How does a satellite get into orbit?

INTRODUCTION

Most students will know that to get something into space you need a rocket, but they may not realize that rockets do not have to 'push off' of the atmosphere to get into space. Also, you don't have to keep pushing a satellite to keep it moving in space because there is no friction in space to cause things to slow down. In this activity, students will learn how Newton's Laws of Motion can be applied to the launching of rockets: "Every reaction causes and equal and opposite reaction". Students will explore how a satellite is placed in orbit. The students will explore how a satellite remains in its orbit.

MATERIALS NEEDED:

1...Balloon
2...Glitter
3...Ball -tennis
4...String
5...Cost feature list (optional)

OBJECTIVES

- Students will explore Newton's Laws of Motion and their application to rocket launching.
- Students will explore Newton's Laws of Motion and their application to satellite orbits.
- Students will develop an understanding of the decisions that a scientist makes when designing a satellite.

CONCLUSIONS

A rocket works by ejecting gas, and because of Newton's Third law of Motion, this produces an equal and opposite force in the direction the rocket travels. Scientists have to design satellites and be very careful of the total weight of the satellite. Heavy satellites may give them more data, but they are also much more expensive to place into orbit with a rocket.

AAAS Benchmarks: 9e-35-1

P R O C E D U R E

How does a satellite get into an orbit?

· Place some glitter inside a balloon. Blow up the balloon and hold the open end. The students should predict what would happen when the balloon is released. The children will need to observe carefully to see what happens when you let go. After the observation, discuss that the air being released was modeled by the glitter that came out. The glitter went in one direction while the balloon went in the opposite direction. This is an example of Newton's Third Law of Motion.

· Have the students imagine that they are going to ride a skateboard. The skateboard and the rider are both still. The rider jumps off the skateboard, representing an action. The skateboard responds to this action by traveling in the opposite direction of the rider. This is another example of Newton's Third Law of Motion. When launching a rocket, the action is the expelling of gas out of the engine. This action or thrust must be stronger than the mass or weight of the rocket to lift the rocket off the launch pad and into space.

How does a satellite stay in orbit?

· Attach a ball to a string. Swing the ball around in a circle. Have the students observe that the path of the ball stays in a circular pattern and that the force on the string is the ball (centrifugal) has to be balanced by your tugging on it (gravity) to keep it going in a circle. This is the way that a satellite remains in orbit. A satellite has its forward thrust, which is offset by the pull of gravity towards the earth. This keeps the satellite circling in its orbit. Newton's First Law of Motion explains how the satellite remains in orbit.

Extensions

Grades 3-6

· Students will design a research satellite, considering the research goals, the budgeted money for the project and the cost of the satellite using the attached instructions and charts.

Key Terms

Newton's First Law of Motion - if an object is at rest, it takes unbalanced forces to make it move. Conversely, if an object is moving it takes an unbalanced force to make it change it's direction or speed.

Newton's Third Law of Motion - for every action there is an opposite and equal reaction.

P R O C E D U R E

1. Select the experiments that you would like the satellite to accomplish from Chart 1. Write down the mass needed for each of your chosen experiments then find the total mass needed. You will also need to write down the power in watts you will need for all your experiments then find the total watts needed.

2. Select the spacecraft mass from Chart 2 by using the number of experiments you have chosen to complete.

3. By looking at Chart 3 find the watts needed to power your experiment, and the additional mass needed to transport the power.

4. To find the grand total mass needed to launch your satellite, add your total mass from Chart 1, your mass to support experiments from Chart 2, and your mass to power your satellite from Chart 3. Find your grand total mass in Chart 4 to determine the appropriate launch vehicle and its cost. (Experiments mass + Spacecraft mass + Power mass = Grand total mass)

5. Students can continue to complete this activity as many times as they would like by simply choosing the different experiment or experiments that the satellite could accomplish.