Candidate Name	Centre Number					Candidate Number				

GCSE PHYSICS

COMPONENT 2

Applications in Physics

FOUNDATION TIER

SAMPLE PAPER

(1 hour 15 minutes)

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**4**	
	2.	**16**	
	3.	**8**	
	4.	**7**	
	5.	**10**	
Section B	**6.**	**15**	
	Total	**60**	

ADDITIONAL MATERIALS

In addition to this examination paper you will need a calculator, a ruler and a resource booklet.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

This paper is in 2 sections, **A** and **B**.
Section **A**: 45 marks. Answer **all** questions. You are advised to spend about 50 minutes on this section.
Section **B**: 15 marks. Read the article in the resource booklet carefully then answer **all** questions. You are advised to spend about 25 minutes on this section.
The number of marks is given in brackets at the end of each question or part-question.
The assessment of the quality of extended response (QER) will take place in question **5(b).**

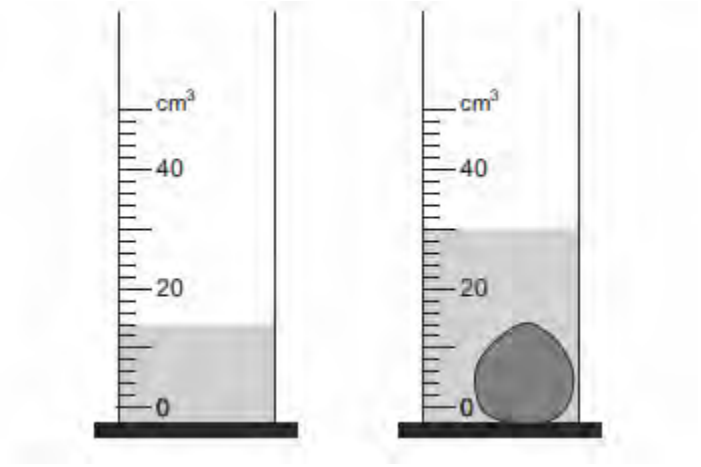
EQUATION LIST

final velocity = initial velocity + acceleration × time	$v = u + at$
distance = ½ (initial velocity + final velocity) × time	$x = \frac{1}{2}(u + v)t$
(final velocity)^2 = (initial velocity)^2 + 2 × acceleration × distance	$v^2 = u^2 + 2ax$
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = mc\Delta\theta$
thermal energy for a change of state = mass × specific latent heat	$Q = mL$
energy transferred in stretching = 0.5 × spring constant × (extension)^2	$E = \frac{1}{2}kx^2$
for gases: pressure × volume = constant (for a given mass of gas at a constant temperature)	pV = constant
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_1I_1 = V_2I_2$

SECTION A

Answer **all** *questions.*

1. A school pupil uses a measuring cylinder to find the volume of a pebble.



(a) Use measurements from the diagrams to **complete the table** below. [1]

Volume of water alone (cm^3)	Volume of water + pebble (cm^3)
.....	.....

(b) Calculate the volume of the pebble. [1]

volume = ... cm^3

(c) The pebble is weighed and is found to have a mass of 40 g. Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

to calculate the density of the pebble. [2]

