ics-2 - 6th advanced

Task

① In 3400 there are 2 significant figures

② In 0.01060 - 3 significant figures

zero after decimal point and Right most and left most end are insignificant.

③ Given error in length = Least count = 0.1 cm. = Δl

$\Delta r = \frac{0.01}{2}$ = [Diameter / 2 = radius]

$l = 4\text{cm}$; $r = 2\text{cm}$.

volume of a rod = $\pi r^2 l$.

% error in volume = $\frac{\Delta V}{V} \times 100 = \left(2 \times \frac{\Delta r}{r} + \frac{\Delta l}{l}\right) \times 100$

$= \left(2 \times \frac{0.01}{2} + \frac{0.1}{4}\right) \times 100$

$= (0.005 + 0.025) \times 100$

$= 0.03 \times 100$

$= 3\%$

④ Given $\frac{\Delta F}{F} = 4\%$; $\frac{\Delta L}{L} = 2\%$.

From pressure = $\frac{F}{A} = \frac{F}{L^2}$

∴ Percentage error $\frac{\Delta P}{P} \times 100 = \frac{\Delta F}{F} \% + 2\frac{\Delta L}{L}$

$= 4\% + 2 \times 2\% = 8\%$.

(5)

Given Percentage error in $I = \frac{\Delta I}{I} = 1\%$

Percentage error in $r = \frac{\Delta r}{r} = 2\%$.

we know Resistance $R \propto \frac{l}{r^2}$

$\therefore$ Percentage error in $R = \frac{\Delta R}{R}\% = \frac{\Delta l}{l} + 2\frac{\Delta r}{r}$

$= 1\% + 2(2\%)$

$= 5\%$

(6)

Given Percentage error in $m = \frac{\Delta m}{m} = 3\%$

Percentage error in $n = \frac{\Delta n}{n} = 5\%$

Given $L = k(m \times n)$

$\therefore$ The percentage Error in $L = \frac{\Delta L}{L}\% = \frac{\Delta m}{m} + \frac{\Delta n}{n}$

$= 3\% + 5\%$

$= 8\%$

(7)

Given Diameter $D = 0.25\ cm \Rightarrow$

Least count = Error in Diameter $= \Delta D = 0.005\ cm$

$\therefore$ % Error in Diameter $= \frac{\Delta D}{D} \times 100 = \frac{0.005}{0.25} \times 100$

$= \frac{0.5}{0.25} = \frac{1}{0.5} = 2\%$

(8)

Given $L \pm \Delta L = (5.5 \pm 0.1)$ cm ; $b \pm \Delta b = (3.5 \pm 0.2)$ cm

∴ Perimeter of a Rectangle $= 2(L+b)$

$= 2[(5.5+3.5) \pm (0.1 \pm 0.2)]$

$= 2(9 \pm 0.3)$

$= (18 \pm 0.6)$ cm

(9)

Given initial temperature $= t_1 \pm \Delta t_1 = 30.4 \pm 0.2\ ^\circ C$

Final temperature $= t_2 \pm \Delta t_2 = 50.6 \pm 0.3$

Rise in temperature $= t_2 - t_1 = 50.6 - 30.4$

$= 20.2$

Error in rise in temperature $\Rightarrow \Delta t = \Delta t_1 + \Delta t_2$

$= 0.2 + 0.3$

$= 0.5$

$\therefore t \pm \Delta t = [20.2 \pm 0.5]^\circ C$

(10)

Given length $l = 50$cm ; Error in length $= \Delta l = 0.25$cm

$\therefore$ Percentage error in length $= \frac{\Delta l}{l} \times 100$

$= \frac{0.25}{50} \times 100$

$= 0.5\ \%$

(13)

Given Distance $= d \pm \Delta d = (20 \pm 0.2)$ m

Time $= t + \Delta t = (4.0 \pm 0.04)$ sec.

Error in distance $= \Delta d = 0.2$ m.

Error in time $= \Delta t = 0.04$ sec

we know velocity $V = \frac{d}{t} = \frac{20}{4} = 5$ m/s

$$\frac{\Delta V}{V} = \left[\frac{\Delta d}{d} + \frac{\Delta t}{t}\right] = \left[\frac{0.2}{20} + \frac{0.04}{4}\right]$$

$$= [1 + 1] = 2$$

$$\frac{\Delta V}{V} = \frac{\Delta d}{d} + \frac{\Delta t}{t}$$

$$\Rightarrow \frac{\Delta V}{5} = \frac{0.2}{20} + \frac{0.04}{4} \Rightarrow \frac{\Delta V}{5} = 0.01 + 0.01$$

$$\Rightarrow \Delta V = 0.2$$

$\therefore$ Velocity of a body $= V \pm \Delta V = (5 \pm 0.1)$ m/s

(14)

(a) Given masses $m_1 = 2.3$ kg ; $m_2 = 41.15$ kg ; $m_3 = 30.19$ gm

Total mass $= m_1 + m_2 + m_3$

$= 2.3 + 0.04115 + 0.03019$ kg

$= 2.37124$

↳ more than 5 so add 1 to 3

$= 2.4$ kg

(b) Trailing zeros in a number with a decimal point are considered significant. eg 2.00 both zeroes significant.

