Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						7 5 4 0 / 0 2	Signature	

Paper Reference(s)

7540/02

London Examinations GCE

Physics

Ordinary Level

Paper 2

Monday 11 January 2010 – Morning

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
Total	

Materials required for examination	**Items included with question papers**
Nil	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.

Information for Candidates

Calculators may be used.
Where necessary, assume the acceleration of free fall, $g = 10$ m/s^2.
The total mark for this paper is 100. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
This paper has 5 questions. All blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.
In calculations, show **all** the steps in your working.

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Answer ALL the questions.

1. This question is about centre of gravity, elastic behaviour and density.

(a) The triangular prism shown in **Diagram 1** has its centre of gravity at the point labelled **X**.

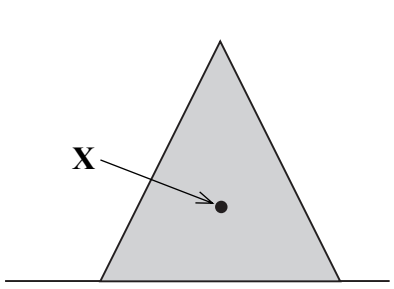

Diagram 1

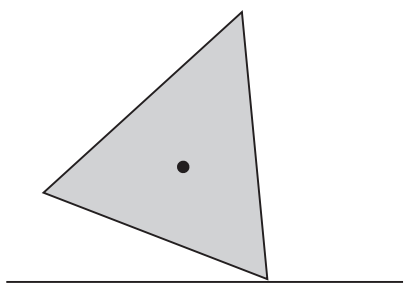

Diagram 2

(i) What is meant by the term centre of gravity?

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(2)

(ii) The triangular prism is tilted as shown in **Diagram 2**. Explain why it returns to its original position when it is released.

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(2)

Leave blank

(b) **Diagrams 3** and **4** show the positions of two other triangular prisms.

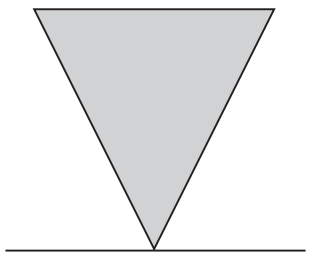

Diagram 3

Diagram 4

Explain why, compared to the prism in **Diagram 1**,

(i) the prism in **Diagram 3** is less stable,

.....

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.....

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(2)

(ii) the prism in **Diagram 4** is more stable.

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(1)

(c) Write down the equation for the moment of a force and explain its effect.

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(3)

Leave blank

(d) **Diagram 5** shows a person balanced on a tightrope.

Diagram 6 represents the person when she is not balanced. The weight of the person is 600 N and the position **X** of her centre of gravity is shown.

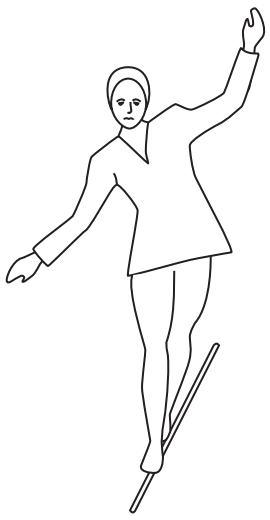

Diagram 5

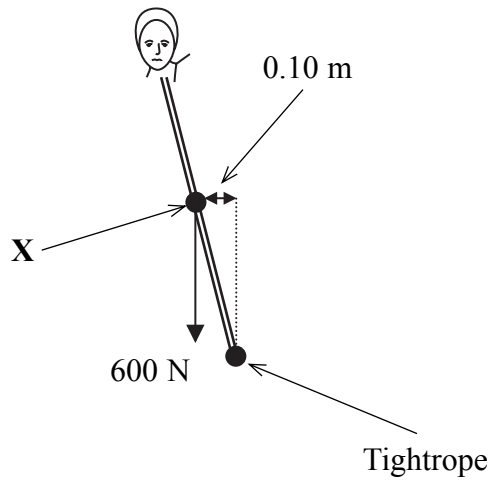

Diagram 6

(i) Calculate the anticlockwise moment about the tightrope in **Diagram 6**.

.....

.....

.....

(2)

(ii) State the value of the clockwise moment required to restore balance in **Diagram 6**.

.....

(1)

(iii) Suggest a way in which balance could be restored.

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.....

