Name: ______________________________ Pd: 3 Week 4 Distance Learning

Mechanical Energy

Use the resources found on Mr. Hanna's website to help you respond to the following items.

VOCABULARY:

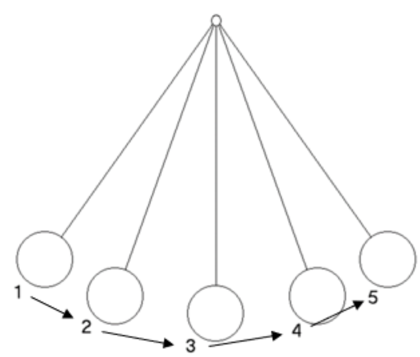
1) MECHANICAL ENERGY – *energy an object has due to its motion or position*
2) KINETIC ENERGY – *energy of motion*
3) POTENTIAL ENERGY – *stored energy*
4) ELASTIC POTENTIAL ENERGY – *energy stored by stretching or compressing an object*
5) GRAVITATIONAL POTENTIAL ENERGY – *energy stored based on an object's height*

SHORT ANSWER:

6) What metric unit do we use to measure energy (including mechanical energy)?
   Joules
7) What two variables affect an object's kinetic energy?
   mass and velocity ($KE = \frac{1}{2}mv^2$)
8) Compare elastic potential energy with gravitational potential energy (how they are similar & different).
   Both types of potential energy store energy in an object; the difference is HOW that energy is stored (either by stretching/compressing or increasing the height of the object).

9) What two variables (*aside from the acceleration due to gravity, "g"*) affect an object's gravitational potential energy?
   mass and height ($PE = mgh$)

INTERPRETING A DIAGRAM: Use the diagram of a swinging pendulum below to answer the following questions.



10) At which point(s) on the diagram would the ball have maximum (the greatest) potential energy? Why?
    1 & 5 – these are the locations where the height of the ball is at its maximum (if we ignore friction)
11) At which point(s) on the diagram would the ball have maximum (the greatest) kinetic energy? Why?
    3 – this is the location where the velocity of the ball is at its maximum value (its moving the fastest)
12) At what point(s) on the diagram would the ball have BOTH kinetic energy and potential energy?
    2 & 4 - Assuming we consider the height at position 3 to be zero, then at positions 2 and 4 the ball has both height (PE) and velocity (KE). At positions 1 and 5 there is no velocity (no KE) and at position 3 there is no height (no PE).
13) Describe how the energy in the ball changes as it moves from position 1 to 2 to 3 to 4 to 5.
    The ball begins with a maximum amount of gravitational potential energy at position 1. As it falls toward position 2, its PE is being converted into KE (it is losing height but gaining velocity). At position 3, all of the original PE has been converted into KE. As it goes up toward position 4, the KE begins converting back into PE (it slows down but it rises). At position 5, all of the energy has been converted back into PE (this assumes there is no friction, which would transfer some of the energy out of the ball as it moves through the air).

PRACTICE PROBLEMS: Use the scenario described below to answer the following questions.
A 1.5 kg book is sitting on the edge of a desk that is 0.75 m tall. A student accidentally bumps the desk, causing the book to fall to the ground. Another student picks up the book, putting it back in its original position on the desk.

14) How much gravitational potential energy did the book have as it rested on the desk?

Given:
m = 1.5 kg
h = 0.75 m
PE = ?

$$PE = mgh$$

$$PE = (1.5\ kg)(9.8\ \tfrac{m}{s^2})(0.75\ \text{m})$$

$$11.025\ \text{J}$$

15) At one instant during its fall, the book has a velocity of 3 m/s down. How much kinetic energy does the book have at this instant?

Given:
m = 1.5 kg
~~h = 0.75 m~~
v = 3 m/s
KE = ?

$$KE = \frac{1}{2}mv^2$$

$$KE = (o.5)(1.5\ kg)(3\ \tfrac{m}{s})^2$$

$$\text{KE} = 6.75\ \text{J}$$