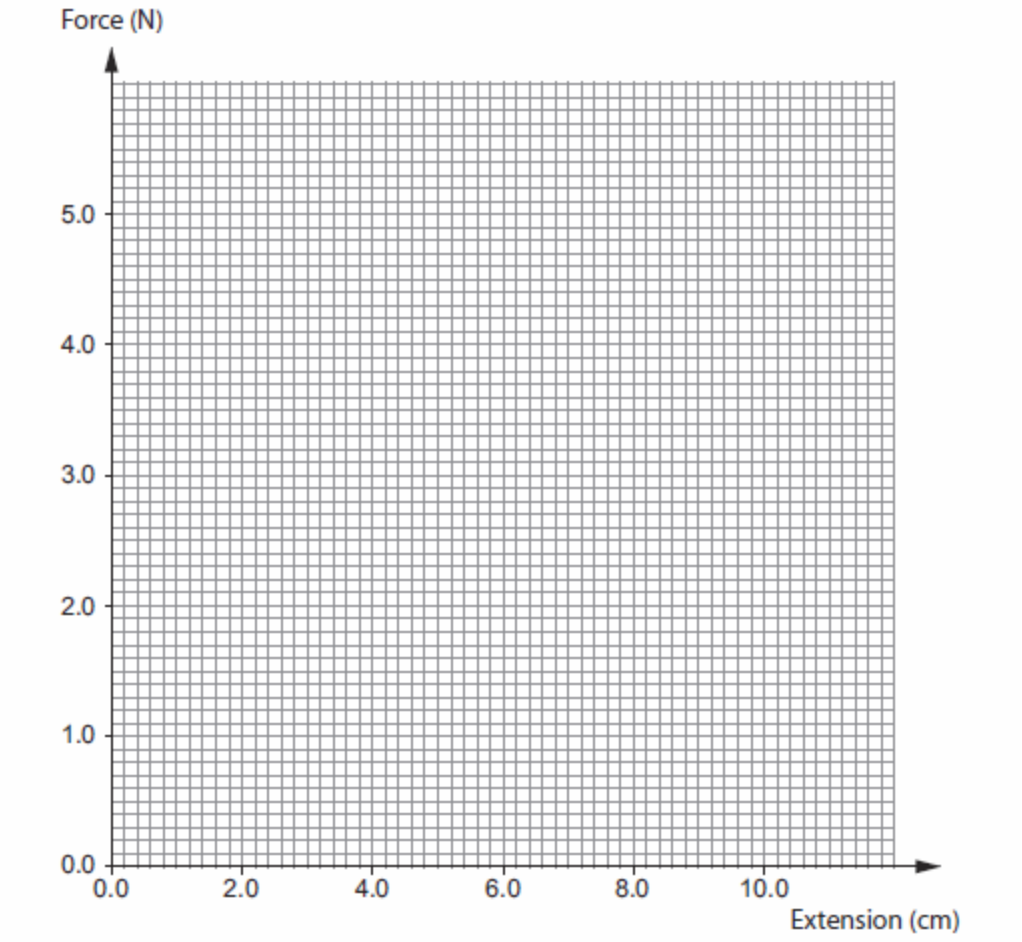
density = ... g/cm^3

4

2. In order to try to make a newtonmeter, some pupils carry out an experiment to find how a spring stretches when loads are hung on it. Forces are applied to the spring and the amount by which it stretches is measured. This is called its extension.

Force applied to spring (N)	Extension (cm)
1.0	2.0
2.0	4.0
3.0	6.0
4.0	8.0
5.0	10.0

(a) (i) Plot the data on the grid below and draw a suitable line. [3]



(ii) An object is then hung on to the spring. The spring stretches 5.0 cm. Use the graph to find the weight of the object. Show on the graph how you obtained your answer. [2]

weight = ... N

(iii) Use the table or the graph to calculate a value for the spring constant. [3]

spring constant = …….N/cm

(b) A conclusion to the experiment is given in the following sentences. Underline the word that correctly completes each sentence. [3]

The extension of the spring is (directly / inversely / not) proportional to the force.

The spring is behaving (plastically / elastically / inelastically).

The spring obeys (Newton's / Hooke's / Ohm's) law.

(c) (i) State how the results and graph show that the value of the spring constant does not change. [1]

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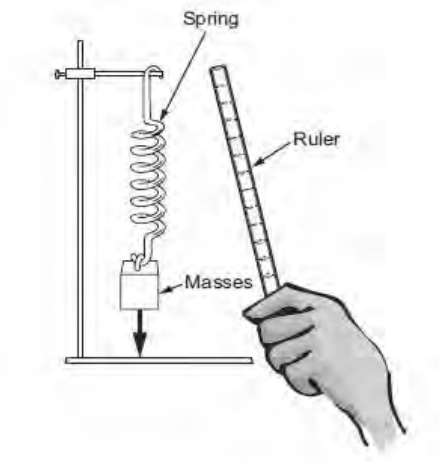
.....

The apparatus the students used is shown below.



(ii) Describe how the students could make measurements of extension using this apparatus. [2]

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(iii) State how the students could make their measurements of extension as accurate as possible. [2]

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16

3. Two students carry out an experiment to measure the speed of sound in air.

A girl stands a distance away from the foot of a cliff and claps her hands. A short time later she hears an echo of the sound and very soon gets into the pattern of clapping at the same instant that the echo is received. Her partner records the number of claps made in 10 s along with her distance from the wall.

The experiment is then repeated for different distances.

