Energy

What is Energy?

- **<u>Energy</u>**
  - Energy is the ability to do work.
    - Work occurs when a force causes an object to move in the direction of the force.
    - Work is a transfer of energy.
  - Work and energy are so closely related, they are expressed in the same unit- joules (J).

Kinetic Energy

- Kinetic energy is the energy of motion.
  - All moving objects have kinetic energy.
- Objects with kinetic energy can do work.
  - Ex: When you roll a bowling ball, you have done work using kinetic energy. Your kinetic energy transfers to the ball and the ball energy transfers to the pins.
  - Ex: When you swing a hammer, you give it kinetic energy, which it uses to do work on the nail.

- Kinetic energy depends on **speed** and **mass**.
  - Formula: **(K)= mass X velocity² /2**
- Two ways to increase kinetic energy:
  1. The faster something is moving, the more kinetic energy it has. (Speed has a greater influence on kinetic energy because it is squared.)
  2. The more massive a moving object is, the more kinetic energy it has.

Solve!

1. What is the kinetic energy of a 4,000kg elephant running at 3m/s? at 4m/s?

Potential Energy

- Potential energy is the energy an object has because of its position or shape.
  - Ex: The stretched bow is not moving, but it has potential energy because work has been done to change its shape. (stretched rubber band too)
- Gravitational Potential Energy
  - Depends on **weight** and **height**
  - Two ways to increase potential energy:
    1. The larger the weight (force) of an object, the more potential energy it has.
    2. The further the object from the Earth's surface (height), the more potential energy it has.

- Calculating Gravitational Potential Energy
  - Formula: **Potential energy= weight X height**
- Calculating an object's potential energy is the same as calculating work because weight is a force and height is a distance.
  - Ex: If you lift a 50N watermelon to the top of a 2 meter refrigerator, how much potential energy do you give the watermelon?
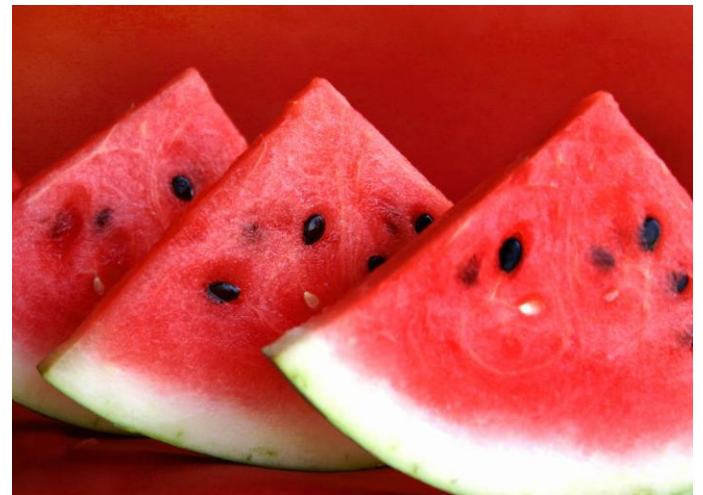
Mechanical Energy

- Sums it all up
  - Mechanical energy is the total energy of motion and position of an object.
  - Mechanical energy can be all potential energy, all kinetic energy, or some of both.
  - Formula:

    Mechanical energy= potential energy + kinetic energy
  - An object's mechanical energy always remains the same.
    1. When potential energy increases (or decreases), kinetic energy has to decrease (or increase).
    2. The amount of an object's kinetic energy or potential energy may change, but its mechanical energy stays the same.

Solve!

1. What is the gravitational potential energy of a cat that weighs 40N standing on a table that is 0.8m above the ground?

2. What is the gravitational potential energy of a diver who weighs 500N standing on a platform that is 10m off the ground?

3. What is the gravitational potential energy of a diver who weighs 600N standing on a platform that is 8m off the ground?

More Equations!

1. What is the kinetic energy of a car that has a mass of 2,400kg and is moving at 20m/s?

2. What is the kinetic energy of a 2,000kg bus that is moving at 30m/s?

3. What is the kinetic energy of a 3,000kg bus that is moving at 20m/s?

Jumping Frogs Lab!

- How does a frog's movement exhibit potential and kinetic energy? You will have to make a frog and investigate.

- In your notebook, copy the following lab procedures:

1. Use the origami instructions to make a "frog" out of an index card.

2. Investigate different ways to make your frog jump. (Height, distance, time, etc.)

3. Create a data table and record your results.

4. Write down and answer the questions that follow.

1. Which tests worked the best? Why?
2. What causes your frog to move?
3. Where does the energy come from to move your frog?
4. Can the amount of energy your frog has be changed to make it jump at different heights and distances? Explain.
5. When does your frog have potential energy?
6. When does your frog have kinetic energy?
7. When does your frog have the MOST energy? Explain.
8. When does your frog have the LEAST energy? Explain.