(1)

Leave blank

(e) It is necessary for the tightrope to behave elastically.

(i) Explain what is meant by elastic behaviour.

.....

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.....

.....

(2)

(ii) Name a suitable material for the tightrope.

.....

(1)

(f) The tightrope stretches when the walker stands on it.

(i) Define density.

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(1)

(ii) State what happens to the density of the tightrope when it is stretched. Explain your answer.

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(2)

Q1

(Total 20 marks)

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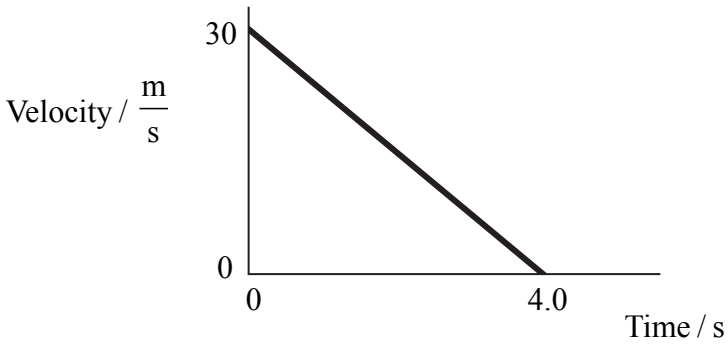
2. This question is about motion.

(a) The diagram below shows the velocity–time graph for a car slowing down to rest from the time when the brakes were applied.



State the feature of the graph that represents

(i) the deceleration of the car,

.....

(1)

(ii) the distance travelled by the car.

.....

(1)

(b) Use the graph to calculate

(i) the deceleration of the car,

.....

.....

(2)

(ii) the distance moved by the car in the 4.0 seconds.

.....

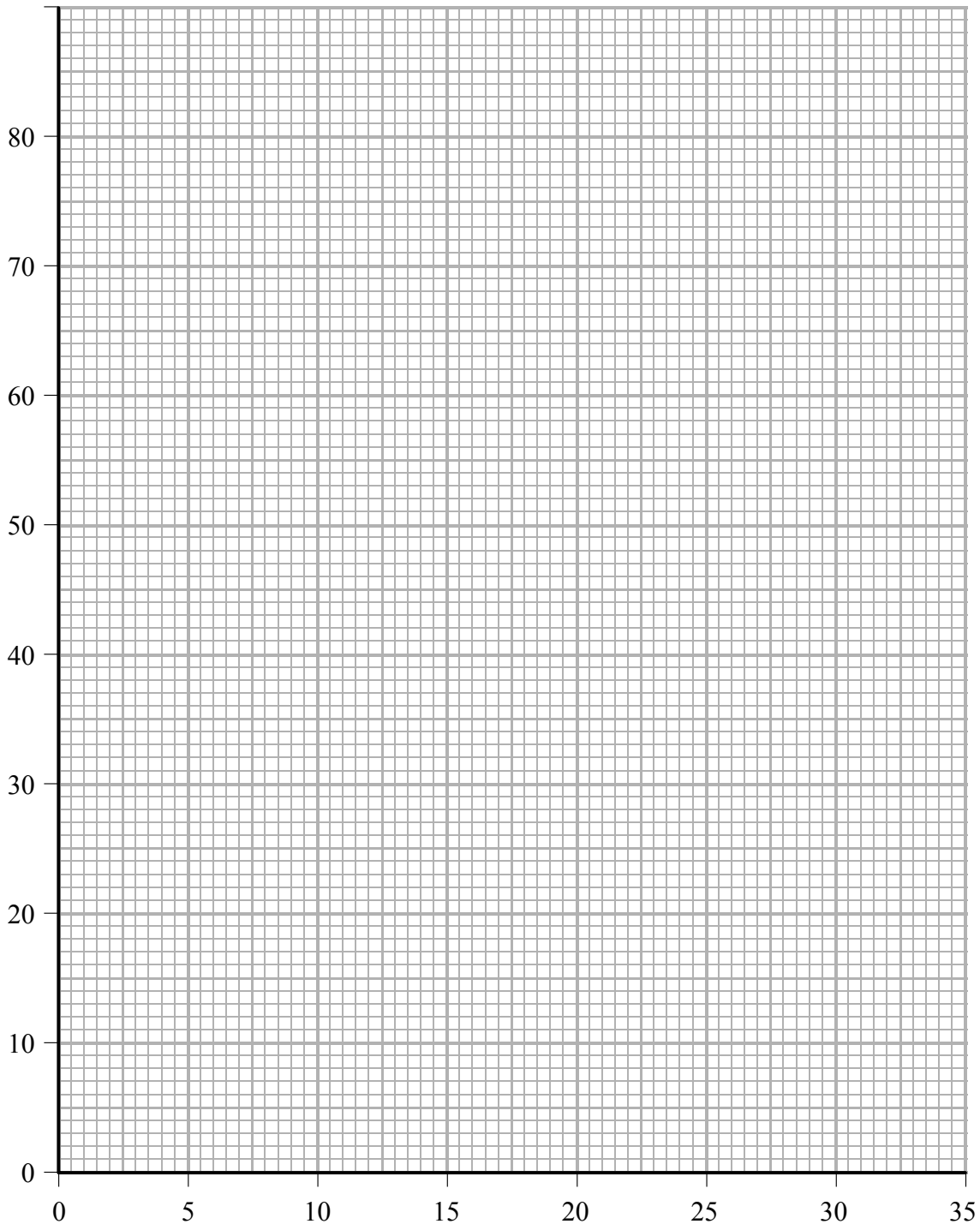
.....

