moving as quickly as possible.
7. When a student completes the building block, they should raise their hand and you can write their name and time up on the board.
8. Have students complete the reflection questions.
9. Discuss reflection questions.
Student Worksheet: Assemble One Building Block

Scenario
A local toy company is calling on engineering teams to implement time saving methods to help them meet the demands of manufacturing their most popular product—“building blocks.” This toy is made out of recycled brown bags and has been very popular. They are constantly selling out! The toy company needs to place an order for two million Building Blocks in only 2 days!

Assemble One Building Block
See how fast you can assemble one Building Block and still meet the criteria.

Criteria:
• The brick must be made up of 2 brown bags.
• The brick must be filled with 4 pieces of recycled paper (lightly crunched up and stuffed into one bag. The other bag will cover this bag and the crunched up paper.)
• The largest sides of the brick must be filled with polka dots. (3 large 1” diameter & 3 medium 0.5” circles scattered per side).
• Both sides of the brick must have Building Blocks written in black marker. Letters must be centered on the sides and 1” in height and 5” long.

Constraint: Use only the materials provided.

Reflect
1. How long did it take you to make 1 color brick?
2. What was the easiest task and why?
2. What was the most challenging task and why?
4. Is there an easier and/or faster way to make the brick? If yes, describe
WEEK 2 - activity 2
Design, Construct, Test, Redesign Assembly Line

Next Generation Science Standards (NGSS):

ODE MNZ05.02 – Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production.

Supporting Materials:
Manufacturing Worksheets (Assembly Line Design Challenge & Assembly Line for Building Blocks)

Background Information:
This lesson shows students the kinds of thinking and skills that go into manufacturing. Students work in teams to design, construct, test, and redesign an assembly line to manufacture a product as quickly and efficiently as possible to meet the quality control criteria.

Setting the Stage:
None
**ENGINNEERING & MANUFACTURING**

**WEEK 2 - activity 2**  
*Design, Construct, Test, Redesign Assembly Line*

**Objectives:**  
During this lesson, students will first assemble a product individually that meets the quality control criteria. Then they will design an assembly line process to assemble a product as quickly and efficiently as possible meeting the quality control criteria. Then teams will construct an assembly line, test and redesign the assembly line process, and compare the difference between assembling a product individually versus with an assembly line.

**Materials:**  
- 30 Brown Paper Bags (per team)  
- 1 Full Set of Markers  
- Stack of Recycled Paper  
- 1 Timer

**Activity Instructions:**  
1. Separate the class into two teams.
2. Handout the Design Challenge Worksheet and discuss.
3. Have student works in their teams to design an assembly line (Engineering Design Process steps 2 & 3: brainstorm solutions and choose best solution).
4. Each team will need to then vote on the best design for their final assembly line.
5. Have students build their assembly line. Students may need to move desks into a line, circle, etc. They need to put the materials and tools at the right stations. They need to assign each person a task and a station.
6. When each team is done with constructing their assembly line, give them some time to test and redesign if necessary (EDP steps 5 & 6).
7. Set the timer to about 10-15 minutes (base your time on how long it took teams during testing to build one). Explain to students that you will be the Senior Quality Control Officer and will be checking to make sure their Building Block meets the criteria.
8. Have each team share their responses to Reflection Questions and have a class discussion. Make sure to compare and discuss individually assembling a product versus an assembly line.

**Quarter 3: Careers**

**Next Generation Science Standards (NGSS):**

ODE MNZ05.02 – Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production
**Student Worksheet: Assembly Line Design Challenge**

**Scenario**
A local toy company is calling on engineering teams to implement time saving methods to help them meet the demands of manufacturing their most popular product—“building blocks.” They will award the contract to the engineering team that can make the bricks the fastest while meeting the quality control constraints.

**Design Challenge**
Each team (approximately 4 per team) will design an assembly line process that will make as many “building blocks” in 10 minutes as possible and still meet all of the quality control constraints.

**Criteria**
- Each brick must be made up of 2 brown bags.
- Each brick must be filled with 4 pieces of recycled paper (crunched up and stuffed into one bag. The other bag will cover this bag and the crunched up paper.)
- The largest sides of the brick must be filled with polka dots. (3 large 1" diameter & 3 medium 0.5" circles scattered per side). One side must have 3 blue and 3 green circles.
- Both sides of the brick must have **Building Blocks** written in black marker. Letters must be centered on the sides and 2" in height and 5" long.

