



(True Value)

(Measured value)

$$\text{Absolute error} = \left| \left( \text{True Value} - \text{Measured value} \right) \right|$$

Modulus or Mode

Q. Find out absolute error, relative error and percentage error of the measurements of diameter of a pipe by vernier calipers. Data are 2.25 cm, 2.29 cm, 2.32 cm, 2.18 cm, 2.33 cm.

Soln ~~Find~~ Mean of the measured value ( $\bar{x}$ ) is given by.

$$\bar{x} = \frac{2.25 + 2.29 + 2.32 + 2.18 + 2.33}{5}$$

$$\Rightarrow \bar{x} = \frac{11.37}{5} = 2.274 \text{ cm}$$

$$\Rightarrow \bar{x} = 2.27 \text{ cm}$$

Individual Absolute error is given by

$$\Delta x_1 = |2.27 - 2.25| = 0.02 \text{ cm}$$

$$\Delta x_2 = |2.27 - 2.29| = 0.02 \text{ cm}$$

$$\Delta x_3 = |2.27 - 2.32| = 0.05 \text{ cm}$$



$$\Delta x_4 = |2.27 - 2.18| = 0.09 \text{ cm}$$

$$\Delta x_5 = |2.27 - 2.33| = 0.06 \text{ cm}$$

(2)

$$\begin{aligned} \text{Mean of absolute error} &= \frac{\Delta x_1 + \Delta x_2 + \Delta x_3 + \Delta x_4 + \Delta x_5}{5} \\ &= \frac{0.02 + 0.02 + 0.05 + 0.09 + 0.06}{5} \\ &= \frac{0.24}{5} \end{aligned}$$

$$= 0.048 \text{ cm. Ans}$$

$$\text{Relative Error} = \frac{\text{Mean of absolute error}}{\text{Mean value}}$$

$$= \frac{0.048 \text{ cm}}{2.27 \text{ cm}}$$

$$= 0.0211 \text{ Ans} \checkmark$$

~~$$\text{Percentage error (Relative error)} = \frac{\text{Relative error} \times 100}{\text{Mean value}}$$~~

$$\text{Percentage error (\% error)} = \text{Relative Error} \times 100$$

$$= 0.0211 \times 100$$

$$= 2.11\% \text{ Ans}$$