WS-3 8th foundation

Task

① initial velocity $u = 36$ kmph

Final velocity $v = 108$ kmph ; $t = \frac{1}{2}$ min $= 30$ sec.

From $v = u + at$ $\Rightarrow a \times 30 = 72$ kmph

$\Rightarrow v - u = at$ $\Rightarrow a \times 30 = \frac{4}{72} \times \frac{5}{18}$ m/s

$\Rightarrow 108 - 36 = a \times 30$ $\Rightarrow 30a = 20$

$a = \frac{2}{3} = 0.66$ m/s²

② After $t = 8$ sec : Final velocity $v = 0$.

$u = 50$ kmph $= 50 \times \frac{5}{18}$ m/sec

∴ From $v = u + at$ $\Rightarrow at = -u$

$\Rightarrow 0 = u + at$ $\Rightarrow a \times 8 = -50 \times \frac{5}{18}$

$\Rightarrow a = \frac{-125}{72} = -1.74$ m/s²

-ve sign indicates retardation

③ Velocity $= 36$ kmph $= 36 \times \frac{5}{18} = 10$ m/s

$t = 10$ sec.

$a = \frac{v}{t} = \frac{10}{10} = 1$ m/s²

(4)

$u = 36$ kmph ; $v = 72$ kmph

change in speed $dv = v - u = 72 - 36 = 36$ kmph

$= 36 \times \frac{5}{18}$

$= 10$ m/sec.

time $= 10$ sec.

Acceleration $= \frac{dv}{t} = \frac{10}{10} = 1 \text{ m/s}^2$

(5)

initial velocity $u = 10$ m/s

$a = 50 \text{ m/s}^2$; $t = 3$ sec

Final velocity $v = u + at$

$\Rightarrow v = 10 + 50 \times 3 = 10 + 150 = 160$ m/s

(6)

$a = 1.8 \text{ m/s}^2$; $t = 2.5$ sec. ; $v = 7.6$ m/sec

$u = ?$

From $v = u + at$

$\Rightarrow 7.6 = u + 1.8 \times 2.5$

$\Rightarrow 7.6 = u + 4.50$

$\Rightarrow u = 7.6 - 4.5 = 3.1$ m/s.

(7)

$a = 3.2 \text{ m/s}^2$; $t = 32.8$ sec. ; $u = 0$

From $s = ut + \frac{1}{2}at^2 = 0 \times 3.8 + \frac{1}{2}(3.2)(32.8)^2$

$= 0 + 1.6 \times 32.8 \times 32.8$

$= 1721$ m.

(8)

$u=0$; $t=5.21$ sec ; $s=110$ m

From $s = ut + \frac{1}{2}at^2$

$\Rightarrow 110 = 0 \times 5.21 + \frac{1}{2} \times a \times (5.21)^2$

$\Rightarrow 110 = \frac{1}{2} \times a \times (5.21)^2$

$\Rightarrow a = \frac{2 \times 110}{(5.21)^2} = 8.1 \text{ m/s}^2$

(9)

$u = 18.5$ m/s ; $V = 46.1$ m/s ; $t = 2.47$ sec

$a = \frac{V-u}{t} = \frac{46.1 - 18.5}{2.47} = \frac{27.6}{2.47}$ m/s^2

From $s = ut + \frac{1}{2}at^2 \Rightarrow 18.5 \times (2.47) + \frac{1}{2}\left(\frac{27.6}{2.47}\right)(2.47)^2$

$\Rightarrow 18.5 \times 2.47 + \frac{27.6}{2} \times 2.47$

$= 79.8$ m

(10)

$u = 444$ m/s ; $t = 1.83$ sec.

$a = \frac{u}{t} = \frac{444}{1.83}$

From $s = ut + \frac{1}{2}at^2 \Rightarrow 444 \times 1.83 + \frac{1}{2}\frac{444}{1.83}(1.83)^2$

$= \frac{3}{2} \times 444 \times 1.83$

$= 406$ m

Advanced

(1)

$u = 0$; $a = 5\ m/s^2$

Initial velocity $u = 0$.

After 5 sec velocity $v = u + at$

$= 0 + 5 \times 5$

$= 25\ m/s$.

After 10 sec $v = u + at$

$= 0 + 5 \times 10$

$= 50\ m/s$.

velocity increases with time. → a, b, c are correct

(2)

Initial velocity $u = 20\ m/s$.

