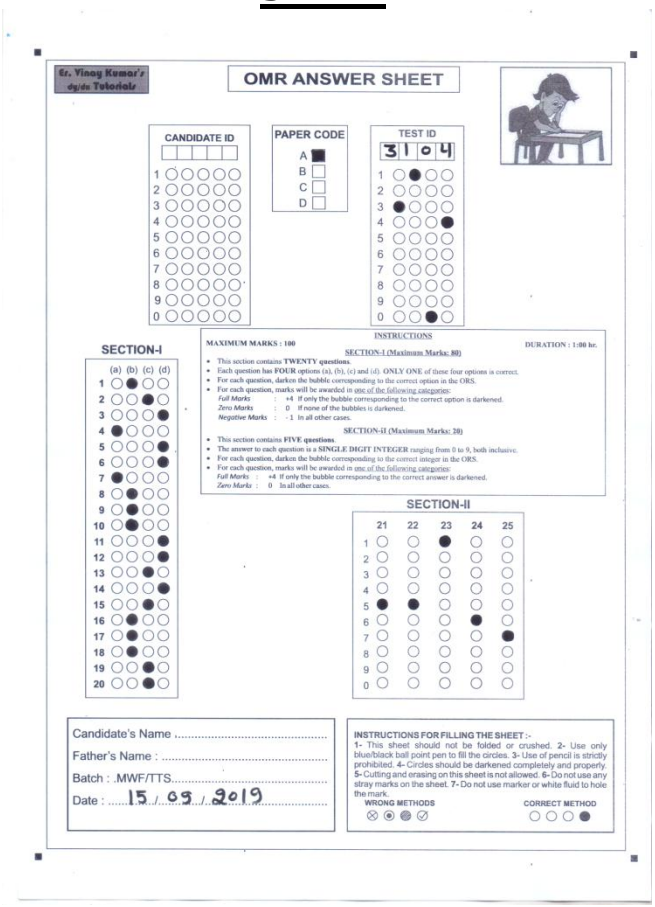
# SET-A




**Q1.** Zero error = - (N + n × LC)

= - (0+5 × 0.1) = - 0.5 mm

**Q2.** $LC = \left(\frac{n-n'}{n}\right)1M = \left(\frac{10-9}{10}\right)\times 1\,mm = 0.1\,mm$

Edge of the cube

= N + n × LC=10mm + 1 × 0.1=10.1 mm

= 1.01 cm

Volume = $(1.01)^3$=1.03 $cm^3$ (balancing the significant figures)

Density

$= \frac{mass}{volume} = \frac{2.736}{1.03} = 2.656$

=2.66 g/cc (balancing the sig. figures)

**Q3.** $LC = \left(\frac{n-n'}{n}\right)1M = \left(\frac{10-9}{10}\right)\times 1\,mm = 0.1\,mm$

= 0.01 cm

Zero error = + (N + n × L.C.)

= + (0+5 × .01) = + 0.05 cm

Reading of length = N + n × LC = 3.2 + 4 × .01

= 3.2 +.04 = 3.24 cm

True length of the cylinder = 3.24 – (+0.05)

= 3.24 – 0.05 = 3.19 cm

**Q4.** Reading $= N + n \times LC = 2 + 31 \times \frac{0.5}{100}$

= 2+0.155 = 2.155 mm

**Q5.** $z = lnx^2 y \;\Rightarrow\; z = lnx^2 + \ln y$

$\Rightarrow\; z = 2lnx + lny \;\Rightarrow\; \Delta z = 2\frac{\Delta x}{x} + \frac{\Delta y}{y}$

$\Rightarrow\; \Delta z = 2 \times \frac{1}{100} + \frac{2}{100} = 0.02 + 0.02 = 0.04$

