Complete the following assignments for week 4.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Agenda</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Space Science</td>
<td>1. Mars Informational Text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Read and annotate the text and answer the questions and mini project</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Planets Review Lesson</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complete all 10 pages of the lesson.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Student Response Journal Entries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complete the journal response entries after watching the videos or reading the quotes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Space Exploration Inquiry Lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complete the inquiry lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Becoming an Astronaut Informational Text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Read and annotate the text and answer the questions and mini project</td>
</tr>
</tbody>
</table>
TEXT ANNOTATION

Use the following directions to annotate each of the texts in this journal.

- **Draw an arrow** pointing at any words, phrases, or paragraphs that help the reader identify something new about the topic presented.

- **Draw a triangle** next to or around any words you do not know. Then, look up the definition of the word. Write it in the margin or in your notes for future reference.

- **Draw a star** next to any significant quotes. In the margin or in your notes, write WHY you believe the quote is significant to the passage.

- **Draw a rectangle** around the part of the passage that BEST represents the author’s main idea. In the margin or in your notes, explain why.

- **Draw a circle** around any use of figurative language. In the margin or in your notes, explain how the figurative language impacts the passage.

- **Place a sticky note** next to any part of the passage that you do not understand. Write a specific question on the sticky note for class discussion.

- **Highlight ONE quote** that stands out most to you. In the margin or in your notes, explain why this quote made such an impact on you.

- **Underline any EXAMPLES** the author provides about the topic.

- **Cross out** any information that is irrelevant to the topic, if any.

© The SuperHERO Teacher, 2018
September 12, 1962, President John F. Kennedy gave a speech at Rice University in Houston announcing to the world, “We choose to go to the Moon in this decade . . . not because it is easy but because it is hard.” This was an astounding declaration at the time, but on July 16, 1969, Neil Armstrong stepped out of the Lunar Module onto the surface of the Moon. The world was astonished.

It’s been a long time since we have visited the Moon, but the Shuttle program and the International Space Station have given us valuable knowledge of how to live and work in space. It’s time to set our sights on new horizons, the planet Mars.

Mars is the fourth planet from the Sun and the second smallest in our solar system. It has a thin atmosphere made up mainly of carbon dioxide. Mars is named for the Roman God of War and has two moons, Phobos and Deimos.

What are some reasons both NASA and Elon Musk’s Space X Program are interested in pursuing Mars as a goal? First, we’ve already sent several robotic scouts to Mars and have data supporting the idea that Mars’ past climate cycle and geology are like Earth’s. We concluded that Mars probably had conditions suitable for life a long time ago. Second, Mars may give us evidence about our own planet’s past and future. Third, could Mars be a suitable planet for humans to inhabit one day?

The challenges of colonizing Mars are going to be immense. Transportation is going to be the number one challenge. Mars and Earth are in closest alignment every two years, so that would be the time to launch materials or a team. The rockets for carrying humans that distance, landing them on Mars, and taking off again have not yet been developed. The goal from the Space X team is to arrive by 2025.

Working on Mars is going to be another challenge. How are all the things needed to sustain human life (oxygen, water, food,) going to be produced on Mars? What affect will the surface gravity of Mars have on the human body? Mars has only 38% of Earth’s gravity. If you weigh 100 pounds on Earth, you’ll weigh 38 pounds on Mars. The red dust on Mars makes it known as the Red Planet. Humans will need to determine how to filter out this dust when they explore the planet outside of their habitat.

Despite the challenges there seems to be enormous energy and excitement about the possibility of visiting or living on Mars. Both government agencies (NASA) and private space agencies will be competing in this new space race. Unlike the competition between the Russians and the United States back in the 1950s and 60s, these new science explorers may even share information with each other to achieve this incredible goal.
Answer the questions below based on the article about Mars: the new frontier.

