



Rewarding Learning

General Certificate of Secondary Education

Centre Number

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Candidate Number

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Physics

Unit 3: Practical Skills

Booklet A

Higher Tier

[GPY33]

Assessment



GPY33

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.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

Examiner's use only	Marks
Experiment 1	
Experiment 2	

Total Marks	
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Experiment 1 Stretching a spring

Introduction

When a mass is hung from a spring it will experience a force. This force causes the spring to extend. The force is increased by adding slotted masses.

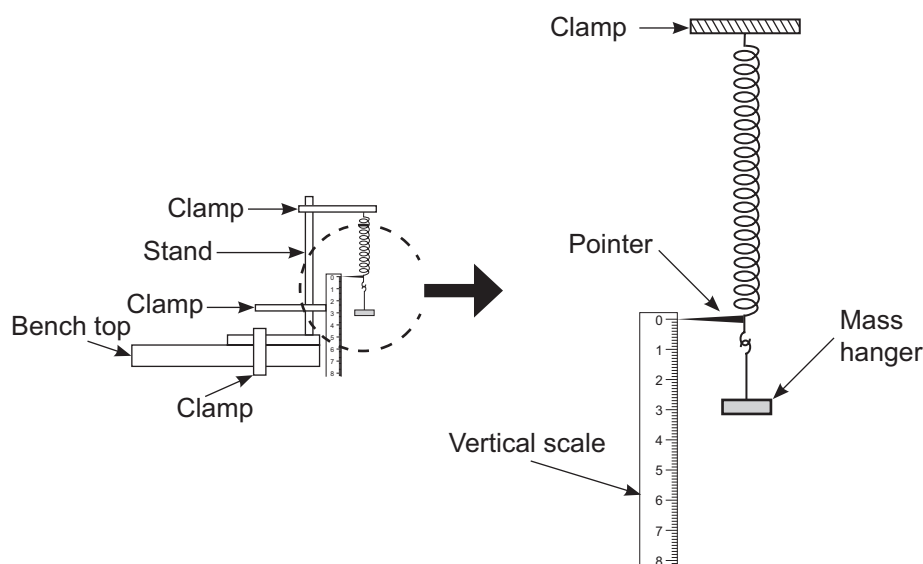
Aims

In the experiment you will investigate how the **extension** of the spring depends on the force applied to the spring. You will repeat this process for increasing force, by adding masses from 100 g to 500 g, in steps of 100 g.

You will plot and draw a graph to show how the extension of the spring depends on the force applied.

You will use the graph to calculate the spring constant.

Apparatus



The apparatus shown in the diagram above has been set up for you.

The bottom of the spring is in line with the 0 cm mark on the metre rule.

A mass hanger is already attached to the spring which you **will not** include in your results.

Procedure

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

Step 1

Add the first 100g mass to the hanger. Record the extension of the spring.

Your measurements should be recorded in cm to one decimal place and added to Column 1 of Table 1, to which you should add an appropriate column heading with unit.

Add another 100g mass and record the **total** extension caused by this 200g mass.

Repeat this until a total mass of 500g has been applied to the spring. [3]

Step 2

Remove all the masses from the spring and ensure that the bottom of the spring returns to the 0 cm mark on the metre rule. Repeat the process again and record your extension measurements in Column 2 of **Table 1**, to which you should add an appropriate column heading with unit.

Record your measurements to **one decimal place**. [1]

Results

Table 1

	Column 1	Column 2
Mass/g		
0	0.0	0.0
100		
200		
300		
400		
500		

← Insert column headings here

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

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

Your teacher will direct you to a place in the room to do this.

Examiner Only

Marks

Remark



For the remainder of Experiment 1 you must work alone.

Analysis of your data

Step 3

Calculate the values of the force due to each of the five masses that you have added.

Record your values of the force in Column 3 of **Table 2** to which you should add an appropriate column heading with unit.

Remember that on Earth a force of 10 N pulls on a mass of 1 kg.

A space has been left below for your calculations, if needed. [2]

Step 4

Using your results from **Table 1**, calculate the average extension for each of the forces and record your calculations in Column 4 of **Table 2**.

