K.E. & P.E.

Rule for Kinetic Energy

KE = ½ Mass X Velocity^2
(Joules) (kg) (m/s)

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

$K_E = \frac{m \cdot v^2}{2}$ → $m = \frac{2K_E}{v^2}$ → $v = \sqrt{\frac{2K_E}{m}}$

Rule for Gravitational Potential Energy

GPE = Mass X Gravitational Acceleration (9.8 m/s^2) X Height (m)
(Joules) (kg) (m)

$G_E = m \cdot g \cdot h$

GPE = m X g X h

$m = \frac{G_E}{g \cdot h}$ $h = \frac{G_E}{g \cdot m}$ $g = \frac{G_E}{m \cdot h}$

Questions

1. What is the kinetic energy of a ball with a mass of 5 kg rolling at 10 m/s?
2. What kinetic energy has a 1 tonne car travelling at 15 m/s?
3. How much kinetic energy has a 5 gram bullet speeding at 100 m/s?
4. What kinetic energy has a 4 kg shotput thrown with a velocity of 13 m/s?
5. If a ball has kinetic energy of 1000 Joules and a speed of 5m/s, what is its mass?
6. What is the gravitational potential energy of a 3 kg ball kicked into the air at a height of 5 metres?
7. How much gravitational potential energy has a boy whose mass is 50 kg and who is standing on top of a 1.5 metre high wall?
8. What is the gravitational potential energy of a 250 kg rock on top of a 200 metre cliff?
9. If an airplane with a mass of 5 tonnes has gravitational potential energy of 1000 kilojoules, what is its height?
10. Describe the changes of energy forms of an arrow from the time just before its release from the bow until its landing on the ground.

Answers

1.500J 2.225000J 3.50J 4.676J 5.8.9kg 6.147J 7.735J 8.490000J 9.20.4m

KE + PE Extension

1)

$KE = ?$
$m = 5kg$
$v = 10m/s$

$K_E = \frac{mv^2}{2} = \frac{5 \times 10^2}{2} = \boxed{250J}$ * error on key!

2) 1 tonne = 1000kg

$K_E = ?$
$m = 1\,\text{tonne} \times \frac{1000kg}{1\,\text{tonne}} = 1000kg$

$V = 15m/s$

$K_E = \frac{mv^2}{2}$

$= \frac{1000 \cdot 15^2}{2} = \boxed{112500J}$ * also key wrong

3) $K_E = ?$

$5g \times \frac{1\,kg}{1000g} = 0.005kg$

$100m/s$

$K_E = \frac{0.005kg \cdot 100^2}{2} = \boxed{25\,J}$

4) $E = ?$
$m = 4kg$
$v = 13m/s$

$E = \frac{4 \cdot 13^2}{2} = \boxed{338\,J}$ or 340 J

5) $E = 1000\,J$
$v = 5m/s$
$m =$

$m = \frac{2 \cdot E}{v^2} = \frac{2 \cdot 2000}{5^2} = \boxed{160kg}$

6) $m = 3kg$
$\Delta h = 5m$
$E = ?$
$g = 9.81m/s^2$

$E = m \cdot g \cdot \Delta h$

$= 3 \times 9.8 \times 5 = 147\,J = \boxed{150\,J}$

7) $m = 50kg$
$\Delta h = 1.5m$
$E = ?$

$E = 50 \times 1.5 \times 9.8$
$= 735\,J = \boxed{740\,J}$

8) $250kg = m$
$\Delta h = 200m$

$E = 250 \times 200 \times 9.8$
$\boxed{= 490000\,J}$

9) $5\ tonne \times \frac{1000\,kg}{1\ tonne} = 5000\,kg$

$E = 1000\,\cancel{kJ} \times \frac{1000\,J}{1\ \cancel{kJ}} = 1000000\,J$

$\Delta h = \Delta h = \frac{G_E}{g \cdot m} = \frac{1000000}{9.8 \cdot 5000} \boxed{\neq 20,000\,\cancel{m}}$

$= 20408.16\,\cancel{m}$

10) Elastic Potential → Kinetic Mechanical