



General Certificate of Secondary Education
2010

Centre Number

71	
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Candidate Number

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Science: Double Award (Non-Modular)

Paper 3
Foundation Tier

[G8403]



FRIDAY 28 MAY, MORNING

TIME

1 hour 30 minutes.

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 fifteen** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 110.

Quality of written communication will be assessed in question **13(a)(i)**.

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

Details of calculations should be shown.

Units must be stated in numerical answers where appropriate.

For Examiner's
use only

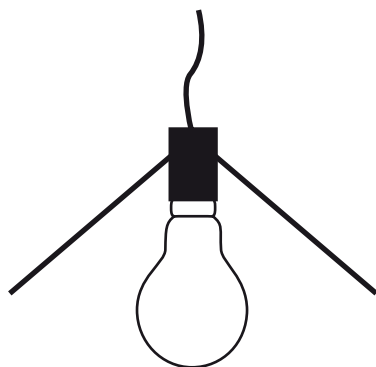
Question Number	Marks
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2	
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Total
Marks

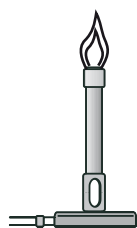
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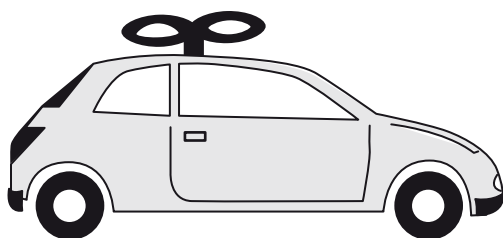
1 A bulb is designed to change electrical energy to light energy.



Describe the energy changes each of the following devices are **designed** to bring about.



(i) A Bunsen burner changes **chemical** energy to _____ energy. [1]



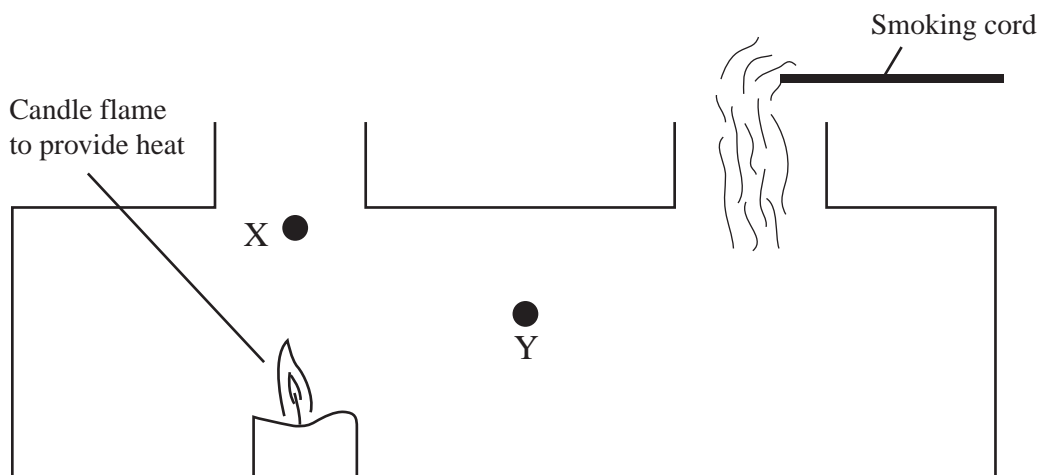
(ii) A wound up spring in a toy car changes **strain** energy to _____ energy. [1]



(iii) A loudspeaker changes **electrical** energy to _____ energy. [1]