Final velocity $v = 60\ m/s$ time = 4 sec.

$$\text{Acceleration} = \frac{v-u}{t} = \frac{60-20}{4} = \frac{40}{4} = 10\ m/s^2$$

In Next 6 sec v will act as initial velocity

$v' = u + at = 60 + 10 \times 6 = 120\ m/s$ Not 120 kmph

(5)

(a) $u = 10\ m/s$; $v = 0\ m/s$; $t = 1s$ → $a = \frac{v-u}{t} = \frac{0-10}{1} = -10\ m/s^2$

(b) $u = 5\ m/s$; $v = 5\ m/s$; $t = 5s$ → $a = \frac{v-u}{t} = \frac{5-5}{5} = 0$

(c) $u = 0\ m/s$; $v = 10\ m/s$; $t = 5sec$ → $a = \frac{v-u}{t} = \frac{10-0}{5} = 2\ m/s^2$

(d) $u = 2\ m/s$; $v = 1\ m/s$; $t = 2sec$ → $a = \frac{v-u}{t} = \frac{1-2}{2} = -0.5\ m/s^2$

(6)

Initial velocity $u = 18$ kmph

Final velocity $v = 72$ kmph $\quad t = 30\text{ sec} = \frac{1}{120}\text{ hr}$

change in velocity $= v - u = 72 - 18 = 54$ kmph

$= 54 \times \frac{5}{18} = 15$ m/s

$\therefore$ acceleration $= \frac{dv}{t} = \frac{15}{30} = 0.5\ m/s^2$

(or) $= \frac{54}{\frac{1}{120}} = 54 \times 120 = 6480\ kmph^2$

(7)

change in velocity $dv = 54$ kmph

time $= 1\text{ min} = \frac{1}{60}\text{ hr}$

acceleration $= \frac{dv}{t} = \frac{54}{\frac{1}{60}} = 54 \times 60$

$= 3240\ kmph^2$

(8)

change in velocity $= 36 - 108 = -72$ kmph

$= -72 \times \frac{5}{18}$

$= -20$ m/s

time $= 4$ sec

deceleration $= \frac{dv}{t} = \frac{-20}{4} = -5\ m/s^2$

(9)

$u=0$; $a = 4\,m/s^2$; $v = 20\,m/s$

From $v^2 - u^2 = 2as$

$\Rightarrow (20)^2 - 0^2 = 2 \times 4 \times s$

$\Rightarrow 400 = 8s$

$\Rightarrow s = 50m$

(10)

Given $s = 100m$; $a = 2\,m/s^2$; $t = ?$ $u=0$

From $s = ut + \frac{1}{2}at^2$

$\Rightarrow 100 = 0 \times t + \frac{1}{2} \times 2 \times t^2$

$\Rightarrow 100 = t^2 \Rightarrow t = \sqrt{100} = 10\,sec.$

L Task

SAQ!

(1)

Initial velocity $u=0$; $v = 7.10\,m/s$; $s = 35.4m$

From $v^2 - u^2 = 2as$

$\Rightarrow (7.1)^2 - 0^2 = 2 \times a \times 35.4$

$\Rightarrow (7.1)^2 = 70.8a$

$\Rightarrow a = \frac{(7.1)^2}{70.8} = 0.712\,m/s^2$

(2)

$a = 3\ m/s^2$; $v = 65\ m/s$; $u = 0$

From $v^2 - u^2 = 2as$

$\Rightarrow (65)^2 - 0^2 = 2 \times 3 \times s$

$\Rightarrow (65)^2 = 6s \Rightarrow s = \frac{4225}{6} = 704\ m$

(3)

$v = 220.4\ m/s$; $t = 2.55\ s$; $a = \frac{v}{t} = \frac{220.4}{2.55}$

$u = 0$

skidding distance $s = ut + \frac{1}{2}at^2$

$= 0 \times 2.55 + \frac{1}{2} \times \frac{220.4}{2.55} (2.55)^2$

$= \frac{1}{2} \times 220.4 \times 2.55$

$= 110.2 \times 2.55 = 280.56\ m$

(4)

$h = s = 2.62\ m$; $a = 9.8\ m/s^2$ $u = 0$; $v = ?$

$\Rightarrow$ From $v^2 - u^2 = 2as$

$\Rightarrow v^2 - 0^2 = 2 \times 9.8 \times 2.62$

$\Rightarrow v^2 = 19.6 \times 2.62$

$\Rightarrow v = \sqrt{51.352} = 7.23\ m/s$

(5)

Here plane is in retardation

$t = 15s$

$u = 145$ m/s to $v = 75$ m/s.

