

Potential and Kinetic Energy Worksheet

Kinetic Energy (KE) = $\frac{1}{2}$ mass times velocity squared

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

Potential Energy (PE) = mass times the acceleration due to gravity times height

$$PE = mgh = N \cdot h \quad (g = 9.8 \text{ m/s}^2)$$

$$1 \text{ Newton (N)} = 1\text{kg} \cdot 1\text{m/s}^2 \text{ or } 1\text{kgm/s}^2$$

1. You serve a volley ball with a mass of 2.1kg. The ball leaves your hand at 30m/s. The ball has Kinetic energy. Calculate it.

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

$$KE = ?$$

$$m = 2.1 \text{ kg}$$

$$v = 30 \text{ m/s}$$

$$KE = \frac{1}{2} (2.1)(30^2)$$

$$KE = \frac{1}{2} (2.1)(900)$$

$$KE = 1.05(900)$$

$$KE = 945 \text{ J}$$

2. There is a bell at the top of a tower that is 45m high. The bell weighs 190N. The bell has Potential energy. Calculate it.

$$PE = N \cdot h$$

$$N = 190$$

$$h = 45$$

$$PE = 190(45)$$

$$PE = 8550 \text{ J}$$

3. The potential energy of an apple is 6.0 joules. The apple is 3m high. What is the mass of the apple?

$$PE = 6.0 \text{ J}$$

$$m = ?$$

$$g = 9.8$$

$$h = 3 \text{ m}$$

$$PE = mgh$$

$$6 = m(9.8)(3)$$

$$\frac{6}{29.4} = \frac{29.4m}{29.4}$$

$$0.2 = m$$

4. What is the velocity of a 500kg elevator that has 4000J of energy?

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

$$KE = 4000$$

$$m = 500$$

$$v = ?$$

$$4000 = \frac{1}{2} (500) v^2$$

$$\frac{4000}{250} = \frac{250 v^2}{250}$$

$$16 = v^2$$

$$\sqrt{16} = v$$

$$4 = v$$

5. What is the mass of an object that creates 33,750J of energy by traveling at 30m/s?

$$KE = 33750$$

$$m = ?$$

$$v = 30$$

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

$$33750 = \frac{1}{2}m(30^2)$$

$$33750 = \frac{1}{2}m(900)$$

$$\frac{33750}{450} = \frac{450m}{450}$$

$$75 = m$$

6. Missy Diwater, the former platform diver for the Ringling Brothers' Circus had a kinetic energy of 15,000J just prior to hitting the bucket of water. If Missy's mass is 50kg, the what was her velocity?

$$KE = 15000$$

$$m = 50$$

$$v = ?$$

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

$$15000 = \frac{1}{2}(50)v^2$$

$$\frac{15000}{25} = \frac{25v^2}{25}$$

$$600 = v^2$$

$$\sqrt{600} = v$$

$$24.5 = v$$

7. A 75kg refrigerator is located on the 70th floor of a skyscraper (300m above ground). What is the potential energy of the refrigerator?

$$PE = ?$$

$$m = 75$$

$$g = 9.8$$

$$h = 300$$

$$PE = mgh$$

$$PE = 75(9.8)(300)$$

$$PE = 220500$$

8. At what height is an object that has a mass of 50kg, if its gravitational potential energy is 9800J?

$$PE = 9800$$

$$m = 50$$

$$g = 9.8$$

$$h = ?$$

$$PE = mgh$$

$$9800 = 50(9.8)h$$

$$\frac{9800}{490} = \frac{490h}{490}$$

$$20 = h$$

9. A 10kg mass is lifted to a height of 2m. What is its potential energy at this position?

$$PE = ?$$

$$m = 10$$

$$g = 9.8$$

$$h = 2$$

$$PE = mgh$$

$$PE = 10(9.8)(2)$$

$$PE = 196 \text{ J}$$

10. Calculate the kinetic energy of a truck that has a mass of 2900kg and is moving at 55m/s.

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

$$KE = ?$$

$$m = 2900$$

$$v = 55$$

$$KE = \frac{1}{2}(2900)(55^2)$$

$$KE = 1450(3025)$$

$$KE = 4,386,250$$

11. A bullet has a mass of 0.0042kg. The muzzle velocity of the bullet coming out of the barrel of the rifle is 993m/s. What is the KE of the bullet as it exits the gun barrel?

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

$$KE = ?$$

$$m = 0.0042$$

$$v = 993$$

$$KE = \frac{1}{2}(0.0042)(993^2)$$

$$KE = (0.0021)(986,049)$$

$$KE = 2070.1$$

12. What is the potential energy of a 3kg ball that is on the ground?

$$PE = ?$$

$$m = 3$$

$$h = 0$$

$$PE = mgh$$

$$PE = 3(9.8)(0)$$

$$PE = 0$$

13. A roller coaster is at the top of a 72m hill and weighs 966N. At the top of the hill the coaster car has ⁱ Potential energy. Calculate it.

$$PE = ?$$

$$N = 966$$

$$h = 72$$

$$PE = mgh = Nh$$

$$PE = 966(72)$$

$$PE = 69552$$

14. What is the kinetic energy of a 3kg ball that is rolling 2m/s?

$$KE = ?$$

$$m = 3$$

$$v = 2$$

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

$$KE = \frac{1}{2}(3)(2^2)$$

$$KE = \frac{1}{2}(3)(4)$$

$$KE = \frac{1}{2}(12)$$

$$KE = 6$$

15. A baby carriage is rolling down a hill at 18m/s. If the carriage has 90J of kinetic energy, what is the mass of the carriage?

$$KE = 90$$

$$m = ?$$

$$v = 18$$

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

$$90 = \frac{1}{2}m(18^2)$$

$$90 = \frac{1}{2}m(324)$$

$$\frac{90}{162} = \frac{162m}{162}$$

$$0.5 = m$$