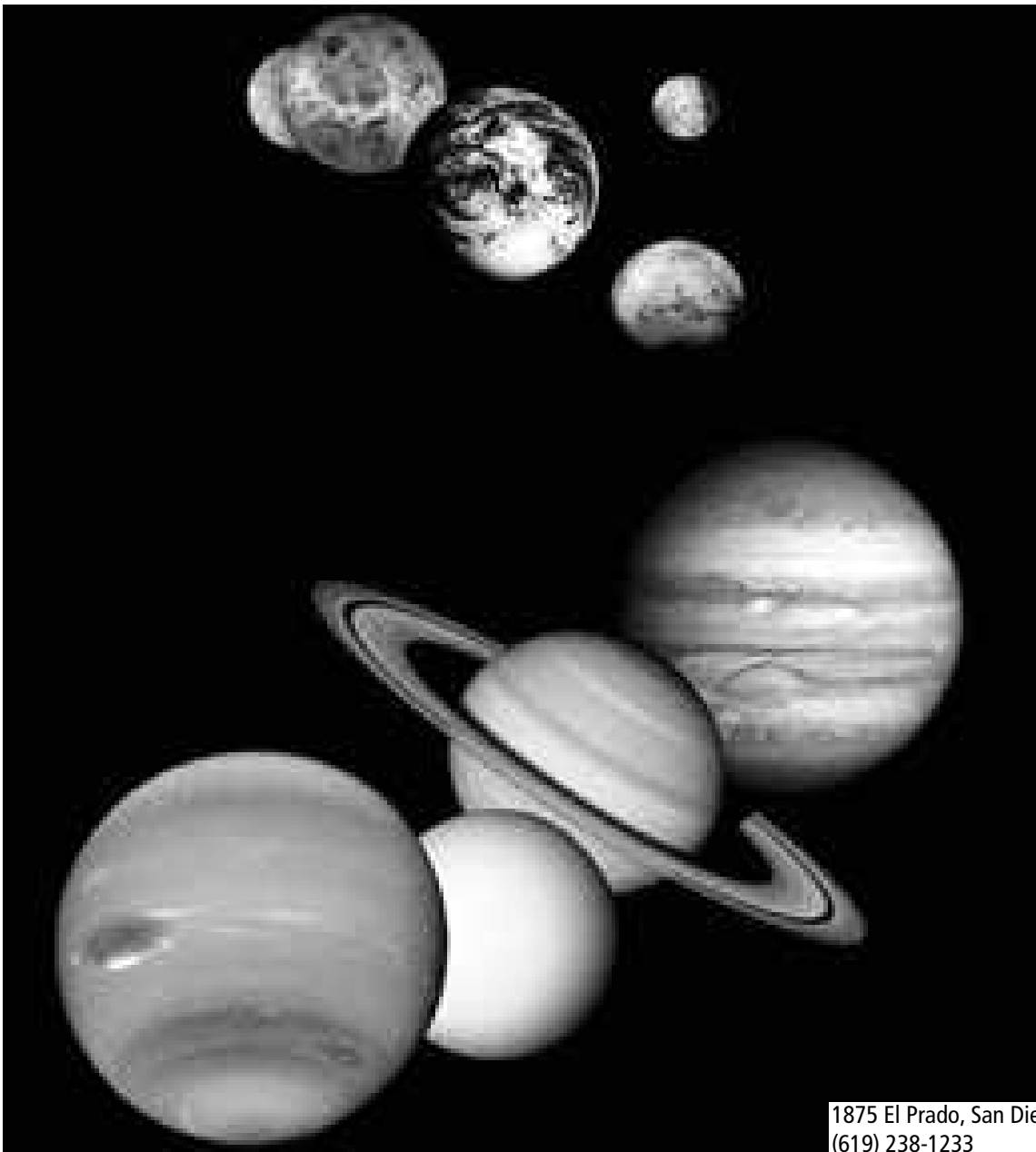


**Educator Guide to**

# **Solar System 101**



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# Pre-Visit Activity: Orbital Paths

## Materials:

- Plastic Plate
- Marble
- Scissors



## To Do:

1. Put the plate on a flat surface and place the marble against the inside edge of the plate.
2. Move the plate in a circular motion until the marble is moving along the inside edge of the plate.
3. What provides the force to keep the marble moving in a circle?
4. Now cut the plate in half and place the marble at one of the cut edges (see the figure below).
5. What path will the marble take when it comes to the end of the plate (path A, B, C or D)?
6. Push the marble to get it rolling along the inside edge of the plate. Pay close attention to the direction of the marble when it rolls off the other end of the plate.



## Now Try This...

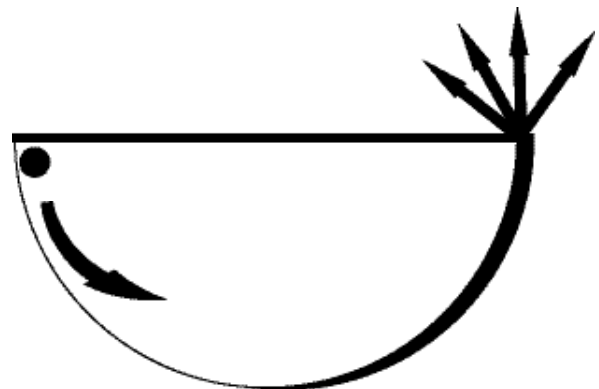
Make a track for your marble using the cut pieces of plate. See if you can arrange the plates so your marble travels from one plate to another.

## What's Going On?

It takes some type of force to make an object move. Newton's first law of motion states that an object at rest tends to stay at rest and an object in motion tends to stay in motion unless acted on by an outside force.

