

## **Adapted from Delaware TOE Curriculum ACTIVITY #5: BOUNCING GOLFBALLS!**

**MAIN IDEAS:** The important concepts and skills covered in this activity are ...

- The energy of a falling ball is transformed from gravitational potential energy to kinetic energy.
- When the ball strikes a surface, part of its kinetic energy is transferred to the surface, and as the ball bounces back up, its remaining kinetic energy transforms back into potential energy. Different materials transfer energy at different rates.
- The kinetic energy transferred to the surface takes the form of organized vibrations of the particles that make up the surface. Through these vibrations, the energy is spread to particles throughout the surface.
- At first, the vibrations of the particles are organized, and produce a wave-like pulse through the solid. Then the particle vibrations become unsynchronized and random. The collective random kinetic energy of the particles is called the heat energy of the substance.
- How much energy is transferred during each bounce is determined by the distance the ball drops, the physical properties of the ball and the surface that the ball strikes, and how well the surface is anchored to the floor.

**Question #1:** We will be repeating this experiment for a number of surfaces. What variables do you plan to keep constant, and what variables do you intend to change.

**Question #2:** Why it is important to keep the fixed variables constant? How do you plan to ensure that these fixed variables remain constant throughout the experiment?

**Question #3:** Looking at the data, it is clear that for some surfaces the ball took more bounces before coming to rest than on other surfaces. Which surfaces accepted the most energy per bounce? How do you know this is true?

- Question #4:** Where do you think the energy transferred to the surface goes? What form does it take?
- Question #5:** Did you feel anything in your hand as the ball was striking the surface? If so, describe what you felt and hypothesize what happened to the kinetic energy that was transferred to the surface when it was struck by the ball.
- Question #6:** Could you feel any difference from one surface to the next? Is there a relationship between what you felt and how many bounces were needed for the ball to come to rest?
- Question #7:** What characteristics of the surface help determine how much kinetic energy it can absorb? Keep in mind that the energy must go somewhere. Why do some surfaces accept more energy than others during each bounce?

## CONNECTIONS

### Scientific Content -

#### **Energy can exist in different forms.**

- There is a form of stored energy (potential energy) that an object can have because of gravity. This stored energy gets larger the higher the object goes, and decreases as the object falls.
- There is an energy called kinetic energy that an object has when it moves.
- The particles that make up objects and substances also have kinetic energy. Most of this kinetic energy is random in its nature, but sometimes the particles have an organized kinetic energy that takes the form of a mechanical wave.

#### **Energy can be transformed from one form to another. This process is called the transformation of energy.**

- Gravitational potential energy is transformed into kinetic energy when an object falls.

- Kinetic energy is transformed into gravitational potential energy when an object rises.
- Kinetic energy of objects can be transformed into the random kinetic energy of particles, called thermal (heat) energy.

**The transfer of energy refers to the passing of energy from one object to a different object or substance.**

- Kinetic energy transferred to another object usually changes the kinetic energy of both objects involved in the collision.
- Kinetic energy transferred to a large stationary solid takes the form of vibrations within the solid. The particles that make up the solid are not free to travel through space, so they vibrate back and forth through very tiny distances. The kinetic energy of these particles is called vibrational kinetic energy.
- Kinetic energy transferred to a gas increases the kinetic energy of the particles that make up the gas.
- The transfer of energy from one object to another may, or may not involve energy transformation.

By understanding energy transformation and energy transfer, we can begin to understand that the energy of an object can change forms and be passed to other objects. We can begin to see that when energy seems to go away, it really is just changing into forms that are more difficult to detect, and may be spreading out, making it even harder to detect. The ideas that energy can change forms, or be passed around but never destroyed are the foundation concepts for the Law of the Conservation of Energy.