**Criteria:** You must only use the materials provided.

**Planning Stage**
Meet as a team and discuss the problem you need to solve. Then develop and agree on a process for solving the challenge. You’ll need to determine what materials you want to use.
Student Worksheet: Design An Assembly Line for Building Blocks

Draw your design below, and be sure to indicate the description and number of parts you plan to use.
WEEK 3
Planting with Precision

Supporting Materials:
Planting with Precision Worksheet

Previous Challenge Review:
Who did the challenge and went screen free? (Pass out certificates)

Instructor Use Only:
Use the attached worksheets. Pass them out and let the students use them to research possible designs.

Next Generation Science Standards (NGSS):

MS-ETS1-1
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Next Generation Science Standards (NGSS):

MS-ETS1-1
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Objectives:
Learn about engineering design and redesign,
Learn about machinery and systems for planting crops, Learn how engineering can help solve society's challenges. Learn about teamwork and problem solving.

Classroom Materials:
- Food Quality pumpkin or sunflower seeds (no risk of harm from fertilizers)
- Cotton Batting or Towel (to serve as "soil")
- Measuring Tape

Student Team Materials:
- Paper Cups
- Rubber Bands
- Glue
- Plastic Wrap
- Plastic Cups or Bowls
- Paper Clips
- String
- Pens
- Empty Cans or Bottles
- Soda Bottle
- Foil
- Pencils

Activity Instructions:

1. Teams of 3 or 4 students will consider their challenge and conduct research into how seeding machines operate.

2. Teams then consider available materials and develop a detailed drawing showing their sower including a list of materials they will need to build it.

3. Students build their sower and test it, and also observe the sowers developed and tested by other student teams.

4. Teams reflect on the challenge, and present their experiences to the class.
Planting with Precision

Student Worksheet:

✦ Engineering Teamwork and Planning
You are part of a team of engineers given the challenge of developing a system out of everyday materials that can drop a pumpkin or sunflower seed every 15 cm over a 60 cm distance.

You have a wide range of materials to use and you can power your device in any way you wish as long as your hands do not touch the seed as it drops.

✦ Research Phase
Read the materials provided to you by your teacher. If you have access to the internet, consider different types of seeding machines and determine a design you think will work best in your classroom setting.

✦ Planning and Design Phase
Draw a diagram of the seeder design on the back of this paper, and in the box below make a list of all the parts you think your team will need to build it.

Materials you will need:
Planting with Precision

Student Worksheet:

- **Presentation Phase**
  Present your plan and drawing to the class, and consider the plans of other teams. You may wish to fine tune your own design.

- **Build it! Test it!**
  Next build your seeder and test it. You may share unused building materials with other teams, and trade materials too. Be sure to watch what other teams are doing and consider the aspects of different designs that might be an improvement on your team’s plan.

- **Reflection**
  Complete the reflection questions below:

  1. How similar was your original design to the actual seeder your team built?

  2. If you found you needed to make changes during the construction phase, describe why your team decided to make revisions.

  3. Which seeder system that another team made proved to be the most precise? What about their design made it more precise?

  4. Do you think that this activity was more rewarding to do as a team, or would you have preferred to work alone on it? Why?

  5. If you could have used one additional material (tape, glue, a computer, sensors -- as examples) which would you choose and why?

  6. How would you have to adjust your seeder if you were instead planting corn? How about orchids?

  7. How did advances in equipment impact the "Green Revolution?"
Planting with Precision

Student Resource: Planting History and Precision

◆ History

The Sumerians used primitive single-tube seed drills around 1500 BC, and tube-based seed drills were invented by the Chinese in the 2nd century BC. Some believe that the seed drill was introduced in Europe after contacts with China. The illustration to the right shows a Chinese double-tube seed drill, published by Song Yingxing in the Tiangong Kaiwu encyclopedia of 1637.

The earliest European seed drill was attributed to Camillo Torell and patented by the Venetian Senate in 1566. And, a seed drill was described in detail by Tadeo Cavalina of Bologna in 1602.

In England, the seed drill was further refined by Jethro Tull, who was said to have perfected a horse-drawn seed drill in 1701 that economically sowed the seeds in neat rows. However, seed drills would not come into widespread use in Europe until the mid-19th century.

◆ Advanced Technology

Over the years seed drills have become more advanced and sophisticated. For example, many companies and universities that focus on research on agriculture are now recommending the use of electronic measuring systems to accurately measure seed spacing.