The motion of your hand provided the initial force to get the marble moving, but why did it keep moving in a circle? The marble follows a curve because the plate keeps it in place. When you cut the plate in half the marble followed a straight line when it left the end of the plate because there was no longer any "force" to keep it traveling in a circle.

This activity can help explain the orbit of the planets around the sun (or the moons around a planet). Due to the gravitational pull of the sun any circling object, like Earth, has a centripetal force (a center seeking force) keeping it in its circular path. The forward speed of the planets keeps them from being pulled into the body they orbit, and the centripetal force acting on the planets keeps them from moving off in space.



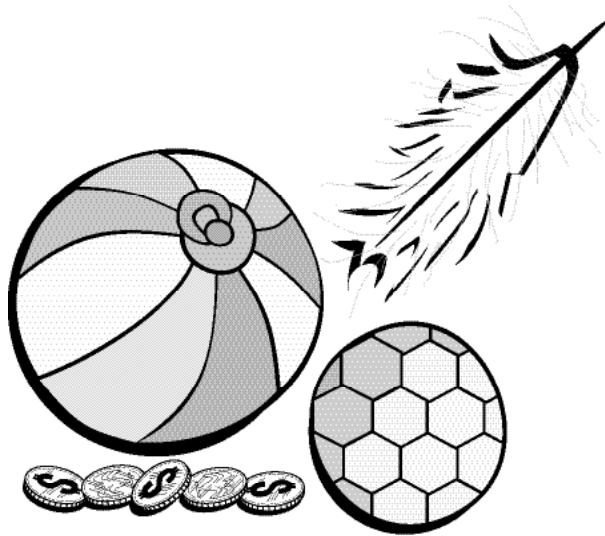
# Post-Visit Activity: Gravity

## Materials:

- Balls of different size and mass
- Rocks
- Feathers
- Balloons (filled with air and water)
- Coins
- Other misc. objects
- Paper
- Pens and pencils
- Jungle gym or other high spot to drop objects
- Balance scale (optional)
- Stopwatches (optional)

## To Do:

1. Choose two different objects to investigate.
2. Predict how the objects will move when dropped. What makes the objects fall when you drop them? Will heavy objects fall faster, slower or at the same rate as lighter objects? Why do you think so?
3. If a balance scale is available, measure the mass of your chosen objects.
4. Stand on a chair and drop your objects. Have a friend watch when the objects hit the floor. Did they land at the same time? Why or why not?
5. Will you get the same result if you drop the objects from a greater height? Take your objects outdoors to the top of a jungle gym or other high area. Drop the objects again and observe when they hit the ground. (If possible, try to time how long it takes for each object to hit the ground.) Did the objects land at the same time? Why or why not?
6. Repeat the experiment with different objects. Be sure to make predictions before you start!
7. How do you think this experiment might be different if conducted on the Moon? Why?

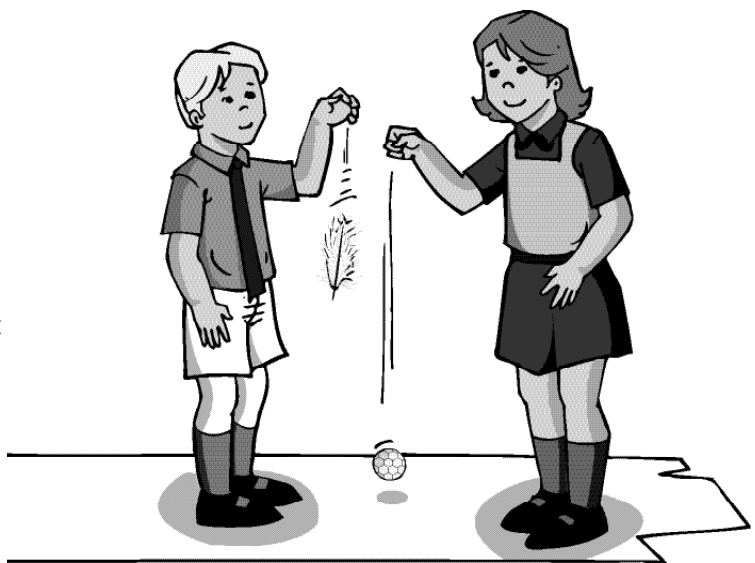


## What's Going On?

The force of gravity causes the dropped objects to fall to the ground. In a vacuum or on the Moon, the objects would land at the same time regardless of their shape, size, or mass. Because of the atmosphere here on Earth however, air resistance can make some objects fall slower than expected. For instance, a feather or a piece of paper has little mass and a large surface area, so air resistance has a bigger influence on these objects.

The Moon has no atmosphere, so gravity is the only force that acts on dropped objects. All of your objects would fall with the same acceleration on the Moon and they would hit the ground at the same time. In contrast, the objects on Earth stop accelerating when the air resistance is equal to the force of gravity. This is called the terminal speed of the object. The terminal speed is different for different objects. A feather has a slower terminal speed than a bowling ball.

Although all of the objects would fall at an equal rate on the Moon, they would take a little longer to hit the ground. This is because the Moon has a smaller mass than the Earth and its gravity is weaker.



# Glossary

**Air resistance** – The opposition of the atmosphere to forward movement.

**Axis** – A real or imaginary straight line about which a body or geometric object rotates.

**Force** – A push or pull

**Gravity** – The force of attraction between all masses in the universe; especially the attraction of the earth's mass for bodies near its surface.

**Lunar** – Relating to the Moon.

**Orbit** – The path of one body around another.

**Planet** – A major object which orbits around a star.

**Revolution** – The movement of a body in an orbit or circle.

**Rotation** – Turning around a center point or axis.

**Terminal speed** – Speed at which the downward pull of gravity is balanced by air resistance.