The power of 10 (10^3) does not effect the number of significant figures $\therefore$ eg $2.00 \times 10^3 \rightarrow$ 3 significant figures are there

(15)

(a) 8200 m it is a measurment so all are significant.

(b) 0.0130

1, 3 and 0 at the end is significant because it indicates that the measurement was precise.

(c) $\frac{9.27}{41} = 0.226$ By round off = 0.23

More than 5 add '1' to previous number (ie to 2)

(d) $117.3 \times 0.002 = 0.2346$ By round off = 0.23.

(16)

Given Error in the measurement of length $\frac{\Delta l}{l} = 1\%$

Error in the measurement of radius $\frac{\Delta r}{r} = 2\%$

We know Volume of a cylinder $= \pi r^2 l$

% Error in Volume $\frac{\Delta V}{V}\% = \frac{\Delta l}{l} + 2\frac{\Delta r}{r}$

$= 1\% + 2(2\%)$

$= 5\%$

(17)

Given percentage error in radius $= \frac{\Delta r}{r} = 0.4\%$

∴ Pe volume of sphere $= V = \frac{4\pi}{3} r^3$

% Error in volume of sphere $\frac{\Delta V}{V} = 3\frac{\Delta r}{r}$

$= 3(0.4\%)$

$= 1.2\%$

(18) $6\,347\ km = 63.47 \times 10^3\ m$

$\simeq 6400\ km.$

(19)

Given $l = 25.2\ cm$: $b = 16.8\ cm$.

$\Delta l = \Delta b = 0.1\ cm.$

Area $= l \times b$

$= 25.2 \times 16.8$

Relative error $\frac{\Delta A}{A} = \frac{\Delta l}{l} + \frac{\Delta b}{b}$

$= \frac{0.1}{25.2} + \frac{0.1}{16.8}$

$= 0.00397 + 0.0059$

$= 0.00985$ Rounding off

$\simeq 0.01$

(20) % Error in area $= \frac{\Delta A}{A} \times 100$

$= 0.01 \times 100$

$= 1\ \%$

L Task

CUQ's

(2) (7) Number of significant figures in $2.64 \times 10^{24} m^2$ is 3.

(6) Given Diameter = 0.25 cm.

Least count = Error in Diameter = $\Delta D = 0.005$ cm.

$\therefore$ % Error in Diameter = $\frac{\Delta D}{D} \times 100$

$= \frac{0.005}{0.25} \times 100 = \frac{0.5}{0.25} = 2\%$

Jee Mains level

(4) Given Error in measurement of current = $\frac{\Delta I}{I} = 4\%$

Error in Measurement of voltage = $\frac{\Delta V}{V} = 2\%$

we know $P = VI$

$\therefore$ Error in measurement of Power $\frac{\Delta P}{P} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$

$= 2\% + 4\%$

$= 6\%$

(13) Given $l = 5$ cm; Δl = Least count = 0.1 mm = 0.01 cm

$\therefore$ Percentage error = $\frac{\Delta l}{l} \% = \frac{0.01}{5} = 0.002 \times 100$

$= 0.2\%$

(12)

Given $Q = K L^{-2} M^{2} N^{3}$

also $\frac{\Delta L}{L} = 1\%$; $\frac{\Delta M}{M} = 2\%$; $\frac{\Delta N}{N} = 1\%$

∴ Percentage error in Q $\frac{\Delta Q}{Q} \% = 2\frac{\Delta L}{L} + 2\frac{\Delta M}{M} + 3\frac{\Delta N}{N}$

$= 2(1\%) + 2(2\%) + 3(1\%)$

$= 2 + 4 + 3$

$= 9\%$

(14)

Given Number 57.986 → more than 5

So we add 1 to 8. By rounding it to 4 significant figures we get 57.99

(15)

The value of $\begin{array}{r} 44.800 \\ -\ 21.235 \\ \hline 23.565 \end{array}$ → Equal or more than 5

add 1 to Previous number

∴ Ans = 23.57 ⇒ After rounding off

= 23.6

(16)

Given $\begin{array}{r} 124.2 \\ +\ 52.487 \\ \hline 176.687 \end{array}$ → more than 5 add 1 to 8

176.69 → After rounding off

(17)

The value of $117.8 \times 0.0024 = 0.28152$

Rounding off 0.28152 to 2 significant figures yields 0.28.

