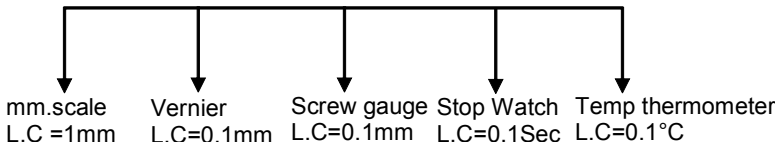


ERROR AND MEASUREMENT

1. Least Count



2. Significant Figures

- Non-zero digits are significant
- Zeros occurring between two non-zeros digits are significant.
- Change of units cannot change S.F.
- In the number less than one, all zeros after decimal point and to the left of first non-zero digit are insignificant
- The terminal or trailing zeros in a number without a decimal point are not significant.



3. Permissible Error

- Max permissible error in a measured quantity = least count of the measuring instrument and if nothing is given about least count then Max permissible error = place value of the last number
- $f(x,y) = x + y$ then $(\Delta f)_{\max} = \max \text{ of } (\pm \Delta X \pm \Delta Y)$

$$\begin{aligned} & \bullet f(x,y,z) = (\text{constant}) x^a y^b z^c \text{ then } \left(\frac{\Delta f}{f}\right)_{\max} \\ & = \max \text{ of } \left(\pm a \frac{\Delta x}{x} \pm b \frac{\Delta y}{y} \pm c \frac{\Delta z}{z} \right) \end{aligned}$$

4. Errors in averaging

- Absolute Error $\Delta a_n = |a_{\text{mean}} - a_n|$
- Mean Absolute Error $\Delta a_{\text{mean}} = \left(\sum_{i=1}^n |\Delta a_i| \right) / n$
- Relative error = $\frac{\Delta a_{\text{mean}}}{a_{\text{mean}}}$
- Percentage error = $\frac{\Delta a_{\text{mean}}}{a_{\text{mean}}} \times 100$

5. Experiments

- Reading of screw gauge
Thicknes of object = Reading of screw gauge

$$= \begin{pmatrix} \text{main} \\ \text{scale} \\ \text{reading} \end{pmatrix} + \begin{pmatrix} \text{circular} \\ \text{scale} \\ \text{reading} \end{pmatrix} \begin{pmatrix} \text{Least} \\ \text{count} \end{pmatrix}$$

$$\text{least count of screw gauge} = \frac{\text{pitch}}{\text{No. of circular scale division}}$$

- Vernier callipers
Thicknes of object = Reading of vernier calliper

$$= \begin{pmatrix} \text{main} \\ \text{scale} \\ \text{reading} \end{pmatrix} + \begin{pmatrix} \text{vernier} \\ \text{scale} \\ \text{reading} \end{pmatrix} \begin{pmatrix} \text{Least} \\ \text{count} \end{pmatrix}$$

Least count of vernier calliper = 1 MSD – 1 VSD