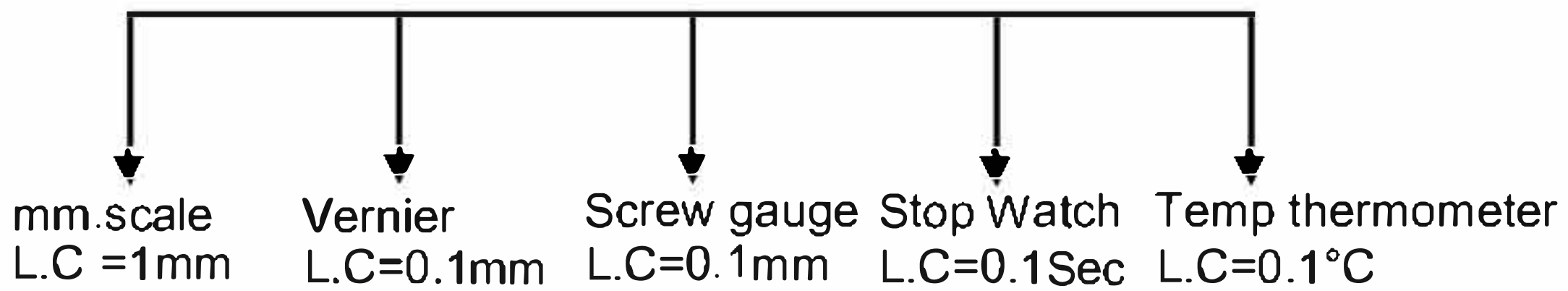


ERROR AND MEASUREMENT

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 $(\Delta f)_{\max} = \max \text{ of } (\pm \Delta X \pm \Delta Y)$

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

4. Errors in averaging

$$\bullet \text{Absolute Error } \Delta a_n = |a_{\text{mean}} - a_n| \quad \bullet \text{Mean Absolute Error } \Delta a_{\text{mean}} = \left(\sum_{i=1}^n |\Delta a_i| \right) / n$$

$$\bullet \text{Relative error} = \frac{\Delta a_{\text{mean}}}{a_{\text{mean}}} \quad \bullet \text{Percentage error} = \frac{\Delta a_{\text{mean}}}{a_{\text{mean}}} \times 100$$

5. Experiments

$$\bullet \text{Reading of screw gauge}$$

$$\text{Thicknes of object} = \text{Reading of screw gauge} = \left(\begin{matrix} \text{main} \\ \text{scale} \\ \text{reading} \end{matrix} \right) + \left(\begin{matrix} \text{circular} \\ \text{scale} \\ \text{reading} \end{matrix} \right) \left(\begin{matrix} \text{Least} \\ \text{count} \end{matrix} \right)$$

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

$$\bullet \text{Vernier callipers}$$

$$\text{Thicknes of object} = \text{Reading of vernier calliper} = \left(\begin{matrix} \text{main} \\ \text{scale} \\ \text{reading} \end{matrix} \right) + \left(\begin{matrix} \text{vernier} \\ \text{scale} \\ \text{reading} \end{matrix} \right) \left(\begin{matrix} \text{Least} \\ \text{count} \end{matrix} \right)$$

$$\text{Least count of vernier calliper} = 1 \text{ MSD} - 1 \text{ VSD}$$