



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

Foundation Tier

[GPY31]

Assessment



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.

### Assessment Level of Control:

Tick the relevant box (✓)

|                       |  |
|-----------------------|--|
| Controlled Conditions |  |
| Other                 |  |

| Examiner's use only | Marks |
|---------------------|-------|
| Experiment 1        |       |
| Experiment 2        |       |

|                    |  |
|--------------------|--|
| <b>Total Marks</b> |  |
|--------------------|--|

## Experiment 1 Stretching a spring

### Introduction

When a force is applied to the end of a spring it will cause the spring to stretch. In this experiment you will investigate how much the spring stretches for different forces. This is the **extension** of the spring.

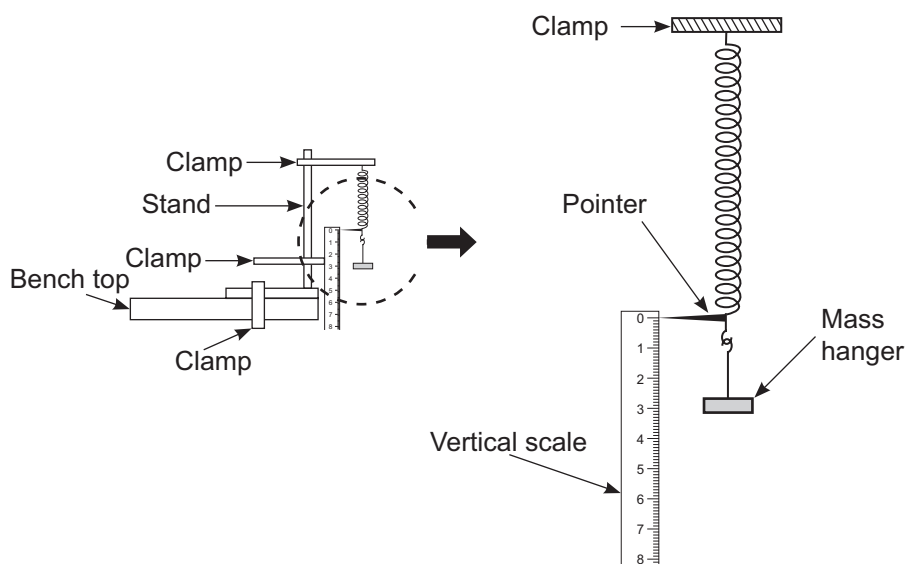
### Aims

The aim of the experiment is to measure the extension of a spring when a force is applied to the end of the spring.

You will repeat this process for increasing forces, from 1 N to 5 N, in steps of 1 N.

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

### Apparatus



Source: Chief Examiner

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 1 N force to the hanger. Record the extension of the spring.

**Your measurements should be recorded to one decimal place and added to column 1 of Table 1.**

Add another 1 N force and record the **total** extension caused by this 2 N force.

Repeat this until a total force of 5 N has been applied to the spring. [3]

### Step 2

Remove all the forces 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 measurements in **column 2 of Table 1.** [3]

## Results

**Table 1**

|          | Column 1        | Column 2        |
|----------|-----------------|-----------------|
| Force/ N | Extension 1/ cm | Extension 2/ cm |
| 0        | 0.0             | 0.0             |
| 1        |                 |                 |
| 2        |                 |                 |
| 3        |                 |                 |
| 4        |                 |                 |
| 5        |                 |                 |

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.



For the remainder of Experiment 1 you must work alone.

**Analysis of your data**

Step 3

Using your results from **Table 1**, calculate the average extension for each of the forces applied to the spring.

Record your calculations in column 3 of **Table 2**.

Record your calculations to **one decimal place**.

*A space has been left below for your calculations, if needed.*

[3]