Some use a system called "PhotoGate" that uses a light emitter with a sensor where seeds fall from a seeder. When a seed passes the opening, it blocks the light from one or more of the sensors and sends a signal to a computer indicating that a seed has dropped. Software then tracks the placement and timing of seed placement and can very accurately report the space between individual seeds.
CLAAS and HORSCH Set World Record in Maize Drilling

Since 28 April 2012, the two companies CLAAS and Horsch have jointly held the world record in the precision drilling of maize. Inside 24 hours, a total area of 448.29 hectares was tilled and fertilised simultaneously by means of a XERION 5000 and a Maestro 24.70 SW single-grain seed drill. The goal of the combined bid was to sow 24 rows of maize at a high speed averaging 14.7 km/h and with a very good coefficient of variation. It is the first world record of this kind in which maize drilling was carried out with underground fertilisation.

The Maestro 24.70 SW single-grain seed drill manufactured by Horsch drills 24 seed rows with a spacing of 70 cm and a sowing depth of between 1.5 and 9.0 cm. For the world record attempt, the depth was set to 6 cm. The seeds are fed by a “Seed on Demand” system, which ensures easy filling and shortens filling times. The central tank has a seed and fertiliser capacity of 2,000 litres and 7,000 litres respectively.

The Maestro permits sowing speeds of 15 km/h and above, depending on the placement accuracy required. At 15 km/h, the machine achieves absolutely precise single-grain results. For this purpose, the chute features an integral grain sensor, which detects not only the number of grains but also their spacing. The sensor sends data to the driver’s control terminal, which informs the driver row-by-row of missing and double spots and displays the coefficient of variation. This enables the driver to react promptly to changing situations and to produce optimum work results.

Throughout the 24 hours, all machine and sowing parameters were monitored and documented constantly by CLAAS TELEMATICS and the grain sensor of the seed drill.

In total, 10 tonnes of seed and 47 tonnes of fertiliser were consumed. As a result, 10 pit stops had to be made to fill the seed drill. Each stop was also used as an opportunity to refuel the tractor.

The world record team of Horsch and CLAAS was 16 men strong. Truck drivers maintained supplies of seed, fertiliser and diesel. Two persons were tasked with ensuring a smooth and, above all, speedy pit stop for quick seed drill refills and tractor refuelling. The machine combination was driven by four drivers on rotation. Technical support was provided by a team of three technicians.

**Planting with Precision**

**Student Resource:** Seed Drills and Planters

✦ **Seed Drill**

A seed drill is a sowing device that precisely positions seeds in the soil and then covers them. Before the introduction of the seed drill, the common practice was to plant seeds by hand. This proved to be very wasteful, as planting was imprecise poorly distributed -- so there was much waste of seeds and usable soil.

In older methods of planting, a field was prepared with a plough which dug rows, or furrows. The field was then seeded by throwing the seeds over the field, sometimes called "manual broadcasting." Some seeds landed in the furrow and were protected, which others might be left exposed...not very efficient! The use of a seed drill can boost the ratio of crop yield by up to nine times, by placing seeds just where they are needed.

✦ **Planter**

Like a seed drill, a planter is towed behind a tractor. Planters lay the seed down in precise manner along rows. The seeds are distributed through devices called row units that are spaced along the back of the planter (the one to the right has the ability to 4 rows at a time. At the moment, the biggest in the world has a 48-row capacity: the John Deere DB120.

Older planters might have a seed bin for each row and a fertilizer bin for two or more rows. In each seed bin plates with "teeth" are installed to correspond to the size of the type of seed to be sown and how quickly seed should be able to come out. The amount of space between each "tooth" would be just big enough to allow one seed in at a time to get through, but not big enough for two.
Planting with Precision

Student Resource: Land Use and Productivity

**Contributions of Norman Borlaug**

Norman Ernest Borlaug was an American agronomist, humanitarian, and Nobel laureate who has been called "the father of the Green Revolution." Borlaug received his Ph.D. in plant pathology and genetics from the University of Minnesota in 1942. He took up an agricultural research position in Mexico, where he developed semi-dwarf, high-yield, disease-resistant wheat varieties. During the mid-20th century, Borlaug led the introduction of these high-yielding varieties combined with modern agricultural production techniques to Mexico, Pakistan, and India. As a result, Mexico became a net exporter of wheat by 1963. Between 1965 and 1970, wheat yields nearly doubled in Pakistan and India, greatly improving the food security in those nations. These collective increases in yield have been labeled the Green Revolution, and Borlaug is often credited with saving over a billion people worldwide from starvation. He was awarded the Nobel Peace Prize in 1970 in recognition of his contributions to world peace through increasing food supply.