(2)

(c) The table shows values of braking distance for a car travelling at different velocities on a dry road.

Braking distance / m	0	6	14	24	38	55	74
Velocity / m/s	0	10	15	20	25	30	35

(i) On the grid opposite, plot a graph of braking distance (*y*-axis) against velocity (*x*-axis).
Label the axes. Draw the best-fit curve through the points.



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(4)

(ii) Use the graph to find the braking distance for a velocity of 23 m/s. Show on the graph how you obtained your value.

.....

(2)

Leave blank

(d) The car has a mass of 800 kg. Calculate:

(i) the kinetic energy of the car when it has velocity of 25 m/s,

.....

.....

.....

(2)

(ii) the average braking force required to stop the car when it is travelling at a velocity of 25 m/s.

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.....

(3)

(e) The same car is travelling at a velocity of 25 m/s on a wet road.

Place a tick in a box to show the effect of the wet road conditions on kinetic energy, braking distance and braking force compared to your values in (c) and (d).

	Greater than	Same as	Less than
Kinetic energy			
Braking distance			
Braking force			

(3)

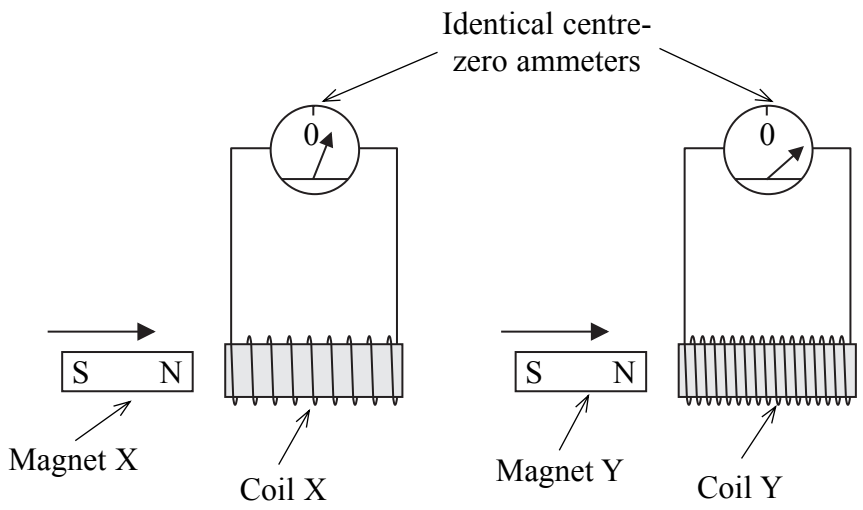
Q2

(Total 20 marks)

Leave blank

3. This question is about electromagnetism.

(a) The diagram below shows two different magnets being moved towards two different coils of copper wire. Each coil is connected to an identical centre-zero ammeter.



(i) Explain why current is indicated on the centre-zero ammeters.

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.....

(3)

(ii) If both magnets are moved towards their respective coils at the same speed, give two reasons why the meter connected to coil Y gives a bigger deflection than that connected to coil X.

1 .....

.....

2 .....

.....

