

ENERGY AND NASCAR

LESSON PLAN 1: POTENTIAL ENERGY

HIDDEN ENERGY

TIME REQUIRED: 1 hour

MATERIALS: Small marble, large marble, Ping-Pong ball, golf ball, large pan, flour, yardstick

ACTIVITY AND RESOURCE SHEETS: Potential Energy Activity Sheets A and B

BEFORE YOU BEGIN: Have students complete the pre-assessment. Save the pre-assessments until the end of the unit to measure the growth in student knowledge.

PRE-ASSESSMENT ANSWER KEY:

1. C; 2. B; 3. D; 4. B; 5. A; 6. A; 7. C; 8. D; 9. D; 10. D



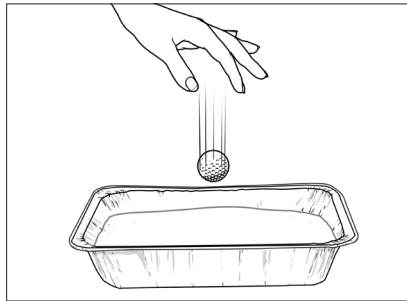
Central question:
What is potential energy?

1. Introduce the concept of potential energy—energy that is stored due to an object's position or condition. Explain that the word "potential" means having the ability to do something. Therefore, potential energy is energy that has not yet been used.
2. To illustrate the concept of potential energy, ask students to imagine a racecar sitting on the top of a steep banking. (See the Build section of Lesson 2: Kinetic Energy for a description of racetrack bankings.) Tell students that in this position the car is loaded with a specific type of potential energy, called **gravitational potential energy**. Explain that when an object, like a racecar, is far above the ground, a force called **gravity** pulls it downward toward Earth's surface.



Central question:
What affects the amount of potential energy an object has?

1. Explain that the potential energy of an object is measured by its ability to exert a specific amount of force for a particular distance. There are three factors that determine how much **gravitational potential energy** an object has: gravity, height, and mass. Gravity is constant, but differences in an object's mass and height can increase or decrease the amount of potential energy the object has.
2. To demonstrate, set a small marble on the floor of your classroom. Ask students if the marble has



potential energy in its current state. (No, because there's no distance for gravity to pull it toward Earth.) Raise the marble about one foot in the air. Ask whether the ball now has any potential energy. (Yes.)

3. Drop the marble into a large pan filled with a few inches of flour. Gently remove it from the pan, and have a volunteer measure the width of the impact crater left in the flour. Climb on a chair and drop the marble from a height of about seven feet. Measure the new impact crater. Repeat the experiment with the large marble, the Ping-Pong ball, and the golf ball. Have students take notes throughout the experiment. After the demonstration is complete, ask them to draw conclusions about how mass and height impact the amount of potential energy an object has.



Central question:
What types of potential energy exist?

1. Hand out *Potential Energy Activity Sheet A*. Tell students that gravitational potential energy is just one type of potential energy. Have them complete the activity to learn about three other forms.
2. Now that students understand potential energy's different forms, have them imagine a racecar sitting in position on the starting grid before the start of a NASCAR race. Ask: *What forms of potential energy might the car have before it starts moving?*

3. Explain that cars use **electric potential energy** to operate. When a driver starts the car, the battery releases a jolt of electricity to power parts inside the car. The fuel in the car's gas tank holds **chemical potential energy**. When the fuel burns, it undergoes a chemical reaction that unleashes energy to power the car's engine and propel the vehicle around the track. Batteries are unique because they hold energy in chemical form, but they release electric energy! (Fun fact: NASCAR racecars use Sunoco Green E15 as fuel. Just like a car, the human body relies on chemical potential energy stored in another type of fuel—food. By breaking down food, our bodies get the energy they need to survive.)

4. Describe how a racecar also has a suspension system between its wheels and its base. This system contains flexible springs that store **elastic potential energy**. This type of energy—also called mechanical energy—is energy stored in an object due to its tension. When the car hits a bump in the road, the springs absorb the impact by compressing. Then they stretch to release the stored energy, pushing the tire back against the road. This helps prevent the car's wheels from losing their grip on the track.



Central question:
How do we identify the different types of potential energy around us?

Divide students into groups, and hand out *Potential Energy Activity Sheet B*. Tell students to study the scenes on the sheet and search for examples of potential energy. See which group can identify the most objects with stored energy. Answers: **Chemical:** snacks in box in stands, gas, battery, racecar, blimp; **Gravitational:** tire raised, food raised overhead, man holding flag, man climbing ladder; **Electric:** lamppost, lights in the viewing boxes, television camera; **Elastic:** muscles, tires, air compressor.