**Calculations**

**Table 2**

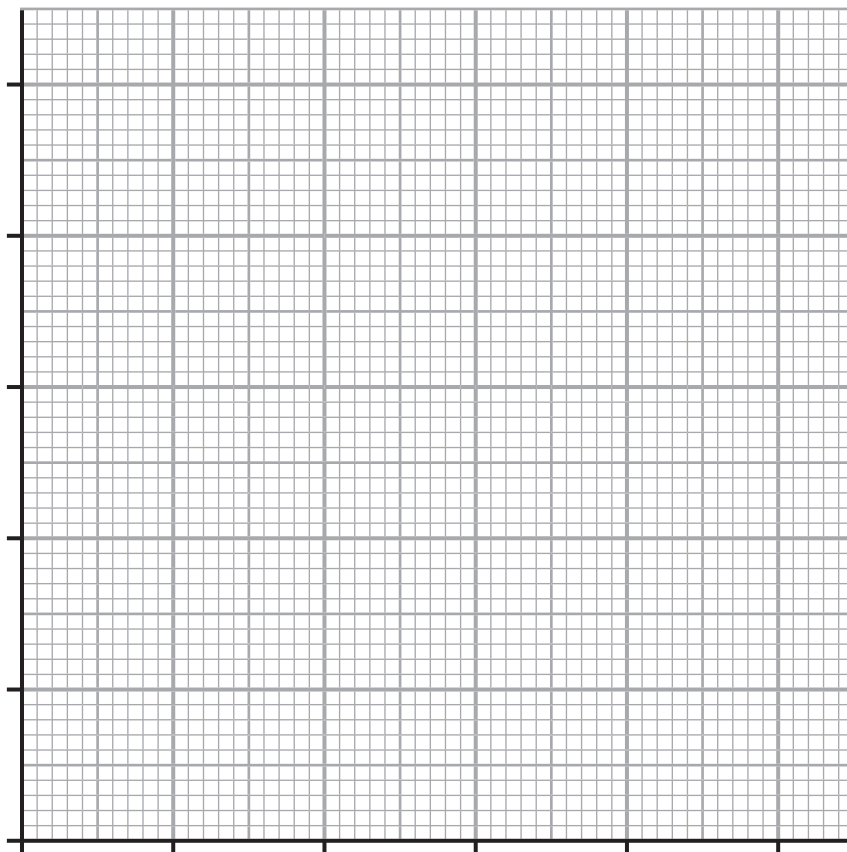
Column 3

| Force/ N | Average Extension/ cm |
|----------|-----------------------|
| 0        | 0.0                   |
| 1        |                       |
| 2        |                       |
| 3        |                       |
| 4        |                       |
| 5        |                       |

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

### 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 Use your graph to clearly state the relationship between the force and the average extension of the spring.  
Explain your answer.

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[2]

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
| ○             | ○      |

## Experiment 2 Refraction of Light

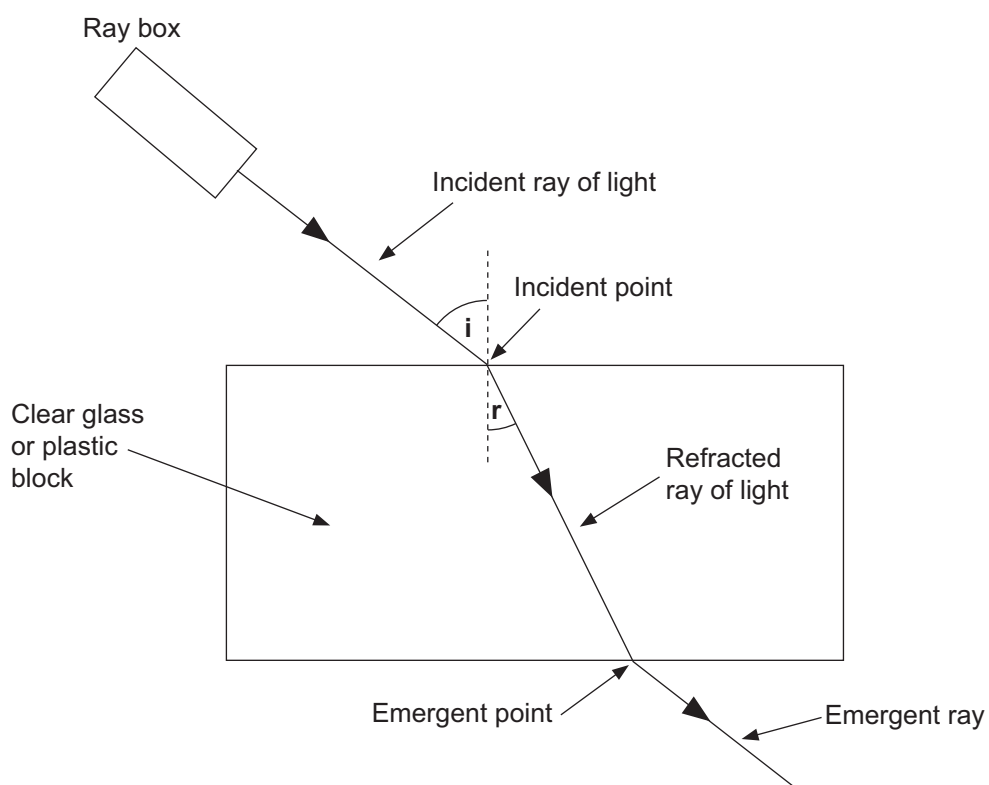
### Introduction

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

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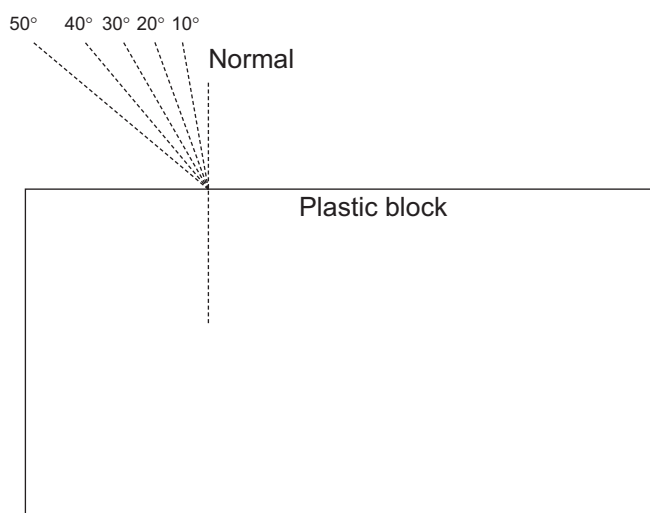
**(Questions continue overleaf)**

