

# CH # 8 WORK, POWER AND ENERGY

**Some important formulae:**

i)  $W = F \cdot S$     ii)  $P = F \cdot V$     iii)  $K.E = \frac{1}{2}mv^2$

iv)  $P = \frac{W}{t}$     v)  $P.E = mgh$  or  $P.E = Wh$

**8.1: How much work is done to displace horizontally a body 40m by a force of 200N, whose angle with the horizontal is  $30^\circ$ ?**

**GIVEN:**

Distance moved =  $S = 40m$

Force applied =  $F = 200N$

Angle of force =  $\theta = 30^\circ$

**REQUIRED:**

Work done = ?

**SOLUTION:**

$W = F S \cos\theta$

$W = (200)(40)\cos(30)$

$W = 8000 \times 0.866$

$W = 6928J$

**8.2: What is the power of an engine that pulls a 1000Kg automobile at a steady speed of 10m/s along a level road.**

**GIVEN:**

Force =  $F = 1000Kg$

Velocity =  $V = 10m/s$

**REQUIRED:**

Power of an engine =  $P = ?$

**SOLUTION:**

$P = F \cdot V$

$P = 1000 \times 10$

$P = 10,000 N$

**8.3: With what constant velocity can a 1960 Watt motor raise a mass of 100Kg.**

**GIVEN:**

Power =  $P = 1960Watt$

Mass raised =  $m = 100Kg$

**REQUIRED:**

Power =  $P = ?$

**SOLUTION:**

$P = F \cdot V$

$P = mg \cdot V (\because F = W = mg)$

$V = \frac{P}{mg}$

$V = \frac{1960}{(100)(9.8)}$

$V = 2m/s$

**8.4: A boy of mass 50Kg on motor bike is moving with 20m/s. What is his K.E.**

**GIVEN:**

Mass =  $m = 2000Kg$

Speed =  $V = 20m/s$

**REQUIRED:**

Kinetic energy =  $K.E = ?$

**SOLUTION:**

$K.E = \frac{1}{2}mv^2$

$K.E = \frac{1}{2}(2000)(20)^2$

$K.E = 10,000J$

**8.5: What is P.E stored by a car of weight 2000N when lifted 50m straight up.**

**GIVEN:**

Weight of body =  $W = 2000N$

Height =  $h = 50m$

**REQUIRED:**

Potential energy =  $P.E = ?$

**SOLUTION:**

$P.E = mgh$

$P.E = Wh (W = mg)$

$P.E = (2000)(50)$

$P.E = 100,000J$

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**8.6: A box is pushed 5m across level surface by a horizontal force of 200N. How much work is done on the box.**

*GIVEN:*

Force applied =  $F = 200\text{N}$

Distance travelled =  $S = 5\text{m}$

*REQUIRED:*

Work done =  $W = ?$

*SOLUTION:*

$W = F \cdot d$

$W = (200)(5)$

$W = 1000\text{J}$

By taking square root on both sides,

$$V = \sqrt{2mgh}$$

$$V = \sqrt{2(10)(9.8)}$$

$$V = 14 \text{ m/s}$$

**8.7: What is K.E of 2000Kg car travelling at 90Km/h.**

*GIVEN:*

Mass of body =  $m = 200\text{Kg}$

Speed of car =  $V = 90\text{Km/h} = 90 \times 1000/3600 = 25\text{m/s}$

*REQUIRED:*

Kinetic energy =  $K.E = ?$

*SOLUTION:*

$$K.E = \frac{1}{2}mV^2$$

$$K.E = \frac{1}{2}(200)(25)^2$$

$$K.E = 625,000\text{J}$$

**8.8: An object weighing 10N falls through distance of 10m. What is its velocity just before it strikes the ground. Assume there is no friction.**

*REQUIRED:*

Weight of object =  $W = mg = 10\text{N}$

Distance (Height) =  $h = 10\text{m}$

*REQUIRED:*

Velocity of object =  $V = ?$

*SOLUTION:*

When an object moves downward the potential energy lost is equal to gain in kinetic energy,

Potential energy lost = gain in K.E

$$mgh = \frac{1}{2}mV^2$$

$$V^2 = 2gh$$

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