

KEY

Name: _____

POTENTIAL AND KINETIC ENERGY CALCULATIONS WORKSHEET

In Lesson 15.1, you learned that Potential Energy = mass x gravity x height. The formula can also be written to find mass or height. Use the below formulas to solve the following problems.

Potential Energy = mass x gravity x height Units: J

Mass = Potential Energy / (gravity x height) Units: kg

Height = Potential Energy / (mass x gravity) Units: m

Gravitational Constant = 9.8 m/s^2

In Lesson 15.1, you learned that Kinetic Energy = $\frac{1}{2} \times \text{mass} \times \text{velocity}^2$.

Kinetic Energy = $\frac{1}{2} \times \text{mass} \times \text{velocity}^2$ Units: J

1. Calculate the potential energy of a rock with a mass of 5 kg while sitting on a cliff that is 30 m high.

$$\begin{aligned} E_p &= m \cdot g \cdot h &= 1470 \text{ Joules} \\ &= 5 \times 9.8 \times 30 \end{aligned}$$

2. Calculate the potential energy of an object with a mass of 15 kg while sitting on a shelf that is 20 m high.

$$2940 \text{ Joules}$$

3. Calculate the potential energy of a statue with a mass of 20 kg while sitting on a table that is 2 m high.

$$392 \text{ Joules}$$

4. What distance is a book from the floor if the book contains 195 Joules of potential energy and has a mass of 5 kg?

$$\frac{195}{5 \times 9.8} = \frac{195}{49} = 3.98 \text{ m}$$

5. What distance is an object from the floor if the object contains 600 Joules of potential energy and has a mass of 15 kg?

$$\frac{600}{15 \times 9.8} = \frac{600}{147} = 4.08$$

6. What distance is a rock from the floor if the rock contains 175 Joules of potential energy and has a mass of 25 kg?

$$\frac{175}{25 \times 9.8} = \frac{175}{245} = 0.71 \text{ m}$$

7. An car is sitting on a hill which is 20 m higher than ground level. Find the mass of the car if it contains 362,600 J of potential energy.

$$m = \frac{362600}{20 \times 9.8} = \frac{362600}{196} = 1850 \text{ kg}$$

8. An car is sitting on a hill which is 30 m higher than ground level. Find the mass of the car if it contains 636,000 J of potential energy.

$$m = \frac{636000}{30 \times 9.8} = \frac{636000}{294} = 2163 \text{ kg}$$

9. An car is sitting on a hill which is 50 m higher than ground level. Find the mass of the car if it contains 800,500 J of potential energy.

$$m = \frac{800500}{50 \times 9.8} = \frac{800500}{490} = 1633.67 \text{ kg}$$

10. Calculate the kinetic energy of a rock that has a mass of 55 kg rolling down a hill with a velocity of 8 m/s.

$$E_k = \frac{1}{2} m v^2 = 257 \times 64 = \frac{1}{2} 55 \times 8^2 = 1760 \text{ Joules}$$

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

$$\frac{1}{2} 2900 \times 55^2 = 4386250 \text{ Joules}$$

or

$$= 1450 \times 3025 = 4386.2 \text{ kJ}$$

12. Calculate the kinetic energy of a 71 kg man walking at 1 m/s.

$$35.5 \text{ Joules}$$

13. Calculate the kinetic energy of a 71 kg man running at 5 m/s.

$$35.5 \times 25 = 887.5 \text{ Joules}$$

14. Calculate the kinetic energy of a 1816 kg car traveling at 26.8 m/s.

15. Calculate the kinetic energy of a 10 kg ball rolling at 10 m/s.

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

$$KE = \frac{1}{2} m v^2$$

$$KE = 33750$$

$$m = ?$$

$$v = 30$$

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

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

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

$$75 = m$$

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?

$$KE = 15000$$

$$m = 50$$

$$v = ?$$

$$KE = \frac{1}{2} m v^2$$

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

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

$$600 = v^2$$

$$\sqrt{600} = v$$

$$24.5 = v$$

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?

$$PE = mgh$$

$$PE = ?$$

$$m = 10$$

$$g = 9.8$$

$$h = 2$$

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

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

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 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?

$$KE = 90$$

$$m = ?$$

$$v = 18$$

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

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

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

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

$$0.5 = m$$