**Q6.** $y = a - b \;\Rightarrow\; \Delta y = \Delta a - \Delta b$

$\Rightarrow\; \frac{\Delta y}{y} = \frac{\Delta a - \Delta b}{a - b}$

Max. error

$\Rightarrow\; \frac{\Delta y}{y} = \frac{\Delta a + \Delta b}{a - b} = \frac{\frac{2}{100}\times 5 + \frac{3}{100}\times 3}{5-3}$

$= \frac{0.1 + 0.09}{2} = \frac{0.19}{2} = 0.095$

% error $= \frac{\Delta y}{y} \times 100 = 0.095 \times 100 = 9.5\%$

**Q7.** $P = \frac{a^3 b^2}{c\sqrt{d}}$

$\Rightarrow$ max. % error

$\Rightarrow\; \frac{\Delta P}{P}\times 100 = 3\frac{\Delta a}{a}\times 100 + 2\frac{\Delta b}{b}\times 100 + \frac{\Delta c}{c}\times 100$

$+\frac{1}{2}\times\frac{\Delta d}{d}\times 100$

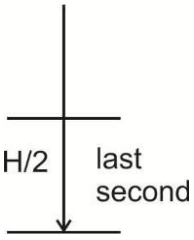
$= 3\times(1\%) + 2\times(3\%) + (4\%) + \frac{1}{2}\times(5\%)$

= 3 + 6 + 4 + 2.5 = 15.5%

**Q9.** $S_T = \frac{1}{2} g\,(2T-1)$

$\Rightarrow\; \frac{H}{2} = \frac{1}{2} g\,(2T-1)$ …….. (1)

$H = \frac{1}{2} g\,T^2$ …….. (2)




$\frac{(1)}{(2)} \;\Rightarrow\; \frac{1}{2} = \frac{2T-1}{T^2}$

$\Rightarrow\; T^2 = 4T - 2 \;\Rightarrow\; T^2 - 4T + 2 = 0$

$$T = \frac{4 \pm \sqrt{16 - 4\times1\times2}}{2} = \frac{4 \pm \sqrt{8}}{2}$$

$$= \frac{4 \pm 2\sqrt{2}}{2} = 2 \pm \sqrt{2} \;\Rightarrow \text{ possible}$$

$$T = 2 + \sqrt{2} \; > 1 \text{sec.}$$

**Q10.** $S = ut + \frac{1}{2}at^2$

$$\Rightarrow \; S = (+4.9)\times2 + \frac{1}{2}(-9.8)\times2^2$$

= 9.8 – 2× 9.8 = - 9.8 m

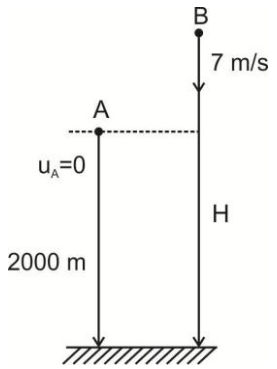
Height = 9.8 m

**Q11.** **For body A**

$$2000 = \frac{1}{2}gT^2$$

$$\Rightarrow \; 2000 = \frac{1}{2}\times10\times T^2$$

$$\Rightarrow \; T^2 = 400 \;\Rightarrow T = 20 \text{sec.}$$




**For body B**

$$H = 7T + \frac{1}{2}gT^2$$

$$= 7\times20 + 2000 = 2140\, m$$

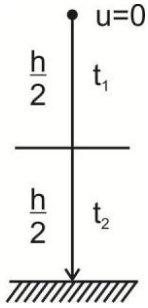
**Q12.** $\frac{h}{2} = \frac{1}{2}gt_1^2$ ……..(1)

$$h = \frac{1}{2}g(t_1 + t_2)^2 \;\ldots\ldots\ldots(2)$$

$$\frac{(1)}{(2)} \;\Rightarrow\; \frac{1}{2} = \frac{t^2}{(t_1 + t_2)^2}$$

$$\Rightarrow \; \frac{1}{\sqrt{2}} = \frac{t_1}{t_1 + t_2} \;\Rightarrow\; t_1 + t_2 = \sqrt{2}\, t_1$$