Record your average extension values to **one decimal place**.

A space has been left below for your calculations, if needed. [2]

Calculations

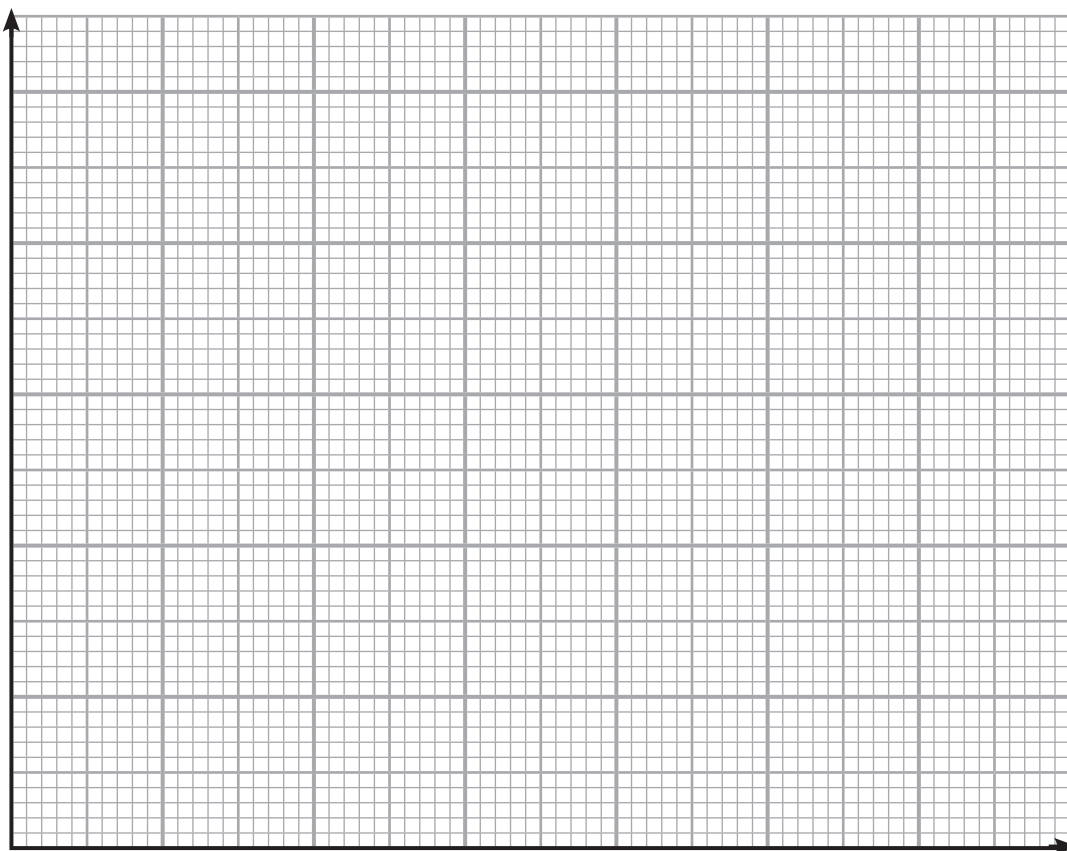
Table 2

	Column 3	Column 4
Insert column heading here →		Average extension/ cm
	0	0.0

Examiner Only	
Marks	Remark
○	○

Interpretation of your data

- 1 Plot, on the grid below, a graph of **force** (y-axis) against **average extension** (x-axis).
Label each axis with the quantity and unit.
Draw a straight line of best fit through your points. [4]



- 2 (i) Find the gradient of your best fit line and state its unit.

Gradient = _____

Unit = _____ [2]

- (ii) What property of the spring is the gradient numerically equal to?

