Name, Date, Period:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Focus on….

**POTENTIAL ENERGY**

**Definition of Potential Energy:** The **energy** of an object that is derived from position, or condition, rather than motion.

1. There are FIVE (5) different types of potential energy.
   1. Gravitational Potential Energy
      * This is associated with the mass of an object and its height above a reference point (such as the floor or the ground).
      * A change in the height of an object is evidence that the gravitational potential energy has changed.
      * Gravitational potential energy increases with increasing height and increasing mass of the objects involved.

Challenge for Gravitational Potential Energy

* Create a scientific experiment to determine the relationship between the height of a metal sphere and the amount of change it can make to sand that is held in a container.
* Determine how to quantify the changes to the sand.
* Formulate a conclusion about how the height of an object is related to its potential energy.
* Represent the data graphically.
* Support the conclusion with data from the experiment.

A follow up question: Would we have a similar conclusion if we tested mass instead of height? (Yes, let’s discuss why.)

* 1. Elastic Potential Energy
     + This is associated with how much an elastic object has been stretched or compressed and how difficult such a compression or stretch is.
     + A change in the amount of compression or stretch of an elastic object is evidence that the elastic potential energy has changed.

Brainstorming Activity for Elastic Potential Energy

* Suggest some objects that can model elastic potential energy. Write these on the board until we have no more than ten objects.
* Briefly discuss how each of the listed objects models elastic potential energy.
* Let’s watch a cool YouTube video about slingshots and take 5 comments from the class about the video. (Video Link: <http://www.youtube.com/watch?v=1v4TEX2erog> by Smarter Every Day)
  1. Chemical Potential Energy
     + This is associated with the position and arrangement of the atoms within substances.
     + Rearranging atoms into new positions to form new substances (chemical reaction) is evidence that the chemical potential energy has most likely changed.
     + The energy transferred when a chemical system undergoes a reaction is often thermal energy.

Activity for Chemical Potential Energy

* Consider a cheeto. It has chemical energy within the bonds of the fat and carbohydrate molecules. Once it is processed by the body, you will use the chemical energy to power your muscles. When your muscles work, they release heat energy.
* In the lab, you can burn a cheeto and see how many calories of energy it would have supplied your body had you eaten it.
* Let’s watch on YouTube video how some eighth graders did this. (Video Link: <http://youtu.be/QdM2EyYYOT8> by stcolumbastv)
* Let`s try the experiment ourselves at our lab stations.
  1. Electrical Potential Energy
     + This is associated with the position of electrically charged objects relative to each other and the amount of charge they have.
     + It refers to the energy contained in electric fields.
     + A change in the position of charged particles relative to each other is evidence of a change in electrical potential energy.

Discussion And Video for Electrical Potential Energy

* First Topic of discussion: How is a battery an example of an object with Electrical Potential Energy?
  + How does the amount of electrical potential energy vary in fresh batteries versus used batteries? Why?
  + Does anyone know of any ways you can extend the life of a battery?
  + Let’s watch on YouTube video how a lead-acid battery is manufactured. (Video Link: <http://youtu.be/P7tOipB_-38> by howstuffworks)
* Second Topic of discussion: How is static electricity an example of Electrical Potential Energy?
  + Has anyone gotten shocked from rubbing feet on a carpet? What’s going on?
  + What about when shopping for canned goods in the grocery store (if you rub your feet while walking through the aisles)?
  + Here’s a video that shows a static electricity experiment with water: <http://youtu.be/VhWQ-r1LYXY> by JeffersonLab
  1. Magnetic Potential Energy
     + This is associated with the position of magnetic objects relative to each other.
     + It refers to the energy contained in magnetic fields.
     + A change in position of magnetic objects relative to each other is evidence of a change in magnetic potential energy.

Let’s Try Some Things for Magnetic Potential Energy

1. We will begin with two strong identical magnets far apart. We will keep nudging them closer together. At some point, they will snap together and remain together.
   * At what position is the magnetic potential energy of each magnet in relation to each other the least and why? (We will discuss and I will reveal the answer.)
   * At what position is the magnetic potential energy of each magnet the greatest in relation to each other and why? (We will discuss and reveal the answer.)
   * Was there an energy conversion of PE to KE and back to PE when the magnets moved toward one another and snapped together? (YES – let’s go over that energy conversion.)
2. Let’s reverse out and return the magnets back to their original locations. The question for you is – Can the magnets return to where they started by themselves? (No, let’s discuss why.)
   * My input of energy to get them apart – does it equal the magnetic potential energy that they have that holds them together? (Yes, let’s discuss that using “equal and opposite.”)
   * Why does it get easier and easier for me to move the magnets apart the further they get away from each other?