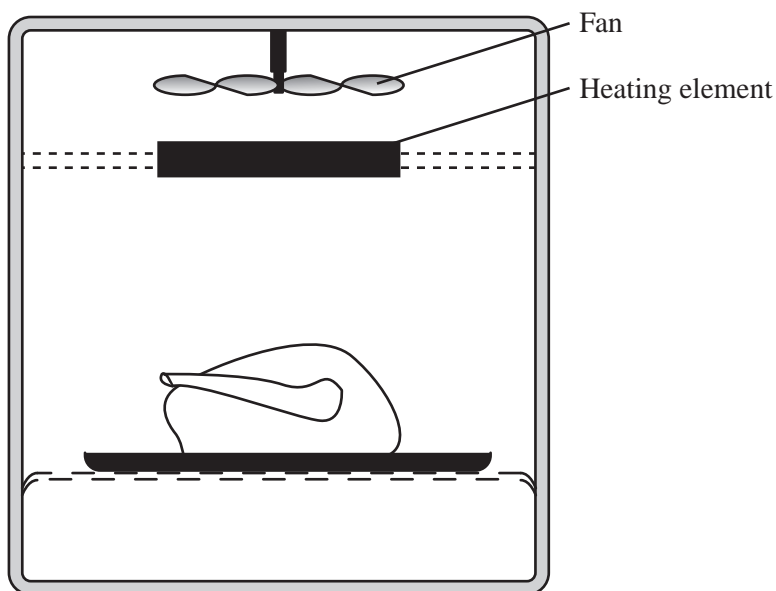
Examiner Only	
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2 The apparatus shown is used to demonstrate convection currents in air.



(a) Mark the direction of the convection current at points X and Y. [2]

An oven has a heating element at the top of the oven. A fan is included in the design as shown.

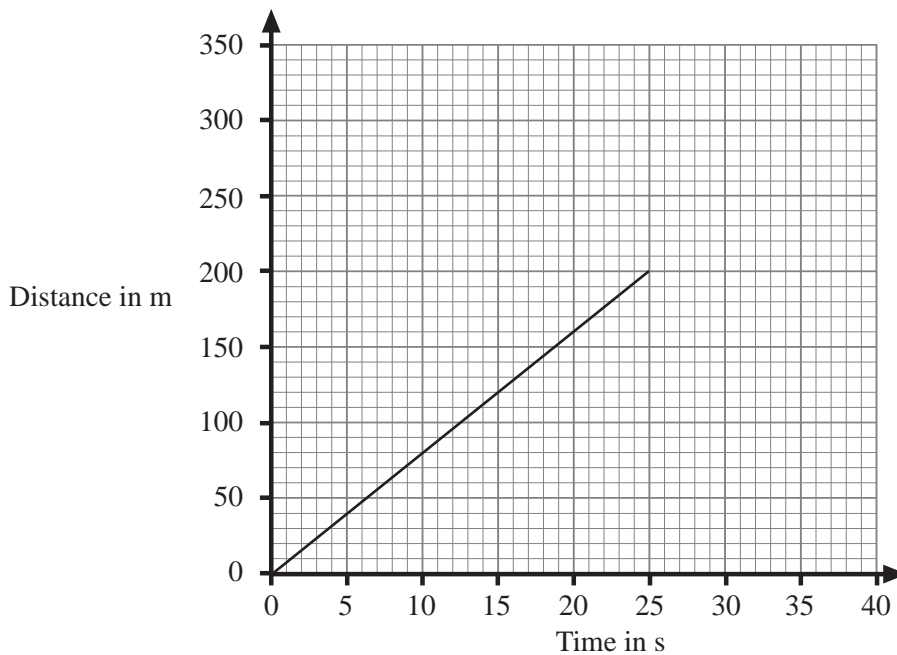


(b) Suggest a reason why the fan is used in this oven.

