



General Certificate of Secondary Education
2022

Centre Number

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Candidate Number

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Physics

Unit 3: Practical Skills

Booklet A

Foundation Tier



GPY31

[GPY31]

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **30**.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Follow all health and safety instructions.

You may use a ruler, protractor and calculator if required.

The apparatus and materials required to complete the task(s) are provided.

FOR TEACHER USE ONLY

In Experiment 2 it is assumed that the candidate was given help to complete the circuit. If this is **not** the case please tick the box below.

No help was given

☐

Examiner's use only	Marks
Experiment 1	
Experiment 2	
Total Marks	

Experiment 1 Density of a liquid

Introduction

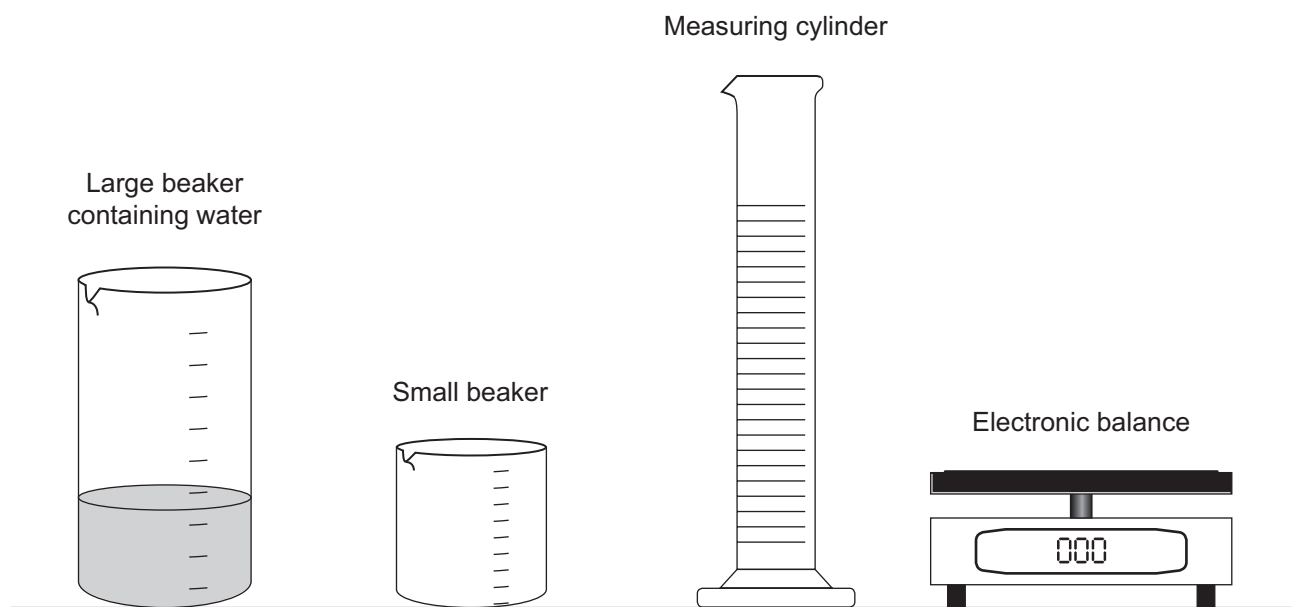
Density is the mass per unit volume. The most accurate way to calculate the density of any solid, liquid or gas is to divide its mass in grammes (g) by its volume in cubic centimetres (cm³).

Aims

The aim of the experiment is to measure different volumes of water and to find their corresponding masses. The results are used to calculate the density of water. A graph will be drawn using the results to show how the mass of water depends on its volume.

Apparatus

The equipment needed for this experiment is shown in the diagram below.



During steps 1, 2 and 3, you can carry out the practical activity individually or in a group of two or three.

Procedure

Step 1

Measure the mass of the small empty beaker using the electronic balance.
Record this result below.

Mass of small empty beaker = _____ g [1]

Examiner Only	
Marks	Remark
<input type="text"/>	<input type="text"/>

Examiner Only	
Marks	Remark

[1]

[2]

Column 2

Volume of water/cm ³	
50	
100	
150	
200	
250	

← Insert column heading here

The teacher will direct you to a place to do this.

Examiner Only	
Marks	Remark

Step 4

Remember, the mass values in **Table 1** include the mass of the small empty beaker that you measured earlier.

Record each measurement in column 2 of **Table 2** below, to which you should add a heading and appropriate unit. [2]

Table 2

Column 1	Column 2	Column 3
Volume of water/cm ³		
50		
100		
150		
200		
250		

Step 5

Calculate the density of water **to one decimal place** for each set of values in **Table 2**.