(18)

Given $L \pm \Delta L = (6 \pm 0.1)$ cm

$b \pm \Delta b = (4 \pm 0.2)$ cm.

Area of plate $A = L \times b = 6 \times 4 = 24$ cm^2

$$\therefore \frac{\Delta A}{A} = \frac{\Delta L}{L} + \frac{\Delta b}{b}$$

$$\Rightarrow \frac{\Delta A}{24} = \frac{0.1}{6} + \frac{0.2}{4} = \frac{0.4 + 1.2}{24}$$

$$\Rightarrow \Delta A = 1.6 \text{ cm}^2$$

$$\therefore A \pm \Delta L = (24 \pm 1.6) \text{ m}^2$$

(19)

$l_A = 5$cm, $l_B = 7$cm and $\Delta l_A = 0.1$cm $\therefore \Delta l_B = 0.2$cm

Error in total length $= \Delta l_A + \Delta l_B = 0.1 + 0.2 = 0.3$ cm

Error in difference of their lengths are $= \Delta l_A + \Delta l_B = 0.1 + 0.2 = 0.3$cm.

(20)

Given $\frac{\Delta A}{A} = 1\%$; $\frac{\Delta B}{B} = 2\%$; $\frac{\Delta C}{C} = 3\%$; $\frac{\Delta D}{D} = 4\%$

$\therefore$ Percentage error in $x = \frac{\Delta x}{x}\% = 2\frac{\Delta A}{A} + 3\frac{\Delta B}{B} + \frac{\Delta C}{C} + \frac{1}{2}\frac{\Delta D}{D}$

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

$= 2 + 6 + 3 + 2$

$= 13\%$

(23) Given $L_1 = (2.02 \pm 0.01)$ m

$(L_1 \pm \Delta L_1)$

$L_2 + \Delta L_2 = (1.02 \pm 0.01)$.

∴ Error in $L_1 = \Delta L_1 = 0.01$

Error in $L_2 = \Delta L_2 = 0.01$.

Error in $L_1 + 2L_2 = 0.01 + 2(0.01)$

$= 0.03$

(24)

(i) 6.320

6, 3, 2 are significant

0 After decimal point is trailing zero and is also significant

∴ 4 significant figures are there in 6.320

(ii) 0.0006032.

6, 3, 2 are significant

0 in between 6 and 3 also significant

So 4 significant figures are there.

(iii) 48000.50

4, 8, 5 are significant

zeros in between 8 and 5 are significant (3 zeroes)

0 after decimal point at the end of 5 is a trailing zero

so it is also significant

So '7' significant figures are there.

(25)

Given $\frac{\Delta r}{r} = 2\%$

volume of sphere $= V = \frac{4\pi}{3} r^3$

$\therefore \frac{\Delta V}{V} = 3\frac{\Delta r}{r} = 3(2\%) = 6\%$

(26)

Given $\frac{\Delta m}{m} = 2\%$ $\quad \frac{\Delta V}{V} = 3\%$

We know kinetic energy $K.E = \frac{1}{2} m V^2$

$$\frac{\Delta K.E}{K.E} = \frac{\Delta m}{m} + 2\frac{\Delta V}{V}$$

$$= 2\% + 2(3\%)$$

$$= 8\%$$

(27)

Number of significant figures 4.8000×10^4

4, 8 are significant, zeros after decimal point after 8 are trailing zero's so they are significant

$\therefore$ total significant fig $= 5$.

(28)

The value of

$$\begin{array}{r} 124.200 \\ -\ 52.487 \\ \hline 71.713 \end{array}$$

By rounding off $= 71.71$

(29)

Given $L_1 = (2.02 \pm 0.01)\,m$ ∴ $L_2 = (1.02 \pm 0.01)\,m$

Error in $L_1 = \Delta L_1 = 0.01\,cm$ ∴ $\Delta L_2 = 0.01\,m$

∴ $L_1 + 2L_2 \Rightarrow (2.02 + 2(1.02)) \pm (0.01 + 2(0.01))$

$= (2.02 + 2.04) \pm (0.01 + 0.02)$

$\Rightarrow (4.06 \pm 0.03)\,m.$

Error in $L_1 + 2L_2 =$ is $\Delta L_1 + 2\Delta L_2$

$= 0.01 + 2(0.01)$

$= 0.01 + 0.02$

$= 0.03\,m$