_____ [1]

Examiner Only	
Marks	Remark
○	○

3 A graph of distance against time is shown for the movement of a train.



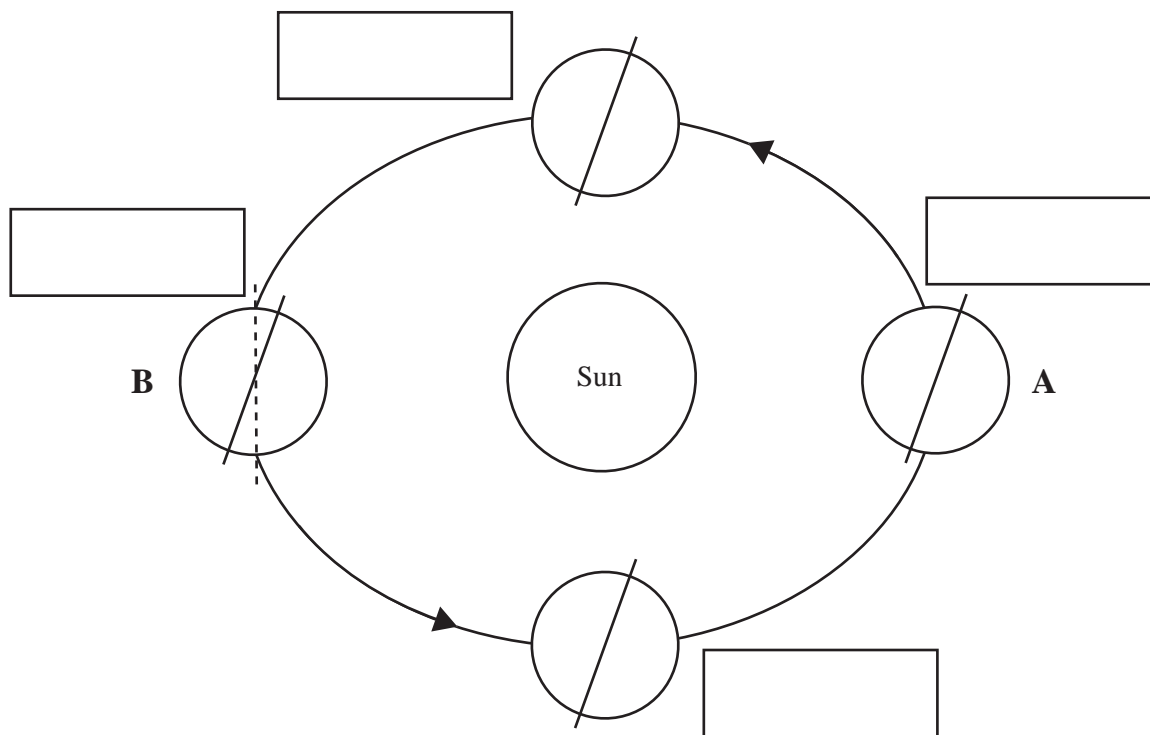
Use the graph to calculate the speed of the train.

You are advised to show your working out.

Speed = _____ m/s [3]

Examiner Only	
Marks	Remark
○	○

4 The following diagram shows the Earth's orbit round the Sun.



(a) Name the seasons for the **northern** hemisphere in the boxes provided. [2]

(b) How long does it take the Earth to move from position **A** to position **B**?

_____ months [1]

(c) How long does it take the Earth to make one complete turn on its axis?

_____ hours [1]

(d) On the diagram above, shade the part of the Earth that is in darkness when the Earth is in position **B**. [1]

Examiner Only	
Marks	Remark
○	○

6 A surfer “rides” the waves on a surfboard.



CCEA – Copyright: John Boyd

The top of the plastic surfboard is rough while the bottom is smooth.

(a) Why is the bottom of the surfboard smooth?

_____ [1]

When the surfer gains speed he stands up on the surfboard.

(b) How does the position of his centre of mass change as he stands up?

_____ [1]

(c) How does this affect the stability of the surfer?

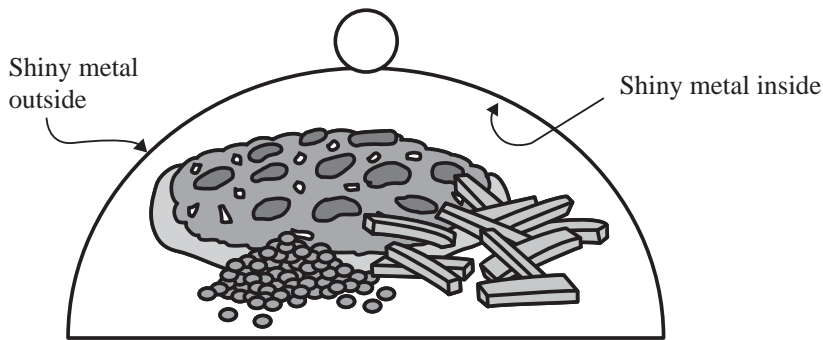
_____ [1]

(d) How could the design of a surfboard be changed to provide greater stability?