_____ [1]

Examiner Only	
Marks	Remark
○	○

Experiment 2 Refraction of Light

Introduction

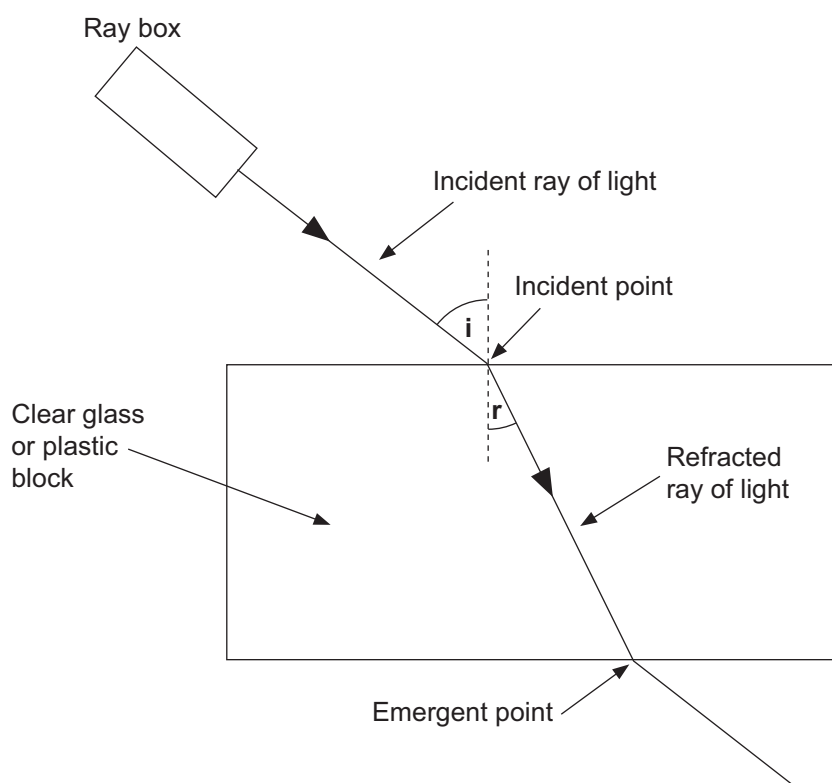
When light passes from air into a block of glass or clear plastic it can change direction. This is called refraction.

Aims

The aim of the experiment is to obtain a range of values of the **angle of incidence** and the **angle of refraction** as the light passes from air into the block.

You will use your measurements to plot a graph of the angle of incidence against the angle of refraction to show how these quantities are related.

Apparatus



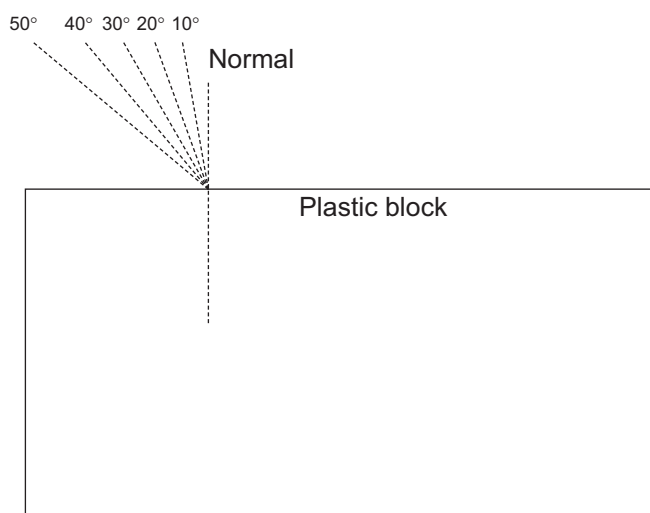
i = angle of incidence r = angle of refraction

Procedure

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

Step 1

You are provided with a sheet of paper on which a number of lines have been drawn from 10° to 50° in steps of 10° . You will use these lines to shine a ray of light into the block at angles of incidence from 10° to 50° in steps of 10° . Place the edge of the block on the marked line. Draw around the block so that you end up with a diagram like the one shown below.



