PURE PHYSICS

2020 "O" LEVEL REVISION NOTES

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NOTES

PRACTICAL NOTES

RECORDING OF DATA

Addition, Subtraction, Multiplication and Division of Quantities

When doing addition or subtraction of two quantities, express the final answer in the lower of the two decimal points (d.p.)

Example:

- 60.32 cm – 45.0 cm = 15.3 cm (1 d.p.)
- 329.421 m + 67.34 m = 396.76 m (2 d.p.)

When doing multiplication or division of two quantities, express the final answer in the lower of the two significant figures (s.f.)

Example:

- 19.8 m x 0.32 m = 6.3 m^2 (2 s.f.)
- 20.3 m ÷ 12.52 s = 1.62 ms^{-1} (3 s.f.)

This rule only applies if addition, subtraction, multiplication or division is done with the obtained data. It does not apply when doing calculation with the data and a constant (e.g. 20 oscillations). This is because the constant is infinitely precise. Just follow the number of the decimal points or significant figures from the data.

Precision of Apparatus

Take the smallest division in the apparatus and divide it by two to obtain the degree of accuracy of the apparatus (if spacing between the divisions are big).

Common Apparatus Used:

Apparatus	Degree of Accuracy
Metre Rule	0.1 cm or 0.001 m
Vernier Calipers	0.01 cm
Micrometer Screw Gauge	0.01 mm
Electronic Stopwatch	0.01 s
Analogue Stopwatch	0.1 s
Electronic Balance	0.1 g
Spring Balance	0.05 N
Thermometer	0.5 °C
Measuring Cylinder	0.5 cm^3
Protractor	1°
Ammeter (0 – 1 A)	0.01 A
Voltmeter (0 – 5 V)	0.05 V

PRESENTATION OF DATA

- Table of clear headings/unit.
- At least 5 sets of data, unless otherwise stated.
- Consistency – Measured Data – follow precision (decimal places) of instrument, unless otherwise stated.
- Consistency – Processed Data – follow rules stated under Recording of Data.

GRAPH

S – Scale (use appropriate scale) such that the graph covers at least half (preferably 75%) of the graph paper. Label the graph at every 2 cm (1 big square).

L – Line/Curve that is best fit.

A – Axes labelled with quantity/unit.

P – Points plotted with small crosses. Join with best fit line or curve.

CALCULATION

To find gradient from straight line graph.

- Identify 2 points far apart on the straight-line graph. Write down the coordinates on the graph.
- Draw big dotted triangle.
- Show working to calculate gradient. Give your answer according to the rules stated under Recording of Data.

Answering questions that requires to state the relationship between the two quantities in the graph,

- y is linearly related to x with a positive gradient. (If line passes through the origin, permissible to say, y and x are directly proportional).
- When x increases, y decreases thus inversely related.

PRECAUTIONS

General

All experiments that include:

- *Ruler*
- *Ammeter*
- *Voltmeter*
- *Spring Balance*
- *Measuring Cylinder*

1. Prevent parallax error by positioning eyes directly at the reading.

Mechanics

Micrometer Screw Gauge/Vernier Calipers

1. Check and correct for zero error.
2. Tighten the ratchet till you hear a clicking sound to ensure a firm grip when using micrometer screw gauge.

Measuring Length

1. Take 3 readings at different positions of the object. Calculate the average length.

Oscillations

1. Angle of displacement should be small (less than 5 to 10 degrees).
2. Use a data logger to measure the period instead of a stopwatch.

Moments

Pendulum/Balancing Beam

1. Determine centre of gravity.

Optics/Light

Use of Pins

1. Pairs of pins should be at least 5 cm apart.
2. Pins should be placed perpendicular to the pin board.
3. Holes made by pins are small so that light ray is drawn as accurately as possible.
4. Use thinner pins.

Electricity

All electric circuits

1. Switch off the circuit when recording data/not in use to avoid overheating of resistors or wires which affect the results.
2. Solder the connections to keep them fixed and avoid variations in readings of ammeter or voltmeter.

SOURCES OF ERRORS

- Air resistance
- Wobbling of oscillating system
- Loose connections
- Friction between surfaces
- Heat generated by resistors which increase resistance affecting the accuracy of results.
- Heat loss to surroundings
- Error incurred when measuring angle θ due to difficulties in alignment of protractor and string
- String not perpendicular to table
- The angle of oscillation is inconsistent
- Difficult to pin-point the exact location of the centre of gravity
- Metre Rule may not exactly be horizontal thus the reading may be higher or lower than the actual value
- Wire is bent/kinked making measurement of length lesser than the actual value

Just look at the experiment and see what was extremely difficult for you to keep constant that affected the results. Any logical answer is possible.

PLANNING

- Aim of Experiment
- Variables – Dependent and Independent Variables
- List of Apparatus (if no specific apparatuses were stated in the question)
- Setup – Draw a Diagram
- Procedure
- Data – Draw a table and state what kind of a graph must be plotted with two quantities from the table.