**Lesson 1: Overview of the Solar System**

**Engagement Questions:**

Name the planets in order, starting with Mercury. ________________________________________________

How do the planets move around the Sun? ______________________________________________________

Describe the difference between rotation and revolution. _________________________________________

**Exploration Activity:**

Choose which bead will represent each planet. Then, tell why you chose each one.

<table>
<thead>
<tr>
<th>Name</th>
<th>Bead Color</th>
<th>Why did you choose this color to represent this planet?</th>
<th>Scaled Distance from the Sun (in cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td></td>
<td></td>
<td>0 cm</td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
<td>4 cm</td>
</tr>
<tr>
<td>Venus</td>
<td></td>
<td></td>
<td>7 cm</td>
</tr>
<tr>
<td>Earth</td>
<td></td>
<td></td>
<td>10 cm</td>
</tr>
<tr>
<td>Mars</td>
<td></td>
<td></td>
<td>15 cm</td>
</tr>
<tr>
<td>Jupiter</td>
<td></td>
<td></td>
<td>50 cm</td>
</tr>
<tr>
<td>Saturn</td>
<td></td>
<td></td>
<td>100 cm</td>
</tr>
<tr>
<td>Uranus</td>
<td></td>
<td></td>
<td>190 cm</td>
</tr>
<tr>
<td>Neptune</td>
<td></td>
<td></td>
<td>300 cm</td>
</tr>
</tbody>
</table>

1. Work with your team to measure 5 meters of yarn.
2. Then, tie the Sun bead to the end of the yarn.
3. Use your centimeter ruler to measure how far Mercury is from the Sun (Use the table above). Then, tie the Mercury bead at that distance (4 cm).
4. In order, and one at a time, measure out the rest of the distances and tie the correct bead at each point.
Explanation:

Using what you have learned, draw a picture of the solar system. Don’t forget to put the planets in the correct order and label them.

Evaluation:

How might you describe the solar system to a friend who knows nothing about the relative sizes of the Sun and planets or the distances among them? ________________________________

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
Lesson 2: Introduction to Mars

Engagement Question:

**Mars**

<table>
<thead>
<tr>
<th>What I KNOW about Mars</th>
<th>What I WONDER about Mars</th>
<th>What I LEARNED about Mars</th>
</tr>
</thead>
</table>

**Exploration Activity:**

Look closely at your sample. Describe three things you observe about its surface.
1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________

Think back to what you learned about Mars. What kind of surface does Mars have?
________________________________________________________

Draw a picture of the surface of your sample.
Exploration Activity:

Ask your teacher to cut your sample in half. Describe what you see inside your sample. ______________________________________________________

Now, draw a picture of the inside of your sample.

How have you changed your sample while studying it? Have you changed the properties of the sample? Explain. ______________________________________________________

Think about what you have learned about Mars. Could this sample have come from Mars? Why or why not? ______________________________________________________

Evaluation:

How will what you learned today about the planet Mars and about making observations help you design a successful mission for your Mars Rover? ____________________________

________________________________________

________________________________________
Engagement Questions:

In the 1900’s our ability to explore Mars via telescope from the Earth had reached its limits. Combined with our space-faring abilities, _____________________ became an excellent candidate for robotic exploration.

The first successful landing was NASA’s _____________________ in 1976.

In 2003, NASA launched the Mars Exploration Rovers (MER), which later came to be called ______________________ and ____________________________.

Phoenix landed so far north at a position similar to the high arctic on Earth that the team knew the spacecraft wouldn’t last very long. It could only operate until the Martian ___________________________ or fall because the sun would dip down low on the horizon, the solar panels would not be able to charge the batteries.