_____ [1]

Examiner Only	
Marks	Remark
○	○

7 Food is kept hot using a cover made of shiny metal.



(a) What is the advantage of using a shiny surface on the **inside** of the cover rather than matt black?

[2]

(b) What is the advantage of using a shiny surface on the **outside** of the cover rather than matt black?

[2]

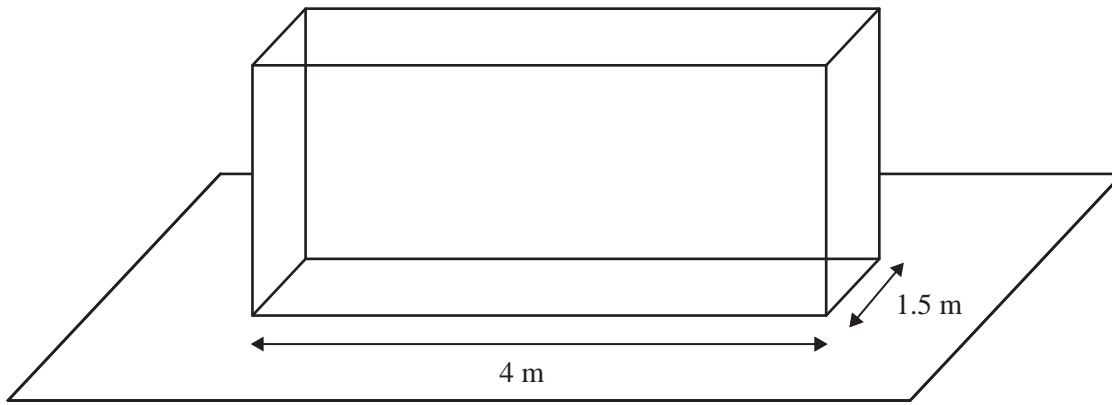
(c) A tea cosy is a cover for a teapot.

Explain fully why a woollen tea cosy is suitable to keep the tea hot in a teapot.

[2]

Examiner Only	
Marks	Remark
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8 A slab of material sits on the ground.



(i) Calculate the area of the base in m^2 .

Area of base = _____ m^2 [1]

(ii) The slab has a weight of 9000 N. Calculate the pressure exerted by the slab on the ground.

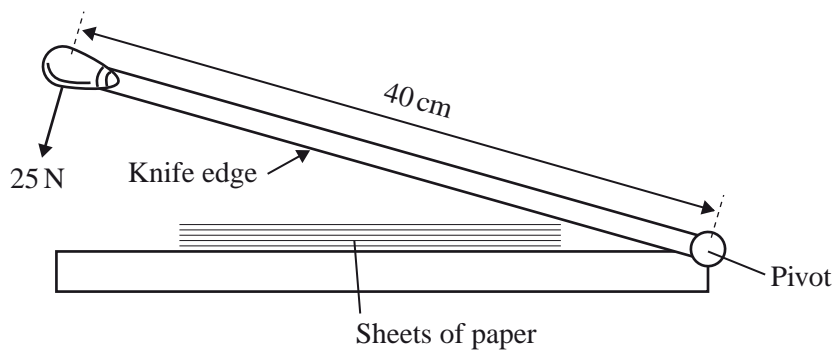
Remember to include the correct unit.

You are advised to show your working out.

Pressure = _____ [4]

Examiner Only	
Marks	Remark
○	○

9 A guillotine is used to cut sheets of paper.



- (i) Calculate the size of the moment of the 25 N force about the pivot in Ncm.

You are advised to show your working out.

Moment = _____ Ncm [3]

- (ii) Tick (✓) the correct box to show the direction of the moment about the pivot.

