

phy

Physics

Apparatus Precision, similar to what is found inside Physics Practical Notes.

Apparatus	Smallest Division	Record as...
Read at normal division		
Protractor	1°	
Metre Rule	0.1 cm	
Digital Caliper	0.001 cm	0.01 cm (2dp)
Digital Micrometer Screw Gauge	0.001 mm	0.01 mm (2dp)
Electronic Balance	0.1 g 0.01 g	
Digital Stopwatch	0.01 s	0.1 s (1dp)
Read to <u>half</u> of normal division		
Measuring Cylinder (100 cm ³)	1 cm ³	0.5 cm ³
Burette (not commonly used...)	0.1 cm ³	0.05 cm ³
Spring balance (0 ~ 10 N)	0.1 N	0.05 N
Thermometer (-10 ~ 110°C)	1°C	0.5°C
Ammeter (0 ~ 1 A)	0.02 A	0.01 A
Milliammeter (0 ~ 100 mA)	2 mA	1 mA
Voltmeter (0 ~ 5 V)	0.1 V	0.05 V

SF ERROR (Number Handling):

- + / - round to **lowest dp**
- x / ÷ round to **lowest sf**

Possible practical topics (non-exhaustive):

(a) measurements of length // time interval // volume of solid or liquids // mass and weight // temperature // current and voltage

(b) density of a liquid, or a regularly or irregularly shaped solid, that sinks in water

(c) value of acceleration of free fall

(d) effects of balanced and unbalanced forces

(e) principle of moments

(f) position of the centre of gravity of a plane lamina

(g) factors affecting transfer of energy by thermal processes

(h) law of reflection

(i) position and characteristics of an optical image formed by a plane mirror or a thin converging lens

(j) refraction of light through glass blocks

(k) resistance of a circuit component

science (chem,phy) practical notes

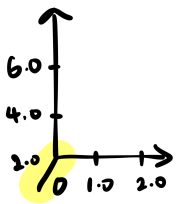
Table drawing (example on the right):

- independent variable is the leftmost column, increase in uniform intervals and as wide as possible for more accurate results
- headings of each column should include both quantity and units (L/cm, V/cm³, t/s etc.)
- calculated data to follow number handling rule

L / cm	time for 20 oscillations			T / s	T ² / s ²
	t ₁ / s	t ₂ / s	t _{ave} / s		
20.0	27.8	27.7	27.8	1.39	1.93
30.0	27.8	28.0	27.9	1.40	1.96
50.0	29.1	27.9	28.5	1.43	2.04
70.0	33.8	33.0	33.4	1.67	2.79
90.0	37.0	37.6	37.3	1.87	3.50

Graph Drawing: remember SLAP

example ref to notes

S – Scale	cover more than ½ of graph paper y & x-axis should have an appropriate & uniform scale
L – Line of best fit	straight line drawn w. sharp pencil, covering as many data points as possible • number & distance of points above and below of best fit line should be about equal gradient calculation • rise / run ($y_2 - y_1 / x_2 - x_1$) ○ positive –  y-intercept ○ negative –  y-intercept • draw dotted triangle on the graph, should cover more than half of the area of data points to minimise error • label gradient coordinates (x, y) ○ should not be from plotted points if anomaly present, to circle and label ‘anomalous’
A – Axes labelling	• x-axis need not start at 0 (show line divider, in yellow)  • check what the question is asking for before plotting ○ if question asks for y-int, the x-axis must start at 0 • x & y-axis labelled with quantity & units (L/cm, V/cm³, t/s etc.) • (y) against (x) ○ use in your title: Graph of (y unit) against (x unit) • origin of (0,0) to label
P – Plotting of points	• mark each point with ‘x’

Sources of errors & improvements

- “identity one source of error in...” – think of: error, affect
- “suggest an improvement...” – think of: error, affect, solution, effect

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Precautions & sources of errors: *most likely to be tested (note: this was from year 2025)*