Exploration Activity:

<table>
<thead>
<tr>
<th>Mars Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mars’ Nickname</td>
</tr>
<tr>
<td>Position from the Sun</td>
</tr>
<tr>
<td>Average Distance from the Sun</td>
</tr>
<tr>
<td>Diameter of Mars in km</td>
</tr>
<tr>
<td>Length of a Day (Rotation)</td>
</tr>
<tr>
<td>Length of a Year (Revolution)</td>
</tr>
<tr>
<td>Atmosphere</td>
</tr>
<tr>
<td>Rings</td>
</tr>
<tr>
<td>Moons</td>
</tr>
</tbody>
</table>
Exploration Activity:

What is Olympic Mons? _________________________________________________
How high is it in feet? ________________________________________________

How did Mars get its nickname? _________________________________________

Why can’t Mars store heat from the sun? _________________________________

What are the ice caps on Mars made of? _________________________________

What is another geographical feature of Mars? __________________________
Name two facts about this feature:
1. __________________________________________________________________
2. __________________________________________________________________

Describe three characteristics of the surface of Mars:
1. __________________________________________________________________
2. __________________________________________________________________
3. __________________________________________________________________

Why does Mars have seasons? _________________________________________
____________________________________________________________________
Explanation:
Based on the information you have researched about Mars, complete the Venn Diagram. If more space is needed, complete your Venn Diagram on a separate page and tape it neatly into the space below.

Evaluation:
Which of the informational text features you learned about today was the most helpful to you in researching information for your Mars Rover project? ____________________
__________________________________
__________________________________
__________________________________
Engagement Questions:

What are the three most important details to help find the lost rover?

1. __________________________________________________________________________
2. __________________________________________________________________________
3. __________________________________________________________________________

Use the information above to design a draft of your lost rover poster. Then, create your final copy on the paper from your teacher.
Exploration Activity:

Using what you have learned about identifying important details, use the resources provided to learn about Mars. Record your important details below. Remember to look for only details that would help distinguish Mars from all the other planets.

1. ________________________________________________________________
   ________________________________________________________________

2. ________________________________________________________________
   ________________________________________________________________

3. ________________________________________________________________
   ________________________________________________________________

4. ________________________________________________________________
   ________________________________________________________________

5. ________________________________________________________________
   ________________________________________________________________

6. ________________________________________________________________
   ________________________________________________________________

7. ________________________________________________________________
   ________________________________________________________________

8. ________________________________________________________________
   ________________________________________________________________

9. ________________________________________________________________
   ________________________________________________________________

10. ______________________________________________________________
    ________________________________________________________________
Explanation:

After each team has shared their important details and you have discussed them with your teacher and class, write the five most important details that your class has found.

1. ________________________________________________________________

2. ________________________________________________________________

3. ________________________________________________________________

4. ________________________________________________________________

5. ________________________________________________________________

Evaluation:

How do I know when I’ve found important information in my reading? ________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________
Lesson 5: Selecting Team Rover Missions

Engagement Questions:

As your teacher shares and discusses your ideas with the class, write the three questions that you think would be the most interesting to investigate.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Exploration Activity:

Work with your team to narrow your possible questions to a total of three for your team. Write them below.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Then, choose the one scientific question that:
- Has a scientific basis
- Is an interesting question to answer
- Addresses a specific problem
- Interests all students on your team

Put a star next to the scientific or technological question that your team has chosen to answer.

Teacher Checkpoint: ________
Explanation:

Now that you have determined your team’s scientific question, use the chart below to help refine your question.

<table>
<thead>
<tr>
<th>Steps</th>
<th>My Teacher’s Example</th>
<th>My Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Topic:</td>
<td>The rings of Saturn</td>
<td></td>
</tr>
<tr>
<td>What I want to know:</td>
<td>Where objects can orbit Saturn</td>
<td></td>
</tr>
<tr>
<td>Question:</td>
<td>Can an object stay in orbit around Saturn somewhere else besides the rings?</td>
<td></td>
</tr>
</tbody>
</table>

Check | Work
--- | ---
Is my question clear? |  
Is my question specific? |  
Can I answer this by gathering data? |  

Evaluation:

Why is it important to ask valid (good) scientific questions?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Teacher Checkpoint: ________
Engagement Questions:

Your teacher’s scientific question has to do with Saturn:

Can an object stay in orbit around Saturn somewhere else besides the rings?

Brainstorm some possible solutions to this scientific question to share with your teacher and your class.

