6. work, foundation 7th

Teaching task

1

Given

F = 50 N : distance = 5 m

work done = F × displacement

= 50 × 5 = 250 J → A

2

Given F = 100N : displacement s = 0 m

work done = Force × displacement

= 100 × 0

= 0 J → B

3

Given F = 30 N : θ = 60° : S = 8 m.

work done = F S cos θ

⇒ 30 × 8 × cos 60°

= $30 \times \cancel{8}^{4} \times \frac{1}{\cancel{2}}$

⇒ 120 J — B

4

④

Given $m = 50$ kg $\quad$ ~~h = 4 m/s~~ $\quad v = 2$ m/s $\quad a = g = 9.8\ m/s^2$

$w = -mgh$ $\qquad h = v^2/2g$

$= -50 \times 9.8 \times \frac{2}{9.8}$ $\qquad = \frac{2^2}{2g} = \frac{2}{g}$

$= -100J \rightarrow B$

⑤

Given $F = 15N$ $\quad \theta = 30^\circ$; $S = 6m$.

we know $\quad W = FS\cos\theta$

$= 15 \times 6 \times \cos 30^\circ$

$\Rightarrow 15 \times 6 \times \frac{\sqrt{3}}{2}$

$\Rightarrow 45 \times 1.732$

$= 77.945 \rightarrow$

component of force $\parallel$el to direction of motion

$= F\cos\theta = 15 \times \frac{\sqrt{3}}{2} = 7.5 \times 1.732$

$= 12.99 = 13N \rightarrow B$

⑥

Given $F = 200N$ $\quad \theta = 45^\circ$; $S = 8m$

work done $= FS\cos\theta$

$= 200 \times 8 \times \cos 45^\circ$

$= 200 \times 8 \times \frac{1}{\sqrt{2}}$

$= 200 \times 4\sqrt{2}$

$= 800 \times 1.414 = 1131.2\ N \rightarrow B$

7,

$F = 30N$; $S = 5m.$

work done against gravity $= -mgh$

$= -30 \times 5$

$= -150J \rightarrow C$

Here displacement of the body and gravity are in opposite direction so we get -ve sign

8

$F = 500N$ $S = 20m$ Here both F and s are in same direction so $\theta = 0°$

$\therefore$ work done $= FS\cos\theta$

$= 500 \times 20 \times \cos 0$

$\Rightarrow 10,000 \times 1 = 10,000J \rightarrow A$

9

Given $m = 70kg$; $n = 36$; $h = 20cm = 20 \times 10^{-2} m$

work done against gravity $= -nmgh$

$= -36 \times 70 \times 9.8 \times 20 \times 10^{-2}$

$\Rightarrow -36 \times 14 \times 9.8$

$\Rightarrow 4939 J \rightarrow D$

10

Given $T = 200N$; $S = 20m$; $\theta = 60$

work done $= FS\cos\theta = TS\cos\theta$

$= 200 \times 20 \times \cos 60$

$= 200 \times 20 \times \frac{1}{2} = 2000J \rightarrow A$

Advanced

(11)

(a) Since the direction of frictional force is always opposite to the motion of a body so the angle between frictional force and displacement is 180°

Since $\cos 180^\circ = -1$

$$W_{friction} = f\, s \cos 180 = -f\, s$$

(b) If the body is projected vertically up Gravitational force and displacement are opp.

$\therefore \theta = 180^\circ$

$$W_{G.F} = F_g\, s \cos 180$$

$$= mg\, h\, (-1)$$

$$= -mgh = -ve.$$

a, d are correct

(a) As the body lifted up A force of equal in magnitude as that of weight (mg) of the body is applied in upward direction.

$\therefore$ $F_{applied}$ and displacement are in same direction so $\theta = 0°$

$\therefore$ $W = F_{app}\, S \cos 0°$

$\Rightarrow mgh\,(1) = mgh = +ve$

(b)

Here gravitational force and displacement are in opposite direction. then $\theta = 180°$

$W = F_g\, S \cos\theta$

$= F_g\, S \cos(180°) = -F_g S = -ve.$

$W_{Total} = W_{app} + W_g = mgh + (-mgh) = 0$

(3) (13)

(a)

The direction of centripetal force and ~~displacement~~ are Perpendicular so work done $= F_c\, S \cos 90°$

$= 0$

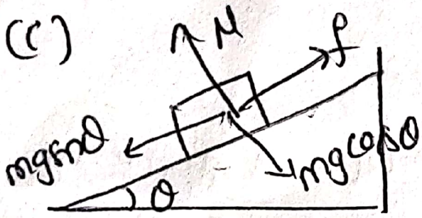
(b)

Tension in string and displacement are Perpendicular

$W = T\, S \cos 90° = 0$

(c) Displacement of person is $S = 0$ $\therefore$ $W = F_g\, S \cos\theta = 0$

(14)

(c) 

work done by the gravity

$W_g = F_g \, s \cos$

$= (mg \sin\theta) s.$

(a) Direction of friction is opposite to that of direction of motion of the body. so $\theta = 180°$

$W = f s \cos\theta$

$= f s \cos 180° \Rightarrow W = -fs = -ve$

(18)

a) If $\theta = 0 \rightarrow W = FS\cos\theta = FS\cos 0 = FS = +ve$

b) If $\theta = 180° \rightarrow W = FS\cos 180° = FS(-1) = -FS = -ve$

c) If $\theta = 90° \rightarrow W = FS\cos 90° = FS(0) = 0.$

(19)

