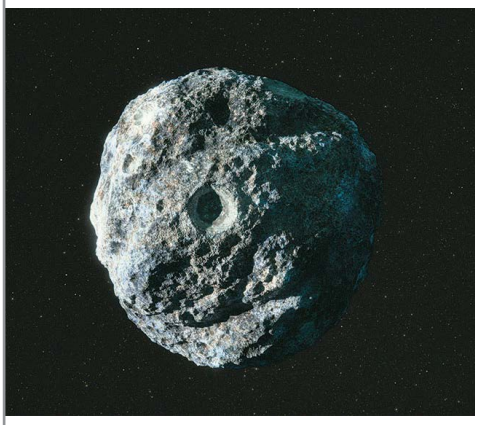
ASTEROIDS IN ORBIT



Boost your STEAM curriculum for grades 3-5 by using the new IMAX experience, ***Asteroid Hunters***, as a launch pad for teaching about force, energy, and the Solar System. Students will learn about the origins of our planets and current asteroid-defense research by NASA and international partners. Set the stage for your learning adventure with the hands-on activity on pages 5-6. Photocopy these pages to provide every student with a pair of activity sheets. (Follow your school's safety rules for all experiments.) For standards correlation, see page 19.

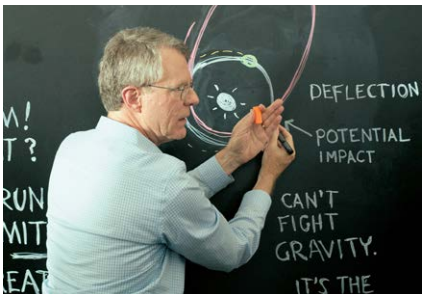
Answers:

Part 1: Students should note that when they try to walk forwards and backwards (perpendicular to the rope), they are pulled towards the post. The rope represents the Sun's gravity pulling the planets towards it, and the person's perpendicular walk is the planet's inertia. *Bonus:* Answers may vary. Scientists believe that gravity from Jupiter prevented the asteroids in the belt from forming into a planet.

Part 2: Students should note that kinetic energy is in moving objects. When a moving object collides with another object, it changes the speed and direction of the second object.

ASTEROIDS IN ORBIT

In an exciting new IMAX experience, ***Asteroid Hunters***, space will feel closer than ever imagined. Travel around the Solar System to discover how our planet formed and get close to the dangers in orbit around us. Watch as fictional asteroid Ficta A3D speeds towards Earth, and meet the teams of scientists and engineers trying to stop it.



PART 1 UNDERSTANDING GRAVITY

Did you know that there are hundreds of thousands of rocky, airless worlds called *asteroids* orbiting the Sun along with our Earth? Some asteroids are as small as pebbles, while others are as big as mountains. Most asteroids orbit in the space between Mars and Jupiter, but they can be found throughout the Solar System. How do they stay in orbit? How does Earth stay in orbit? Let's head out to the schoolyard and try an experiment to find out. (Follow your school's safety rules for all experiments.)

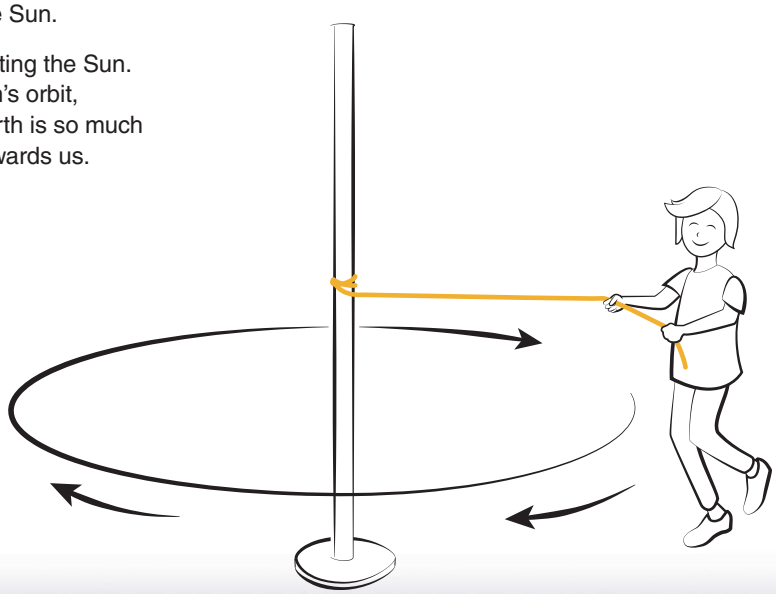
1. You will need a long rope, like a jump rope or sturdy twine.
2. Tie the rope around a sturdy pole. The pole will act as the Sun. If no pole is available, have one classmate stand in the center of an open area and hold one end of the rope.
3. Take turns with your classmates holding the other end of the rope. Walk as fast as you can perpendicular to the rope, pulling away from the pole as you go to create an orbit.