Clockwise

Upwards

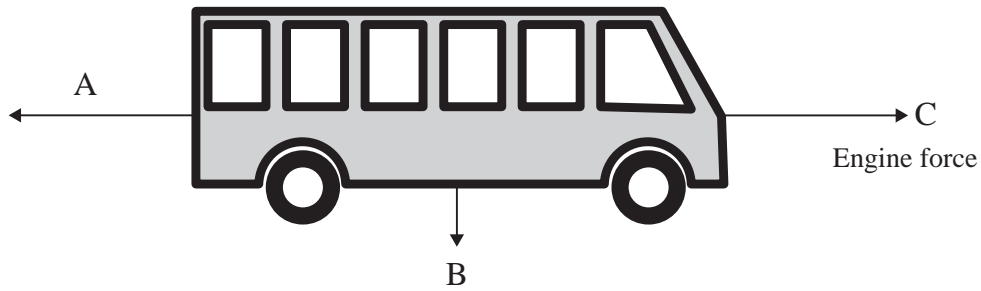
Anticlockwise

Downwards

[1]

Examiner Only	
Marks	Remark
○	○

10 Three forces, A, B and C act on a bus.



Force C has been named.

(i) Name the other two forces.

Force A _____ Force B _____ [2]

(ii) When the bus is moving at **constant speed**, two of the three forces, A, B, or C must balance. Name the two forces.

Force _____ and force _____ [1]

(iii) Later in the journey, force A decreases. Forces B and C remain unchanged. Describe the motion of the bus.

_____ [1]

Examiner Only	
Marks	Remark
○	○

11 (a) (i) Give an advantage other than cost of using a renewable energy source.

_____ [1]

(ii) State two sources of renewable energy.

1. _____ 2. _____ [2]

Solar panels are installed on the roof of a house to make use of the energy of the Sun.

(b) Explain why it is not possible for solar panels in Northern Ireland to produce all the energy required by a household during the day.

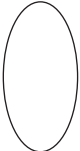

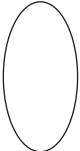

_____ [1]

12 When a hairdryer is used for 30 seconds it uses 15 000 J of electrical energy. What is the power of the hairdryer?

Remember to include the correct unit.

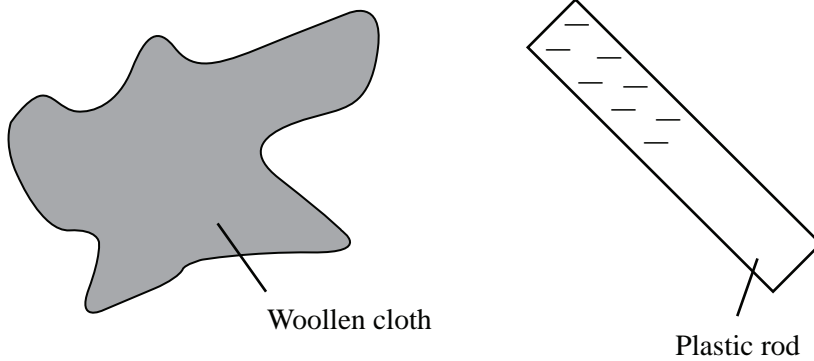
You are advised to show your working out.

Power = _____ [4]

Examiner Only	
Marks	Remark
	
	

13 (a) When insulators are rubbed together, static electricity is produced.

A plastic rod becomes negatively charged when it is rubbed with a woollen cloth.



(i) Explain fully why the plastic rod becomes negatively charged.

_____ [2]

Quality of written communication [1]

A garage uses a spray gun to paint a car. Positively charged paint drops from the spray gun are directed at the body of the car.



(ii) Why do the positively charged paint drops move apart when they leave the spray gun?

_____ [1]

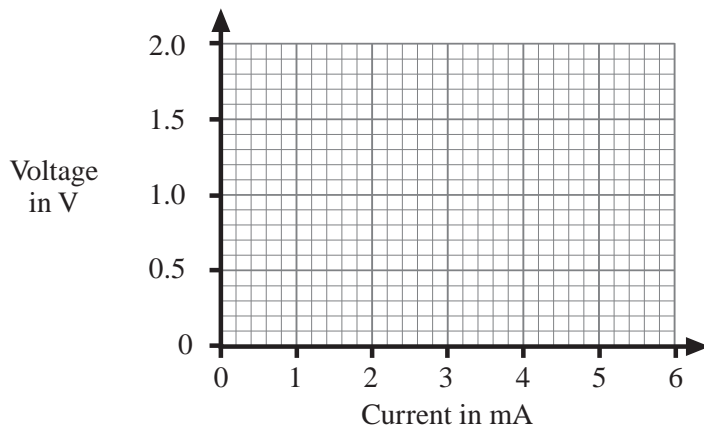
(iii) Why should the car body be negatively charged?