## 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  $10^\circ$  to  $50^\circ$  in steps of  $10^\circ$ . You will use these lines to shine a ray of light into the block at angles of incidence from  $10^\circ$  to  $50^\circ$  in steps of  $10^\circ$ . 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  $10^\circ$  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  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$  and  $50^\circ$ . 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                      |
| 10                    |                        |
| 20                    |                        |
| 30                    |                        |
| 40                    |                        |
| 50                    |                        |

**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.**

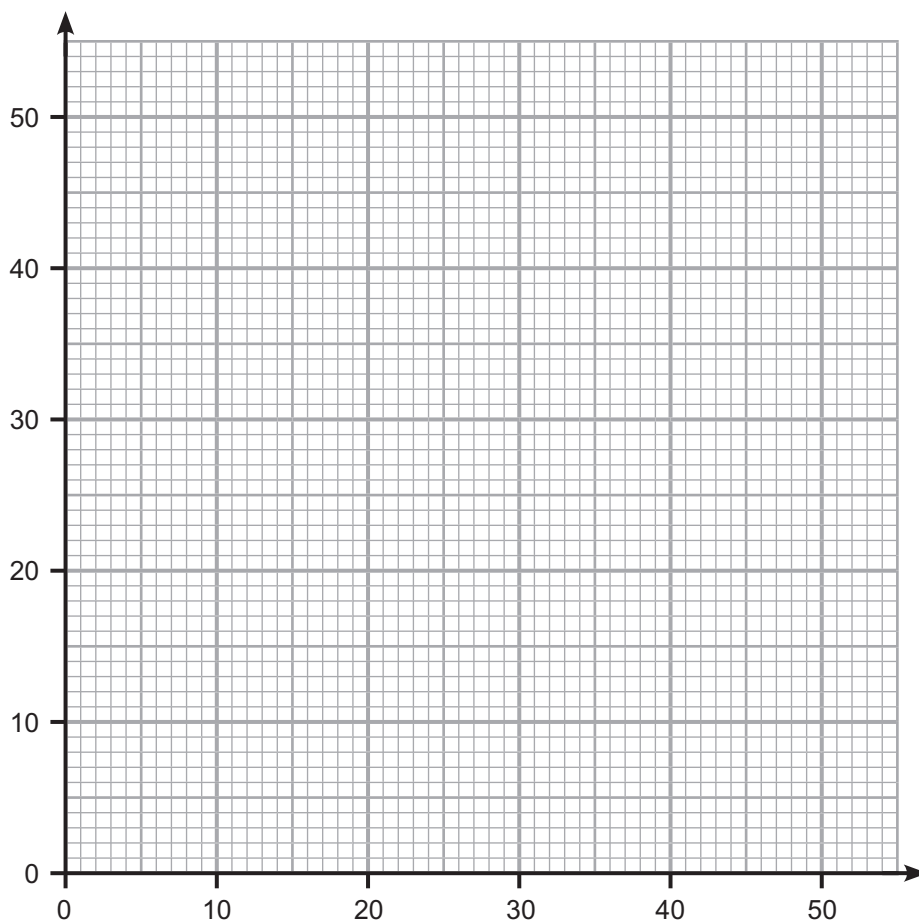
**Your teacher will direct you to a place in the room to do this.**

| Examiner Only   |   |
|---|---|
| Marks   | Remark  |
|  |  |

For the remainder of Experiment 2 you must work alone.

**Analysis of your data**

- 1 Plot, on the grid below, a graph of the angle of incidence against the angle of refraction. Label each axis with the appropriate quantity. [4]
- 2 Draw a line of best fit through your points. [1]



| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
| ○             | ○      |

### Interpretation of your data

- 3 Using your graph, determine the value of the angles of refraction when the angles of incidence are  $24^\circ$  and  $48^\circ$ .  
Record these values in the table below.

| Angle of incidence/ $^\circ$ | Angle of refraction/ $^\circ$ |
|------------------------------|-------------------------------|
| 24                           |                               |
| 48                           |                               |

[2]

- 4 Describe fully, using either your graph or the table above, the relationship between the angle of incidence and the angle of refraction.

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[2]

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**THIS IS THE END OF THE QUESTION PAPER**

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Examiner Only

Marks

Remark



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