**The Green Revolution**

Green Revolution refers to a series of research, development, and technology transfer initiatives, occurring between the 1940s and the late 1970s. The effort increased agriculture production around the world, beginning most markedly in the late 1960s. The initiatives involved the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, modernization of management techniques, distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers. The Green Revolution spread technologies that had already existed before, but had not been widely used outside industrialized nations.

**High Yield Crops**

Cereal production more than doubled in developing nations between the years 1961–1985. Yields of rice, maize, and wheat increased steadily during that period. The production increases can be attributed roughly equally to irrigation, fertilizer, and seed development. While agricultural output increased as a result of the Green Revolution, the energy input to produce a crop has increased faster, so that the ratio of crops produced to energy input has decreased over time. Green Revolution techniques also heavily rely on chemical fertilizers, pesticides and herbicides, some of which must be developed from fossil fuels, making agriculture increasingly reliant on petroleum products. Between 1950 and 1984, as the Green Revolution transformed agriculture around the globe, world grain production increased by over 250%.
## Quarter 3: Careers

### Next Generation Science Standards (NGSS):

**MS-LS2.1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

**MS-LS2.2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

### Supporting Materials:

None

### Background:

None

### Setting the Stage:

None

### Activity Extensions:

Ask the students the following:

1. Where do all living things get energy from?
2. What is a producer?
3. What do the arrows mean?
4. What is a first order consumer? Give an example of a first order consumer.
5. What is a second order consumer? Give an example of a second order consumer.
6. What is a top order consumer? Give an example of a top order consumer.
7. If an organism does not get posted what will happen to it?
8. What is the difference between biotic and abiotic?
9. Can you name a few abiotic elements we should add here?
10. What does a food web tell us about life?
### Objectives:
Show students that a food web consists of many food chains put together. It illustrates the relationships between living organisms in an ecosystem.

### Materials:
- Index Cards
- Tape
- Markers/Colored Pencils
- Chalkboard/Large Sheet of Paper

### Activity 1 Instructions:
1. Obtain an index card from the teacher. Write the name of one living thing (plant or animal elements are called biotic) on the card. Draw a picture of the organism.
2. The teacher will begin by sticking the “SUN” to the board (it is abiotic, non-living).
3. If you (the students) have something on your card that needs the sun directly to grow, raise your hand then attach your card to the board.
4. Draw the arrows in the proper places, following the energy flow.
5. See if your organism will eat any of the new organisms just posted. If it does, raise your hand. Attach your card to the board. Draw the arrows.
6. Continue to see if your organism will eat any of the new organisms posted. If so, raise your hand and then attach your card to the board. Draw the arrows.
7. Continue to add all the cards, if possible. Try not to get caught without a place in the food web for your organism.
8. Give the students a few biotic cards that change the environment, like a shopping mall, a river, a dam on the river, etc.
9. Ask, what would happen to the organisms? Would their populations change?

### Activity 2 Instructions:
1. Ask the class to name the natural resources that exist in the ecosystem they created. Examples might be air, trees, water, soil, rocks, as well as the plants and animals in the ecosystem.
2. In two teams, come up with a design that might help protect the most natural resources in your ecosystem. Draw your design on a piece of paper. Present it to the class.
3. Ask the class to discuss the designs and what affects they might have.
HEALTH SCIENCE: CELL CITY

WEEK 5
Cell City

Quarter 3: Careers

Next Generation Science Standards (NGSS):

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS12. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

MS-LS13. Use argument supported by evidence for how the body is a system of interacting Sub-systems composed of groups of cells.

Supporting Materials:
Worksheets: Parts of a Cell Analogy & Cell Organelles

Background:
Health and Medical careers like nurses, doctors, and veterinarians, begin by learning about cells. All living organisms are made up of cells. Some are made up of just one, but human beings are made up of many. Each cell is made up of parts that serve specific functions. Because cells carry our genes and create all of the parts of our bodies, it is important to understand how they work!