_____ [1]

Examiner Only	
Marks	Remark
○	○

- (b) A pupil investigated the variation of voltage with current for a resistor. The results are given below.

Voltage in V	0	0.5	1.5	2.0
Current in mA	0	1	3	4



- (i) Plot the points on the grid. [1]

- (ii) Draw the best fit straight line through the points. [1]

- (iii) Use your graph to find the voltage across the resistor when the current flowing through it is 2 mA.

Voltage = _____ V [1]

- (iv) Convert 2 mA to A. Remember 1 mA = 0.001 A

Current = _____ A [1]

- (v) Use your answers to parts (iii) and (iv) to calculate the resistance of the resistor.

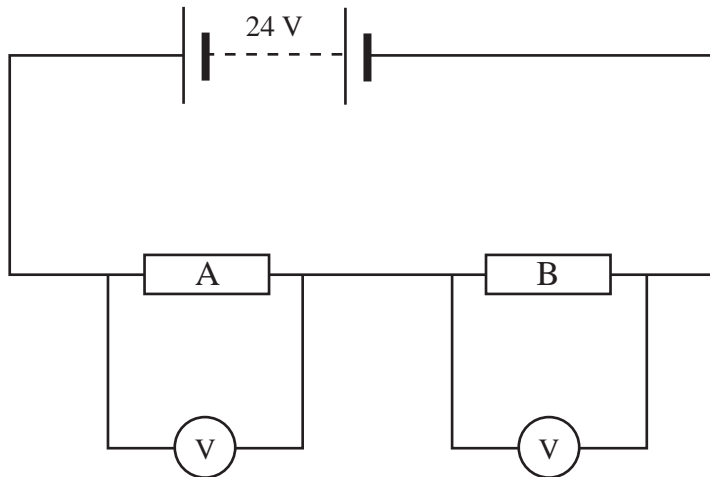
You are advised to show your working out.

Resistance = _____ Ω [3]

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Marks Remark

- (c) The following circuit contains two **identical** resistors A and B and a 24 V battery.

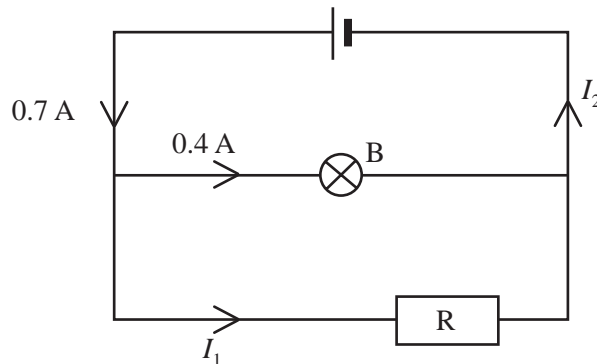


What are the voltmeter readings across the resistors?

Voltage across resistor A = _____ V

Voltage across resistor B = _____ V [2]

The following circuit contains a resistor R and a bulb B.



- (d) What is the current I_1 flowing through the resistor?

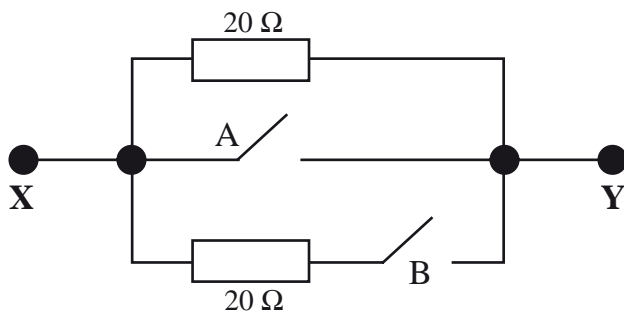
$I_1 =$ _____ A

What is the current I_2 ?