(2)

(iii) Give two ways in which the meters could be made to deflect the opposite way without changing the connections between the coil and the meter.

1 .....

.....

2 .....

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(2)

Leave blank

(iv) Give one way in which the deflection produced by coil X could be increased using the same magnet and without changing the coil.

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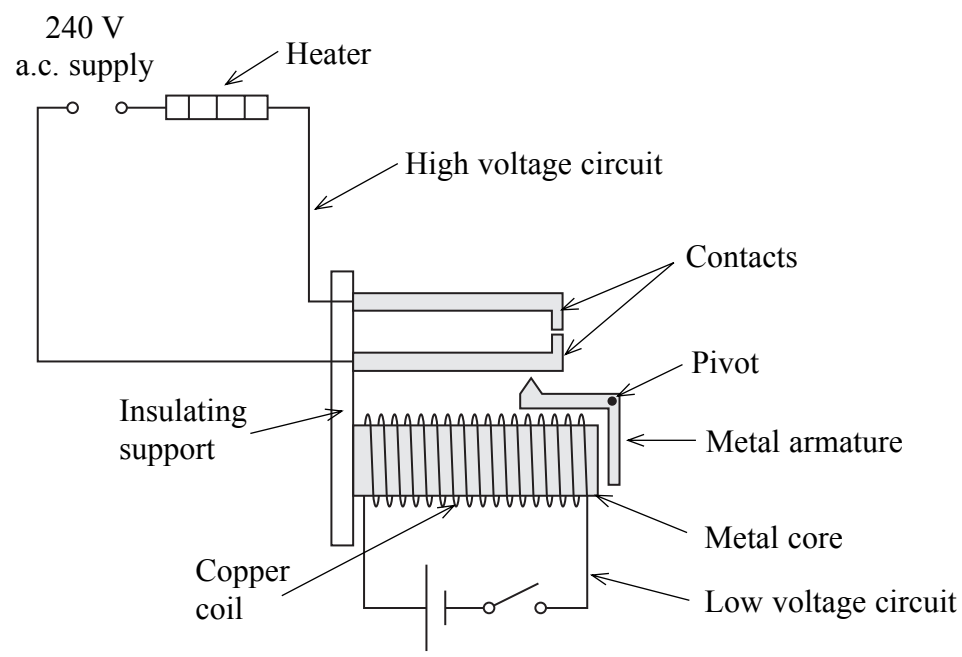
(1)

(b) The diagram below shows a low voltage circuit linked to a high voltage circuit by an electromagnetic relay.



(i) Name a suitable metal for the core and the armature. Explain the reason for your choice.

Metal .....

Reason .....

.....

.....

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(3)

Leave blank

(ii) Describe all the changes that happen when the switch in the low voltage circuit is closed.

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(5)

(iii) The power rating of the heater is 1920 W. Calculate the current passing through the heater when the switch is closed.

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(2)

(iv) Explain what would happen if the metal core or the metal armature had been made of steel.

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(2)

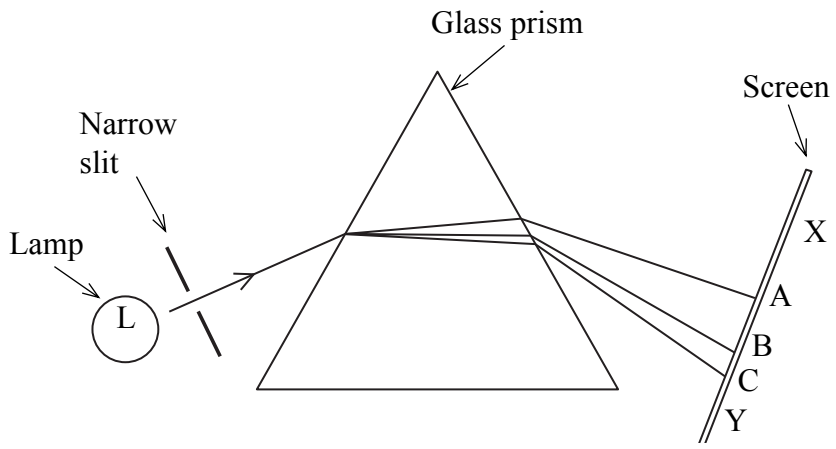
Q3

(Total 20 marks)

Leave blank

4. This question is about the behaviour of waves.

The diagram below shows a lamp L which emits a mixture of red, blue and violet light and two invisible radiations. A narrow beam of this light passes through a glass prism. The light emerging from the prism produces three bands of coloured light labelled A, B and C.