Solution #1 ______________________________________________________
_________________________________________________________________
Why is this solution a good idea? ______________________________________
_________________________________________________________________

Solution #2 ______________________________________________________
_________________________________________________________________
Why is this solution a good idea? ______________________________________
_________________________________________________________________

Solution #3 ______________________________________________________

Why is this solution a good idea? ______________________________________
_________________________________________________________________

Solution #4 ______________________________________________________
_________________________________________________________________
Why is this solution a good idea? ______________________________________
_________________________________________________________________
**Exploration:**

Using your teacher’s example as a guide, brainstorm your team’s scientific or technological question on the worksheet that your teacher will give you. Narrow your solutions down to one and record it below:

<table>
<thead>
<tr>
<th>Mission Questions</th>
<th>Chosen Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>How might this happen?</td>
<td></td>
</tr>
<tr>
<td>What else could happen?</td>
<td></td>
</tr>
<tr>
<td>Have I thought this through?</td>
<td></td>
</tr>
<tr>
<td>What measurements will I need to make to carry out my mission?</td>
<td></td>
</tr>
<tr>
<td>Does this mission make sense? What problems could cause my mission to fail?</td>
<td></td>
</tr>
</tbody>
</table>

**Evaluation:**

Why is it important to write your scientific question so you can answer it using data?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Lesson 7: How Do I Measure This?

Engagement Questions:

Why was it a bad idea for the king to walk around the queen to measure for her bed?

________________________________________________________________________________________

________________________________________________________________________________________

Why did the bed end up being too small for the queen?

________________________________________________________________________________________

________________________________________________________________________________________

How could this problem have been avoided?

________________________________________________________________________________________

________________________________________________________________________________________

Exploration Activity:

The reason to do an experiment is to answer a question. The question that you and your team will answer is:

How is the size of the crater related to the size of the item and the height from which it is dropped?

During this experiment you will learn how craters form. To start, we will need three objects that we will pretend are meteors. With your team, circle the three objects you will use:

- marble
- ping pong ball
- dried peas
- golf ball
- gumball
- cinnamon imperial

So that we can get good results, we will need to drop each object from the same height. Circle the one height that your team will drop your objects from:

- 30 centimeters
- 50 centimeters
- 70 centimeters

Then, use this information to fill in the shaded parts of the table on the next page.
Exploration Activity Cont.: 

<table>
<thead>
<tr>
<th>Drop Height</th>
<th>Diameter of Crater from Drop Height _______</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items that will be dropped ↓</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Teacher Checkpoint: Once you and your team have completed the shaded areas, ask your teacher to check it over. Teacher’s Initials: ________________

Now that you have correctly created your table, begin the experiment by dropping the first item from the height your team selected. Then, carefully remove the object from the pan using the tongs.

With your team, examine the crater. Use your ruler to measure the diameter of the crater (in cm). The diameter is the distance across the widest part of the circle.

Repeat these steps with your two other objects. Each time:

1. Drop the next object into the pan from the correct height.
2. Carefully remove the object with the tongs.
3. Measure the diameter of the crater left behind.
4. Record the diameter of the crater correctly on the chart.

When you have finished, we will need something to compare it to. Place an X over your Drop Height and work with your team to circle a different number. Then, write this number in the third column of your table above:

30 centimeters  50 centimeters  70 centimeters

Teacher Checkpoint: After you and your team have circled your second Drop Height and written it in the third column of your table, show it to your teacher. Teacher’s Initials: ________________
Exploration Activity Cont.:

Now that your chart is complete, we need to draw conclusions from the information we gathered.

Which item created the biggest crater? Why? ____________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Using the diagram below, choose one of your objects and describe in detail what the crater looked like after the object was removed.
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

How does the crater change as the height an object is dropped from changes?
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
Explanation:

What scientific or technological question will your team answer? (Go back through your Science Notebook and copy it from Lesson 6.)

Our Team’s Question: ____________________________________________

__________________________________________________________________________________

Now, think about the experiment that you conducted and how you measured the craters to help answer this question.

What things will you measure with your own rover experiment:

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

List three ways you and your team will take these measurements in your own experiment?

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Evaluation:

Why are taking accurate measurements critical to your Mars rover mission? ________

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________
Lesson 8: Where is the Best Place to Measure?

