

Oval Orbits

Activity Objectives

- To introduce the concept of orbit
- To observe that objects can orbit in both oval and circular orbits

Materials

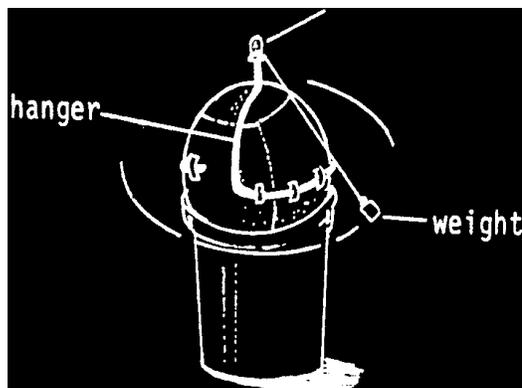
- ✓ Basketball
- ✓ Coat hanger
- ✓ Tape
- ✓ Two or three feet of string
- ✓ Weight (lead sinker works well)
- ✓ Pail
- ✓ Thimble
- ✓ Softball

Background

Most earth satellites have orbits which are oval shaped. The oval pattern is determined by the angle of Insertion Into space. The point farthest from the earth is called apogee. The point in the orbit nearest to the earth is called perigee.

Instructions

1. Before class, place the basketball in the pail; bend the coat hanger and tape it to the ball so that it is in an upright position. Attach the string to the thimble and place it on top of the upright hanger. Attach the weight to the other end of the string.



2. Upright the pail, with a weight hanging off a string that is attached to a bent coat hanger

3. When the class arrives, get the softball and take the students outside. Standing at a marked line, have a student toss the ball out gently. Mark the spot where it lands. Have another student throw it out a little harder and mark the landing spot. Last, have someone throw the ball as hard as he/she can and mark the spot where the ball lands.
4. Ask the students to speculate about whether anyone could throw a ball hard enough so it would fall over the horizon and miss the earth altogether. Ask the group to think about such things as, "Why spacecraft have to be launched with more powerful launch systems in order to reach orbit in space as opposed to suborbital flights," or "What sort of orbital configuration do spacecraft fly in as they orbit?"
5. When students are back in the classroom, explain to them that the ball in the bucket represents Earth and the weight represents a satellite. Ask a student to tap the weight away from the ball and observe how and where it turns. Have the student carefully push the weight away at different angles. At different speeds. While it is in motion. What does the student notice? Are there differences in the shapes of the orbits? Are some elliptical? Circular? How can the type of orbit be determined?
6. Discuss apogee and perigee with the students. Explain the smallest distance the weight (satellite) is from the ball (earth) is called perigee of the orbit and the farthest distance is called the apogee.
7. Allow the students the opportunity to experiment with the ball and the weight. By the end of the lesson, the students should be able to address the following questions:
 - How is the type of orbit determined? (By the angle of insertion and speed.)
 - What kind of orbit occurs when the weight is pushed out from the surface of the ball? (An elliptical orbit.)
 - What must be done to achieve a circular orbit? (Tap the weight away from the ball and then tap again or start the orbit with the weight already away from the ball.)
 - What is the farthest distance the satellite orbits from the earth called? (Apogee)
 - What is the shortest distance the satellite orbits from the earth called? (Perigee)