Gravitational Potential Energy Notes

Potential Energy:

- *Potential Energy* – energy that is being stored

We will be talking about one specific types of potential energy today.

Gravitational Potential Energy– the potential energy an object has due to it's location above Earth's surface.

- ***Gravity*** is the natural force that causes any two objects with mass to attract each other. It is the force that causes all objects to fall to the ground
- When you release an object that is held in the air, it falls to the ground with increasing speed because it is accelerating downward
- Normally when you drop an object, air friction exerts an upward force on it that balances the force of gravity.
- However, for the purposes of calculating gravitational potential energy we are going to assume that there is no air friction, so all objects would fall to the ground with the same acceleration, called the acceleration due to gravity
- The acceleration due to gravity is symbolized by g and has an approximate **value of** $9.81 m/s^2$

* locate on formula sheet *

- Gravitational Potential Energy can be calculated by using the following formula:

$$E_p = mgh$$

E_p: Potential Energy (J)

h: height of object (m)

m: mass (kg)

g: acceleration due to gravity ($9.81 m/s^2$)

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Variations to the Formula: *(remember- you need to develop the skill of rearranging but the formulas will be supplied on formula sheet)*

$E_p = mgh$

$\frac{E_p}{gh} = \frac{mgh}{gh}$

$\frac{E_p}{gh} = m$

$E_p = mgh$

$\frac{E_p}{mg} = \frac{mgh}{mg}$

$\frac{E_p}{mg} = h$

* locate on other formula sheet *

Example #1: The shelf in your school locker is 1.8 m above the floor. If your science book has a mass of 1.2kg, what is its gravitational potential energy relative to the floor if it is sitting on the shelf?

$h = 1.8m$

$m = 1.2kg$

$E_p = ?$

$g = 9.81 m/s^2$

$E_p = mgh$

$E_p = (1.2kg)(9.81m/s^2)(1.8m)$

$E_p = 21.1896J$

$E_p = 21J$

Example #2: A 55.0 kg diver standing on a diving platform has a gravitational potential energy of 54000J. What is the vertical height of the diving platform?

$m = 55kg$

$E_p = 54000J$

$h = ?$

$g = 9.81 m/s^2$

$h = \frac{E_p}{mg}$

$h = \frac{54000J}{(55kg)(9.81m/s^2)}$

$h = 100.083m$

$h = 100m$

* Show how to enter into calculator *

Example #3: Fred is doing a workout and lifts a barbell 0.86m above his head. If the barbell has 8.44J of energy when it is lifted what is it's mass?

$h = 0.86m$

$E_p = 8.44J$

$m = ?$

$g = 9.81 m/s^2$

$m = \frac{E_p}{gh}$

$m = \frac{(8.44J)}{(9.81m/s^2)(0.86m)}$

$m = 1.000403 kg$

$m = 1.0kg$