

- 1 (a) Distinguish between a *systematic* and a *random* error in the measurement of a physical quantity.

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..... [2]

- (b) A travelling microscope fitted with a vernier scale is used to measure the internal diameter of a capillary tube. Fig. 1a and Fig. 1b show the vernier when the microscope is adjusted so that the cross-wires are aligned at opposite ends of a diameter.

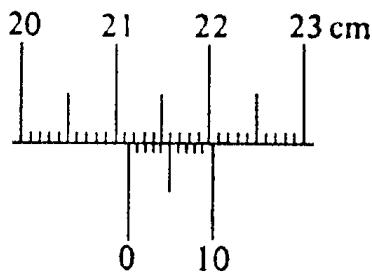


Fig. 1a

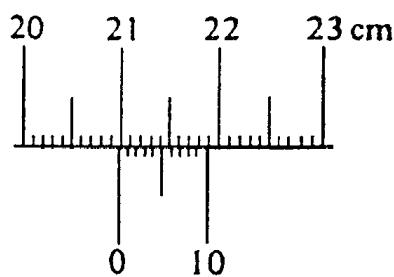


Fig. 1b

- (i) Write down the two vernier readings.

$$\text{Fig. 1a} = \dots \text{cm}$$

$$\text{Fig. 1b} = \dots \text{cm} \quad [1]$$

- (ii) State the absolute uncertainty in a single reading of the vernier.

$$\text{absolute uncertainty} = \dots \text{cm} \quad [1]$$

- (iii) Hence determine the percentage uncertainty in the cross-sectional area of the capillary tube that could arise if it were calculated using these two readings.

$$\text{percentage uncertainty} = \dots \% \quad [2]$$