(1)

Given weight $mg = 600\ N$

height $h = 10m$; 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) $= 120\ m$.

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

$$= 800\ w\ (or)\ 784\ w \quad [\text{if } g = 9.8\ m/s^2)$$

$\rightarrow A$

(3)

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

$P = 1568\ w$. let mass of man $= M$.

Total mass $= (M + 50)$.

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

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

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

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

(1) (2)

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

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

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

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

(5)

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

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

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

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

(6)

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

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

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

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

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

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

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

(7)

$m_2 = 2m_1 \qquad v_2 = \frac{1}{2} v_1$

we know Power $= \frac{w}{t} = \frac{n \times \frac{1}{2} m v^2}{t}$

$P \propto m v^2$

$\Rightarrow \frac{P_1}{P_2} = \frac{m_1}{m_2} \left(\frac{v_1}{v_2}\right)^2$

$\Rightarrow \frac{P_1}{P_2} = \frac{m_1}{2m_1} \times \left(\frac{v_1}{\frac{1}{2} v_1}\right)^2$

$\Rightarrow \frac{P_1}{P_2} = \frac{1}{2} \times 2^2 = \frac{2}{1} \rightarrow D.$

(8)

No. of bullets per sec $= \frac{420}{60}$

Velocity $v = 300$ m/s ; mass $= 1gm = 10^{-3}$ kg.

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

$= \frac{420}{60} \times \frac{1}{2} \times 10^{-3} \times (300)^2$

$= 7 \times \frac{1}{2} \times 10^{-3} \times 45 \times 10^3$

$\Rightarrow 315 W \rightarrow A$

(9)

velocity $v = 3$ m/s ; Force $F = 5N$.

Power $= F.v$

$= 3 \times 5$

$= 15 W \rightarrow A$

(10)

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

we know Power $= F\ V$

$\Rightarrow 100 = 10\ V$

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

Advanced

(2)

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

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

$= 16000\ J$.

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

(5)

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

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

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

(6), (7), (8)

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

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

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

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

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

LTask

CUQ's

(2)

let mass = M : velocity = V.

weight = mg = F.

∴ Power = Force × 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 = $\frac{W}{t} = f \times \frac{\text{displacement}}{\text{time}}$

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

Jee main level

(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 $= 100\ kg$ $\therefore$ 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)

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

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

Total mass $= M + 20$

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

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

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

(4)

Power $= 6\ kw = 6 \times 10^3\ w$ $\therefore$ 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 $m_{a_1} = 3gm = 3\times10^{-3}\ kg$

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

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

$$P = \frac{1}{2}\times3\times10^{-3}\times(200)^2$$

$$P = \frac{1}{2}\times3\times10^{-3}\times4\times10^{4}$$

(6) $P = 60\ w \rightarrow B.$

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

$m_{a_1} = 10\ gm = 10\times10^{-3}\ kg = 10^{-2}\ kg.$

Power $= 3.6\ kw = 3.6\times10^{3}\ w.$

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

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

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

(7)

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

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

$$P \propto m v^2$$

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

$$\Rightarrow \frac{P_1}{P_2} = \frac{1}{2}\times16 = \frac{8}{1} \rightarrow D$$

(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.

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

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

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

$= 20\,w \rightarrow 4.$

(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 is the time, more is power.

④.⑤.⑥

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

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

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

$= 2 \times 25$

$= 50\,J.$

$P.E = mgh$

$= 4 \times 10 \times 10$

$= 400\,J \rightarrow D$

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

$\Rightarrow 50 + 400$

$= 450\,J.$