SC 4.2 Force, Motion, and Energy

Motion is described by an object's *direction* and *speed*.

- **Direction** can be described with terms such as forward, backward, up or down.
- **Speed** is a measure of motion.
- **Motion** is caused by a **force**.
- **Force** can be a push or a pull.

What is motion?
What causes motion?
What are the two kinds of forces? Name some examples of each.

***Energy* is present in many sources, but it may not always be doing *work*.**

- **Energy** is the ability to do work
- **Work** is the result of a force moving an object over a distance.

Explain what energy and work are.

Changes in *motion* are related to *force* and *mass*.

- The larger the mass, the larger the forced needed to move it.
  - This is part of **Newton's Second Law of Motion** "Mass=Force x Acceleration."
- **Inertia** is the property of matter that causes it to resist any change of motion (in either direction or speed.)
  - Unless acted upon by a force, "objects in motion tend to stay in motion and objects at rest tend to stay at rest."
  - This is **Newton's First Law of Motion!**
- **Mass** is the measure of the amount of matter in an object. It is different from weight (a measure of the pull of gravity.) However, if both objects are on earth, mass and weight will measure the same.

How is mass related to motion?
What is inertia?
What is Newton's 1st Law of Motion? How does this law relate to Virginia's seat belt laws?

***Friction* is a force that opposes motion.**

- **Friction** is created when two objects move against one another. Friction resists motion and creates heat.
- **Newton's Third Law of Motion** states that for every action, there is an equal and opposite *re*action.

Explain what friction is. Give some examples when friction operates.
What is created as a result of friction?

Moving objects have *kinetic energy.*

- **Kinetic Energy** is energy in motion. Ex. Energy which runs a car's motor, energy a person uses to jump.
    - **Types of Kinetic Energy:** light energy (radiant energy,) thermal energy (heat energy,) motion energy, sound energy, and electrical energy.
        - **Potential Energy** is stored energy or energy not in motion.

    Potential Energy has the *ability* to cause motion or turn into kinetic energy.
    - **Types of Potential Energy:** chemical energy (ex. Energy in coal, oil, wood, or natural gas,) mechanical energy (compressed spring or stretched rubber band,) nuclear energy, and gravitational energy (stored by height, ex. A bike at the top of a hill, a diver at the top of a diving board, an object teetering on the top of a desk.)

Explain what kinetic energy is.
What is energy NOT in motion?
Identify whether each of the following is an example of kinetic or potential energy.

1) A pile of firewood not yet burned
2) Sunshine
3) Car crash
4) Wind
5) Stretched rubber band
6) Bike at the top of a hill
7) Boiling water
8) Sound from stereo speakers
9) battery
10) X-ray
11) Swinging ax
12) Ax held up high
13) Coal burning in a fire

Answers:
Kinetic: *2, 3, 4, 7, 8, 10, 11, 13*
Potential: *1, 5, 6, 9, 12*