Engagement Questions:

What is your team’s scientific or technological question? ________________
_______________________________________________________________________
_______________________________________________________________________

Why is it important to select a good landing site for Curiosity? ________________
_______________________________________________________________________
_______________________________________________________________________

Exploration Activity:

Explore Gale Crater and complete the chart:

<table>
<thead>
<tr>
<th>Weather/Climate</th>
<th>What are some characteristics of the climate on Mars?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain</td>
<td>How does the terrain differ from the terrain on Earth? How is it the same?</td>
</tr>
<tr>
<td>Constants</td>
<td>What elements will remain the same when you test your team’s question?</td>
</tr>
<tr>
<td>Variables</td>
<td>What elements will change when you test your team’s question?</td>
</tr>
</tbody>
</table>
Exploration:

Based on what you have learned about Gale Crater, name 3 reasons why it was a good place for Curiosity to land.

1. ________________________________________________________________
   ________________________________________________________________

2. ________________________________________________________________
   ________________________________________________________________

3. ________________________________________________________________
   ________________________________________________________________

Now, use Google Earth Mars to locate a place for your team’s landing site. Use a separate pieces of paper to research the following locations:

- Eberswalde Crater
- Holden Crater
- Mawrth Vallis
- Olympus Mons
- Valles Marineris

Once you have completed your research and decided on a landing site for your rover, complete the following details:

Chosen Landing Site ________________________________________________

Exact Location on Mars ____________________________________________

Description of terrain and climate at this location ____________________
   __________________________________________________________________
Explanation:

Now that you have gathered the important details of your team’s landing site, record that information on a piece of chart paper.

Along with the landing site, exact location on Mars, description of terrain and climate, be sure to include:

Three reasons why your team chose this site
1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________

How will this landing site help your team to answer your scientific question?
1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________

Evaluation:

How did you select the place for your Mars rover mission? Describe how the site you selected meets the needs of your question. ____________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
### Lesson 9: Spacecraft Structure and Design

**Engagement Questions:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Facts</td>
</tr>
<tr>
<td>2</td>
<td>Questions</td>
</tr>
<tr>
<td>1</td>
<td>Opinion</td>
</tr>
</tbody>
</table>

**Exploration Activity:**

**Rover Communication**

**Scenario #1**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite</td>
<td></td>
</tr>
<tr>
<td>Ground Receiver/Transmitter</td>
<td></td>
</tr>
</tbody>
</table>

**Scenario #2**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite</td>
<td></td>
</tr>
<tr>
<td>Ground Receiver/Transmitter</td>
<td></td>
</tr>
</tbody>
</table>

**Scenario #1**

<table>
<thead>
<tr>
<th>Trials</th>
<th>TotalSeconds on Target in two minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td></td>
</tr>
<tr>
<td>Trial 4</td>
<td></td>
</tr>
<tr>
<td>Trial 5</td>
<td></td>
</tr>
</tbody>
</table>

**Scenario #2**

<table>
<thead>
<tr>
<th>Trials</th>
<th>TotalSeconds on Target in two minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td></td>
</tr>
<tr>
<td>Trial 4</td>
<td></td>
</tr>
<tr>
<td>Trial 5</td>
<td></td>
</tr>
</tbody>
</table>
Exploration Activity:

Spacecraft Design

Before building:
What is the purpose of your space probe (use your article to help you)?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

What three things will you need to think about when you build your space probe?
1. _______________________________________________________________
2. _______________________________________________________________
3. _______________________________________________________________

During Building:
What design elements will you build to make sure that your probe always lands bottom down?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

After Building:
How does your team’s design compare with NASA’s Design?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Testing:
Drop your probe from the following heights and record your observations.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Height</th>
<th>Scientific Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>1 foot</td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td>2 feet</td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td>3 feet</td>
<td></td>
</tr>
</tbody>
</table>
Exploration:

Research and Investigation

<table>
<thead>
<tr>
<th>Team Job</th>
<th>Role</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigator</td>
<td>Using correct terms, gives the Operator directions</td>
<td></td>
</tr>
<tr>
<td>Operator</td>
<td>Operates the mouse and keyboard</td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>Keeps all team members focused and on task</td>
<td></td>
</tr>
<tr>
<td>Monitor</td>
<td>Monitors the noise level of the group and watches the time</td>
<td></td>
</tr>
<tr>
<td>Recorder</td>
<td>Record their data in their Science Notebooks</td>
<td>Everyone</td>
</tr>
</tbody>
</table>