Setting the Stage:
None

Activity 2 Extensions & Modifications:

• Give all the students the cell part names and have each student group research the function of the parts and come up with a new theme or metaphor to represent the functions, like a factory or a body.

• Each group compose two test questions and answers from their research. When all the groups are finished, use the questions and/or answers to play a form of Jeopardy! or some other game of team competition.
HEALTH SCIENCE: CELL CITY

WEEK 5
Cell City

Next Generation Science Standards (NGSS):

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS12. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

MS-LS13. Use argument supported by evidence for how the body is a system of interacting Sub-systems composed of groups of cells.

Objectives:
By the end of the lesson, students will understand how various cell parts function and how they are related to the genetic process by creating a model and symbol to depict the

Materials:
- Construction Paper
- Yarn
- Old Magazines to be cut up
- Colored Markers
- Crayons
- Scissors
- Two Pieces of White Butcher Paper cut in a 3’ sq. with a large circle on each

Instructor Notes:

Activity 1 Instructions:
1. Arrange the group in a circle with one person in the middle. Everyone should be seated in a chair except for the person in the middle.
2. The person in the middle says, “I Love my Neighbor because they are wearing blue [insert any description you like].”
3. Then everybody in the circle who is wearing blue gets up and moves to an open chair.
4. The person who does not find an empty seat to sit on is in the middle and becomes the next caller.

Activity 2 Instructions: Making a Cell City
1. On one large paper circle, have students think of a city and how it operates. Draw and label figures within the circle that represent key buildings and people that are important for a city to run smoothly. Prompt students with questions like the following: Who protects the city? Where do we get electrical power? Where do we get food? How do you know when you are out of city limits? etc.
2. Display a picture or diagram of an animal cell with its parts labeled. (See additional resources.)
3. Discuss the fact that each cell part has an important function, just like parts of a city. Explain that some parts of a cell are directly involved in the genetic process, while other parts take a supporting role but are still necessary to the whole cell. Tailor the complexity of the discussion and the number of cell parts discussed to student ability level.
4. Divide the class into small groups, and assign a cell part to each group. Instruct them to research the cell part to determine its function. (You can have them go online, or use the worksheets attached.) Challenge them to think of a creative way to depict the function. Example: the cell membrane could be pictured as a gatekeeper, a wall, or a city limits sign etc., because it determines what enters and leaves a cell.
5. Have each group cut out, draw, or construct a picture to represent the cell part's function. When each group is finished, have them attach their creation to another three-foot paper circle, which represents a cell, and explain the function and the symbol to the class. Pay special attention to the cell parts' genetic functions.
Health Science: The Cell and Its Parts

According to the **Cell Theory:**
- The cell is the basic unit of life
- A cell must come from a previously existing cell
- All living organisms are made of cells.

Living organisms are either composed of one cell (unicellular) or more than one cell (multi-cellular). Each cell is made of basic parts called organelles (cell organs). Just like our bodies have tissues and organs, cells have organelles that perform functions to help the cell carry on life activities. Each structure works collectively to help the cell do a few basic things: *take in energy, *release waste, *make proteins, *metabolize energy, *grow and *reproduce.
Plant and animal cells are extremely similar yet, remarkably different. They both contain organelles that perform similar functions. On the back of the worksheet are a few of these organelles.

1. **The nucleus** is the control center for the cell. It contains the chromosomes that have all of our unique characteristics on them. Chromosomes are made of DNA (deoxyribonucleic acid) and protein. The nucleolus is also housed in the nucleus. It is made of DNA (deoxyribonucleic acid), RNA (ribonucleic acid), and protein. The main job of the nucleolus is to make ribosomes. Once they are made, they are transported through the pores of the nuclear membrane and stick to **endoplasmic reticulum**, making it rough.

2. **The cytoplasm** is the jelly-like stuff inside the cell, between the nucleus and the cell membrane, which helps surrounds the organelles and free ribosomes. Contains some nutrients for the cell.

3. **The cell membrane** is the structure that protects what goes in and out of the cell. It is made of a phospholipid bilayer, sort of like having 2 layers of fatty stuff surrounding the cell.

4. **Mitochondria** are nicknamed the power houses because they provide energy for the cell. They use oxygen and sugars that enter through the cell’s membrane to make that needed energy. They release carbon dioxide and water as waste. This is the place where cellular respiration takes place.

5. **Endoplasmic reticulum** is a structure that is a continuation of the nuclear membrane. Close to the nucleus, the endoplasmic reticulum is covered with ribosomes.