$$\Rightarrow \; t_2 = (\sqrt{2} - 1)\, t_1$$



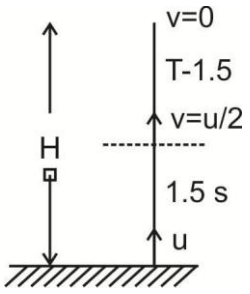

**Q13.** $u = gT$ …….(1)

$$\frac{u}{2} = g\,(T - 1.5) \;\ldots\ldots..(2)$$

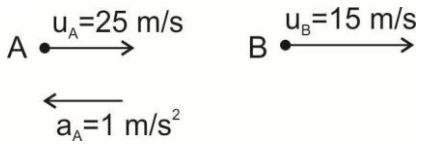
$$\frac{(1)}{(2)} \;\Rightarrow\; 2 = \frac{T}{T - 1.5}$$

$$\Rightarrow \; 2T - 3 = T \;\Rightarrow\; T = 3\text{sec.}$$

$$H = \frac{1}{2}g\,T^2 = \frac{1}{2}\times10\times3^2 = 45\, m$$




**Q14.**




**In frame of A;**

$u_r$ = - (25 – 15) = - 10 m/s

$a_r$ = + 1 m/s²

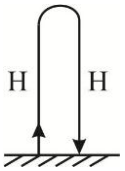
$$v_r^2 = u_r^2 + 2a_r\, s_r \;\Rightarrow\; 0 = (-10)^2 + 2\times1\times s_r$$

$$\Rightarrow \; 2s_r = -100 \;\Rightarrow\; s_r = -50\, m$$

**Q15.** $t_1$ = 4sec, $t_2$ = 6 sec.

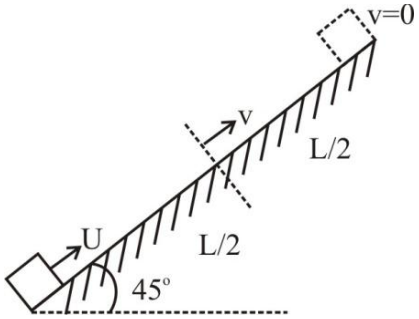
T= $t_1$ + $t_2$ = 4 + 6 = 10 sec.

$$H = \frac{1}{2}g\left(\frac{T}{2}\right)^2 = \frac{1}{2}\times10\times\left(\frac{10}{2}\right)^2 = 125\, m$$




distance $= 2H = 2\times125 = 250m$

**Q16.**




$$U^2 = 2g\sin45^\circ.L$$

$$= 2\times10\times\frac{1}{\sqrt{2}}\times20\sqrt{2} \;\Rightarrow\; U = 20\text{m/s}$$

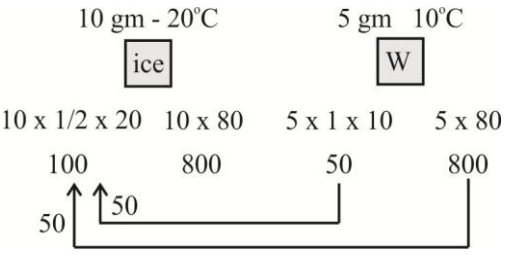
$$U^2 = 2g\sin45^\circ.L \;\ldots\ldots\ldots\ldots (1)$$

$$v^2 = 2g\sin45^\circ.\frac{L}{2} \;\ldots\ldots\ldots\ldots (2)$$

$$\frac{(2)}{(1)} \;\Rightarrow\; \frac{v^2}{U^2} = \frac{1}{2} \;\Rightarrow\; v^2 = \frac{U^2}{2}$$

$$\Rightarrow \; v = \frac{U}{\sqrt{2}} \;\Rightarrow\; v = \frac{20}{\sqrt{2}} = 10\sqrt{2}\text{ m/s}$$

