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Activity 4:5: Orbit or Not?

You are swinging the bat as hard as you can. The ball comes and "WHACK." You just know it is a homerun, so you let go of the bat and start running. What direction (or shape) is the bat moving as you swing to hit the ball? What do you think will happen when you let the bat go? Which direction will it fly?

Objective:

Students will observe different models of Newton's First Law of Motion in order to apply Newton's First Law of Motion to the earth's revolution around the sun.

Materials:

Plastic tubing
Styrofoam ball
or small paper wad
Whiffle bat
Rope
String
Print resources
Internet resources

Procedures:

There is a big difference between a guess and a hypothesis. A guess is what you suppose might be the answer to a question, although you're not sure. A hypothesis is a possible explanation for some phenomenon that you've observed.

1. Have you ever seen a batter swing very hard at a pitch, miss, and lose his grip on the bat? Predict which direction does the bat travel?

_____

_____

_____

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2. Now let's think about the universe and our solar system: Predict what would happen to the earth if the sun's gravity were to suddenly disappear?

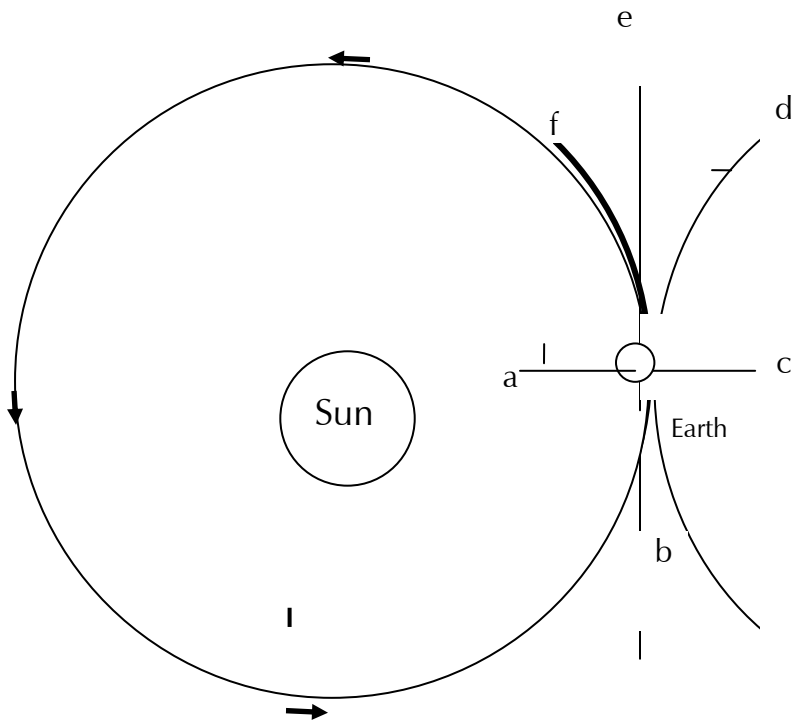
_____

_____

_____

3. View Diagram 1, "Path of the Earth's Orbit," and answer the questions that follow

Diagram 1: Path of the Earth's Orbit



4. The earth is moving around the sun counterclockwise. Now imagine that the sun suddenly vanished. Predict the earth's new path, by circling one of the choices below:

I think the earth would follow path **a, b, c, d, e, f .**

Did you have a reason for your prediction? _____

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Activity 4:5: Orbit or Not?

1. Explain your prediction for the path you thought the Earth should foll

_____

_____

_____

2. Predict what would happen if you spun a ball connected to a string around your head and let it go.

_____

_____

_____

Scientists observe the world around them and then write a hypothesis that will explain their observations. Based on your observations of the bat and ball and prior knowledge construct a hypothesis that describes how an object in circular motion will travel when you let go of the object and also explains why it will travel that way.

3. Hypothesis:

If_____

_____,

then_____

_____

because_____

_____

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Station #1: Ball on a String

1. Get a ball with an attached string from your teacher.
2. Slowly spin the ball over your head...not too fast now! (NOTE: If safety or space is a problem, your teacher may tell you to spin the ball on the floor, instead of in the air.)
3. Tell your group that you are going to let go, then let go when it is directly in front of you!
4. Observe what path the ball took when it left your hand. Record the path in Data Chart 1, "Path of Ball."
6. Repeat two more trials. Record the path in Data Chart 1, "Path of Ball."