Given

$m = 300\,kg$; $u = 0$; $v = 90\,kmph = 90 \times \frac{5}{18}$

$= 25\,m/s$

$t = 5\,sec$; $S = 1.5\,km$

$= 1.5 \times 10^3\,m$

From $v = u + at$

$\Rightarrow 25 = 0 + a \times 5 \Rightarrow 25 = 5a \Rightarrow a = 5\,m/s^2$

From $F = ma = 300 \times 5 = 1500\,N$

work done $= FS\cos\theta$

$= 1500 \times 1.5 \times 10^3\,J$

$\Rightarrow 15 \times 15 \times 10^4 = 225 \times 10^4\,J$

(20)

Given $F = 80\,N$; $S = 10\,m$

work done $= FS\cos\theta$

$= 80 \times 10 \times \cos 0° = 800\,J$

(21)

Given $F = 50\,N$; $\theta = 30°$; $S = 15\,m$

work done $= FS\cos\theta$

$= 50 \times 15 \times \cos 30°$

$= 750 \times \frac{\sqrt{3}}{2}$

$= 750 \times 0.833$

$\simeq 625\,J \simeq 650\,J$

LTask

(3)

(1)

Given $F = 30N$; $s = 4m$ Both F and s are in same direction.

work done = $F s \cos\theta$

$= 30 \times 4 \times \cos 0$

$= 120 \times 1 = 120\,J \rightarrow A$

(2)

Given $F = 80\,N$; $h = 4m$

work done against gravity $= -mgh$

$= -80 \times 4$

$\Rightarrow -320\,J \rightarrow A$

(3)

Given $S_A = 10m$; $S_B = 5m$.

work done ~~done~~ $= F s \cos\theta$.

$W \propto s$

$\Rightarrow \frac{W_A}{W_B} = \frac{S_A}{S_B} = \frac{10}{5} = \frac{2}{2}$

$\Rightarrow W_A = 2W_B$ A will do more work. $\rightarrow A$

(4)

$n = 4$; $m = 50\,kg$; $h = 20m$

work done in lifting $w = n\,mgh$

$= 4 \times 50 \times 9.8 \times 20$

$\Rightarrow 3920\,J$

$= 3.92\,kJ \rightarrow B$

(5)

$m = 60\,kg$; $S = 30m$; $F = 3N$; $\theta = 60°$

work done $= FS\cos\theta$

$= 3 \times 30 \times \cos 60°$

$= 90 \times \frac{1}{2}$

$= 45J \rightarrow D$

(6)

Given $F = 5\hat{i} - 3\hat{j} + 2\hat{k}$ N

$r_1 = 2\hat{i} + 7\hat{j} + 4\hat{k}$ $\rightarrow$ $r_2 = 5\hat{i} + 2\hat{j} + 8\hat{k}$.

$\therefore$ displacement $\vec{S} = \vec{r_2} - \vec{r_1}$

$\vec{S} = 5\hat{i} + 2\hat{j} + 8\hat{k} - 2\hat{i} - 7\hat{j} - 4\hat{k}$

$= 3\hat{i} - 5\hat{j} + 4\hat{k}$

work done $= \vec{F} \cdot \vec{S} = (5\hat{i} - 3\hat{j} + 2\hat{k}) \cdot (3\hat{i} - 5\hat{j} + 4\hat{k})$

$= 5 \times 3 + (-3)(-5) + 2 \times 4$

$= 15 + 15 + 8 = 38\,J \rightarrow C$

(7)

Given $F = 80N$; $\theta = 60°$; $S = 10m$.

Component of force in the direction of motion

$= F\cos\theta$

$= 80\cos 60$

$= 80 \times \frac{1}{2} = 40N \rightarrow A$

Scanned with OKEN Scanner

(8)

$F = 120\,N$; $S = 25\,m$; $\theta = 45^\circ$

work done $= F S \cos\theta$

$= 120 \times 25 \times \cos 45^\circ$

$\Rightarrow 3000 \times \frac{1}{\sqrt{2}}$

$= 2121\,J \rightarrow B$

(9)

Given

$S = 10m$; $F = 5N$; $W = 25J$.

From $W = FS\cos\theta$

$\Rightarrow \cancel{25}^{5} = \cancel{5} \times \cancel{10}^{2} \times \cos\theta$

$\Rightarrow \cos\theta = \frac{1}{2} \Rightarrow \theta = 60^\circ \rightarrow C$

(10)

Given

$F = 6\hat{i} - 8\hat{j}\,N$, $\vec{S} = 4m\hat{i} + 6\hat{j}$.

work done $W = \vec{F} \cdot \vec{S}$

$= (6\hat{i} - 8\hat{j}) \cdot (4\hat{i} + 6\hat{j})$

$= 6 \times 4 + (-8)(6)$

$= 24 - 48$

$= -24J \rightarrow C.$

Advanced

1

work done by the suitcase depends only on it's weight

a, b, d are correct

2

Gravitational force and displacement of bucket are opposite $\omega = -ve$ $\theta = 180°$

$\cos 180 = -1$

Applied force and displacement are in same direction $\theta = 0°$ $\cos 0 = 1$

$\omega = +ve$

8, 9, 10

Given $m = 1\,kg$: $l = 1\,m$; $F_{Horizontal} = 8\,N$

$h = 2\,m$.

work done in moving horizontally = $\omega = F_{Horizontal}\, l \cos\theta$

$\theta = 0°$ $\omega = 8 \times 1 = 8\,J$

work done in moving vertically $\omega = -mgh$

$= -1 \times 2 \times 10 = 20\,J$

Here G.F and displacement are in opposite directions.

Net work done $= \omega_{Horizontal} + \omega_{Vertical}$

$= 8 + 20$

$= 28\,J$.