WS-19 - Power 6th foundation + Ttask

(1)

Given weight $mg = 600\,N$

height $h = 10\,m$; time $t = 12\,sec$

$$\text{Power} = \frac{w}{t} = \frac{mgh}{t}$$

$$P = \frac{600 \times 10}{12} = 500\,W \rightarrow B$$

(2)

$m_{water} = 200\,kg$; time $t = 5\,min = 5 \times 60\,sec.$

depth (h) = 120 m.

$$\text{Power} = \frac{w}{t} = \frac{mgh}{t} = \frac{200 \times 10 \times 120}{5 \times 60}$$

$= 800\,W$ (or) $784\,W$ (if $g = 9.8\,m/s^2$)

$\rightarrow A$

(3)

Given $m = 50\,kg$: height $h = 40\,m$; $t = 25\,sec$

$P = 1568\,W$. let mass of man = M.

Total mass = (M+50).

$$\therefore \text{Power} = \frac{w}{t} = \frac{(M+50)gh}{t}$$

$$\Rightarrow 1568 = \frac{(M+50)\,9.8 \times 40}{25}$$

$$\Rightarrow (M+50) = \frac{1568 \times 25}{98 \times 4} = 100$$

$\Rightarrow M = 50\,kg. \rightarrow B$

(4)

Given power $P = 3\ kw$ · height $h = 10m$; $t = 60sec$

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

$$\Rightarrow 3\times10^{3} = \frac{m\times10\times10}{60}$$

$$\Rightarrow 1800kg = m \rightarrow D$$

(5)

$m_{air} = 2\ gm = 2\times10^{-3}\ kg$; $t = 1\ sec.$; speed $= 150\ m/s$

$$\text{lung's Power} = \frac{w}{t} = \frac{\frac{1}{2}mv^2}{t}$$

$$P = \frac{1}{2}\times2\times10^{-3}\times(150)^2$$

$$P = 22500\times10^{-3} = 22.5w \rightarrow B$$

(6)

Given $\frac{n}{t} = 240/60$ bullets / sec

$m_{bullet} = 10\ gm = 10\times10^{-3}\ kg$; Power $= 7.2\times10^{3}\ w$

$$\text{Power} = \frac{w}{t} = \frac{n}{t}\frac{1}{2}mv^2$$

$$\Rightarrow 7.2\times10^{3} = \frac{240}{60}\times\frac{1}{2}\times10^{-2}\times v^2$$

$$\Rightarrow \frac{7200}{36} = v^2\times10^{-2}$$

$$\Rightarrow v^2 = 100\times3600$$

$$\Rightarrow v = 600\ m/s \rightarrow B$$

(10)

Given $F = 10N$; Power $= 100\ W$.

We know Power $= F \cdot V$

$\Rightarrow 100 = 10\ V$

$\Rightarrow V = 10\ m/s \rightarrow B$

Advanced

(2)

Total mass $= 50 + 30 = 80\ kg$; height $h = 20m$; $t = 40s$

work done $= mgh = 80 \times 20 \times 10$

$= 16000\ J$.

Power $= \frac{W}{t} = \frac{16000}{40} = 400\ W. \rightarrow A$

(5)

$[work] = ML^2T^{-2}$; $[Linear\ momentum] = MLT^{-1}$

$[Power] = ML^2T^{-3}$; $[\eta] = \frac{[P_{out}]}{[P_{in}]} = \frac{ML^2T^{-3}}{ML^2T^{-3}}$

$= M^0L^0T^0$

(6), (7), (8)

$T.E = P.E + K.E = mgh$.

$\therefore$ at height $= \frac{3h}{4}$ $P.E = mgH = mg\left(\frac{3h}{4}\right) = \frac{3mgh}{4}$.

Kinetic energy $= T.E - P.E = mgh - \frac{3}{4}mgh$

$= \frac{1}{4}mgh$

$\therefore \frac{K.E}{P.E} = \frac{\frac{1}{4}mgh}{\frac{3}{4}mgh} = \frac{1}{3}$.

Eeo LTask

CUQ's

(2)

let mass = M ; velocity = V.

weight = mg = F.

∴ Power = Force x velocity

$= mgV$.

(4)

weight to be lifted = Mg ; height = h.

∴ Power $= \frac{W}{t} = \frac{mgh}{t} = mgV$

here 'h' is displacement of the body ∴ $V = \frac{h}{t}$

(5)

we know Power $= \frac{W}{t} = \frac{F \times \text{displacement}}{\text{time}}$

Powe $=$ kg $m/s^2 \times \frac{m}{s}$

$= kg\, m^2/s^3 = kg\, m^2 s^{-3} \rightarrow$ c.

(6)

We know that power $= F \cdot V = FV\cos\theta$.

when force and velocity are perpendicular $\theta = 90°$

$P = FV\cos 90° = 0$.