**COMPREHENSION QUESTIONS:**

1. What planet do scientists think will be the next one inhabited by humans?

2. What are three facts about Mars? Underline your answers in the text.

3. What are some challenges to colonizing Mars?

4. What program has provided valuable information regarding how to work and live in space?

5. Who is interested in Mars as the next planet to be colonized? Highlight your answer in the text.

6. What is needed on Mars, at the very least, to sustain human life?

---

**MINI-PROJECT:** DIY ENVIRONMENT

Based on what you’ve learned about Mars, as well as additional research, design a house that you think would fit the living conditions on Mars. NOTE: Because this is not realistic, you’ll need to use your creativity and imagination to design a living environment that would be suitable based on the facts about Mars.
## Weight of Basketball Card Sort

<table>
<thead>
<tr>
<th>Planetary Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth</td>
<td>22 oz.</td>
</tr>
<tr>
<td>Mercury</td>
<td>8.3 oz.</td>
</tr>
<tr>
<td>Venus</td>
<td>19.9 oz.</td>
</tr>
<tr>
<td>Mars</td>
<td>8.2 oz.</td>
</tr>
<tr>
<td>Jupiter</td>
<td>55.6 oz.</td>
</tr>
<tr>
<td>Saturn</td>
<td>23.4 oz.</td>
</tr>
<tr>
<td>Uranus</td>
<td>19.5 oz.</td>
</tr>
<tr>
<td>Neptune</td>
<td>24.7 oz.</td>
</tr>
<tr>
<td>Planet</td>
<td>THREE DAY-LENGTHS</td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
</tr>
<tr>
<td>Earth</td>
<td>72 Hours</td>
</tr>
<tr>
<td>Mercury</td>
<td>4,224 Hours</td>
</tr>
<tr>
<td>Venus</td>
<td>17,496 Hours</td>
</tr>
<tr>
<td>Mars</td>
<td>75 Hours</td>
</tr>
<tr>
<td>Jupiter</td>
<td>30 Hours</td>
</tr>
<tr>
<td>Saturn</td>
<td>33 Hours</td>
</tr>
<tr>
<td>Uranus</td>
<td>51 Hours</td>
</tr>
<tr>
<td>Neptune</td>
<td>48 Hours</td>
</tr>
</tbody>
</table>
Sports on Other Planets

There are a lot of factors that can change a sport when played on Earth. Think about if you are playing on your home field compared to visiting a new field. The rules of the game don’t change, but the environmental factors can.

The chart below compares Earth to other planets in the solar system.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Rotation</th>
<th>Gravity (compared to Earth)</th>
<th>Size (Diameter)</th>
<th>Other Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth</td>
<td>23 hour 56 min</td>
<td>100%</td>
<td>12,750 km</td>
<td>• Only planet that sustains life</td>
</tr>
<tr>
<td>Mercury</td>
<td>58.6 Earth days</td>
<td>38%</td>
<td>4,879 km</td>
<td>• The sun appears 3x as large. • A year is only 88 Earth days.</td>
</tr>
<tr>
<td>Venus</td>
<td>243 Earth days</td>
<td>91%</td>
<td>12,112 km</td>
<td>• Rotates in a retrograde (opposite) motion • Incredibly dense atmosphere • Hottest planet in the solar system</td>
</tr>
<tr>
<td>Mars</td>
<td>24 hours 37 min</td>
<td>38%</td>
<td>6,790 km</td>
<td>• Home to the largest volcano in the solar system (Olympus Mons)</td>
</tr>
<tr>
<td>Jupiter</td>
<td>9.9 Earth hours</td>
<td>240%</td>
<td>142,800 km</td>
<td>• Great Red spot is about twice the size of Earth</td>
</tr>
<tr>
<td>Saturn</td>
<td>10.7 Earth hours</td>
<td>107%</td>
<td>120,536 km</td>
<td>• Saturn is the least dense planet. It could float in water!</td>
</tr>
<tr>
<td>Uranus</td>
<td>17 Earth hours</td>
<td>86%</td>
<td>51,118 km</td>
<td>• The axial tilt is 98 degrees.</td>
</tr>
<tr>
<td>Neptune</td>
<td>16 Earth hours</td>
<td>110%</td>
<td>49,500 km</td>
<td>• Winds can be up to 2,000 km/h</td>
</tr>
</tbody>
</table>

Read the article above, then answer the following question on your sheet:

Choose one of the planets above and compare it to Earth. How would the sport you pictured be different if it was played on a different planet in our solar system? How would the rules change? How would the playing field/court change? Briefly summarize how your sport will change in about three sentences.
**Card Sort**: Use the two card sets (weight of basketball and tournament time) to answer the following questions on your answer sheet.