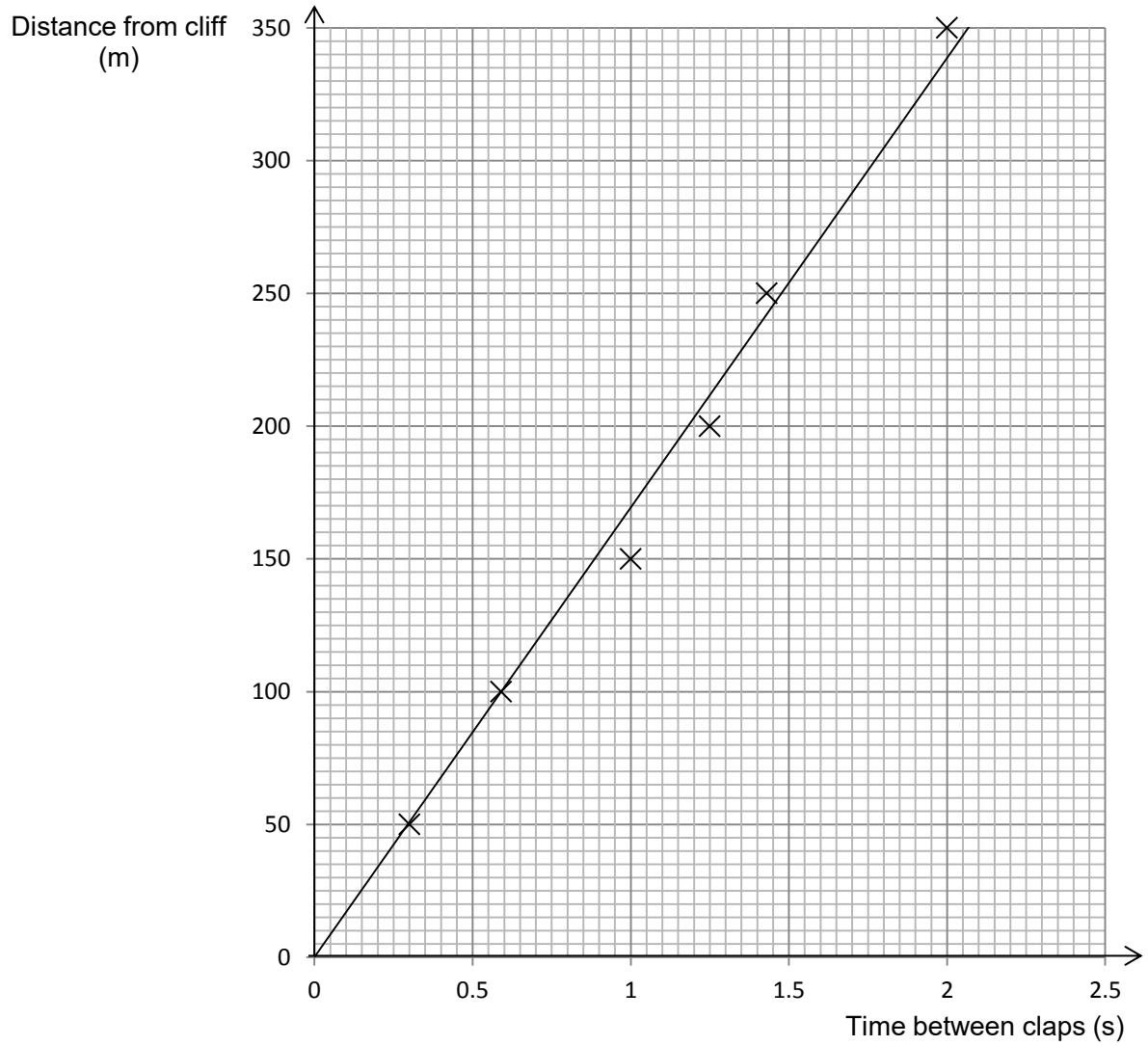
The results are shown in the table below.

Distance from cliff (m)	Time between claps (s)	Number of claps in 10 s
50	0.30	33
100	0.59	17
150	1.00	10
200	……	8
250	1.43	7
350	2.00	5

(a) Calculate the frequency of the claps when the distance from the wall is 50 m. [1]

frequency = ... Hz

(b) The data in the table has been used to plot points on the grid below.



(i) State why the straight line is considered to be a good line of best fit. [1]

.....

.....