Type of exp.	Precaution	Source of error & Improvements
light	- optical pins placed at least 5cm apart / upright - mark holes with 'x' - place one eye at same level as pins when viewing - place reflecting surface of mirror on the line - stick metre rule to bench with plasticine - torch, obj, lens, screen in one str. line - light source, obj, centre of lens → same height - torch → horizontal - place lens upright aligned with centre of lens holder - measure object and image distance along a line parallel to principle axis of lens	- thickness of mirror → affect reflection and angle - mirror is very light, shifts easily → error in angle of incidence and reflection - holes by optical pins are large → affect accurate construction of paths of incident and emergent light rays - rectangular glass block has bevelled edged, hard to replace on exact position, hence value of i and r inconsistent. - middle of lens may not coincide with centre of lens, affect image and obj dist - when measure img and obj dist by placing ruler against lens, may shift slightly → affects distances - range of distances sharp, difficult to determine exact position when it is sharpest, affect image dist. - sides of obj not even, affect position of sharp img and img dist.
heat	- provide insulation to container - place thermometer in middle of liquid - stir gently → uniform temp - read when thermometer reading is steady - place measuring cylinder on level surface - place one eye directly in front of liquid level in meas. cyl.	- water stick to side of cylinder → affect vol - time lapse btwn reading of temp & stopwatch → affect temp reading - thermometer response time slower than actual thermometer → affect temp reading

For readings that can reset:

- check that reading is 0 before starting recordings to prevent **zero error**

For manually done readings:

- position eye above apparatus to prevent **parallax error**

During Electricity Experiments:

- Open the switch when not conducting the experiment unless recording data to reduce heating of components (may affect data points!!)

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precautions & sources of error (rest) *(note: this was from year 2025)*

Type of exp.	Precaution	Source of error & Improvements
(pendulum) Oscillations and time taken	- angle of oscillation must be small, e.g 5° - repeat timing and use avg timing, prevent systematic error - ensure bob swings freely in same plane	- human reaction time (random error) → record time for more oscillations taken → reduce percentage error - pendulum with short length, shorter time taken → larger % error to timing (human reaction time) - larger osc obj: presence of air resistance prevents from oscillating freely → inaccurate measurement of time taken - wobbled swing → affects time
measurements	- ensure newton-meter/digital caliper/mmmsg does not have zero error. adjust pointer until at 0 mark / zero the digital caliper/mmmsg - take multiple length measurements at diff positions and take avg readings, obj may not be uniform throughout - ensure metre rule is vertical → place set sq. against rule and bench top - pointer of spring must touch scale of metre rule	- dimensions of obj may not be uniform throughout - ruler cannot be held steadily by hand close to spring, hence measurement must be estimated - as spring stretches, may not be possible to find same reference points to measure length, hence cannot measure consistently - centre of mass of ruler may not be at centre → affect dist. - spring did not oscillate vertically → affect time
moments	- ensure metre rule balanced horizontally by measuring height at each end with another metre rule to be equal	- retort stand provided does not allow small changes to height, metre rule not horizontal, reading of height/length may be higher/lower than actual value - CG of metre rule may not be at midpoint, hence inaccurate measurements of lengths to calculate moments
electricity	- do not switch circuit on for too long - place one eye directly in front of pointer for am/voltmeter - place jockey vertically and firmly on the wire	- current flow →  temp of wire → changes R of wire → affect V and I conduct experiment at high V (low I) // open switch when not conducting experiment - non-uniform thickness of resistance wire (cross sectional area and resistance) → affect V and I - wire not straightened → affect length - contact of jockey on wire not consistent → affect am/voltmeter

credits

credits for those who helped me make these during o-level period (in 2025!):

- my friends
- my school notes
- some of grail's notes!

document is separated into two:

- combined sci (**chem**) practical notes
- combined sci (**phy**) practical notes

all the best for your practical!