Observations: Use the back of this sheet to take notes. Think about what happens when you try to walk towards the pole, away from it, and perpendicular to the rope. Which part of this experiment represents the force of the Sun's gravity on the planets?

What's happening here? In our Solar System, the Sun pulls everything towards it with a force called *gravity*. Meanwhile, the planets move around the Sun, and as Newton taught us, objects don't easily change direction once they are moving. This is called *inertia*. It is the balance of the planets' inertia and the Sun's gravitational pull that holds the planets in a continuous orbit around the Sun.

Now imagine hundreds of thousands of asteroids orbiting the Sun. Their orbits are not the same size and shape as Earth's orbit, which can cause our paths to cross. And because Earth is so much bigger than any asteroid, our gravity can pull them towards us.

Bonus! In the film, we see how gravity helped form the planets in our Solar System. How did gravity also stop some asteroids from forming into planets?



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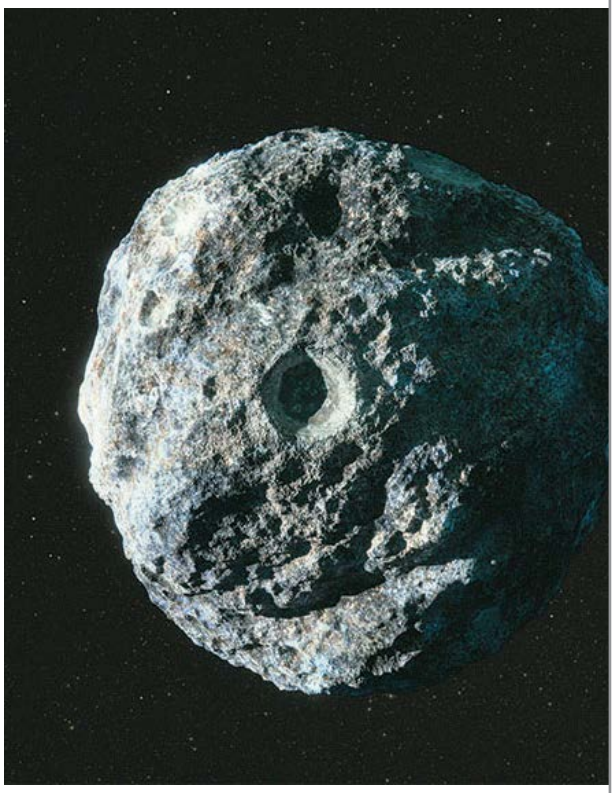

PART 2 CHANGING PATHS

In ***Asteroid Hunters***, we meet scientists who track and study asteroids, and learn about ways they plan to prevent a collision with Earth. Most plans are to change the asteroid's path, either by explosives, a push, or even light from the Sun. Now it's your turn to come up with solutions. Put on your engineering hat and safety goggles, and head back out to the schoolyard.

1. You will need several balls of various sizes. Roll your largest ball (Earth) on a smooth, flat area as your classmates try to hit it by rolling smaller balls (asteroids) towards it.
2. Now try to deflect the asteroids by rolling balls of various sizes towards them.
3. Try balls of different materials (spongy, hard, etc.) and write your notes about how well each one works.

Observations: Was it easy to *deflect* or move the asteroid off its path? What types of balls and rolling methods worked best? Did any of the balls cause a bigger collision, or hit Earth by accident?

Problem Solve: Now imagine that you have to create something to protect the Earth ball from an asteroid ball hitting it. What could you build that would deflect the asteroid ball, without damaging the Earth ball?