Step 2

Using the ray box, direct a light ray into the block at an angle of incidence of 10° to the normal. The point where the incident ray enters the block is called the incident point. Mark the emergent point where the emergent ray leaves the block. Remove the block. Join the emergent point and incident point to form the refracted ray through the block. Measure the angle of refraction. Record your measurement in **Table 3** opposite. [2]

Step 3

Continue by repeating the experiment for angles of incidence of 20° , 30° , 40° and 50° . In each case, measure the angle of refraction and record these results in **Table 3**. [4]

Examiner Only

Marks Remark



Results



Table 3

Angle of incidence /°	Angle of refraction /°
0	0

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

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

Your teacher will direct you to a place in the room to do this.

Examiner Only	
Marks	Remark
	

Analysis of your data

For the remainder of Experiment 2 you must work alone.

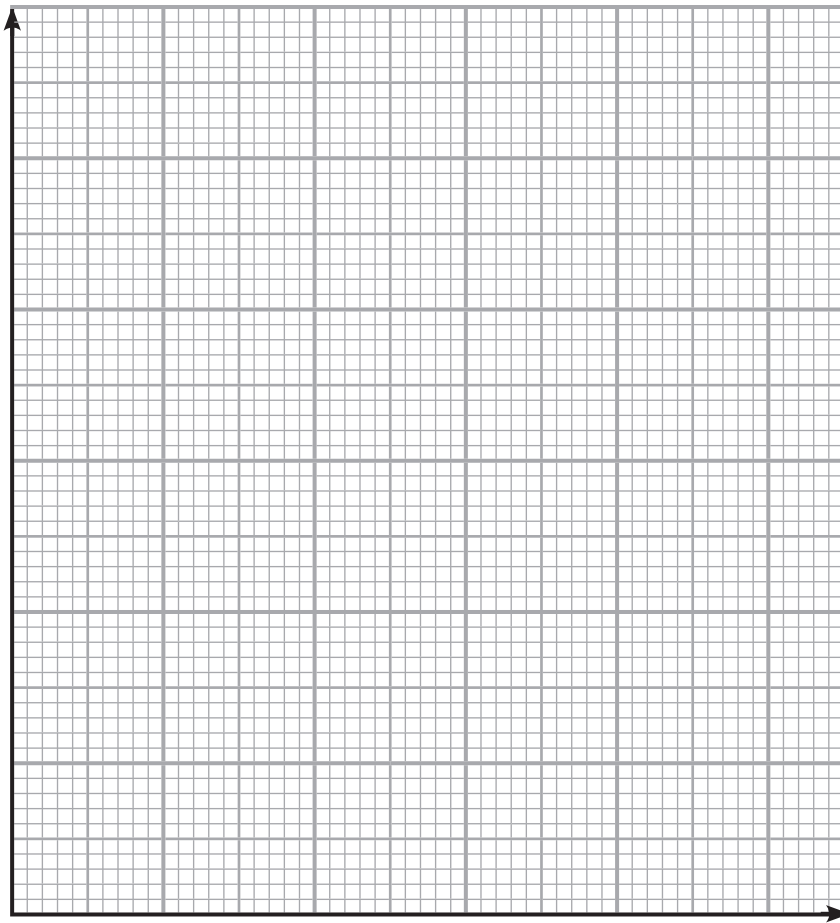
- 1 Plot, on the grid below, a graph of the angle of incidence (y-axis) against the angle of refraction (x-axis).

Make sure you label the x-axis and y-axis with the quantities and their units.

[4]

- 2 Draw a line of best fit through your points.

[1]



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

Interpretation of your data

- 3 The angle of refraction is approximately proportional to the angle of incidence for angles of incidence up to 50° .

What two features of your graph support this?

1. _____
2. _____ [2]

- 4 A student carried out a similar experiment and measured the angle of refraction for angles of incidence greater than 50° . The results are shown in **Table 4**.



Table 4

Angle of incidence/ $^\circ$	Angle of refraction/ $^\circ$
60	35
70	39
80	41

- (i) Using appropriate calculations, show that for the range of angles of incidence used in the table above the angle of refraction is **not** proportional to the angle of incidence.
Use the space below for your calculations.

[2]

Calculations

Examiner Only	
Marks	Remark
	

THIS IS THE END OF THE QUESTION PAPER

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