### Rutherford County Schools – Individual Learning Modules

<table>
<thead>
<tr>
<th>Grade</th>
<th>Course</th>
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<tbody>
<tr>
<td>8&lt;sup&gt;th&lt;/sup&gt; Grade</td>
<td>Science</td>
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**Unit Focus**
Develop and use models to describe the movement of celestial bodies in our solar system.

**Week of 4/27 – 5/1**

**Standard(s)**
8.ESS1.2 Explain the role of gravity in the formation of our sun and planets. Extend this explanation to address gravity’s effect on the motion of celestial objects in our solar system and Earth’s ocean tides.

**Resources**

- **Lesson Intro:** [Gravity and Tides](#)
- **Vocabulary:** [Quizlet](#)
- **Simulations:**
  - Newton’s Cannonball simulation,
  - “Gravity and Orbits”
- **Activity Sheet:** [Attachment #2](#)

### Tasks

**Day 1**

**Phenomenon:**
Isaac Newton was very curious about what affects the motion of celestial bodies in our solar system. He presented a thought experiment called “Newton’s Cannonball,” in which he imagines a cannon on top of a very high mountain. Newton said that logically, the cannonball should follow a straight line away from Earth, in the direction it was fired, instead of falling.

[Newton’s Cannonball simulation](#)

**Part 1**

Use the [Newton’s Laws Cannonball simulation](#) to answer the following question:

1. If you set it to **1500 m/s**, what happens? **Explain why you think it moves this way.**

2. The moon orbits at **7,300 m/s**. If you set the cannonball to this speed, what happens? **Why is this different from the first setting?**

3. Now set it to **8000 m/s**. What happens?
4. How would you describe the relationship of an object’s speed and the force of gravity when it comes to orbits?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

Part 2
Gravity is the force that attracts objects towards physical bodies that have a lot of mass.

Based on this definition, what object in our solar system do you think has the largest gravitational pull?

a. The sun  
b. The moon  
c. Jupiter  
d. Earth

Why?

_________________________________________________________________

Study your vocabulary on Quizlet

Modeling the Solar System

Open up the PHET Simulation “Gravity and Orbits”

1. Launch the simulation and select “Model.”
2. Click the selection showing the Sun, Earth, & Moon.
3. Then click the boxes to show Gravity Force and Path.
4. Experiment with different masses of the Sun and Earth.

Discussion Questions:

1. How does the mass of the Sun impact the orbit of the Earth? Use an example from the simulation.
The mass of the Sun impacts the orbit of the Earth because _________________
__________________________________________________________________________.

2. **How does the mass of the Earth affect the Moon?** Use an example from the simulation.
   The mass of the Earth impacts the orbit of the Moon because _________________
   ________________________________________________________________________

3. **What role does gravity play in maintaining the solar system?** (What would happen to our solar system if there was **NO GRAVITY**)
   ________________________________________________________________________
   ________________________________________________________________________

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### Ocean Tides

Watch this timelapse video of [Ocean Tides in Kingsport Nova Scotia](#);
Watch this studyjam that explains [Tides](#)

1. **What force produced by the sun and the moon creates the ocean tides on earth?**
   
   a. Friction
   b. Gravity
   c. Resistance
   d. Acceleration

2. **When high tides are on the northern and southern poles, what type of tides are on the equator?**
   
   a. high tide
   b. low tide

   **Label** on the diagram the following:
   
   *High Tide*
   *High Tide*
   *Low Tide*
What Causes Tides? Listen here

Gravitational forces of the Moon and Sun on the Earth cause tides. Tides are periodic rises and fall of large bodies of water. As the tide flows in, water level rises and rises. When the water reaches its highest level, it is considered high tide. After the point of high tide, the waters ebb (go out slowly) away. When the water reaches its lowest point, it is considered low tide. The water level difference between high and low tides varies from a few centimeters to 13 meters depending on the location.

The gravitational attraction of the moon causes the oceans to bulge out in the direction of the moon. Another bulge occurs on the opposite side, since the Earth is also being pulled toward the moon. Isaac Newton was the first person to explain the tides scientifically. Spring tides are especially strong tides. They occur when the Earth, the Sun and the Moon are in a straight line.

Spring tides occur during the full and the new moon. Neap tides are especially weak tides. They occur when the gravitation forces of the Moon and Sun are at right angles to each other. Neap tides occur during quarter moons.

http://www.millerslocal.co.za/the-inside-skinny-on-tides.html
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>cannon</td>
<td>a big gun, especially one mounted on a base or wheels</td>
</tr>
<tr>
<td>distance</td>
<td>How far an object moves</td>
</tr>
<tr>
<td>formation</td>
<td>something that is made</td>
</tr>
<tr>
<td>gravitational force</td>
<td>the force of attraction between all masses in the universe the pull of gravity</td>
</tr>
<tr>
<td>gravity</td>
<td>A force that pulls objects toward each other</td>
</tr>
<tr>
<td>Word</td>
<td>Definition</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>inertia</td>
<td>the tendency of an object to resist a change in its motion</td>
</tr>
<tr>
<td></td>
<td>keeps moving until stopped OR doesn't move until something moves it</td>
</tr>
<tr>
<td>mass</td>
<td>A measure of the amount of matter in an object</td>
</tr>
<tr>
<td>nebula</td>
<td>A large cloud of dust and gas in space</td>
</tr>
<tr>
<td>orbit</td>
<td>The path of an object as it moves around an object in space the moon orbits earth</td>
</tr>
<tr>
<td>simulation</td>
<td>an example of a possible situation</td>
</tr>
<tr>
<td>solar system</td>
<td>sun, planets, and all the other objects that revolve around the sun</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>telescope</td>
<td>A device built to observe distant objects by making them appear closer</td>
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Graphing Tidal Readings

Graph the following Tidal Readings from Galveston Bay, Texas. Don’t forget to give your graph and title and to label your X and Y axes.

<table>
<thead>
<tr>
<th>Day</th>
<th>High Tide Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>7</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Questions:
1. Which day was probably a full moon? ____________
2. Why do you think so? _______________________
3. Which day was probably the 1st quarter? __________
4. Why do you think so? _______________________

Conclusion:

(WORD BANK - Neap, gravitational, greatest, moon, high, Spring, low, Sun)
Ocean tides are caused by the ___________ pull of the _______ and the _______. The moon has the _________ effect on the tides. When the Sun, moon and earth are in a straight line, we have _________ tides. When the Sun, moon and earth are at right angles we have _________ tides. Spring tides are especially _________ tides while neap tides are especially _________ tides.