Use the equation below to calculate the density.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Record the values in column 3 of **Table 2**. Add a column heading with appropriate unit to column 3. [3]

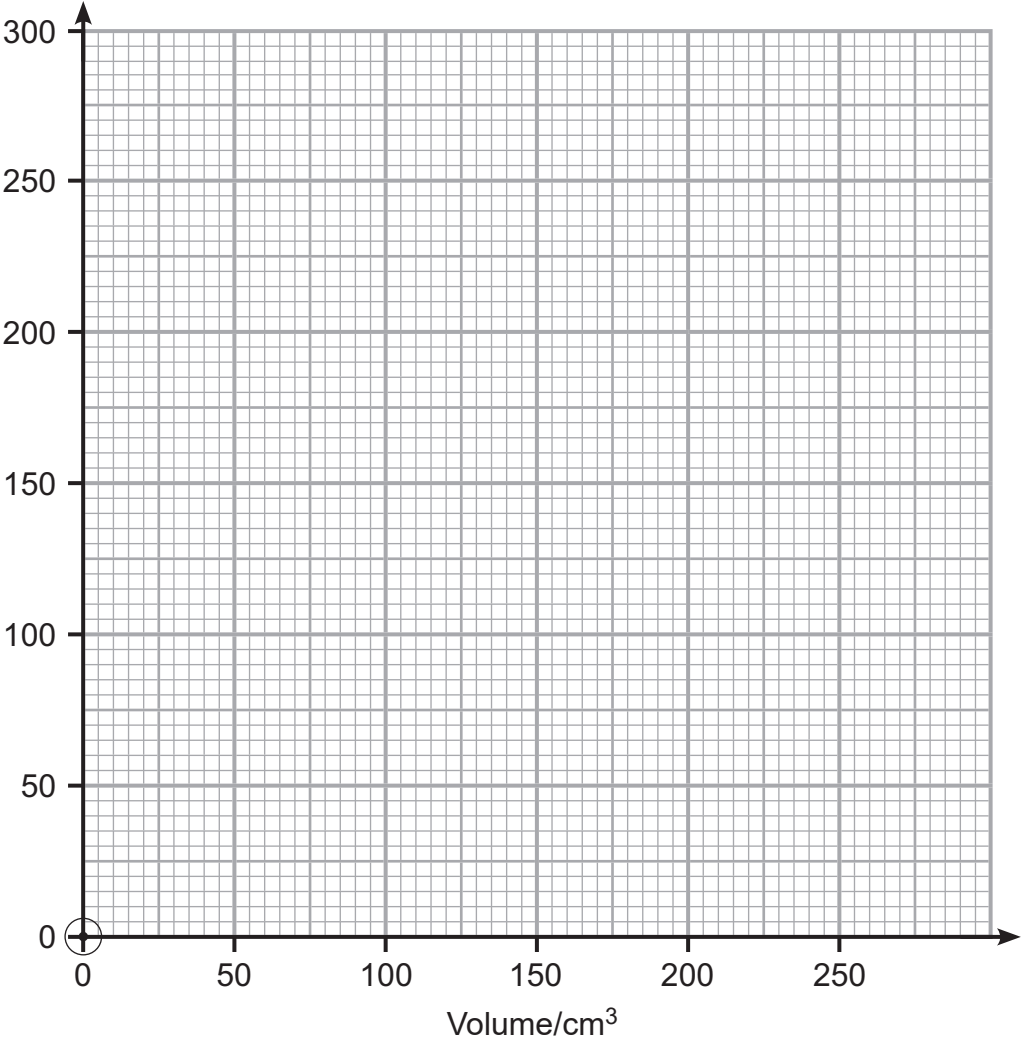
Use the space below for your calculations.

Examiner Only	
Marks	Remark

Interpretation of the data

- 1 Use the values of mass and volume from **Table 2** to plot a graph on the grid below.
Use the vertical axis for the mass and the horizontal axis for the volume.
Label the vertical axis with the quantity and its unit.
Use $\odot$ or $\times$ to clearly show your points.
Draw a straight line of best fit through the points.
The straight line should pass through the origin (0,0) which has been plotted for you.

[3]



Examiner Only	
Marks	Remark
<div></div>	<div></div>

- 2** Name the mathematical relationship between the mass of water and its volume shown by this graph.

 [1]

- 3** Calculate the gradient of the graph and state its unit.

Gradient = _____

Unit = _____ [2]

Experiment 2 Strength of an electromagnet

Introduction

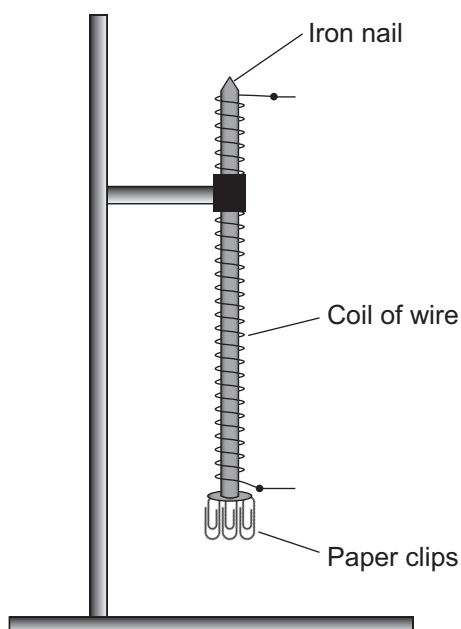
A coil is wrapped around an iron nail. This arrangement of coil and iron nail forms an electromagnet. The strength of the electromagnet depends on the current flowing through the coil.