**Weight of Basketball**: Because of the difference in the gravitational pull on other planets, the weight of objects vary. A regulation men’s basketball weighs 22 ounces on Earth.

1. Order the weight cards from least to greatest and write them down.
2. On what planet does the basketball weigh the least?
3. On what planet does the basketball weigh the most?
4. Based on the weight of a basketball on Mercury, how might the game be different?

**Tournament Time**: We measure days on planets by the amount of time it takes for a planet to completely spin around its axis to make one rotation. Earth takes roughly 24 hours to make a full rotation. This time varies on other planets.

5. Order the day-length cards from least to greatest and write them down.
6. On what planet is a basketball tournament the shortest?
7. On what planet is a basketball tournament the longest?
8. Based on the tournament time on Venus, how might the game be different?

**Sport on Another Planet**: Decide how you would need to modify a sport to be played on another planet from the chart. Assume that your athletes have everything they need to survive (water, air, moderate temperatures, etc.). Be sure to choose the planet with the right amount of gravity to best fit your modified sport. Answer the questions on your sheet.

**Extension**: If you have less than 10 minutes left, try the following:
In the space on your answer sheet, sketch a shirt design to advertise your new sport. Come up with a hashtag to include in your advertisement.

**Extension**: If you have more than 10 minutes left, try the following:
Choose a characteristic from the informational chart, such as gravity or length of days. Create a graph that compares this data for all the planets. Be sure to include a title, scale and labels for your axis.

**Assessment**: Answer the questions on your sheet using your sport and chosen planet.

**Show What You Know**: Describe how the equipment for your new sport would change on your chosen planet. Fill in the chart on your answer page with drawings and descriptions.

Example: Hurdles on Earth are approximately 70 cm tall. On Mars, hurdles should be 100 cm because I can jump higher on this planet because it has less gravity than on Earth.
Reading: Sports on Other Planets

---

Card Sort:

Weight of Basketball

1. __________  __________  __________  __________
   __________  __________  __________  __________

2. __________________________

3. __________________________

4. __________________________

---

Tournament Time

1. __________  __________  __________  __________
   __________  __________  __________  __________

2. __________________________

3. __________________________

4. __________________________
Sport on Another Planet:

Planet: _______________________________

1. Why did you choose this planet? __________________
   ________________________________________________
   ________________________________________________

2. Name of your new sport: _______________________

3. What sport is it similar to on Earth? ______________

4. How many players are on a team, or is it an individual sport? 
   ______________________________

5. How many teams compete at the same time? _______

6. What are the rules of the game?
   _______________________________________________
   _______________________________________________
   _______________________________________________
   _______________________________________________
   _______________________________________________
   _______________________________________________

   How would the playing field/court change?
   _______________________________________________
   _______________________________________________
   _______________________________________________
   _______________________________________________

7. Would you need to change the amount of playing time? 
   __________
   Explain: __________________________________________
   _______________________________________________
   _______________________________________________
Extension 1:

Extension 2: Be sure to include a title, scale and axis labels.
Assessment:
1. How did gravity on another planet change your sport? Explain.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. How did rotation on another planet change your sport? Explain.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. Look back at the informational chart. Which planet would cause the most changes to your sport? Explain.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Show What You Know:

<table>
<thead>
<tr>
<th>Equipment needed on Earth</th>
<th>Modified equipment needed</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Initials: _______
Student Response Journal Entries
If you were given the opportunity, would you go on the Mars One mission? Explain the reasons why or why not.
Have you ever used a telescope to look at the stars? Describe the experience. If you haven’t, what do you imagine it would look like?

https://www.youtube.com/watch?v=D6FT3cMdImE
Mae shares some of the objects she decided to bring with her to space. If you had been in her shoes, what would you have brought?

https://www.youtube.com/watch?v=B0vGDfuWhfl
Explain what this quote means in your own words.

