**Seasons on Earth & Mars**

**Part I:**

1. First, we are going to watch the following video: [https://www.youtube.com/watch?v=mgeywzp5JOo](https://www.youtube.com/watch?v=mgeywzp5JOo)
   
   While you watch, jot down notes/evidence in the boxes below for each of the 4 facts regarding seasons.

2. Next, individually read the article “Seasons on Mars”. Add more notes/evidence in the boxes below. Then discuss the following 4 facts with your team and add final notes that support the statement.

3. Create a model that depicts the fact that Earth’s seasons are caused by the tilt on its axis. (Remember that a model shows both the visible and invisible, everything is labeled, includes a brief description(s), and often includes arrow showing a process or order.)

   - **Earth’s seasons are caused by the tilt on its axis.**
     
     ![Image](image)

   - **Earth’s seasons are caused by the changing of position between Earth and the Sun at different times of the Year.**
     
     ![Image](image)

   - **Mars has the same number of seasons as Earth.**
     
     ![Image](image)

   - **Seasons on Mars are longer than seasons on Earth.**
     
     ![Image](image)
**Part II: Directions: Go to the following websites and answer the questions**

Website #1: [https://mars.nasa.gov/allaboutmars/facts/#?c=inspace&s=tiltseasons](https://mars.nasa.gov/allaboutmars/facts/#?c=inspace&s=tiltseasons)

Fill in the table below

<table>
<thead>
<tr>
<th></th>
<th>Earth</th>
<th>Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Distance from the Sun</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Average Speed in orbiting the Sun</strong></td>
<td></td>
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<tr>
<td><strong>Diameter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tilt of Axis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Length of Year</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Length of Day</strong></td>
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<tr>
<td><strong>Gravity</strong></td>
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<tr>
<td><strong>Temperature</strong></td>
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<tr>
<td><strong>Atmosphere</strong></td>
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<tr>
<td><strong>Number of Moons</strong></td>
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</table>

1. What does having a similar tilt to Earth mean for Mars?
   ____________________________________________________________
   ____________________________________________________________

2. Why are seasons longer on Mars?
   ____________________________________________________________
   ____________________________________________________________

3. Why do you weigh less on Mars?
   ____________________________________________________________
   ____________________________________________________________

Website #2: [https://www.nasa.gov/audience/foreducators/postsecondary/features/F_Planet_Seasons.html](https://www.nasa.gov/audience/foreducators/postsecondary/features/F_Planet_Seasons.html)

1. There are several factors that affect the weather on the planets:
   a. _______________________________________________________
   b. _______________________________________________________
   c. _______________________________________________________
   d. _______________________________________________________
   e. _______________________________________________________

2. Earth's axis is tilted about ________ degrees. On Earth, that tilt is the primary reason for the differences in _________________ we observe between summer and winter.
   Planets with smaller tilts might have _________________ weather variations; planets with larger tilts could have more _________________ variations
3. Earth’s orbit is nearly ______________________, so there is little variation in Earth's overall climate, averaged over both northern and southern hemispheres. But other planets have more ____________________ orbits, and therefore their seasonal variations in weather are much ________________ than what we experience. We are much further from the Sun than Mercury or Venus, but closer than the other six planets. Generally, weather variations are more pronounced for those planets closer to the Sun.

4. The terms "summer" and "winter" tend to be Earth-oriented terms but can be applied to the other planets as well. When the North Pole of any planet is tilted toward the sun, astronomers call it the Summer Solstice; when the South Pole is tilted toward the sun it's called the Winter Solstice.

5. Read the paragraph on Mars.
   a. Why does mars have seasonal changes far greater than we experience here on Earth?
      ____________________________________________________________________________
      ____________________________________________________________________________

   b. Why are dramatic dust storms common on Mars?
      ______________________________

   c. Explain why seasons change roughly every six months?
      ____________________________________________________________________________
      ____________________________________________________________________________


1. Watch the 3 minute video. Write down 3 things that you learned.
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

2. What are some similarities and differences between Earth and Mars for the following:

<table>
<thead>
<tr>
<th></th>
<th>Earth</th>
<th>Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seasonal Temperatures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ranges of Atmospheric Water content and Humidity</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Ranges of Atmospheric Pressure</strong></td>
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</tbody>
</table>
That our seasons come from the tilt of Earth’s axis relative to its orbit of the Sun is easy to grasp, once you have used this Interactive. It shows the flow of seasons as the planet orbits the Sun, the angle of the Sun’s rays for a given location on Earth, how temperature varies at that location, and how the Sun’s path varies in the sky by season. Choose from 3 planets to see how their seasons reflect their unique tilts, or customize the tilt. What would “winter” be like if Earth had no tilt? This Interactive will show you!

Once you choose from the 3 planets and see how seasons reflect their tilts, then click on “Exercises” tab and go through #1-5. Click on “solutions” after you tackle it on your own. Explain each one in one sentence.

1. ______________________________________________________________________

2. ______________________________________________________________________

3. ______________________________________________________________________

4. ______________________________________________________________________

5. ______________________________________________________________________

Now, Answer Questions #1-5

1. Between the summer and winter solstices, how much does the altitude of the noon sun vary for observers in the United States?
   ______________________________________________________________________

2. Which of the statements is NOT a correct explanation for the extra heating of summer for the United States?
   ______________________________________________________________________

3. Based on its axial tilt, which of the planets will show a seasonal cycle most like our own Earth’s?
   ______________________________________________________________________

4. While several planets have tilts like our own, which jovian world has the most extreme tilt, with observable atmospheric seasonal changes now being studied closely for the first time?
   ______________________________________________________________________

5. While the Earth’s orbit is almost circular and little seasonal change arises here from our changing distance from the Sun, which of these planets would find its northern hemisphere summer solstice much colder than its southern hemisphere one, due to larger changes in perihelion and aphelion.
   ______________________________________________________________________