Aims

The aim of this experiment is to determine the relationship between the strength of the electromagnet and the current flowing through the coil. The strength of the electromagnet will be measured by how many paper clips the electromagnet can lift.

Apparatus

The electromagnet is held in place on a stand as shown in the diagram below.



The diagram opposite shows the circuit diagram for the apparatus.

Part of the circuit has been built for you.

You will complete the circuit by adding a component that will allow you to change the current in the coil.

During steps 1 and 2, you can carry out the practical activity individually or in a group of two or three.

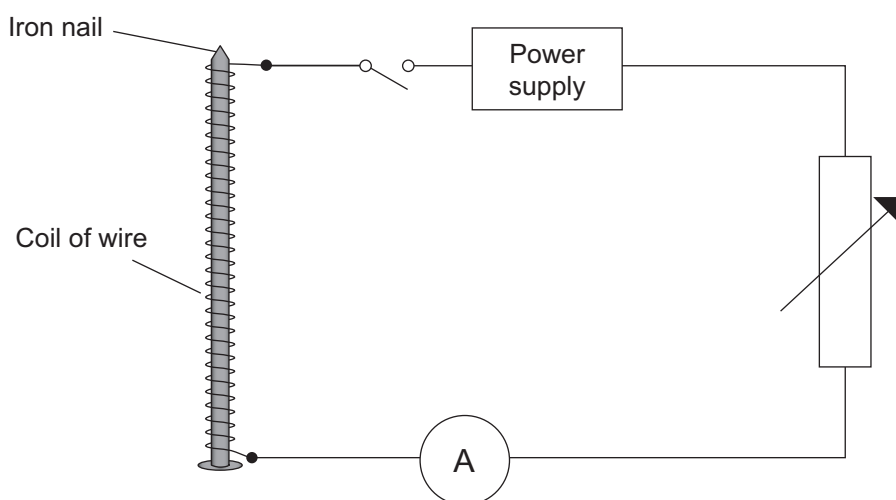
Procedure

Step 1

Complete the circuit described in the diagram below by adding the variable resistor to the correct place.

Before proceeding have the teacher check your circuit.

[2]



If you cannot set up the circuit, raise your hand and tell the teacher, who will then assist you.

You will not then be credited with the two marks for this part of the practical assessment.

Now raise your hand and ask permission to switch on the power supply. Do NOT proceed until permission has been given to you.

Switch on the Power Supply Unit, but do NOT adjust any voltage setting on the power supply unless the teacher gives you permission to do so.

Examiner Only	
Marks	Remark
<input type="text"/>	<input type="text"/>

Step 2

Close the switch and check that you can obtain currents up to 2.0A when you adjust the variable resistor. Now switch the current off.

Trial 1

Switch on the current and adjust the variable resistor to give a current of 0.5A.

Attach as many paper clips as you can to the **bottom** of the iron nail, as shown in the diagram. Record the number of paper clips in the column headed Trial 1 in **Table 3** opposite.

Adjust the current to a value of 1.0A and add more paper clips to the bottom of the iron nail. Record the **total** number of paper clips in the column headed Trial 1 in the table opposite.

Repeat this process by increasing the current to 1.5A and then 2.0A. Record the **total** number of paper clips collected for each current in the column headed Trial 1 in the table opposite.

When you have completed Trial 1, switch off the current after you have recorded the total number of paper clips, and remove all the paper clips from the nail.

[2]

Trial 2

Repeat all the measurements you made in Trial 1 and record your results in the column headed Trial 2 in **Table 3** opposite.

When you have finished, switch off the power supply.

[2]

Examiner Only	
Marks	Remark

Table 3

	Maximum number of paper clips held by electromagnet	
Current/A	Trial 1	Trial 2
0.0	0	0
0.5		
1.0		
1.5		
2.0		

When you have taken all the measurements, or when the teacher tells you that 30 minutes are over, stop using the apparatus.

To complete the remainder of the assessment, you must work alone.

The teacher will direct you to a place to do this.

You must work alone for the remainder of Experiment 2.

Analysis of data

Step 3

For each current, use the values from **Table 3** to calculate the average number of clips. Write these values in **Table 4** below. [4]

Table 4

Current/A	Average number of paper clips held by the electromagnet
0.0	0
0.5	
1.0	
1.5	
2.0	

Examiner Only	
Marks	Remark
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Interpretation of Data

- 1 Which one of the following statements best describes what you have found?

Tick the appropriate box below. Tick (✓) only **one** box.

The average number of paper clips held by the electromagnet decreases as the current increases	
The average number of paper clips held by the electromagnet increases as the current increases	
The average number of paper clips held by the electromagnet does not depend on the current	

[1]

- 2 In the experiment that you carried out, name the independent variable.

_____ [1]

- 3 In the experiment that you carried out, name the dependent variable.

_____ [1]

- 4 In the experiment that you carried out, name two controlled variables.

 _____ [2]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
	

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