

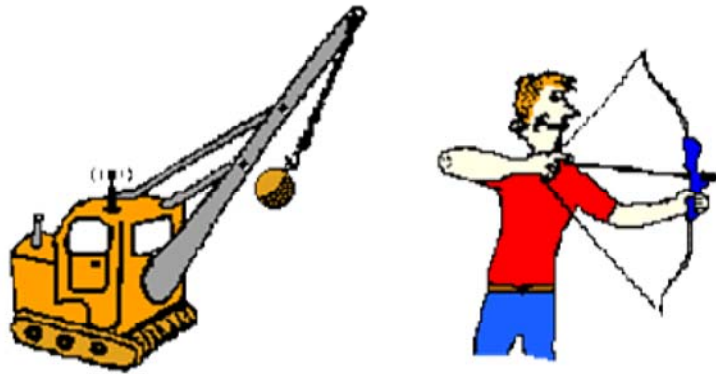
POTENTIAL, KINETIC, MECHANICAL, AND THERMAL ENERGY

Unit Overview

When you hear the word “energy,” what comes to mind? Do you think of how much energy you currently have? Do you think of electricity, or charging your devices? The term is used in many different ways. What is energy, exactly? **Energy** is a measurement of the ability of something to do work. It is not a substance, but it can be stored, transferred, and transformed. There are different types of energy, and most energy on Earth is derived from the sun’s nuclear reactions (radiant energy). In this unit you will investigate potential, kinetic, mechanical, and thermal energy.

Potential Energy

Potential energy is often thought of as energy of position or rest energy. Potential energy exists because an object has potential to move. It is often called gravitational potential energy because of its height above the surface of the Earth. The higher an object, the more energy it can gain as it falls towards the Earth. A book sitting on a table possesses potential energy since it has the potential to fall off of the table. Why might the book fall? There is a force pulling on the book known as gravity. The formula for potential energy is $P.E. = mgh$ (m = mass, g = gravity and h = height). Since gravity on earth is a constant, there are two things that can increase potential energy: mass and height. The height is measured from a reference point that is considered to be at a point of zero energy. This point can change with the situation. It can be the ground under your feet, the floor of the class room, even the top of your desk. A student on the 3rd floor of a building has more potential energy compared to another student on the 2nd floor. A 200-gram weight sitting on a table has more potential energy than a 100-gram weight on the same table.



The massive ball of a demolition machine and the stretched bow possesses stored energy of position - potential energy.

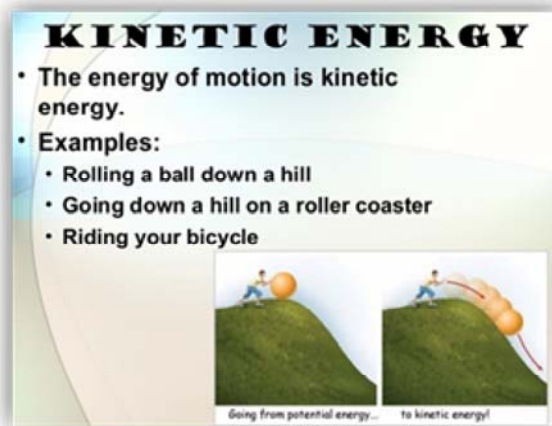
To learn more about potential energy, click on this link:

<http://www.physicsclassroom.com/class/energy/Lesson-1/Potential-Energy>

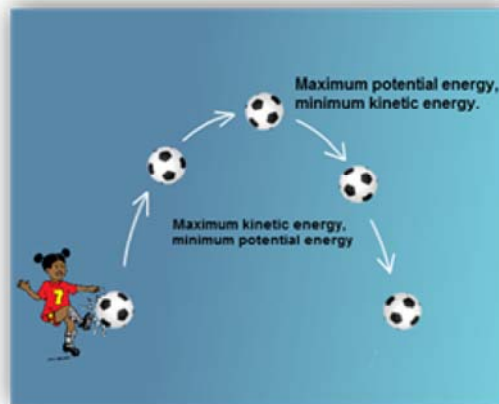
Kinetic Energy

Kinetic energy is the energy of motion, or the energy of a moving object. The amount of kinetic energy an object has depends on its mass and velocity. As the kinetic energy of an object increases due to increased mass or velocity, its potential energy decreases. This is because the energy is no longer being stored as potential energy but is rather used as kinetic energy. A substance with a higher kinetic energy level will also have a higher temperature. Likewise, as heat is added to a substance, the particles gain energy and move faster, increasing kinetic energy.

The formula for kinetic energy is $K.E. = \frac{1}{2} mv^2$ (m = mass and v = velocity). By looking at the equation, you can see there are two ways to increase kinetic energy, by changing the mass or changing the velocity. For example, a cup of water has a certain KE. To increase the KE you would need to add more water (mass) or increase the speed of the molecules by adding heat. Applying the formula in an everyday example, a small car traveling very fast will have the same kinetic energy as a large truck traveling slowly. The car has a high velocity and a small mass, while the truck has low velocity and a large mass, causing both moving objects to have the same kinetic energy.



The image above shows examples of kinetic energy.



The image above shows a simple example of the relationship between potential energy and kinetic energy.

For more information on kinetic energy, visit the following website:

<http://www.physicsclassroom.com/class/energy/Lesson-1/Kinetic-Energy>

Mechanical Energy

The sum of potential energy and kinetic energy that an object possesses is called *mechanical energy*. In other words, mechanical energy is an object's energy due to its motion and its position. The term "mechanical energy" is sometimes used interchangeably with the term "energy," describing an object's ability to do work.

For more information on mechanical energy, read the following:

<http://www.physicsclassroom.com/class/energy/Lesson-1/Mechanical-Energy>

Thermal Energy

Thermal energy is the heat generated by movement of particles that make up matter. There are many applications of thermal energy beyond the way it will be discussed in this unit. The mechanics problems using potential and kinetic energy typically calculate to less than 100% efficiency, and this is because of the production of thermal energy in the process. Thermal energy can result due to the forces of friction and drag.

Read on to learn more about thermal energy in the context of mechanics:

<https://www.khanacademy.org/science/physics/work-and-energy/work-and-energy-tutorial/a/what-is-thermal-energy>

PhET Simulation: Energy Skate Park Basics

Complete the PhET Simulation below and answer question 9 through 12.



Intro



Friction



Playground

Directions: Click on “Intro.” When the intro opens, the U shape ramp will be selected; keep it on this one. Click the check boxes to turn on the bar graph, grid, and speed. Notice the toggle bar to change the mass of the skateboarder. Slide it down to the “small” end. Click and drag the skateboarder to place him at the beginning of the ramp, right next to the “6 meters” mark on the grid. The skater will automatically start moving.

[PhET Simulation Student Guide](#)

Quizlet Vocabulary

The image shows the Quizlet logo, which consists of the word "Quizlet" in white, sans-serif font, centered within a blue rounded rectangular button.