A1-1: Measurements and Accuracy

Apparatus

Microscope slide; vernier calipers; magnifying glass; micrometer; beam balance with masses; Archimedes' bridge; beaker of water (250ml); metre ruler.

Procedure

For each of the following, record the observations together with the possible error (i.e.: ½ the smallest scale division), e.g.: 46 ± 0.5 mm. Calculate the mean value of repeated readings together with the error. Calculate the % error.

1. Measure the slide thickness in a number of places using the metre ruler.
2. Repeat using the vernier calipers instead.
3. Measure the slide thickness in several places using the micrometer. For a mechanical micrometer, record the 'zero reading' and adjust the other readings correctly.
4. Measure the length l and the width w using the metre ruler. Find the mass of the slide in air m, and then its apparent mass when suspended in water m_a.

Then:

$$\begin{aligned} \text{upthrust} &= \text{weight of liquid displaced} \\ mg - m_a g &= \rho_w \times \text{slide volume} \times g \\ \text{slide volume} &= \frac{m - m_a}{\rho_w} \end{aligned}$$

(where ρ_w = density of water)

Then calculate the slide thickness d since:

$$w \times l \times d = \text{slide volume}$$

When you have completed the above, arrange the estimates of slide thickness in order (most accurate first).

Explain carefully why some methods are more accurate than others.