**Q17.**



Let the mass of water freezed be $m \Rightarrow$

$Q = mL \;\Rightarrow\; 50 = m \times 80 \;\Rightarrow\; m = \frac{5}{8}$

Mass of ice infinal mix $\Rightarrow$

$m = 10 + \frac{5}{8} = \frac{85}{8} = 10.6\ gm$

**Q18.** $m \times 0.46 \times (200-100) + m \times 540 + m \times 1 \times (100-70)$

$= (500 + 200 \times 0.08) \times 1 \times (70-20)$

$46\,m + 540\,m + 30\,m = 516 \times 50$

$616m = 516 \times 50 \;\Rightarrow\; m = 41.9\ gm$

**Q19.** $\Rightarrow$ slope $\propto \frac{1}{S}$ ……..(1)

Slope of solid portion $= \frac{2T - T}{t - 0} = \frac{T}{t}$ .....(2)

Slope of liquid portion $= \frac{4T - 2T}{7t - 4t} = \frac{2T}{3t}$ ..... (3)

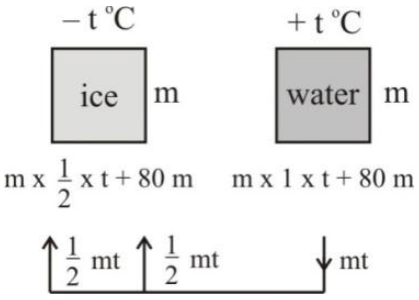
From eq (1)

$\frac{(slope)_{solid}}{(slope)_{liquid}} = \frac{(sp\ heat)\ liquid}{(sp\ heat)\ solid}$

$\Rightarrow \frac{T/t}{2T/3t} = \frac{(sp\ heat)_{liquid}}{(sp\ heat)_{solid}}$

$\frac{(sp\ heat)_{liquid}}{(sp\ heat)_{solid}} = \frac{3}{2} = 1.5$

**Q20.**




ice melted 25% of $m = \frac{25}{100} m = \frac{m}{4}$

heat required for melting of ice⇨$\boldsymbol{Q = mL}$

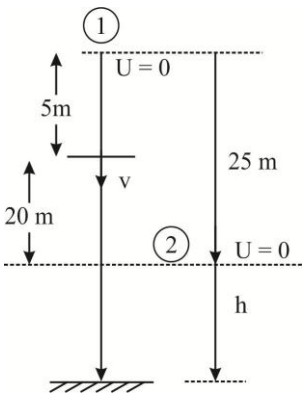
$\Rightarrow \frac{1}{2} mt = \frac{m}{4} \times 80 = \;\Rightarrow\; t = 40^{\circ}C$

**Q21.** Velocity of stone (1) after falling 5m, $v^2 = 2gh$

$\Rightarrow v^2 = 2 \times 10 \times 5 = 100$

$\Rightarrow v = 10\ m/s$

After falling through 5m of (1) the body (2) starts and both have relative distance of 5 m.




In frame of (2) : the relative distance between (1) & (2) is (25 - 5 = 20 m)

$\Rightarrow S_r = -20\ m\ ,\ u_r = v = -10\ m/s$

$a_r = 0$

$S_r = u_r t + \frac{1}{2} a_r t^2$

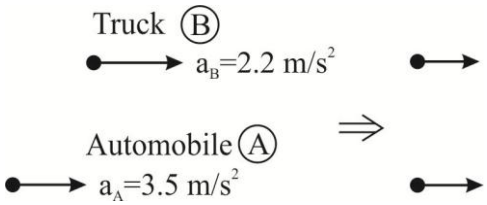
$\Rightarrow -20 = -10 \times t + 0 \;\Rightarrow\; t = 2s$

