ENERGY IN ACTION

GRADE LEVEL: ELEMENTARY SCHOOL

Student Objectives

- Understand the difference between potential and kinetic energy
- Illustrate when potential and kinetic energy occur in a race car
- Name three different types of energy
- Demonstrate how two different forms of energy work

Materials List

- SPARK! Education Video: Energy in Action
- Pencil
- Paper
- Music source (phone, app, record player, etc.)
- Chairs
- Flashlights or lamps (two or more)
- Marbles, buttons or children bouncy balls

Lesson Plan and Procedures for Adults

Note: Energy is a thread of learning for students.

1. What is energy? Discuss the following terms with the student(s) either by exploring suggested web links or using vocabulary descriptions.
    - Energy definition: the ability to do work
    - Work definition: when a force acts on an object to move the object from one point to another
2. Illustrate the definitions with a simple experiment.
    - Using a bowl or any object, place the object on a table and ask the student if the object is moving. Once they answer, ask the student how can we have the object move?
    - Explain the object cannot move without a force. The work required to move the object from one place to another requires energy.
3. Energy is needed for everything that moves. Conduct an energy inventory by having the student(s) select a room in the home to identify what requires energy to move. Inventory can be completed by taking photos, writing down a list or even drawing the items. Discuss each item illustrated and verify it needs energy. Remember, even a toothbrush requires energy to move.
4. Explain there are two primary forms of energy – potential and kinetic.
    - Potential energy is stored energy that has potential to do work. An example includes an apple – it has stored energy that is released when it's eaten and distributed throughout the body to allow work to occur.
    - Kinetic energy is energy that is in motion or moving. Example include going down a slide as you are in motion or walking.
5. Time to experiment: let's get active and play!

    Game: Freeze Tag
    - Gather between two and six individuals to play the game.
    - One person will be the caller (adult or other sibling) and the rest will be players. The caller will call out a command, either freeze/stop or go.
    - When you hear freeze, stop where you are in motion and don't move. When you hear go, start to move around again.
    - If a person moves when they are frozen, they're out of the game (if you wish).
    - Play the game three times, changing callers every 3 to 5 minutes.

6. Review the game, thinking of potential and kinetic energy. When was a person in potential energy (stopped/frozen)? When was a person in kinetic energy (going/running around)?
7. Ask the student(s) to define potential and kinetic energy. You can also have them demonstrate the two. For adults, the mannequin challenge fad is a great example of potential and kinetic energy in action.
8. Review the NASCAR Hall of Fame SPARK! Education energy video. Watch the video twice, then discuss with the child when a race car is in potential and kinetic energy. Talk about why energy is important for racing. For grades 3rd through 5th, continue to step 10.
9. Play additional games from the list below to reinforce the concept of energy, work, potential and kinetic energy.
10. **For grades 3rd through 5th**, students can now explore different types of energy beyond potential and kinetic. Discuss four different types of energy that can be found in racing – chemical, sound, heat and mechanical.
    - Chemical energy is energy that's stored in molecules and atoms; chemical energy is converted to other forms of energy, such as mechanical. Examples include how food is chemical energy, and fuel and air are chemical energy transformed to mechanical for a race car.
    - Sound energy is energy that is created via vibrations with air molecules. The energy is transformed into waves that reach our ears as sound. Examples include TV, video games and music, and in racing – race car engines, fans yelling and teams talking.
    - Heat or thermal energy is energy created from molecules moving and rubbing against each other. Friction generates heat or thermal/radiant energy from sun. Examples include oven, heaters and sun, and in racing – tires against the track and pistons inside an engine.
    - Mechanical energy is energy in motion. Examples include getting out of bed, brushing your teeth and sliding down a slide, and in racing – car moving, rotating the axel and spinning the drive train.
11. Read the following information and review race footage to identify the different types of energy. Remember, gravitational energy is a potential energy demonstrated in racing.

