Name: Anoj Sapkota Class: 8'G' Roll no: 6

Date
Page

Work, Energy, Power - 3

7. Name the equipment that transforms energy as follows:

a) Light energy into electrical energy
→ Solar cells

b) Mechanical energy into electrical energy
→ Dynamo

c) Electrical energy into heat energy
⇒ Electrical Heater

d) Electrical energy into heat energy
→ Light bulb

e) Chemical energy into heat and light energy
→ Burning coal

f) Mechanical energy ~~and~~ into sound energy.
→ Guitar

Date
Page

g) Sound energy into electromagnetic energy
→ ~~Electric bell~~ Microphone

h) Electromagnetic energy into sound energy
→ Radio

8. Numerical problems.

a) An object can be displaced to 5m by the application of 20N force. Calculate the work done.

→ Soln,

Here,

Displacement [d] = 5m

Force [F] = 20N

Work done [W] = ?

We have,

$W = F \times d$

or, $W = 20N \times 5m$

$\therefore W = 100J$

$\therefore$ Work done is 100J.

b. Calculate the work done if a boy of mass 20kg is taken to a height of 2m. (take $g = 9.8 m/s^2$)

→ Soln,

Here,

mass [m] = 20kg

acceleration due to gravity [g] = $9.8 m/s^2$

height [h] = 2m

Work [W] = ?

We have,

$W = m \times g \times h$

$= 20kg \times 9.8 m/s^2 \times 2m$

$\therefore W = 392 J$

$\therefore$ Work done is 392J.

8. Numerical Problems

Exmpl. Calculate the potential energy contained by the water of 2500kg in a dam if the height of the water column is 12m. [Given: density of water = 1000 kg/m^3 and ~~the~~ acceleration due to gravity = 9.8 m/s^2]

→ Soln,

Here,

mass [m] = 2500kg

height [h] = 12m

gravity [g] = 9.8m/s^2

density of water [d] = 1000 kg/m^3

We have,

$PE = mgh$

$= (2500 \times 9.8 \times 12) J$

$= 294000 J$

d.) An object of mass 20kg is moving with the velocity of 15m/s. Calculate the kinetic energy.

⇒ Soln,

Here,

mass [m] = 20kg

Velocity [v] = 15m/s

Kinetic energy [KE] = ?

Now,

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

$= \left(\frac{1}{2} \times 20 \times (15\text{m/s})^2\right) J$

$= (0.5 \times 20 \times 225) J$

$= 2250 J$

e) A crane can lift a load of 3000N to a height of 10m in 10 seconds. Calculate the power of the crane in horse power.

⇒ Sol?

Here,

Force [F] = 3000N

distance [d] = 10m

time taken [t] = 10s

[p] power = ?

we have,

$$P = \frac{W}{t}$$

$$= \frac{Fxd}{t} \quad [\because W = FxD]$$

$$= \frac{3000N \times 10m}{10s}$$

$$= \frac{30000J}{10s}$$

$$= 3000 \text{ watt}$$

Converting watt to horse power,

1watt = 1hp = 746watt

or,

746 watt = 1 h.p.

or, 1 watt = $\frac{1}{746}$ h.p

Or, 3000 watt = $\frac{1}{746} \times 3000 = 4.02$ h.p.

∴ Ans. = 4.02 h.p.

6. A porter carries 30 bricks to a distance of 50m is in 25s. If the weight of one brick is 12N, calculate the work done and power.

→ Sol^n,

Here,

Total bricks = 30

Weight of 1 brick = 12N

Weight of 30 brick = 12N × 30 = 360N

Force [F] = 360N

distance [d] = 25~~5~~0

Now,

$W = F \times d$

$= (360 \times 25)$ J

$= \sout{9000}$ J 18,000 J

$$P = \frac{W}{t}$$

$$= \frac{18000}{25}$$

$$= 720W$$

∴ Work done = 18000J

∴ Power = 720W

Work, Energy and Power [continued]

Numerical Problems:

1) Find the force required to do 25 joule work when the force causes a displacement of 0.5m.
2) A boy pushes a book by applying force of 5N. Find the work done by this force as the book is displaced through 20cm while pushing.
3) Find the kinetic energy of a ball of mass 200grams moving at a speed of 20m/s.
4) A stone 'x' of mass 2 kg is at the height of 2m from the ground level. Another similar stone 'y' of mass 4kg is at the height of 4m from the ground level. What is the difference between their potential energy?
5) A 60kg person climbs stairs of total height of 20m in two minutes, calculate the power delivered. [$g = 10ms^{-2}$]
6) How much time will it take to perform

440 joule of work at a rate of 11w?