$h = \frac{1}{2} gt^2 = \frac{1}{2} \times 10 \times 2^2 = 20\ m$

height of tower = 25+20=45 m $\Rightarrow 45 = 9 \times n$

$\Rightarrow n = 5$

**Q22.**



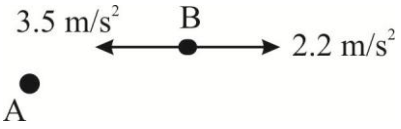

The time taken by the truck in moving 60 m

$\Rightarrow S = ut + \frac{1}{2} at^2 \;\Rightarrow\; 60 = 0 + \frac{1}{2} \times 2.2 \times t^2$

$\Rightarrow t^2 = \frac{60}{1.1} = \frac{600}{11}$ ..... (1)

In the same time the relative distance between the bodies are covered.

In frame of (A) :




$u_r = 0\ ,\ a_r = -(3.5 - 2.2) = -1.3\ m/s^2$

$S_r = U_r t + \frac{1}{2} a_r t^2 = 0 + \frac{1}{2} \times (-1.3) \times \frac{600}{11}$

$= -35.45$ m $\Rightarrow 35.45 = 30.45 + x$

$\Rightarrow x = 5$

**Q23.** In the frame of elevator the speed of ball is 20 m/s upward.

$U_r$ = + 20 m/s $\qquad a_r$ = - (g + a)

$S_r$ = - 5 $\qquad$ = - (10 + 40) = - 50 m/s²

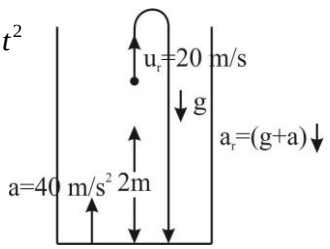
$S_r = U_r t + \frac{1}{2} a_r f^2$

$\Rightarrow -5 = 20\,t + \frac{1}{2}(-50)\,t^2$

$\Rightarrow -5 = 20\,t - 25\,t^2$

$\Rightarrow 25t^2 - 20t - 5 = 0$

$\Rightarrow 25\,t^2 - 20t - 5 = 0$



$\Rightarrow 25t^2 - 25t + 5t - 5 = 0$

$25t(t-1) + 5(t-1) = 0$

t = 1 sec.

**Q24.** Diameter of wire `d' = N + n × L.C.

$= 1 \text{ mm} + 47 \times \frac{1mm}{100} = 1.47\ mm$

$= \frac{1.47}{10}\ cm$

Radius of wire `r' $= \frac{d}{2} = \frac{1}{2} \times \left(\frac{1.47\ cm}{10}\right)$

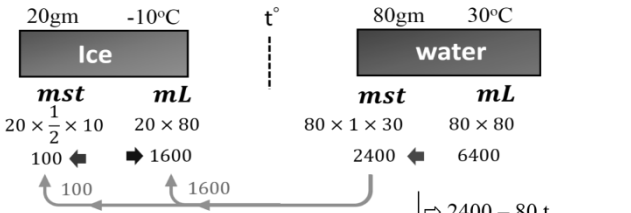
Curved surface area, $A = 2\pi rl$

$= 2\pi \times \frac{1}{2} \times \left(\frac{1.47\ cm}{10}\right) \times 5.6\ cm$

$= 2.586\ cm^2 \Rightarrow 2.6\ cm^2$ [After rounding off to 2 significant digits]

$2.6 = 2.x \Rightarrow x = 6$

**Q25.**




To find temperature of the final mixture:
Let the final temp. be 't'

Heat given by water = heat taken by ice

$80 \times 1 \times (30 - t)$

$= 20 \times \frac{1}{2} \times [0 - (-10)]$ Heat for raising temp. of ice to 0°C

$+20 \times 80$ Heat for melting of ice

$+ 20 \times 1 \times (t - 0)$ Heat which increases temp. of water formed by ice.

⇨ 2400 – 80 t
= 100 + 1600 + 20t

⇨ 100 t = 700

⇨ t = 7°C