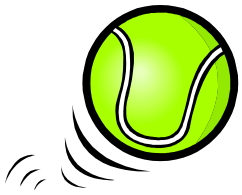
HIDE AND SEEK ENERGY



BENCHMARKS and TASKS

SC.B.1.2.4 The student knows the many ways in which energy can be transformed from one type to another.

SC.C.1.2.1 The student understands that the motion of an object can be described and measured.

- The student identifies force as any push or pull (e.g., gravity, electricity and magnetism) that causes objects to change their state of motion. The greater the force is, the greater the change in motion.
- The student traces the flow of energy as it is converted from one form to another (e.g., potential to kinetic) through a system.

KEY QUESTION

Does a ball dropped from knee-height have the same amount of energy as a ball dropped from above the head?

BACKGROUND INFORMATION

Mechanical energy is the energy an object has because of its motion or position. There are two kinds of mechanical energy - kinetic and potential. **Potential energy** is energy an object has because of its position or shape. As you hold each ball, it has stored, or gravitational potential energy. The higher the ball is held, the greater the amount of potential energy. When you drop each ball, the potential **energy is transformed** to **kinetic energy**, the energy an object has because it is moving. The greater the speed and the **mass** of an object, the greater its kinetic energy is.

MATERIALS

Per group

1 large pan half-filled with wet sand
4 tennis balls – same size, same mass
1 metric measuring tape
1 balance and mass set

Per student

science journal

TEACHING TIP

Take the students outside for this activity.

ENGAGE

Predict whether a ball dropped from a lower height will make a dent smaller than, equal to, or bigger than the dent made by a ball dropped from a greater height. Chart predictions on the board.

EXPLORE

1. Have students find the mass of the tennis balls. (They should be *approximately* the same.)
2. Model how students should carry-out the activity.
3. Ask one student in each group to stand by the pan of sand and hold one of the tennis balls at knee-height over the sand. Tell the students to let the ball drop.
4. Students in the group should closely observe the dent the ball made in the sand.

5. Next, have the same student stand by the pan of sand and hold the second tennis ball at knee-height over the sand.
6. All students in the group should observe the dents the two balls made in the sand.
7. Students should use a metric measuring tape to measure and compare the depth and circumference of the two dents in centimeters. Record this data in the science journal.
8. Next, have students repeat these steps but this time, the balls should be dropped from a height above the head. (Note: Students should use fresh balls, since the first two balls will likely be covered in sand.)
9. Again, all students in the group should observe the dents the balls made in the sand.
10. Students should use a metric measuring tape to measure and compare the depth and circumference of the two dents in centimeters. -Record this data in the science journal.
11. Students should compare the two sets of data and determine the answer to the Key Question: *Does a ball dropped from knee-height have the same amount of energy as a ball dropped from above the head?*
12. Have students smooth out the sand and try the investigation again by dropping the balls from two different heights.

EXPLAIN

Which ball had more energy as it hit the sand? (The ball dropped from above the head.)
How can you tell that it had more energy? (The dent in the sand was bigger.)
Why do you think the ball dropped from overhead had more energy? (It had more gravitational potential energy since it was held up at a higher position.)
When did potential energy transform to kinetic energy? (When the ball was poised overhead, it had gravitational potential energy, or stored energy. When the ball was released and started to fall, potential energy was converted to kinetic energy, energy of motion.)
Force is any push or pull that causes objects to change their state of motion. What force acted on the balls? (gravity)

EXTEND/APPLY

1. Have students brainstorm a list of follow-up questions to investigate: Would the results be the same if you dropped a different kind of ball? What would happen if you dropped balls with different masses from the same height?
2. Have each group choose one of the questions and carry out another investigation.

BOUNCING BALLS!

BENCHMARKS and TASKS

SC.B.1.2.4 The student knows the many ways in which energy can be transformed from one type to another.
SC.C.1.2.1 The student understands that the motion of an object can be described and measured.
SC.C.2.2.2 The student knows that an object may move in a straight line at a constant speed, speed up, slow down, or change direction dependent on net force acting on the object.
SC.C.2.2.4 The student knows that the motion of an object is determined by the overall effect of all of the forces acting on the object.

- The student identifies force as any push or pull (e.g., gravity, electricity, and magnetism) that causes objects to change their state of motion. The greater the force is, the greater the change in motion.
- The student describes the motion of an object by its position, direction, and speed.
- The student uses scientific tools (e.g., stopwatch, meter stick) to measure the speed and distance traveled by an object and displays the data in a graphic representation.
- The student traces the flow of energy as it is converted from one form to another (e.g., potential to kinetic) through a system.
- The student demonstrates how inertia (an object's tendency to resist a change in motion), gravity, friction, and mass affect motion.

KEY QUESTION

What will happen if the same ball is dropped from the same height onto the same surface over and over again?

BACKGROUND INFORMATION

Sir Isaac Newton discovered basic laws about how things move. His first law of motion states that objects at rest remain at rest and objects in motion remain in motion unless acted upon by an external **force** - a push or pull - that sets them in motion. **Gravity** is a force that's always pulling things down toward the center of the planet. A tablecloth can be pulled out from underneath a set of dishes, if it is pulled quickly. This is because the dishes have **inertia**, a tendency to remain at rest. A bowling ball, once in motion, will continue in a straight line forever, unless it hits the pins, or **friction** eventually supplies the force to slow it down.

In this activity, a force, gravity, acts upon the ball to pull it down when it is dropped. The force of the surface acts upon the ball to push it back up. The ball changes direction (acceleration). However, the ball does not bounce back to its original height because some **energy** is absorbed by the surface on which it was dropped. Some of the energy is changed into **heat** energy in the collision.

As you hold each ball, it has stored, or **gravitational potential energy**. The higher the ball is held, the greater the amount of potential energy. When you drop the ball, the potential **energy is transformed** to **kinetic energy,** energy of motion.