Physics Paper 3 Notes
Grass

Planning Exercise

V-CID [1m]

Constant Variables

E.g.:

1. Material of the lens
2. Distance y
3. Type of material of the glass block
4. Length of nichrome wire

☐ At least one constant variable (Not environmental variables, must be controllable)

Independent Variable:

E.g.:

1. Focal length of the different lenses
2. u (Object distance in cm)
3. Vertical height, h/cm

Dependent Variable:

1. Image distance, x
2. v (Image distance in cm)
3. Time taken, T/s for the marble to roll the distance d.

Steps:

mrc (Meaure, Record, Calculate)

1. **Set up the apparatus as shown in the diagram**

⋮ (Describe how to collect the dependent variable)

n. Calculate (whatever you need for graphing [E.g.: $\frac{1}{T^2}$])

$n+1$. **While keeping the key variables constant, repeat steps 2 to k for a total of 6 sets of data for (independent variable) and (dependent variable)**

☐ Copy words from the short experiment instructions. DO NOT change them into your own words.

tgr (Tabulate, plot Graph, conclude Relationship)

$n+2$. Tabulate all the readings of (whatever you need for your graph + what you originally recorded)

$n+3$. Plot a graph of (variable for vertical axis) against (variable for horizontal axis)

$n+4$. If the relationship is true, the graph should [E.g.: show a straight line with a positive gradient cutting through the origin]

$n+5$. To determine (constant in the equation given [E.g.: G in $f = G(\frac{x}{y})$]), calculate the gradient of the graph. (Add somemore stuff if somemore manipulation is needed to determine that constant).

Accuracy and other Notes

- ☐ Literally **everything 3 s.f.**
- ☐ Rmb to put the correct units in the answers.
  E.g.: $t = x\,s$, $E = x\,J$, $c = x\,J/g^{\circ}C$, $G = x$ (The gradient might not have any units attached)
- ☐ Careful of the table labels. Do not put units in your readings or write down the readings for the wrong units.

No.	Instrument	Smallest div	Uncertainty / Accuracy	No. of dp	Examples
1	Ammeter	$0.02A$	$0.01A$	2	$0.20A$, $0.21A$
2	Electronic Balance	$0.01g$	$0.01g$	2	$121.10g$, $121.01g$
3	Metre Rule	$0.1cm$	$0.1cm$	1 in cm	$12.0cm$, $12.1cm$
4	Measuring Cylinder	$1cm^3$	$0.5cm^3$	1	$18.0cm^3$, $18.5cm^3$
5	Spring Balance	$0.1N$	$0.05N$	2	$3.65N$, $3.70N$
6	Stopwatch	$0.01s$	$0.01s$	2	$28.11s$
7	Thermometer	$1\,^{\circ}C$	$0.5\,^{\circ}C$	1	$23.0\,^{\circ}C$, $23.5\,^{\circ}C$
8	Voltmeter	$0.1V$	$0.05V$	2	$1.50V$, $1.55V$

- ☐ Types of relationships / graphs
  1. Directly Propertional – Passes through the origin + Straight line (+/- gradient doesn't matter)
  2. Linearly related (either with +/- gradient) – Doesn't cut origin + Straight line
  3. Inversely Propertional – Looks similar to $\frac{1}{x}$. Well, by definition, it should follow a form of $y = \frac{k}{x}$, where k is constant.

Example Qns

Accuracy

1. Suggest **two** ways in which you assembled the apparatus to make the temperature readings accurate.
   - Ensure that the thermometer is clamped vertically to avoid parallex error.
   - ENsure that the bulb of the thermometer is fully immersed in the oil.
   - Ensure the resistors are fully immersed in the oil.
2. Explain two sources of error in the experimental procedure that cause the value of c_1 to be different from the value of c_2. [c_1 and c_2 are values for specific heat capacity calculated with 2 different ways]
   - Some thermal energy is lost ot the surroundings from the uncovered oil
   - The current reading drops slightly during the experiement as the resistors and the oil gets hotter. (This was an observation when actually conducting the expt)
3. Suggest one reason why the actual length L of the resistance wire in the coil is different from the value calculated in $(h)(i)$ [theoretical calculation from equation given] .
   - The wire on the metre rule cannot be fully straightened
   - There is a section of resistance wire which is not coiled and also not on the metre rule
   - Temperature of resistance wire rose while current was flowing. So, resistance was not constant, and hence, the voltage recorded was affected.
4. Identify any key sourcesof error and explain how the yaffect the accuracy of the readings. [Find refracted angle of a ray of light in glass block expt]
   - The holes made by the pins are rather large. This affects the accuracy in constructing the path of the incident and emergent rays.

- The glass block, with bevelled edges, makes it hard to replace the block on the exact position each time. Thus, the value of i and r may be inconsistent.

5. State ONE key source of error in this experiement. [Resistance Experiment]
   - The temperature of the fixed resistor increases with time.
6. State **one** key source of error for this experiement.
   - The sharpness of the image is an estimation. This affects the accuracy of distance x measured. [Converging Lens Expy]
   - The centre of the lens may not be accurate. This affects the accuracy of distances x and y measured.
7. Explain whether your value for a in **(d)** supports the suggestion made by the student in **(e)**.
   - No. Suggestion in (e) does not take into account the energy lost due to friction.

Comments on Relationship

1. Plot a graph of d against i to find k and hence, comment on the relationship between d and i.
   Ans: d is linearly related to i with a negative gradient.
2. Ues the graph to rdecide the relationship between the voltage and the length of wire, when the current is constant. Explain your answer.
   Ans: The voltage is linearly related to the length of wire when the current is constant, as the graph shows a straight line with a psoitive gradient.