**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Gravity and Orbits PhET Simulation Lab**

**Learning Objectives-** Students will be able to:

* Draw motion of planets, Moons and satellites.
* Draw diagrams to show how gravity is the force that controls the motion of our solar system.
* Identify the variables that affect the strength of the gravity.
* Predict how motion would change if gravity was stronger or weaker.

**Part 1: Pre-lab**

1. In the picture below, draw how Earth moves.

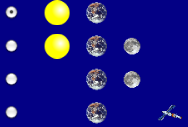


2. A **force** is a push or pull upon an object resulting from the object's interaction with another object. Whenever there is an interaction between two objects, there is a force upon each of the objects. When the interaction ceases, the two objects no longer experience the force. Forces only exist as a result of an interaction.

On the picture above, add arrows to show what you think the forces might be on the Earth and the Sun.

You can draw a longer arrow to represent a big force, and a shorter arrow to represent a small force.

3. Draw a picture of how you think the Earth would move if these forces were not there.

**Part 2: Understanding motion**

Explain your thinking. Why did you draw the movements of Earth and sun this way without any forces being exerted on them?

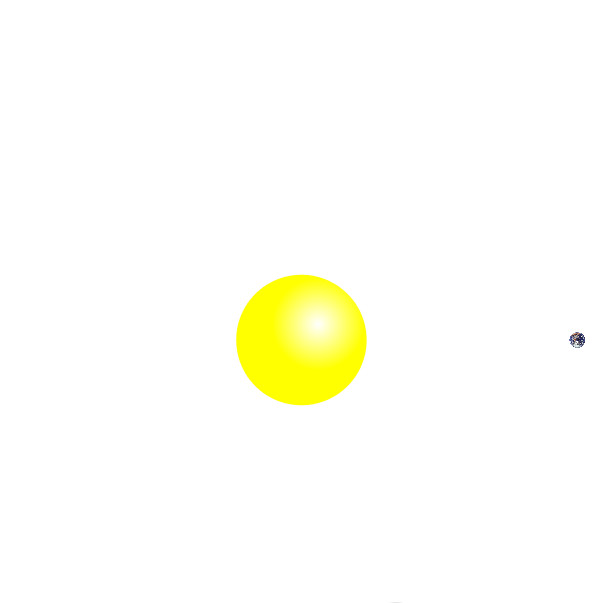
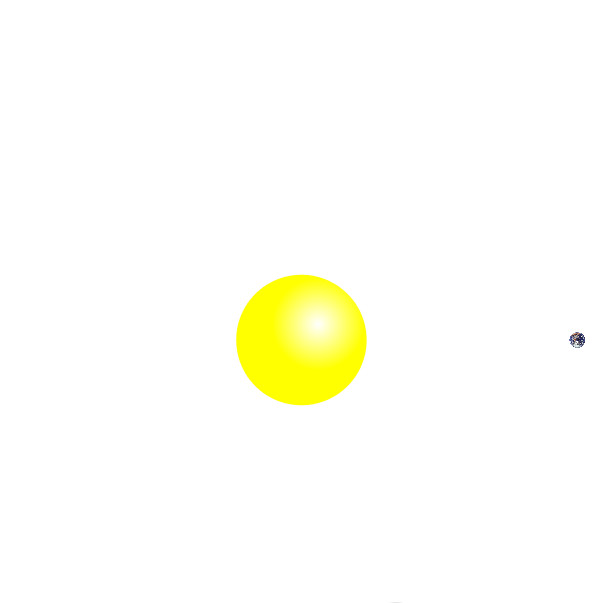
1. Open the ***Gravity and Orbits*** simulation posted in Google Classroom. Take 5 minutes to **explore** how the Earth, Moon, and the Space Station move.
2. Reset your simulation. Compare the motion of the **Earth moving around the Sun** with the **Moon moving around the Earth**.

|  |  |
| --- | --- |
| **Earth moves around the Sun**  Your Picture  Your Description | **Moon moves around the Earth**  Your Picture  Your Description |
| What are some things you find that are the **same** about these motions?  What are some things you find that are **different** about these motions? | |

**Part 3: Understanding Gravity**

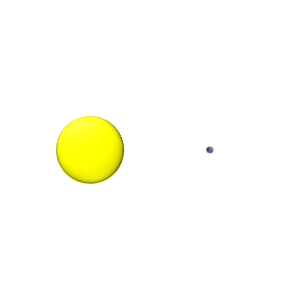
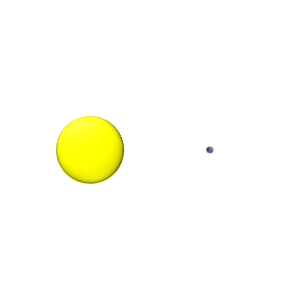
1. For the Sun and Earth system:
   1. **Draw** the path of the Earth with **Gravity ON** and **Gravity OFF**

**GRAVITY ON GRAVITY OFF**



* 1. **Why** do you think gravity is important?