Equipped with his five senses, man explores the universe around him and calls the adventure Science.

**Edwin Hubble**

Regarded as one of the most important observational cosmologists of the 20th century

How does this quote apply to your life or the world today?
We look at science as something very elite, which only a few people can learn. That’s just not true. You just have to start early and give kids a foundation. Kids live up, or down, to expectations.

**Dr. Mae Jemison**
American physician, NASA astronaut, and the first African American woman to travel in space

Explain what this quote means in your own words.

How does this quote apply to your life or the world today?
Space Exploration Student Lab Sheet

Essential Question:
How do scientists and engineers decide what equipment and transportation is necessary for space travel?

Background or Phenomena:
Humans have always been curious. Early explorers covered vast oceans to find new territory. Today’s explorers are looking to the sky to find new life. But how do they decide what they need or how to get there?

NASA (National Aeronautics and Space Administration) is responsible for many types of missions. For example, Mariner 4 was a flyby mission to Mars, where the spacecraft gathered information about its target as it passed by. The Mars Reconnaissance Orbiter is an orbital mission that has been circling Mars since 2006. The Mars Exploration Rover program is a lander/rover mission that put 384-pound remote-control mobile robots on the planet’s surface.

NASA has also succeeded with several manned missions. The Mercury missions of the early 1960s put the first Americans into space. The one-person Mercury capsule was mounted on top of its launch rocket. It was only 2 meters long and 1.9 meters in diameter.

The Gemini missions of the mid-1960s used a bigger, two-person capsule launched by a Titan II rocket. The Gemini program was the first to include a spacewalk and stay in orbit for 2 weeks.

The Apollo missions of the late-1960s to early 1970s placed man on the moon. The Apollo Command Module had room for three astronauts. The Lunar Module was used for landing on the moon and could only hold two astronauts. Launching two vehicles to the moon required the powerful, three-stage Saturn V rocket.

From 1981-2011 NASA used the reusable space shuttles: Atlantis, Challenger, Columbia, Discovery, and Endeavour. There were 135 total space shuttle missions with up to 7 astronauts. Each mission lasted 1-2 weeks in space. The shuttle was launched with two solid rocket boosters along with the main engines on the orbiter. The boosters, but not the fuel tank, could be reused.

Each time NASA plans a mission, its scientists and engineers choose mission goals that will answer questions like, what is out there? And, how will what we learn out there make life better here on Earth? They reuse old technology when they can, and design new technology to fit their needs. In this lab, you will choose your mission goals, then determine what you will need to succeed!
**Space Exploration Student Lab Sheet**

**Procedure:**
You have been hired by NASA to plan a mission to a planet in our solar system!

1. For each planet, calculate the time in hours it would take to reach it traveling as fast as the Apollo astronauts (25,000 mph). Then turn that time into months (there are 720 hours in a 30-day month).

   \[ \text{Time} = \frac{\text{Distance}}{\text{Speed}} \]

<table>
<thead>
<tr>
<th>Choice</th>
<th>Planet</th>
<th>Distance from Earth</th>
<th>Time in Hours</th>
<th>Time in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mercury</td>
<td>48 million miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Venus</td>
<td>162 million miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mars</td>
<td>140 million miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jupiter</td>
<td>601 million miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saturn</td>
<td>746 million miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uranus</td>
<td>1.6 billion miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neptune</td>
<td>2.7 billion miles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Distances from Earth and the time to reach the planets are averages. Because all objects in the solar system are moving, distances from each other are constantly changing.*

2. Think about the times and distances, then choose what planet you are exploring. Put a star next to the planet you chose in the “Choice” column.

3. What are your mission goals when you reach your target planet? Choose at least two areas and write goals in those areas:

<table>
<thead>
<tr>
<th>Measure:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photograph:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experiment:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explore:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
**Procedure:**
4. Choose what type of mission you will attempt based on your goals. Be sure to consider the travel time for any manned mission.