From $a = -\left(\frac{v-u}{t}\right) = -\left(\frac{145-75}{15}\right) = -\frac{70}{15} = -5 \text{ m/s}^2$

From $v^2 - u^2 =$ $s = ut + \frac{1}{2}at^2$

$= 145 \times 15 + \frac{1}{2} \times -5 \times (15)^2$

$= 2175 - 562.5$

$\simeq 1650$ m

(6)

$u = 1.6$ m/s ; $a = 4$ m/s^2 ; $t = 4$ sec

From $s = ut + \frac{1}{2}at^2$

$= 1.6 \times 4 + \frac{1}{2} \times 4 \times 4^2$

$\Rightarrow 6.4 + 32 = 38.4$ m

(7)

$u = 12$ m/s $\rightarrow a = -1.0$ m/s^2 ; $t = 6$ sec

From $s = ut + \frac{1}{2}at^2$

$= 12 \times 6 + \frac{1}{2}(-1)(6)^2$

$\Rightarrow 72 - \frac{1}{2} \times 36$

$\Rightarrow 54$ m

(8)

$u = 0$; $a = 5\ m/s^2$; $s = 500m$ $v = ?$

From $v^2 - u^2 = 2as$

$\Rightarrow v^2 - 0^2 = 2 \times 5 \times 500$

$\Rightarrow v^2 = 5000 \Rightarrow v = \sqrt{5000} \simeq 71\ m/s$

(9)

$a = -11\ m/s^2$; $u = 55\ m/s$; $v = 0$

From $v^2 - u^2 = 2as$

$\Rightarrow 0^2 - (55)^2 = 2(-11)s$

$\Rightarrow +55 \times 55 = +22 \times 11\ s$

$s = 55 \times 2.5 \simeq 138m$

(10)

$u = 4\ m/s$; $a = -2\ m/s^2$; $v = 0$; $t = ?$

From $v = u + at$

$\Rightarrow 0 = 4 + (-2)t$

$\Rightarrow 4 = 2t \Rightarrow t = 2\ sec.$

Advanced

(2)

$u=0$; $v = 75$ kmph ; $t = 5$ min (or) $\frac{1}{12}$ hr

$= 75 \times \frac{5}{18}$ m/s (or) $= 300$ sec.

Acceleration $= \frac{v}{t} = \frac{75 \times 5}{\frac{18}{300}} = \frac{5}{72}$ m/s^2.

Distance $= v \times t = 75 \times \frac{1}{12}$ hr $= \frac{25}{4}$ km.

(5)

$u=0$; $a = 2$ m/s^2 $t_1 = 30$ sec.

$t_1 = 30$ sec

$s_1 = ut + \frac{1}{2}at^2 = 0 \times 30 + \frac{1}{2} \times 2 \times 30^2 = 900$ m

or $v = u + at = 0 + 2 \times 30 = 60$ m/sec. After half min.

In Next half min (30 sec) $s_2 = vt + \frac{1}{2}at^2$

$= 60 \times 30 + \frac{1}{2} \times 2 \times (30)^2$

$= 1800 + 900 = 2700$ m

In one min distance travelled $= 900$ m $+ 2700$ m

$= 1800$ m $= 108$ km

$v' = 60$ m/s is max speed attained

At half of max speed $v^2 - u^2 = 2as$

$V = \frac{v'}{2}$

$\Rightarrow (30)^2 - 0^2 = 2 \times 2 \times s$

$\Rightarrow s = \frac{900}{4} = 225$ m

(6)

$u=0$; $a=0.5\ m/s^2$; $v=54$ kmph

$= 54 \times \frac{5}{18} = 15\ m/s$

From $v = u + at$

$\Rightarrow 15 = 0 + 0.5 \times t \Rightarrow t = \frac{15}{0.5} = 30$ sec

(7)

$u=0$; $a=0.5\ m/s^2$; $v=54$ kmph $= 54 \times \frac{5}{18}$

$= 15\ m/s$

Velocity at the end of 5 sec.

$v = u + at \Rightarrow 0 + 0.5 \times 5 = 2.5\ m/s$

(9)

$u=0$; $a=0.5\ m/s^2$; $v=54$ kmph $= 54 \times \frac{5}{18}$

$= 15\ m/s$.

Velocity at the end of 21^{th} sec

$v_1 = u + at = 21t$

Velocity at the end of 7^{th} sec $v_2 = 7t$

$\therefore \frac{v_1}{v_2} = \frac{21t}{7t} = \frac{3}{1}$

(10)

(a) $u = 5\,m/s$; $v = 15\,m/s$; $t = 2\,sec \Rightarrow a = \frac{v-u}{t} = \frac{15-5}{2} = \frac{10}{2} = 5\,m/s^2$

(b) $u = 30\,m/s$; $v = 10\,m/s$; $t = 4\,sec \Rightarrow a = \frac{v-u}{t} = \frac{10-30}{4} = \frac{-20}{4} = -5\,m/s^2$

In uniform motion velocity is constant

So acceleration = 0

(c) $u = 2\,m/s$; $v = 22\,m/s$; $t = 5\,sec \Rightarrow a = \frac{v-u}{t} = \frac{22-2}{5}$

$a = \frac{20}{5} = 4\,m/s^2$