1. **Explore** the simulation to find out how you can change the force of gravity and observe what happens.
2. **Draw** the Sun’s gravitational pull on the Earth **Draw** the Earth’s gravitational pull on the Sun



Why do you think the Earth moves, but the Sun does not move?

1. Return to your pictures in Question 2 and add arrows to **show the force of gravity**. Label them with “Gravity Force”.

1. **Play** with the simulation to find ways to change the length of the blue gravity force arrows. Collect your results in the table below.
2. Complete each of the first three actions listed in the table. Write whether gravitational force increases, decreases, or stays the same in the EFFECT column.
3. Come up with your own actions in the blank sections, and record their effects, too.

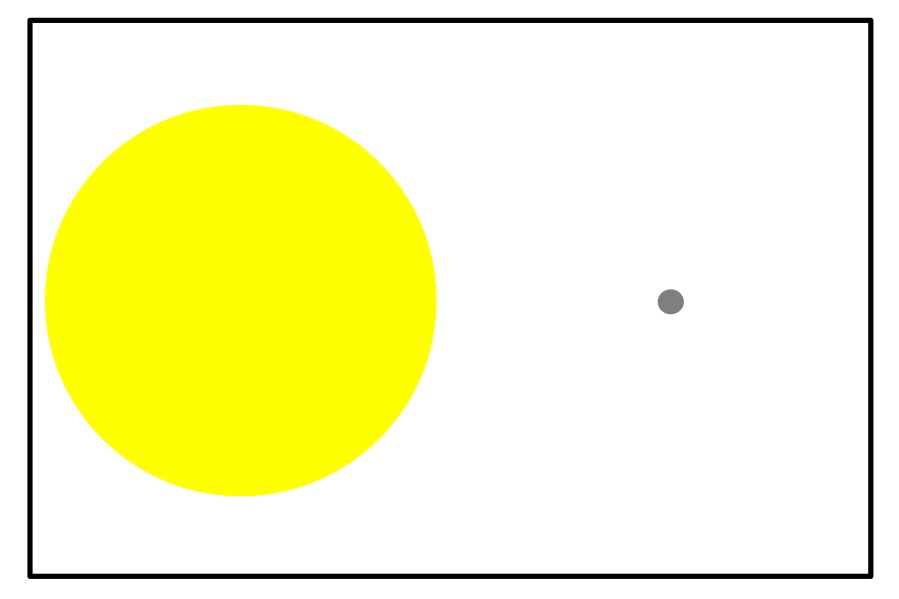
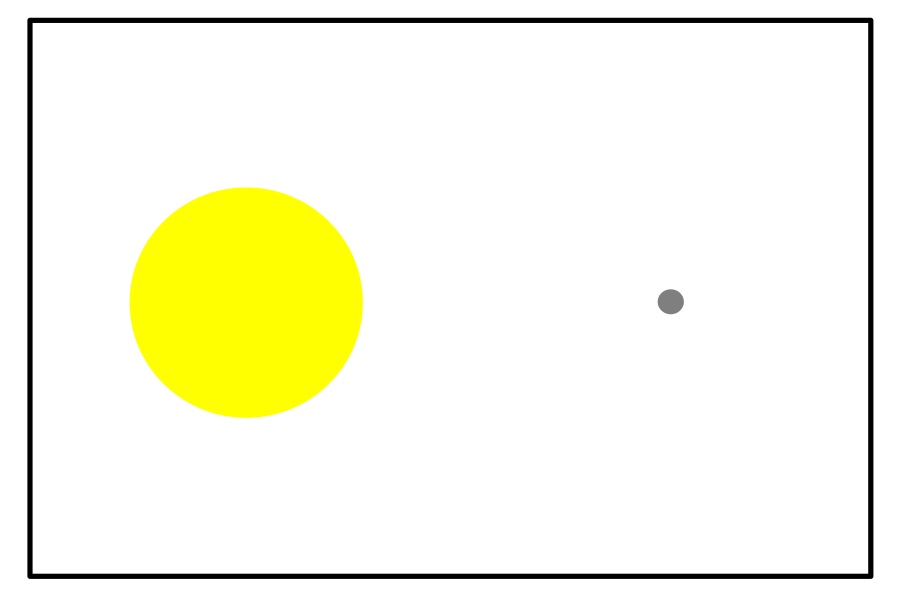
|  |  |
| --- | --- |
| **ACTION** | **EFFECT** |
| Put star and planet closer together |  |
| Increase the size of the star |  |
| Decrease the size of the planet |  |
|  |  |
|  |  |

