KINETIC AND POTENTIAL ENERGY WORKSHEET

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

$$E_p = mg\Delta h$$

Level 1: Basic

1. A 1.0 kg ball is thrown at 10 m/s. What is the kinetic energy of the ball?

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(1.0kg)(10m/s)^2 = 50J$$

2. A 5.0 kg ball is thrown at 8.0 m/s. What is the kinetic energy of the ball?

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(5.0kg)(8.0m/s)^2 = 160J$$

3. A 5.00 kg box is sitting on a ledge 3.00 m above the floor. What is the potential energy of the box relative to the floor?

$$E_p = mg\Delta h = (5.00kg)(9.81m/s^2)(3.00m) = 147J$$

4. A 2.00 kg box is sitting on a ledge 4.50 m above the floor. What is the potential energy of the box relative to the floor?

$$E_p = mg\Delta h = (2.00kg)(9.81m/s^2)(4.50m) = 88.3J$$

Level 2a: With Unit Conversion

5. A 530 g Cooper's hawk is flying horizontally with a velocity of 50 mph. What is the kinetic energy of the hawk? Hint: 1 m/s is 2.25 mph

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(530g \times \frac{kg}{1000g})(50mi/h \times \frac{m/s}{2.25mi/h})^2 = 130J$$

6. A 20 g dwarf hamster is scurrying along at a velocity of 8.0 km/h . What is the kinetic energy of the hamster? Hint: 1 m/s is 3.6 km/h

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(20g \times \frac{kg}{1000g})(8.0km/h \times \frac{m/s}{3.6km/h})^2 = 0.049J$$

7. A wheel is beginning to roll down from the top of a 30.0 ft tall hill. The wheel weighs 8.00 lb. What is the potential energy of the wheel? Hint: 1 m is 3.28 ft

$$E_p = mg\Delta h = (8.00lb \times \frac{0.454kg}{lb})(9.81m/s^2)(30.0ft \times \frac{m}{3.28ft}) = 326J$$

Level 2b: Formula Manipulation

8. A bowling ball has 18 J of kinetic energy as it rolls down the gutter at 3.0 m/s. What is the mass of the bowling ball?

$$m = \frac{2E_k}{v^2} = \frac{2(18J)}{(3.0m/s)^2} = 4.0kg$$

9. A 3.00 kg brick is dropped and hits the ground with 300 J of energy. What height above the ground did the brick drop from?

$$\Delta h = \frac{E_p}{mg} = \frac{(300J)}{(3.00kg)(9.81m/s^2)} = 10.2m$$

Level 3: Advanced

10. Miss Fortune fires 20.0 g Love Taps from her twin pistols 'Shock' and 'Awe' with a muzzle energy of 1.65 kJ. What is the velocity of the Love Taps leaving the muzzle?

$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2(1.65kJ \times \frac{1000J}{kJ})}{20.0g \times \frac{kg}{1000g}}} = 406m/s$$

11. Ashe fires a 200 lb Enchanted Crystal Arrow which travels at constant velocity and is propelled by 154 kJ of magical energy. What is the velocity of the arrow?

$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2(154kJ \times \frac{1000J}{kJ})}{200lb \times \frac{0.454kg}{lb}}} = 58.2m/s$$

12. Draven throws his 20.0 lb Spinning Axes with 2.87 kJ of energy. What is the velocity of the axes leaving the Draven's hands?

$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2(2.87kJ \times \frac{1000J}{kJ})}{20.0lb \times \frac{0.454kg}{lb}}} = 25.1m/s$$

13. An Olympic diver steps off a 32.8 ft diving platform and hits the water with 5.75 kJ of energy. What is the weight of the diver? Hint: 1 m is 3.28 ft

$$m = \frac{E_p}{g\Delta h} = \frac{(5.75kJ \times \frac{1000J}{kJ})}{(9.81m/s^2)(32.8ft \times \frac{m}{3.28ft})} = 58.6kg$$

14. Pantheon channels his Grand Skyfall, which launches him 300 ft into the air. He then comes crashing down with his body weight delivering 81.2 kJ of energy to the target area. What is Pantheon's weight? Hint: 1 m is 3.28 ft

$$m = \frac{E_p}{g\Delta h} = \frac{(81.2kJ \times \frac{1000J}{kJ})}{(9.81m/s^2)(300ft \times \frac{m}{3.28ft})} = 90.5kg$$

15. Galio channels his Hero's Entrance, which launches him 1.00 mile into the air. He then comes crashing down with his body weight delivering 64.5 GJ of energy to the target area. What is Galio's weight? Hint: 1.609 km is 1 mi

$$m = \frac{E_p}{g\Delta h} = \frac{(64.5GJ \times \frac{1{,}000{,}000{,}000J}{GJ})}{(9.81m/s^2)(1.00mi \times \frac{1.609km}{mi} \times \frac{1000m}{km})} = 4{,}090{,}000kg$$