Topic: 1. Measurements and Uncertainties

Formulae

If $y = a \pm b$
then $\Delta y = \Delta a + \Delta b$

If $y = \frac{ab}{c}$
then $\frac{\Delta y}{y} = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta c}{c}$ (Root)

If $y = a^n$ if $\frac{1}{3}$ or $\frac{1}{2}$, Δy is smaller than Δa
then $\frac{\Delta y}{y} = |n \frac{\Delta a}{a}|$ $(\frac{1}{3}\frac{\Delta a}{a})$

$\Delta x = \frac{x_{max} - x_{min}}{2}$

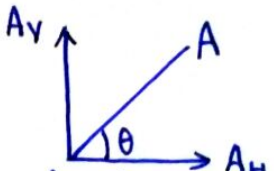
Absolute $= \Delta a$

Fractional $= \frac{\Delta a}{a_0}$

Percentage $= \frac{\Delta a}{a_0} \times 100$

Gradient m, $\Delta m = \frac{m_{max} - m_{min}}{2}$

Δ intercept $= \frac{I_{max} - I_{min}}{2}$



$A_H = A\cos\theta$
$A_V = A\sin\theta$
$A = \sqrt{A_V^2 + A_H^2}$

Required Definitions

Accuracy - accurate when systematic error is small.

Precision - precise when random uncertainty is small. Individual values have small differences from each other.

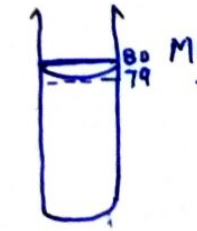
Systematic error - reproducible inaccuracies that are consistently in the same direction. Occur throughout experiment E.g. Graph not going through origin but parallel to the ideal line.) E.g. the electronic scale reads 0.05g too high.

Random error - statistical fluctuations due to precision limitations, where values can be too small or too large, not biased in one direction. E.g. Fluctuating data measurements with a stopwatch (human error).

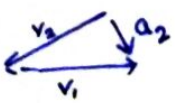
Vector - direction and magnitude. Force, electric field, magnetic field, g. field, momentum, area, angular velocity

Scalar - direction ignored. Only magnitude. Time, e. and g. potential, charge, density, temperature, work / energy / power

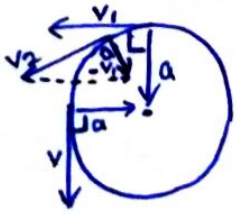
Common Diagrams



Measure from bottom.
79 ✓ 80 ✗

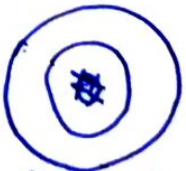


Circle Vectors



Precise ✓
Accurate ✗

Precise ✗
Accurate ✓



Precise ✓
Accurate ✓

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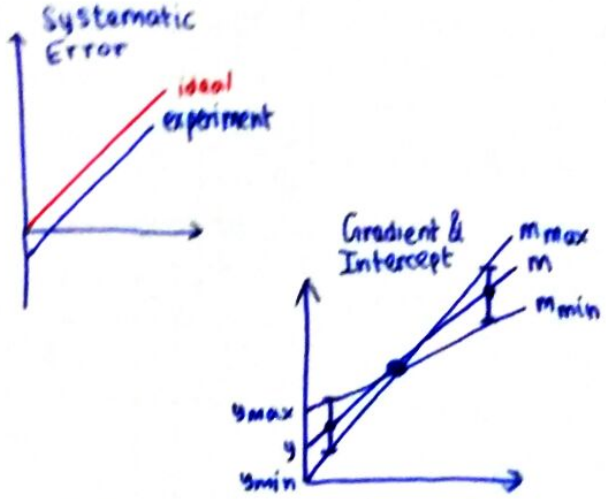
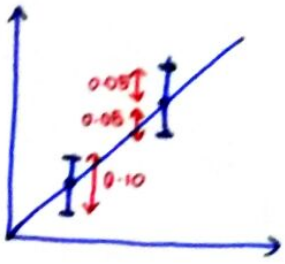
Common Graphs





* $\Delta y = 0.05$

Experiment Summaries

Other Notes Learned From Past Papers

Significant Figures in answers - state original answer and then write in appropriate sigFig.

Use calculator answer for follow-up questions and next parts.

Pass origin = Proportionality is direct $x \propto y$

For linearity, no need to pass through origin. Origin is for proportionality