(ii) The gradient of a distance-time graph gives a value for the speed. Calculate the speed shown by the graph. [2]

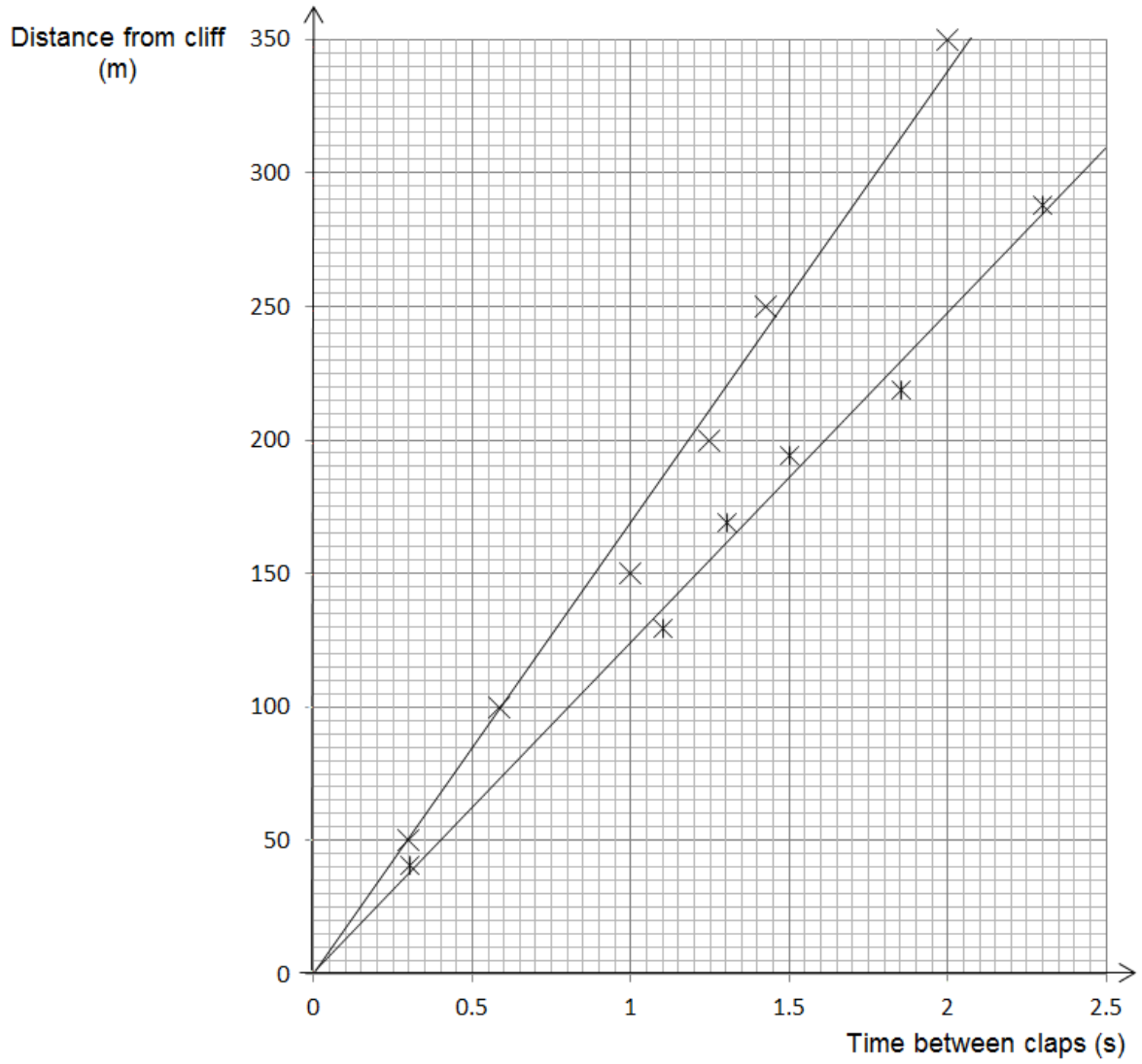
speed = ... m/s

(iii) The speed of sound in air has a value of about 340 m/s. Compare your answer to part (b)(ii) and suggest a reason for the difference. [2]

.....

.....

(c) A second group of students obtained the results shown on the lower line.



Comment on whether the results of the experiment are reproducible or not. [2]

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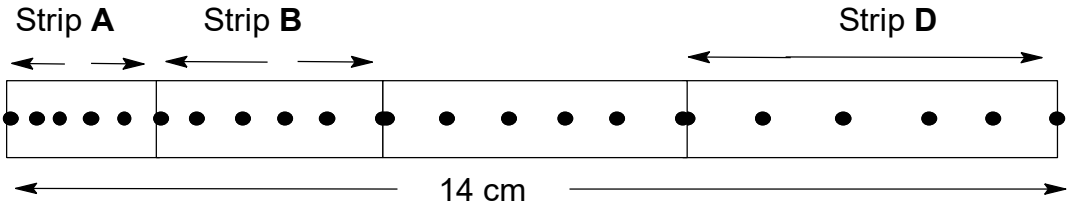
4. One way of analysing motion in a physics lab is to user ticker tape.