Data Chart 1: Path of Ball

Trial	Path of the Ball
1	
2	
3	

7. Draw and describe the path of the ball when it is spinning around your head.

_____

_____

8. Draw and describe the path of the ball when you let go of the string.

_____

9. Explain what the string and the ball represent.

_____

_____

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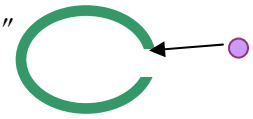
Station #2: Hula Hoop

1. Place the small ball or round candy in the cut hula hoop.
2. Cup your hands around the end and blow as hard as you can.
3. Record the path the ball took when it leaves the hula hoop in Data Chart 2, "Hula Hoop."
4. Repeat two more times and record in Data Chart 2, "Hula Hoop."



Data Chart 2: Hula Hoop

Trial	Path of the Ball
1	
2	
3	

5. Explain why you think the ball travels in a straight line when it leaves the hula hoop.

_____

_____

_____

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Activity 4:5: Orbit or Not?

Station #3: Ring and Ball

1. Place the ball on one end of the hoop with a section cut out and roll it around the hoop.
2. Record what happens when the ball leaves the hoop in Data Chart 3, "Ring and Ball."
3. Repeat two more times and record in Data Chart 3, "Ring and Ball."

Data Chart 3: Ring and Ball

Trial	Path of the Ball
1	
2	
3	

5. Explain how why you think the ball travels in a straight line when it leaves the ring.

_____

_____

_____

6. Reexamine your hypothesis. Revise your hypothesis thinking about what happened in this investigation.

If_____

_____,

then_____

_____

because_____

_____

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7. Do you think your hypothesis will always be proven accurate? Expla

_____

_____

_____

Activity #4: Reading, "Planetary Motion: Inertia and Gravity"

Planetary Motion: Inertia and Gravity

In the seventeenth century, Sir Isaac Newton, for the first time, explained the law of inertia, which states that an object's motion will not change unless an unbalanced force acts upon it. If no force is applied, then the object will not change its speed or direction. Newton used this law to describe the motion of the planets.

He reasoned that planets should move in a straight line at a constant speed, if they move like all other objects. Why, then, does the earth stay in an almost-circular orbit around the sun? Newton applied the law of inertia to deduce that some force must be affecting the earth's motion. Newton concluded that this force must be the gravity of the sun. Just as the earth's gravity pulls you toward the center of the earth, the sun also exerts a gravitational force that pulls objects toward to the sun. The farther away the object is, the weaker the gravitational force. As the earth moves, the sun's gravity continuously tugs on the earth.

Inertia causes an object such as a planet to travel in a straight line (if there are no unbalanced external forces). Gravity is the external force that causes a planet to be drawn toward the sun. Therefore, the earth stays in orbit because of the way that inertia and gravity affect its motion. Newton made the more general hypothesis that planets deviate from their otherwise straight-line motion and curve around the sun because of the combined effects of inertia and gravity. This hypothesis has since been confirmed.

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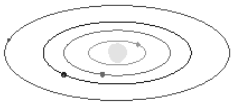


1. Describe a planet's path in space.

_____

_____

2. Explain the "Law of Inertia."

_____

_____

_____

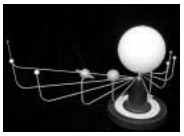
3. Explain the importance of gravity.

_____

_____

_____

4. Draw and explain the path the earth would take if the sun disappeared.



_____

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_____

Analysis:

1. Explain what causes the planets to be pulled towards the sun.

_____

_____

_____

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Activity 4:5: Orbit or Not?

2. Draw and explain the path a planet would take if there was no gravity from the sun. Support your answer with data from today's activity and information from the reading.

_____

_____

_____

_____

_____

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_____

_____

3. Explain why you think planets don't crash into the sun or each other.

_____

_____

_____

_____

_____

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Activity 4:5: Orbit or Not?

4. Explain why you think smaller celestial objects, such as asteroids, v ange directions and move toward earth. Support your answer with information from the activity and the reading.

_____

_____

_____

_____

_____

5. Predict what would happen to the orbits of the planets if we had two suns. Explain your prediction.

_____

_____

6. Predict what you think would happen to the earth's orbit if the moon suddenly disappeared.

_____

_____

7. Predict what you think would happen to the earth's orbit if the sun's mass doubled. Explain your prediction.

_____

_____

_____

8. Go to http://www.fearofphysics.com to observe the gravitational pull of the earth on satellites. At 1000 feet how fast does a satellite have to travel not to crash? _____

At 23,000 feet how fast does a satellite have to travel not to crash? _____