(a) (i) What name is given to the bending of light as it enters and leaves the prism?

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(1)

(ii) Explain in terms of a property of **light** why the narrow beam is bent as it enters the prism.

.....

.....

.....

(2)

(iii) What colour bands are seen at A and B?

A.....

B.....

(1)

(iv) What name is given to the spreading of the different colours of light as they pass through the prism?

.....

(1)

Leave blank

(v) Explain in terms of a property of light why the different colours are separated as shown in the diagram.

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.....

(2)

(b) (i) Name the invisible radiations that fall at X and at Y.

X .....

Y.....

(2)

(ii) State two different properties of the light at C and the invisible radiation at Y.

1 .....

.....

2 .....

.....

(2)

(iii) State two similar properties of the light at C and the invisible radiation at Y.

1 .....

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2 .....

.....

(2)

(iv) Describe a simple experiment to detect infrared radiation.

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(3)

Leave blank

(c) The refractive index of the glass can be calculated using this equation

$$\text{Refractive index} = \frac{\text{Speed of light in a vacuum}}{\text{Speed of light in the glass}}$$

(i) If the speed of blue light in a vacuum is 3.00×10^8 m/s and the speed of blue light in the glass is 1.88×10^8 m/s, calculate the refractive index of the glass.

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(2)

(ii) If the angle of incidence of blue light at the first surface of the glass prism is 30°, calculate the angle of refraction.

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(2)

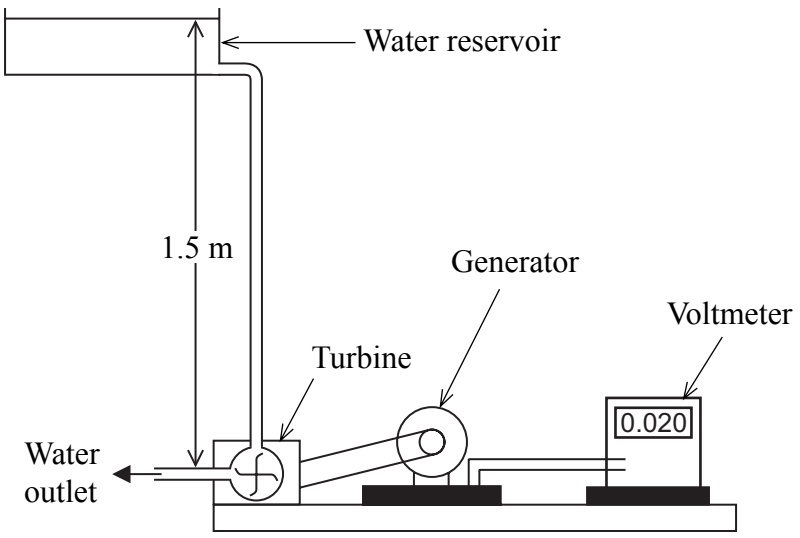
Q4

(Total 20 marks)

Leave blank

5. This question is about energy and the design of an experiment.

The diagram shows a model hydroelectric power generator. Water flows out of the reservoir and turns the turbine which makes the generator rotate and produce electricity.



(a) (i) In the spaces below, list the two main energy changes that occur.

1 ..... energy to kinetic energy.

2 Kinetic energy to ..... energy.

(2)

(ii) 0.40 kg of water flows from the reservoir to the turbine. Calculate the loss of gravitational potential energy of the water as it falls through 1.5 m.

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(2)

Leave blank

(b) A student decides to investigate how the energy output of the generator depends on the mass of water used.
Describe how the student would carry out this investigation using the apparatus shown in the diagram.

Your account should include:

(i) Three additional items of apparatus that would be needed.

1 .....

2 .....

3 .....

(3)

(ii) Three essential measurements that must be taken.

1 .....

2 .....

3 .....

(3)

(iii) A description of how the apparatus would be used.

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(5)

Leave blank

(iv) The headings of a table suitable for recording the measurements and the results.

(3)

(v) In the space below, sketch a labelled graph to show the expected results.

(2) **Q5**

(Total 20 marks)

TOTAL FOR PAPER: 100 MARKS

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