

## Unit 6: Energy

### Content Outline: Types of Energy (6.1)

- I. **Energy** can be defined as the *ability to do work* or the *ability to cause change*.
  - A. If an object or organism does work, the object or organism *uses energy*.
  - B. In addition to using energy to do work, objects *gain* energy because work is being done on them.
  - C. The *combination of energy and matter* make up the universe.
    - a. Matter is *substance*, energy is the *mover of the substance*.
- II. **Work** – when a force *acts on an object* to cause *displacement* of the object, it is said that work was done on the object.
  - A. Work is caused by three key things: *force, displacement, and cause*.
    - a. In order for a force to qualify as having done work there must be a displacement and the force *must* have caused the displacement.
- III. Energy can be described as either Kinetic or Potential.
  - A. **Kinetic Energy (KE)** is the energy of *motion*.
    1. Kinetic energy is determined by an object or organism's *mass* and *speed*.
    2. The *faster* an object moves, the *more kinetic energy* it has.
    3. The *greater* the mass of the moving object, the *more kinetic energy* it has.
    4. Speed has a *greater effect* on the amount of kinetic energy than mass.
  - B. **Potential Energy** is energy that is *stored in an object* as a result of its *position, shape or chemical composition*.
    1. **Gravitational Potential energy** – is the energy due to an object's position *above* the earth's surface.
      - a. There is a *direct relation* between gravitational potential energy and the mass of an object. The *more mass* an object has the *greater* the gravitational potential energy.
      - b. There is also a *direct relation* between gravitational potential energy and the height of an object. The *higher* that an object is elevated, the *greater* the gravitational potential energy.
    2. **Elastic Potential Energy** – is the energy *stored in elastic materials*, such as rubber bands and springs, as the result of their *stretching* or *compressing*.
      - a. The amount of elastic potential energy stored is related to the amount of stretch of the object; the more stretch the more energy.
    3. Springs are a special instance of a device that can store elastic potential energy by compressing or stretching.
      - a. For some springs, the amount of force is *directly proportional* to the amount of stretch or compression, the constant of proportionality is known as the **spring constant (k)**. These springs are said to follow Hooke's Law.
      - b. If a spring is *not stretched* or *compressed* it is in **equilibrium**. Such cases represent 0 potential energy.
      - c. The equation used to calculate such energy is  $PE_{\text{spring}} = 0.5 \bullet k \bullet x^2$  where x=compression, k =spring constant
    4. **Chemical Potential Energy** – is the energy *stored in a substance*, such as sugars or fats, due to its chemical composition.