

Honors Astronomy S/G

Phet Activity

“My Solar System”

INSTRUCTIONS: You will need to run the simulation “My Solar System” either from the website https://phet.colorado.edu/sims/my-solar-system/my-solar-system_en.html or by downloading the simulation. All that will be required to run this simulation is Adobe Flash Player.

Part 1 – The Orbit of a Single Planet around the Sun

Directions

1. Open the simulation.
2. Under “Initial Settings,” for number of bodies, select 2.
3. Note the velocity vector of the Pink Planet as the simulation waits to be started.
4. In the green box on the right, unselect “Show Traces.”
5. In the green box on the right, move the slider all the way to the left to “accurate.”
6. In the green box on the right, make sure “Show Grid” is selected for this entire exercise.
7. Start the simulation by selecting “Start” in the green box on the right. Observe the orbit of the Pink Planet for an orbit or two.
8. Select “Stop.”

QUESTION 1 Is the Sun remaining stationary as the Pink Planet orbits?

9. Now, reselect “Show Traces” in the green box on the right.
10. Reset the simulation.
11. Run the simulation again, observing the Pink Planet and the Sun and their traces.

QUESTION 2 What type of motion is the Sun making as the Pink Planet orbits?

QUESTION 3 Why would the Sun move as a planet orbits it?

Part 2 – The Orbits of Three Bodies

QUESTION 4 When we observe the Moon going through its phases, what do we assume about the orbit of the Moon from the reference frame of Earth?

Directions

1. Reset the simulation.
2. Now, click 3 for the number of bodies under “Initial Settings.” You will now see the Pink Planet and a Cyan Moon with their initial velocity vectors.
3. We are going to let the Pink Planet be Earth and the Cyan Moon be our Moon.
4. Deselect “Show Traces” and run the simulation for a few orbits.
5. Select “Stop.”

QUESTION 5 From the point-of view of Earth, does the motion of the Moon agree with your answer from Question 4?

6. Now, we are going to witness the orbital motion of the Moon from a reference frame outside of the Solar System.
7. Reset the simulation.
8. Select “Show Traces.”
9. Run the simulation.

QUESTION 6 How would you describe the motion of the Moon (the cyan trace) from a reference frame outside the Solar System?

Part 3 – Mass is Where it’s At

Directions

1. Select 2 for the Number of Bodies under the Initial Settings. The Pink Planet with its initial velocity vector will move back to its starting position.
2. Run the simulation. Allow the Pink Planet to make at least one orbit with a trace before stopping the simulation.
3. Select “Tape Measure” in the green box on the right.
4. The tape measure can be extended and moved.

- QUESTION 7
- a) What is the aphelion of the Pink Planet’s orbit (no units)?
 - b) What is the perihelion of the Pink Planet’s orbit (no units)?
 - c) What is the average orbital distance of the Pink Planet (no units)?
5. Get rid of the tape measure by unselecting it.
 6. Reset the simulation.
 7. Under “Initial Settings,” increase the mass of body 1 (yellow – the Sun) to 400.
 8. Rerun the simulation for 1 orbit. Reselect the tape measure.

- QUESTION 8
- a) What is the aphelion of the Pink Planet’s orbit (no units)?
 - b) What is the perihelion of the Pink Planet’s orbit (no units)?
 - c) What is the average orbital distance of the Pink Planet (no units)?
9. Now, repeat the simulation, but by setting the mass of the Sun to be 175.

- QUESTION 9
- a) What is the aphelion of the Pink Planet’s orbit (no units)?
 - b) What is the perihelion of the Pink Planet’s orbit (no units)?
 - c) What is the average orbital distance of the Pink Planet (no units)?

QUESTION 10 How does the speed of the orbit of the Pink Planet change as its distance from the star (Sun) changes?