   The choices are:
   - ____ fly-by: take photos/measurements of the planet while flying by
   - ____ orbital: take photos/measurements from orbit
   - ____ remote rover: land a large, mobile robot on the surface to take samples, photos, measurements, and explore and do experiments
   - ____ manned landing: human crew will use lander to take samples, photos, measurements, and explore and do experiments

5. What equipment will you need to use or design to achieve the mission goals? If you have chosen a manned landing, what equipment will your crew need to travel, survive the planet, and return to Earth?

**Check for Understanding:** How does the distance to the planet affect your choice of missions?
Procedure:
6. You need to choose your vehicle from the graph below. Notice the different payloads (amount of weight) each can carry. Put a star by your launch rocket.

Check for Understanding: Why did you choose this vehicle?
Conclusion: How do scientists and engineers decide what equipment and transportation is necessary for space travel?

Claim:

Evidence:

Reasoning:

Reflections:

1. Why do scientists use different types of missions into space?

2. What are some reasons that manned missions to outer planets are difficult?
Use the following directions to annotate each of the texts in this journal.

Draw an arrow pointing at any words, phrases, or paragraphs that help the reader identify something new about the topic presented.

Draw a triangle next to or around any words you do not know. Then, look up the definition of the word. Write it in the margin or in your notes for future reference.

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Highlight ONE quote that stands out most to you. In the margin or in your notes, explain why this quote made such an impact on you.

Underline any EXAMPLES the author provides about the topic.

Cross out any information that is irrelevant to the topic, if any.
Watching a video feed of astronauts working and playing in the space station arouses a sense of adventure and maybe even envy. But what happens to your body after a prolonged stay in space?

NASA groups the risks into five categories related to the stresses they place on our astronauts. Of course, the amount of time spent in space either increases or decreases these risks. Scott Kelly was the first American to spend a year in space. Researchers are still studying Scott to see the long-term effects on his body, so when we travel to Mars, we’re equipped to deal with this issue.

Heading to space takes an astronaut from the Earth’s gravity to microgravity. The change in gravity has an alarming effect on astronauts. Astronauts experience disorientation, slower eye-hand coordination, balance, locomotion, and even motion sickness issues. Without the Earth’s gravity, bone density drops, and humans are at greater risk for osteoporosis and fractures in later life. Vision problems can also occur because blood moves to the upper body putting pressure on the eyes.

If gravity isn’t enough to detour you from becoming an astronaut, isolation and confinement might be. You may suffer from a decline in mood, trouble thinking, depression, and problems with your crew mates. Sleep can also be difficult in space, which can cause irritability.

NASA’s third risk category is hostile/closed environments. Closed environments cause an elevation in your stress hormones and alter your immune system making you susceptible to illnesses.

Astronauts on the space station receive over 10 times the amount of radiation they do on Earth. This exposure can increase their cancer risk, cause damage to their central nervous system, alter thinking, motor, and behavioral function.

And finally, just the distance from Earth is enough to be considered a risk for astronauts. What if you needed immediate medical attention or a specific medication quickly? They must wait for the next transport.

While preparing to go to Mars, NASA is making every attempt to mitigate the negative effects of space on the human body.
Answer the questions below based on the article about becoming an astronaut.

COMPREHENSION QUESTIONS:
1. Who was the first American astronaut to spend a year in space?
______________________________________________________________________________

2. How does the change in gravity affect an astronaut?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3. What problems do astronauts suffer due to isolation and confinement?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

4. What can the increased exposure to radiation do to the astronauts?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

5. Do you think keeping the space program is a good idea? Why or why not?
______________________________________________________________________________
______________________________________________________________________________

6. Why are researchers still studying Scott?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Mini-PROJECT: DESIGN A CAMP

NASA provides several space camp opportunities for youth throughout the year. Think about a hobby or career you are passionate about and design a camp brochure that encourages others to learn about the topic. For your camp, come up with the following:
- A location for your camp
- An explanation of four courses you’d offer at the camp that focus on the hobby or career being highlighted
- Opportunities offered at the camp
- Pricing, dates, and deadlines for the camp