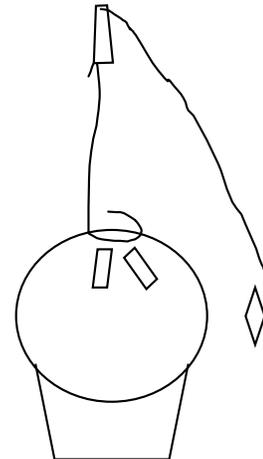


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1. Explain that the basketball represents the Earth, and the sinker represents the satellite. Newton's 1st law states that a body remains in its state of motion or lack of motion unless acted on by an external force (Galileo's principle of inertia defining "natural motion"). Newton's 2nd law states, "A net force acting on an object causes the object to accelerate in the direction of the force. The larger the force acting on an object, the faster the object will accelerate."
 2. Let's demonstrate these two theories. Tie the sinker to the string and tape the string to the ball. If you hold very still, the sinker does not move – Newton's 1st law. All it takes to get the sinker into motion is a tap of the finger. The sinker will move in the direction of the tap – Newton's 2nd law.
 3. What about an orbit?

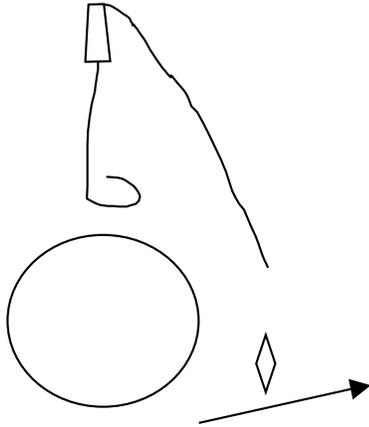
- Place the ball securely in the bucket.
- Bend the wire so that about a foot of it is straight up and the rest is curved into a circular base.
- Using masking tape, secure the circular portion on the ball with the straight part in the center of the ball.
- Attach the sinker or weight to the string.
- Fasten the other end of the string to the inverted test tube or lipstick cap and place on top of the wire.
- The inverted test tube or cap should be able to rotate freely on the wire.



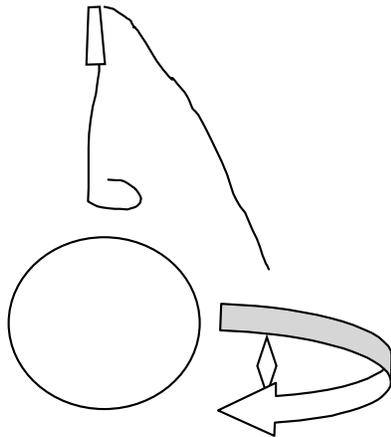
4. Swing the sinker into an orbit around the ball in an oblong motion. The closest distance from the Earth is the perigee of the orbit. The farthest distance away from the Earth is called the apogee of the orbit. Because of friction between the cap and the wire, the size of the orbit will gradually decrease until the sinker plunges back to the surface of the ball (Earth). In the same way, friction from the thin atmosphere eventually causes a real satellite to fall back to Earth and burn like a meteor as it passes through the denser atmosphere on its downward journey. If the school has a tetherball, a similar activity may be performed with it.
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5. Try the following experiments:

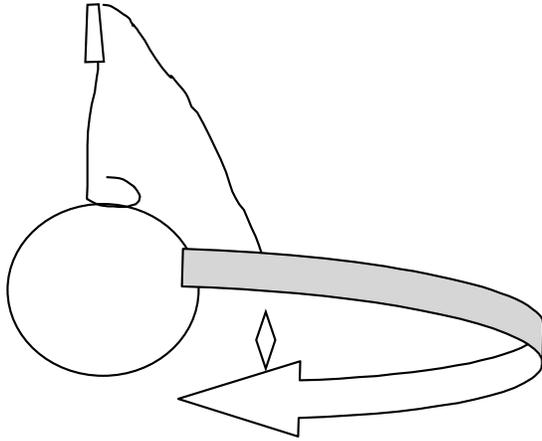
-With a slight tap, make the sinker move up away from the ball. The sinker moves up and falls back to the starting point. This is how an object travels when projected at low speed from Earth.



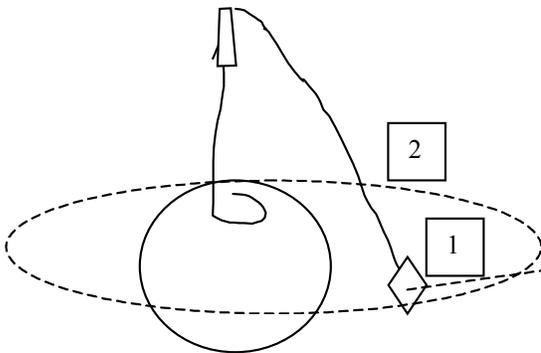
- With a slight tap, make the sinker move off the surface of the ball at an angle. Show by a diagram what happens. The sinker moves away from the ball and then falls back at some distance from the starting point. The distance spanned depends upon the angle of launch and the force at which the object was propelled.



- With a stronger tap, push the sinker off the surface of the ball at an angle. Make a diagram of the orbit. The sinker moves away from the ball, circles it, and lands near the starting point. This is one complete orbit.



-With one tap, push the sinker up from the surface of the ball. With another tap, push the sinker in a direction that is parallel to the surface. Is this orbit different from the one in Step 3? The sinker goes into orbit, circling the ball without touching it more than once. Since the sinker passed the starting point without touching Earth, the orbit is completely in "space" and doesn't crash into Earth.



Extensions:

Research and write a report on Newton's Laws of Motion.

Search the internet for information on history of space flight.

Draw a poster that would illustrate satellite orbits and include apogee and perigee.

Find the moon at perigee and apogee

References / Resources :

<http://www.trinityprep.org/MAZZAR/thinkquest/lawsofmotion.htm>

http://www.fourmilab.ch/earthview/moon_ap_per.html