How Spacecraft are Built

How Spacecraft Enter an Atmosphere and Land

Scientific Instruments Spacecraft May Carry

Other Facts I found: (If you need more space, record your data on another sheet and tape it into your Science Notebook.)
### Explanation:

<table>
<thead>
<tr>
<th>Statement</th>
<th>True or False?</th>
<th>How do you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrology and astronomy are basically the same thing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rovers communicate with Earth using radio waves.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since we already went to the Moon, it is easy to send people to Mars.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Because Mars has a thinner atmosphere than Earth, the shape of a space probe is critical for landing on Mars.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Although spacecraft are constructed for specific missions and purposes, they are all designed and built in the same way.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Evaluation:

What attributes will my Mars Rover need to:

Get to Mars __________________________________________________________

_____________________________________________________________

Carry out its mission ____________________________________________

_____________________________________________________________

Send the data back to Earth? _____________________________________

_____________________________________________________________
Engagement Questions:

Different ways we could land a rover on Mars:

1. _____________________________
2. _____________________________
3. _____________________________

<table>
<thead>
<tr>
<th>Ways to Land a Rover on Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landing Strategy</strong></td>
</tr>
<tr>
<td>Rover Size</td>
</tr>
<tr>
<td>Landing Speed</td>
</tr>
</tbody>
</table>

Exploration Activity:

My chosen Landing Strategy: _____________________________

<table>
<thead>
<tr>
<th>How My Strategy Can be Successful</th>
<th>How My Strategy Can be Problematic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exploration Cont.:

<table>
<thead>
<tr>
<th>How My Strategy Can be Successful</th>
<th>How My Strategy Can be Problematic</th>
</tr>
</thead>
</table>

The Landing Strategy my team decided to use: __________________________

We picked this landing strategy because:
1. ________________________________________________________________
2. ________________________________________________________________
3. ________________________________________________________________

Next, work with your team to decide how your rover will move around once it lands on Mars. ________________________________________________________________

_______________________________________________________________
Exploration Cont.:

How will your rover survive the harsh conditions on Mars?

Cold Temperatures on Mars

Rover Power Source

Dust in the Environment

Our Rover

Evaluation:

Why is the method you chose for landing your Rover on Mars the best one for your mission?__________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Engagement Questions:

Why do we need the Engineering Design Process?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

How will you use the Engineering Design Process when you build your Mars rover?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Lesson 11: Brainstorm and Preliminary Design
Exploration Activity:

Team Information:

Who are the members on your team?

_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________

What is your team name? _______________________________

What will each person do to help build your Mars Rover?

<table>
<thead>
<tr>
<th>Team Member’s Name</th>
<th>How will they help?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
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<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teacher Checkpoint _______________
Exploration Activity:

Work with your team to draw a sketch of what your rover will look like. Be sure to keep your mission in mind. Tape or staple extra pages into your Science Notebook as needed.
Explanation:

Show your completed concept map to your teacher for approval. Once it is approved, tape it neatly in the space below. (You may need to fold it so it will fit.)
Evaluation:

Which step of the Engineering Design Process was the most difficult for your team? What made this step so challenging for you?

___________________________________________________________

___________________________________________________________

___________________________________________________________

___________________________________________________________

___________________________________________________________

___________________________________________________________

Elaboration (optional):

Once you are finished building your Mars Rover, make sketches of its top, front, and side views.

How does your original sketch compare with your actual prototype? What changes did you need to make? Why?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
**Lesson 12: Final Design**

**Engagement Activity:**

<table>
<thead>
<tr>
<th>Engineering Careers</th>
<th>Examples of this Career</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace</td>
<td>Designing airplane engines,</td>
</tr>
<tr>
<td>Chemical</td>
<td></td>
</tr>
<tr>
<td>Civil</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
</tr>
<tr>
<td>Mechanical</td>
<td>Creating a new part for a bicycle,</td>
</tr>
</tbody>
</table>

**Exploration Activity:**

Mars Rover Curiosity

Career:  
How this Career Contributes to Curiosity:

Career:  
How this Career Contributes to Curiosity:

Career:  
How this Career Contributes to Curiosity:

Career:  
How this Career Contributes to Curiosity:
Exploration:

<table>
<thead>
<tr>
<th>My Team</th>
<th>My Career Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Use your Science Notebooks and additional paper to collect the following information:

- Mission (Scientific or Technological question to be answered)
- Specific Location of the Mission
- Requirements of the rover
- Features of the rover

Once you have gathered this information, work with your group to finalize your rover design. Then, copy it neatly onto a piece of chart paper. Be sure to state your mission, tell your specific location, and label your requirements and features. When you are finished, work with your team to write a caption for your poster.