    The four most famous words in racing – "Drivers, start your engines," the command that gets every heart pumped up in us, is the same in a race car. It's the call for energy to be put into action. Energy is the ability to do work. There are two different types of energy – potential (or energy that is stored, waiting to do work) and kinetic energy (or energy that is in motion or doing work.)

    A race car, before the command to start the engine, is in potential energy. Race cars are moved to position for the race by pit crews pushing and pulling the car. The kinetic energy to move the car is coming from the crews – not the car itself. But once the command is given, the kinetic energy gets moving.

Let's explore a few types of potential and kinetic energy working within the race car – and how you know it's working.

In a race car, potential energy is available in chemical energy stored in bonds of atoms. For the race car this is in the fuel. When a race car is started, chemical energy stored in the fuel is combined with energy from air, ignited by a spark inside to create combustion. The transfer of energy from the stored molecules in the air and in the fuel is what gets the kinetic energy to flow.

But once the kinetic energy is flowing it moves rapidly, changing forms based on the work to get the wheels of the car turning. Race car drivers and teams monitor the engine for how effective it is transferring energy from potential and kinetic through RPM, or how fast the engine is moving.

Kinetic energy inside the engine is transformed from chemical energy (fuel, air and spark plugs) to mechanical energy. All the moving parts – like the piston, battery, alternator to run the dashboard, communication (radio) and other devices – then convert to thermal (the heat caused by friction in the engine and by product of the transformed energy) which we can feel radiating off the car. Drivers feel the thermal energy inside the car, with temperatures inside the race car getting over 100 degrees with no air conditioning. But the energy continues to change to sound energy – the sound from the engine – which communicates to the drivers and team how the car is performing.

There is one rule that governs energy: Energy cannot be created or destroyed. It can only be transformed. So the final transformation of the energy is moving from the engine through the drivetrain (to shift the car to drive forward), to the axels, to the tires (which push the car forward) and finally to the track. Energy is being transformed along the way to provide motion to the car – or the ability to work. Without energy, race cars cannot move upwards of 200 mph.

12. Using the inventory created in step 3, classify (name) the energy types from the inventory in step 3. There are nine different types of energy (kinetic) and four different forms of potential energy. Students can explore different forms beyond the four listed in this lesson.
13. Try a few more games to explore energy from list provided.
14. Discuss with the student(s) what the definitions of energy, work, potential and kinetic are. Ask them to name two or four different forms of energy.

More Games to Try:

- Musical Chairs: This game requires five or six players. Gather the participants with one less chair than people. Begin playing music and then stop. Individuals then should move to sit in chair. The person who doesn't make it to a chair in time is out of the round. Remove another chair, play music, stop music and repeat until there are two individuals and only one chair. Play one more time to see who the winner is.
  - What type of energy was involved in this game? Potential, kinetic, gravitational, mechanical and/or sound?
- Marbles: This game requires between two and five players. Place the marbles in a center circle, and then use another marble to "shoot" the marbles out of the center. The person with the most marbles at the end wins. You can also do variations such as pixie sticks, where you can drop sticks and try to pull them out without dislodging the whole pile.
  - What type of energy was involved in this game? Potential, kinetic, gravitational, mechanical, thermal and/or sound?
- Flashlight Tag: This game requires between two and six players. Select one person as 'it,' and everyone else's goal is to not get 'hit' by the beam of light. The individuals that are not it can run, walk or skip within a designated area. The 'it' must count to 10 or 20 with their eyes closed before they can try and tag one of the others with the beam of light. If the other individuals get tagged with light, they can either be out or frozen until someone else can 'untag' them.
  - What type of energy was involved in this game? Potential, kinetic, light, mechanical and/or sound?
- Bounce the Ball and Spin: This game requires between two and four players. Using any size rubber ball, players take turns bouncing the ball and completing a spin based on the number of bounces. See how many times you can perform the activity without drooping or missing the ball. One bounce is one spin, two bounces are two spins, etc.
  - What type of energy was involved in this game? Elastic, mechanical, sound and/or thermal?