3.) A 100 watt electric bulb is used for 5 hours. How much energy is consumed by the bulb?

4.) A coolie of 40kg weight carries 20kg salt and climbs up 20 steps of 20 centimetres each in two minutes. Calculate the work done by him and his power. [g = 10m/s²]

Answers

1) → Soln,

Here,

Work [W] = 25J

distance [d] = 0.5cm

Force [F] = ?

We know,

$W = F \times d$

or, $25J = F \times 0.5cm$

or, $F = \frac{25J}{0.5cm} = 50N$

∴ The force is 50N

2) → Soln,

Here,

Force [F] = 5N

distance [d] = 20cm

Work [W] = ?

We know,

$W = F \times d$

or, $= 5N \times 20cm$

$\therefore W = 100J$

∴ The work done is 100J.

3. → Soln,

Here,

Mass [m] = 200g $= \frac{200}{1000} = 0.2kg$

Velocity [v] = 20m/s

Kinetic Energy [KE] = ?

We know,

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

$= \frac{1}{2} \times 0.2 \times (20)^2$

$= \frac{1}{2} \times 200 \times 400$

$= \frac{1}{2} \times 80000$

$= \frac{80000}{2}$

$= 40J$

∴ The Kinetic energy is 40J.

4.) Soln

Here,

Of stone X,

mass [m] = 2kg

height [h] = 2m

acceleration due to gravity [g] = $9.8 ms^2$

Now,

$PE = mgh$

$= 2 \times 9.8 \times 2$

$= 39.2J$

Of stone Y,

mass [m] = 4kg

height [h] = 4m

Potential Energy [PE] = ?

Now,

PE = mgh
= (4 × 9.8 × 4) J [∵ g = 9.8 ms^{-2}]
∴ PE = 156.8 J

Now,
The difference of PE between stone X and Y is;
PE of Y = 156.8 J
PE of X = 39.2 J

∴ Difference = 117.6 J

5] → Soln,
Here,
Mass [m] = 60kg
Height [h] = 20cm
Time [t] = 2min = (2 × 60)s = 120s
Power [P] = ?

We have,

$$P = \frac{W}{t}$$

$$= \frac{F \times d}{t} \quad [\because W = F \times d]$$

$$= \frac{mgh}{t} \quad [\because F = mg \text{ and } d = h]$$

$= \frac{60 \times 9.8 \times 20}{120}$

$= 98$ watt.

∴ The power delivered is 98watt.

6. → Soln,

Here,

Time[t] = ?

Work[W] = 440J

Power[P] = 11W

Now,

$P = \frac{W}{t}$

or, $11W = \frac{440J}{t}$

or, $11 \times t = 440$

or, $t = \frac{440}{11}$

∴ $t = 40s$

∴ Time taken is 40s.

7) → Soln, Here,

Power [P] = 100 Watt
Time [T] = 5 hours = 5 × 60 × 60
= 18,000 s

~~Energy or~~ Energy [e] = ?

~~Now,~~

~~P =~~ Work done [W] = ?

Now,

$$P = \frac{W}{t}$$

or, $100 = \frac{W}{18000}$

or, $W = 100 \times 18000$

$\therefore W = 1800000 J$

$\therefore$ 18,00,000 J energy is released.

8 → Soln

Here,

Man Mass [m_1] = 40kg

Salt mass [m_2] = 20kg

Total mass [m_3] = $m_1 + m_2$

= (40 + 20) kg

= 60kg

Height [h] = 20cm

No. of Staircase [s] = 20

[h_2] Total height = 20×20 cm = 400 cm

Time [t] = 2m = 2×60s = 120s

Now,

$W = F \times d$

$= m \times g \times h$ [$\because F = mg$ & $d = h$]

$= 60 \times 9.8 \times 400$

$= 235200$ J

Again,

$P = \frac{W}{t}$

$= \frac{235200}{120}$

$= 1960$ watt.

∴ work done is 235200 J and power is 1960 watt.