6. **Rough Endoplasmic Reticulum** synthesizes proteins for the cell.

7. **Smooth Endoplasmic Reticulum** synthesizes hormones and secretory products.

8. **The Golgi Apparatus** is the packaging center for the cell. This structure receives protein material from the endoplasmic reticulum, processes this protein material into a macromolecule the cell can use, then packages it for transport through out the cell.

9. **Vacuoles** are storage organelles in the cell. Plant cells contain one large vacuole, while animal cells contain many small ones. A plant vacuole also provides support when it is filled.

10. **Lysosomes** are found in animal cells for digestion of proteins, lipids and macromolecules inside the cell.

11. **Chloroplasts** are the place where photosynthesis takes place. They contain chlorophyl that traps light energy from the sun.

12. **Cell walls** are contained in plant cells and provide extra support.
Quarter 3: Careers

Next Generation Science Standards (NGSS):

MS-ETS1-2 competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Background Information:
Interactive media careers like video game design and computer programming use technology to create ways of sharing information. In this lesson, we are going to start a project that tells the story of your future in STEM!

Setting the Stage:
None

Instructor Use Only:
Be careful that the content your students view online is appropriate! Try to set up a class time so that you can easily see what your students are accessing online.
**WEEK 6**

*Build a Website!*

**Objective:**
Students will research and review the kinds of STEM careers that have been covered in the class so far and brainstorm some that haven’t. They will then apply their knowledge to building a fun and informative webpage with Mozilla’s Webmaker App.

**Materials:**
- STEM Worksheet Notebook
- Other STEM Career Research

**Activity Instructions:**
1. Divide students into groups of two to discuss and write down the STEM Careers that are most exciting to them. Each student should fill out a STEM Careers worksheet. It should include all of the important information about what their new career would involve and require, from skills to school and beyond. The partner teams can help each other brainstorm or use the Oregon Department of Education Skill Sets guide to do some research.

2. The Career chosen by the students should be specific, like Aerospace Engineer if they want to build rockets, Wildlife Biologist if they want to care for wild animals, Farm Manager if they want to plan the operations of a farm, or Video Game Designer if they want to design video games.

3. Here’s where the Technology comes in! After Students have completed their research, they can work in their teams to make a Website page about their STEM future that explains to other kids how to get there too!

Each Web page should include:
- A job title
- A short description of the career including where it takes place and what tasks are involved.
- A short description of the STEM skills needed to do this work and classes to take to gain these skills
- At least one picture to give more detail to the description

The website can be made using html code at: [https://webmaker.org/en-US/madewithcode-firstwebpage](https://webmaker.org/en-US/madewithcode-firstwebpage)

**Let your Students Know!**
These Mozilla Apps will go step by step to explain how to create your website. These are tools used by people in the field of Information and Communication Technology. Everyone who uses digital or web-based technology in their work needs the skill of writing code to jumpstart their work!
ARTS & INFORMATION COMMUNICATION TECH

WEEK 6
Build a Website! - Cont’d

Quarter 3: Careers

Next Generation Science Standards (NGSS):
MS-ETS1-2 competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

<table>
<thead>
<tr>
<th>6-8</th>
<th>2 Hours</th>
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</table>

Supporting Materials

Background Information:
Interactive media careers like video game design and computer programming use technology to create ways of sharing information. In this lesson, we are going to start a project that tells the story of your future in STEM!

Setting the Stage:
None

Instructor Use Only:
Be careful that the content your students view online is appropriate! Try to set up a class time so that you can easily see what your students are accessing online.
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**ARTS & COMMUNICATION TECH**

**WEEK 8**

*Make a STEM Video!*

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**Quarter 3: Careers**

**Next Generation Science Standards (NGSS):**

MS-ETS1-2 competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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**6-8**

**2 Hours**

**Supporting Materials**

Get on the computer and go to the Mozilla Popcorn link below to get started:


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**Background Information:**

For the next two weeks, students will use their research to make a video with code! The video can be about one of three things, their future STEM Career, How to do a good job interview for a specific STEM Career, or Information about what STEM is for students who don’t know yet.