A long tape is attached to a moving trolley and threaded through a device that places a tick upon the tape at regular intervals of time.

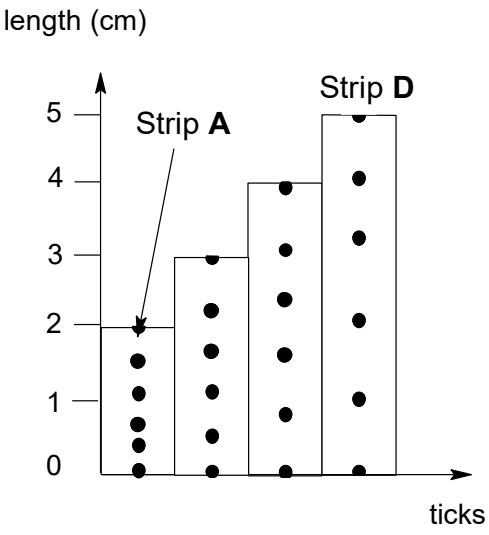
The movement of a trolley down a slope was investigated using ticker tape with a frequency of 50 Hz. The ticker tape produced 50 dots per second.

The 14 cm length of the ticker tape was cut into four strips. It was cut through the middle of the first and then the sixth hole.



Start

The four cut lengths of ticker tape are shown below.



(a) (i) What is meant by acceleration? [1]

……

(ii) How would the appearance of ticker tape be different if the trolley moved at constant velocity? [1]

……

(iii) Calculate the time that it took for each strip to form and hence show that the **mean velocity** of the trolley in the strip marked **A** was 20 cm/s. [2]

(b) The mean velocity of the trolley in strip **B** was 30 cm/s. Select a suitable equation from page 2 to calculate the acceleration of the trolley. [3]

acceleration …….cm/s^2

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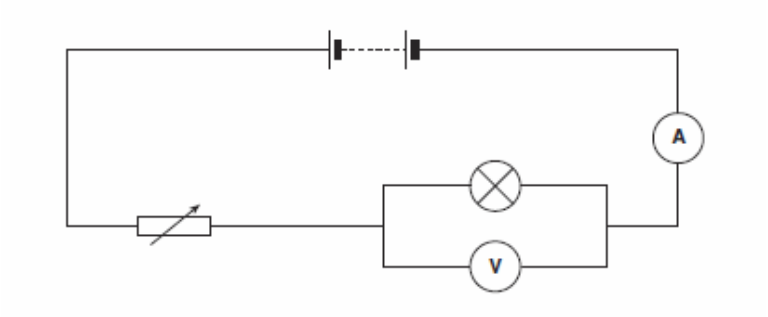
5. A class of students is told that the resistance of a lamp changes when the current through it is changed.

Some of the students wanted to find out how the resistance changes, so they set up the following circuit which shows a lamp connected to other circuit components.



(a) Answer the questions based upon this circuit.

(i) State the purpose of the components marked Ⓐ and Ⓥ in the diagram above. [2]

……

……

(ii) State how increasing the resistance will change the current in the circuit. [1]

……

(iii) A variable voltage power supply is used in place of the battery. State which component in the above circuit would no longer be needed. [1]

……

(b) The students are then asked to write instructions so that others could set up the circuit shown.
Write these instructions in detail explaining how the components in the circuit are connected together. [6 QER]

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SECTION B

Read the article in the resource booklet carefully and answer **all** *the questions that follow.*

6. (a) Explain how the shape of the blades creates a force on the wind turbine blades. [2]

.....

.....

(b) A wind turbine of blade diameter 80 m is placed at an altitude of 160 m.

(i) Calculate the swept area of the blades. [2]

swept area = ... m^2

(ii) Calculate the mean kinetic energy/second delivered to the turbine. [3]
(Use wind speed^3 = 1 300 m^3/s^3)

mean kinetic energy/second = ... J/s

(c) (i) Use the information in **Table 1** to answer the questions below.

I Describe how the annual mean wind speed varies with altitude. [1]

.....

.....

II Explain why altitude will affect the maximum power output of a wind turbine. [2]

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(ii) Use the information in **Table 2** to explain why the power output of the wind turbine will be different in summer and winter. [2]

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(d) Describe the benefits and drawbacks of meeting more of the demand for electricity with wind power in the future. [3]

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