Tips and Revision

Alternative to Practical Paper 6

Variables

<u>Independent:</u> The one that you change (normally plotted on the x-axis)

<u>Dependent:</u> Changes because of the changes you make in the independent variable (y- axis)

<u>Control</u> : What you keep the same to ensure that the experiment is fair. (Tip: Imagine you doing the experiment, don't just say keep the same measuring cylinder, keep using the same stop watch – those things are assumed and will not get you mark!)

Example: When investigating the rate of cooling , controls would be keeping the room temp constant, start temperature of water the same, ensuring there are no draughts, keeping the amount of liquid the same and keeping the amount of stirring constant.

Drawing a graph

Usually worth 5 marks:

1) Draw axes correct way round, label axes and include units e.g. Resistance / Ω (Don't write Resistance (Ω), use the forward slash "/")
2) Use appropriate scales so that the graph takes up most of the graph paper available. If your range of values is, for example, 89 to 170, you don't need to start at zero, start at 80. No need for the squiggly line you use in maths either. Do not use an awkward scale to force the graph to take up all of the grid.
3) Plot all points to within ½ small square (examiner checks this very carefully!)
4) Ensure line of best fit (as many points above as below the line). Don't force a line through 0,0 unless the graph should go through the origin (for example this is fine in the case of someone starting a stopwatch at a start line if you're plotting time against displacement).
5) Draw a single, continuous and sharp line.

   Always use a very sharp pencil to plot points correctly and to draw a sharp line.

A straight line shows that x is proportional to y. A straight line through the origin shows that x is directly proportional to y.

Calculating a gradient

- Always draw a gradient triangle which takes up over half the length of the line.
- Show your working out – put numbers into $y_2 - y_1 / x_2 - x_1$

- Gradients have units (unit on the y axis divided by unit of x axis, so for a speed – time graph the unit of the gradient is m/s / s which is m/s^2 which is the unit of acceleration (as you would expect!))

Column headings in tables

Column headings in tables of readings must be headed with the quantity and unit as in these examples: I/A, or t/s, or y/m.

Calculations

Always show answers to 2 or 3 significant figures. Double check all calculations at the end of the test and check that you have given the correct unit.

How to Improve Accuracy / Reliability

When carrying out practical work there are usually measurements that are in some way difficult to take in spite of taking great care. You should comment about these difficulties when asked about precautions taken to improve accuracy.

TIP: Try and imagine or picture yourself carrying out the experiment.

Top tips to improve accuracy:

- How to measure something accurately from a scale: Avoid parallax error!
- Check for zero error. Eg If you're measuring the length of something, make sure the start of the object is in line with the zero on your ruler. Or if using a stopwatch, check it is zeroed first.
- Repeat experiments to identify anomalous errors or to calculate an average.

Some more specific examples:

Hooke's Law experiments / Experiments involving springs

- Avoid parallax error / line of sight error by reading the ruler at eye level
- Always measure from same point on spring (top or bottom of ring)
- Wait for spring/weight to stop bouncing
- Use of horizontal aid/ensure ruler is vertical

In experiments involving the measurement of a length

- Explain how to avoid parallax error
- When measuring heights ensure that the rule is held perpendicular to the base
- Explain how to arrange apparatus so that it is parallel or perpendicular to a bench

In experiments using objects, lenses and a screen

- Ensure each item is aligned so that the centre of each item is at the same height and on the same horizontal straight line.
- Mark the middle of the lens on the bench or on holder
- Perform the experiment in a shaded part of the laboratory
- Avoidance of parallax error

In ray tracing experiments

- Space marker pins so they are at least 60mm apart
- Ensure the pins are vertical
- Draw neat thin lines

In heat experiments

- Choose volume / mass values of the quantities that give large changes in the temperature
- Insulate the container, cover the container
- Position the eye so that the mercury thread appears to touch the scale
- Stir and wait for the highest temperature after stopping heating – wait for thread of mercury to stop moving. Ensure the thermometer bulb is in the liquid while you take the reading.

In electrical experiments

- Check for a zero error
- Always check that connections are clean
- When measuring resistance use low currents / voltages to avoid heating and changing the resistance you are measuring

For oscillations (of a pendulum or vibrating rule) be able to define a complete oscillation

- Time N oscillations, usually N>10 and use the terminology periodic time $T = t / N$
- Explain where the eye should be placed to avoid parallax error.

"Within the limits of experimental accuracy"

There will no doubt be a question on the exam paper asking you if your result is accurate / correct:

Example: You calculate the voltage V_A across 3 lamps to be 1.9V. A student says that V_A should equal V_B which is 2.0V.

The exam question and the answers you should provide are shown below:

State whether the results support this suggestion and justify your answer with reference to the results.

statement .....**if it is close to the published value say "Yes", if not "No** ……………………

justification…… **It is (not) within the limits of experimental accuracy**................................

Justification

If you are asked to justify a statement that you have made it must be justified by reference to the readings. A theoretical justification in a practical test will not gain marks.

For example:

You are shown the following table which shows the temperature of two different volumes of water.

	volume of water	
	150 cm³	250 cm³
t/	θ/	θ/
0	84	85
30	79	79
60	74	75
90	70	72
120	68	70
150	66	68

Q: State whether the rate of cooling is significantly faster, slower, or about the same when using the larger volume of hot water. Justify your answer by reference to the readings.

Statement: **The rate of cooling is about the same**

Justification: **The 150cm³ beaker cools from 84°C to 66°C in 150 seconds, which is an 18°C drop and the 250cm³ beaker cools from 85°C to 68°C which is a 16°C drop.**

The mark scheme states that you must use numbers in the table to get the mark.

Precaution to achieve a reliable result

A safe thing to say is "Repeat and average". Don't forget to say "and average", just saying repeat won't get you the mark.