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**Setting the Stage:**

None
**WEEK 8**

*Make a STEM Video!*

<table>
<thead>
<tr>
<th>Objective:</th>
<th>Instructor Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make A STEM related video using Mozilla’s Online tool</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Materials:</th>
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<td></td>
</tr>
<tr>
<td>- Logbooks</td>
<td></td>
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</tbody>
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<table>
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<tr>
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<td>1. Start by explaining that there are lots of STEM careers that involve using digital media, computers, cameras, and other technology to share information. Technology is an important part of marketing and creative production work, so it is important to know how to use it!</td>
<td></td>
</tr>
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<td>2. Set the students up in pairs to get started. Tell them that they will be making a short video online with a Mozilla Application called Popcorn. The application will walk them step-by-step through the process of making their own short.</td>
<td></td>
</tr>
<tr>
<td>3. Remind the students of their research and ask them to use their worksheets and notebooks to give them ideas. The video can be about one of three things, their future STEM Career, How to do a good job interview for a specific STEM Career, or Information about what STEM is for students who don’t know yet. You can write this on the board or have them write it in their notebooks as a reminder.</td>
<td></td>
</tr>
<tr>
<td>5. Students can create their movie in pairs. They will need to pull source material from the web, so make sure that the content they choose is related to their STEM film! They will present it on the last day when each group shows what they’ve made online for the rest of the class.</td>
<td></td>
</tr>
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</table>
WEEK 9
*Make a STEM Video! - Cont’d*

**ARTS & COMMUNICATION TECH**

**Quarter 3: Careers**

**Next Generation Science Standards (NGSS):**

MS-ETS1-2 competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

**Supporting Materials**

Get on the computer and go to the Mozilla Popcorn link below to get started:


**Background Information:**

For the next two weeks, students will use their research to make a video with code! The video can be about one of three things, their future STEM Career, How to do a good job interview for a specific STEM Career, or Information about what STEM is for students who don’t know yet.

**Setting the Stage:**

None
Objective: Make A STEM related video using Mozilla’s Online tool

Materials:
- Research on STEM Careers done in class
- Logbooks

Activity Instructions:
1. Start by explaining that there are lots of STEM careers that involve using digital media, computers, cameras, and other technology to share information. Technology is an important part of marketing and creative production work, so it is important to know how to use it!

2. Set the students up in pairs to get started. Tell them that they will be making a short video online with a Mozilla Application called Popcorn. The application will walk them step-by-step through the process of making their own short.

3. Remind the students of their research and ask them to use their worksheets and notebooks to give them ideas. The video can be about one of three things, their future STEM Career, How to do a good job interview for a specific STEM Career, or Information about what STEM is for students who don’t know yet. You can write this on the board or have them write it in their notebooks as a reminder.

4. Get on the Computer and go to the Mozilla Popcorn link below to get started:

5. Students can create their movie in pairs. They will need to pull source material from the web, so make sure that the content they choose is related to their STEM film! They will present it on the last day when each group shows what they’ve made online for the rest of the class.
Write and/or explain the 8 steps in the Scientific Inquiry Process.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

3. ____________________________________________________________
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4. ____________________________________________________________
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5. ____________________________________________________________
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6. ____________________________________________________________
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7. ____________________________________________________________
   ____________________________________________________________

8. ____________________________________________________________
   ____________________________________________________________
STEM Career Information Guide Worksheet

1. STEM Career Title:

2. Learning Area:

3. Tasks

4. Tools and Technology:

5. Knowledge:

6. Skills:

7. Education:

8. Site Details:

9. What is the most interesting thing about this career?
1. **STEM Career Title:** Wind Turbine Service Technician

2. **Learning Area:** Engineering

3. **Tasks:** Figuring out problems with wind turbines, especially the generators or control systems. Climbing Wind turbines to inspect, maintain, or repair them.

4. **Tools and Technology:** Voltage and current meters, Industrial control, software, computers, power tools

5. **Knowledge:** Mechanical, Computers, Engineering, Physics, Construction, Public Safety

6. **Skills:** Repairing, Troubleshooting problems, equipment maintenance, reading comprehension, communication, complex problem solving

7. **Education:** Training, on the job experience, or associates degree. Usually three or four years of previous experience in the field and a license id required.

8. **Site Details:** Most work outside on the turbines, high up in the air. Most work in teams and talk to people everyday. The job may require looking out for the organization and safety of a crew.

9. **What is the most interesting thing about this career?** Wind turbine technicians get to work outside in an exciting environment and have to find ways to fix problems with big machines. They have to be fit, smart, and good at working with people.