c) What can affect the strength of gravitational force? What can you conclude from the results in your table?

1. Comparisons:

a) **Compare** these two cases:

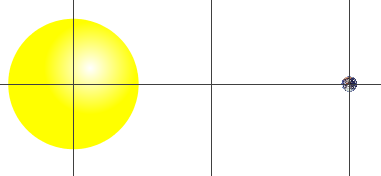
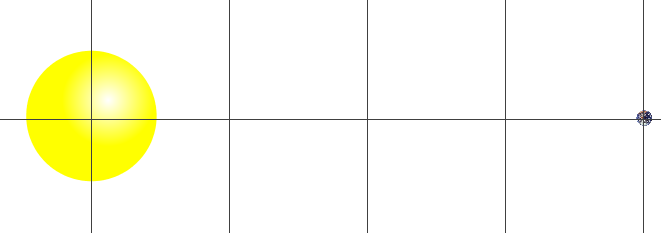
**CASE 1** **CASE 2**

What was changed between Case 1 and Case 2? **Draw** the force of gravity on the Earth in each case.

b) **Compare** these two cases:

**CASE 1** **CASE 2**



What was changed between Case 1 and Case 2? **Draw** the force of gravity on the Earth in each case.

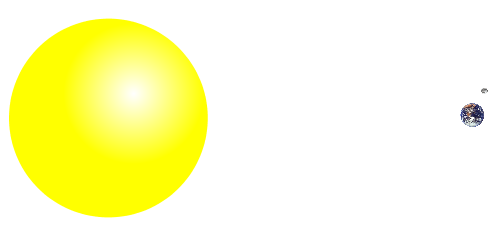
**Part 4: Gravity and Motion**

Fill in the table to help describe what you find out.

|  |  |  |  |
| --- | --- | --- | --- |
| **How can you….** | Explain what you changed | Draw the motion paths | What other changes do you notice? |
| **...make the Moon**  **go around the Earth in a bigger circle?** |  |  |  |
| **...make the Earth**  **take more time to go around the Sun?** |  |  |  |
| **...make the Earth**  **take less time to go around the Sun?** |  |  |  |

**Part 5: Post-Lab**

1. In the picture below, draw how you think the Earth and the Moon move.

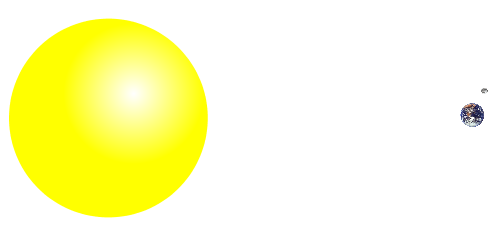


1. On the picture above, use arrows to show the gravity forces on the Earth, Sun and the Moon. Explain how you placed your arrows to show these forces below.

3. Fill in the following table with your predictions and a drawing of each case.

|  |  |  |
| --- | --- | --- |
| **Predict** what would happen to the gravity force if you… | Gravity **Increases**, **Decreases** or **Stays the Same**? | **Your Drawing** |
| ...increase the size of the Star |  |  |
| ...move the star and the planet away from each other |  |  |
| ...decrease the size of the Planet |  |  |
| ...move the Star and Planet closer to each other |  |  |

4. Show in the picture below how you think the Earth and Moon would move if there were no gravity forces at all.



Explain why you think the Earth and Moon would move in this way.

5. Tell us what you think about the activity:

a. How ***useful for your learning*** was this science activity, compared to other science class activities? (circle)

More useful About the same Less useful

b. How ***enjoyable*** was this science class activity, compared to other science class activities? (circle)

More enjoyable About the same Less enjoyable

c. Why did you or did you not find it useful or enjoyable?