Evaluation:

Essential Question? __________________________________________

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

_______________________________________________________

_______________________________________________________

_______________________________________________________
Lesson 13: Construct Mock-Up

Engagement Activity:

| Characteristics of a Successful... |
|-------------------------------|----------------|----------------|----------------|
| Engineer                      | Scientist      | Designer       | Project Manager |
|                               |                |                |                |

Evaluation:

How does assigning a different job to each member of your team (designer, scientist, project manager, engineer) help you to complete your Mars rover mission?________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
STEP 1:

With your team, brainstorm ideas for your skit. As you share ideas, answer the following questions:

1. What is the purpose of our skit?

2. Who is our audience?

3. Should our skit be PROFESSIONAL or INFORMAL? (Circle one)
   Explain why

Use the information in the table below as you write your skit to ensure you are writing for the correct audience.

<table>
<thead>
<tr>
<th></th>
<th>Professional</th>
<th>Informal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>short or long</td>
<td>short</td>
</tr>
<tr>
<td>Preparation</td>
<td>large amount of time</td>
<td>very little preparation time</td>
</tr>
<tr>
<td>Visual Aids</td>
<td>frequently used, polished</td>
<td>sometimes used</td>
</tr>
<tr>
<td>Rehearsals</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Refinements</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Audience</td>
<td>large: adults, experts</td>
<td>small: family, friends, classmates</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>academic, consistent</td>
<td>language often varies from one performance to the next</td>
</tr>
</tbody>
</table>
STEP 2:

Now that you have the idea for your skit, it’s time to capture the details:

Skit Title:

____________________________________________________________________________________________________

Props Needed/Team member responsible:

<table>
<thead>
<tr>
<th>Prop</th>
<th>Team Member Responsible</th>
</tr>
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<tbody>
<tr>
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</table>

Backdrop: YES  NO
If YES....
What will the backdrop be?__________________________________________________________________________

Who will design backdrop? ________________________________________________________________________

What role will each team member play in the presentation?

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Character</th>
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<tbody>
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</table>
STEP 3: Outline

Use your own paper to create your outline. Your outline doesn’t have to follow this list exactly, but be sure to include all the major categories listed below.

I. Basic Information
   a. Introduce our Team
   b. ____________________________________________

II. Purpose/Goals of the Rover Mission
   a. ____________________________________________
   b. ____________________________________________
   c. ____________________________________________

III. Important Facts/Notes to Tell Audience
   a. ____________________________________________
   b. ____________________________________________
   c. ____________________________________________

IV. Rover Design
   a. Landing on Mars __________________________________
   b. Overcoming Conditions on Mars ______________________
   c. Powering & Controlling the Rover _____________________
   d. Communicating with Earth __________________________
   e. Special Instruments ________________________________

V. Other Information (if needed)
   a. ____________________________________________
   b. ____________________________________________

VI. Conclusion
    ________________________________________________

Teacher Checkpoint: ________
**Explanation:**

To make a large project easier, share the work. Using the chart below, record the duties each person on your team will be responsible for.

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Responsible For…</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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**Evaluation:**

What are the key elements of an effective presentation that your group should keep in mind when writing your Mars Rover skit?

_______________________________________________________________________
______________________
_________________________________________________
_______________________________________________________________________
________________________
_______________________________________________
_________________________________________________________________

Teacher Checkpoint: ________
Lesson 15: Present Skits and Rovers

Engagement Questions:

Great ideas I heard from other teams that I can borrow and include in our presentation:

- ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________

- ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________

- ________________________________________________________________
  ________________________________________________________________

- ________________________________________________________________
  ________________________________________________________________

- ________________________________________________________________
  ________________________________________________________________

Evaluation:

How did listening to the other teams present help you to improve your own Mars rover presentation? Be specific.______________________________________________________________
  ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________
  ________________________________________________________________