(8)

Given Power = 0.392 kW = 392 W ; h = 10m ; t = 60sec

Power $= \frac{W}{t} = \frac{mgh}{t}$

$\Rightarrow 392 = m \times \frac{9.8 \times 10}{60}$

$\Rightarrow m = \frac{392}{98} \times 60$

$\Rightarrow m = 4 \times 60$

$= 240\, kg \rightarrow$ A

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Jee main Level

(4)

(1)

weight $= mg = 300N$ height $= h = 10m$ $\therefore t = 10sec$

$$\text{Power} = \frac{mgh}{t}$$

$$P = \frac{300 \times 10}{10} = 300\ w$$

(2)

Given mass $= 100kg$ $\therefore$ time $= 2 \times 60 sec$ $\therefore$ depth $h = 120m$

$$\text{Power} = \frac{\text{work}}{\text{time}} = \frac{mgh}{t}$$

$$= \frac{100 \times 10 \times 120}{2 \times 60}$$

$$= 1000\ w \rightarrow A.$$

(3)

$m = 20kg$ $\therefore$ height $= 20m$ $\therefore$ time $= 25 sec.$

Power $= 200w$ Mass of man $= M.$

Total mass $= M + 20$

$$\therefore \text{Power} = \frac{mgh}{t} = \frac{(M+20) \times 10 \times 20}{25}$$

$$\Rightarrow 200 = \frac{(M+20) \times 200}{25}$$

$$\Rightarrow M + 20 = 25 \Rightarrow M = 5kg \rightarrow B$$

(4)

Power $= 6kw = 6 \times 10^3\ w$ $\therefore$ height $h = 20m$

time $= 60 sec$

$$\text{Power} = \frac{mgh}{t}$$

$$\Rightarrow 6 \times 10^3 = \frac{m \times 10 \times 20}{60}$$

$$\Rightarrow m = \frac{6 \times 6 \times 10^3}{20} = 6 \times 3 \times 10^2 = 1800\ kg \rightarrow D$$

(5)

Given $m_{bullet} = 3gm = 3\times10^{-3}\ kg$

$v = 200\ m/s$; time $t = 1sec.$

$$Power = \frac{W}{t} = \frac{\frac{1}{2}mv^2}{t}$$

$$P = \frac{1}{2}\times 3\times10^{-3}\times (200)^2$$

$$P = \frac{1}{2}\times 3\times10^{-3}\times 4\times10^{4}$$

$$P = 60\ W \rightarrow B$$

(6)

No. of bullets per sec $= \frac{120}{60}$

$mass = 10\ gm = 10\times10^{-3}\ kg = 10^{-2}\ kg$

$Power = 3.6\ kW = 3.6\times10^{3}\ W$

$$Power = \frac{W}{t} = \frac{n\frac{1}{2}mv^2}{t}$$

$$\Rightarrow 3600 = \frac{120}{60}\times\frac{1}{2}\times10^{-2}\times v^2$$

$$\Rightarrow 3600\times10^{2} = v^2 \Rightarrow v = \sqrt{3600\times10^{2}} \Rightarrow v = 600\ m/s \rightarrow B$$

(7)

Given $m_2 = 2m_1$; $v_2 = \frac{1}{4}v_1$

$$\therefore Power = \frac{W}{t} = \frac{n\cdot\frac{1}{2}mv^2}{t}$$

$$P \propto m v^2$$

$$\Rightarrow \frac{P_1}{P_2} = \left[\frac{m_1}{m_2}\right]\left[\frac{v_1}{v_2}\right]^2 = \left[\frac{m_1}{2m_1}\right]\left[\frac{v_1}{\frac{1}{4}v_1}\right]^2$$

$$\Rightarrow \frac{P_1}{P_2} = \frac{1}{2}\times 16 = \frac{8}{1} \rightarrow D$$

(8)

No. of bullets per sec $\frac{n}{t} = \frac{120}{60} = 2$.

velocity $V = 100$ m/s

mass $= 2$ gm $= 2 \times 10^{-3}$ kg.

$$\text{Power} = \frac{W}{t} = \frac{n}{t} \frac{1}{2} m v^2$$

$$P = 2 \times \frac{1}{2} \times 2 \times 10^{-3} \times (100)^2$$

$$= 2 \times 10^{-3} \times 10^4$$

$$= 20 W \rightarrow A.$$

(9)

Given velocity $v = 6$ m/s

force $= 10$ N.

Power $= F v = 10 \times 6 = 60 W \rightarrow A$

(10)

Given Force $= 20$ N ; Power $= 200$ W

Power $= F v$

$\Rightarrow 200 = 20 v$

$\Rightarrow v = 10$ m/s $\rightarrow B$

Advanced

(1)

we know that Power $= \frac{W}{t}$

Power $\propto \frac{1}{\text{time}}$

less in the time, more in power.

④, ⑤, ⑥

Given $m = 4\,kg$; velocity $= 5\ m/s$; height $h = 10m$

Kinetic energy $K.E = \frac{1}{2} m v^2$

$= \frac{1}{2} \times 4 \times 5^2$

$= 2 \times 25$

$= 50J.$

$P.E = mgh$

$= 4 \times 10 \times 10$

$= 400J \rightarrow D$

Total energy $= K.E + P.E$

$\rightarrow 50 + 400$

$= 450J.$