$I_2 =$ _____ A [2]

Examiner Only	
Marks	Remark

(e) Two resistors are connected between X and Y as shown below.



Complete the following table to show the total resistance between X and Y for the different switch settings.

Switch		Resistance between X and Y in Ω
A	B	
Open	Open	
Open	Closed	
Closed	Open	
Closed	Closed	

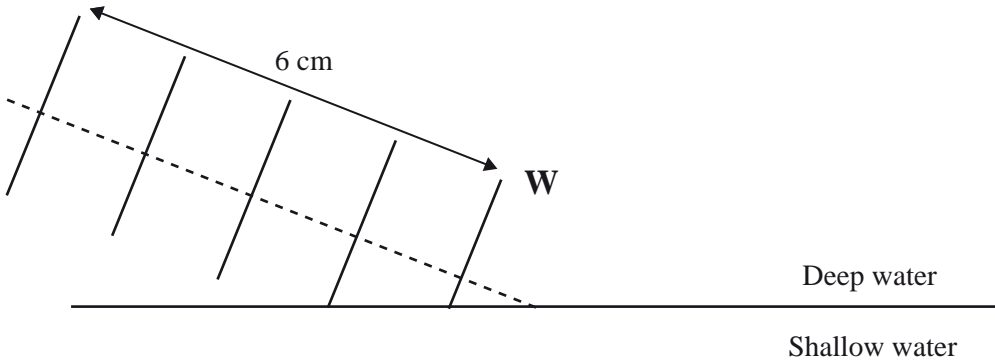
[4]

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Marks	Remark

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(Questions continue overleaf)

14 (a) The following diagram (not to scale) shows water waves travelling through deep water.



(i) Part of wave **W** has not been completed as it enters the shallow water.

Complete wave **W** in the shallow water. [1]

(ii) Use the diagram to find the wavelength of the waves in deep water.

Remember the diagram is not drawn to scale.

Wavelength = _____ cm [1]

(iii) If 12 waves reach the edge of the shallow water in 2 seconds, what is the frequency of the waves?

Frequency = _____ Hz [1]

(iv) Use your answers to parts (a)(ii) and (a)(iii) to calculate the speed of waves in deep water.

Give your answer in cm/s.

You are advised to show your working out.

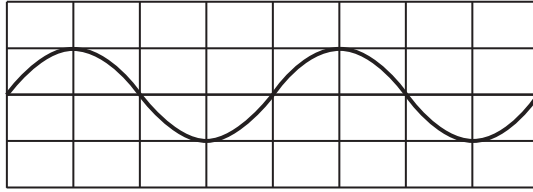
Speed = _____ cm/s [3]

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Marks	Remark
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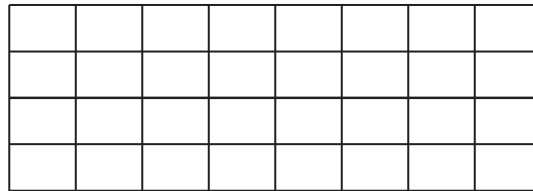
- (v) What, if anything, happens to the wavelength of the water waves as they leave deep water and enter shallow water?

_____ [1]

- (b) The outline of water waves is shown below.



- (i) On the following grid draw waves with half the wavelength and double the amplitude.

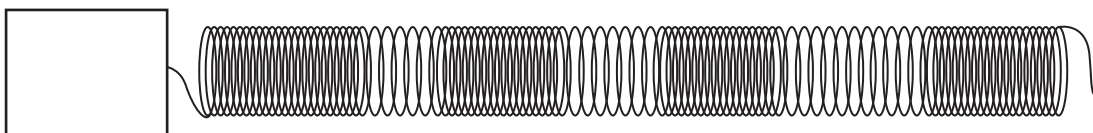


[2]

- (ii) Water waves are classified as transverse waves. Give two more examples of transverse waves.

1. _____ 2. _____ [2]

- (c) Longitudinal waves can be demonstrated using a slinky spring.



- (i) In the box, draw the direction in which the end of the spring is moved to produce longitudinal waves. [1]

- (ii) Give another example of a longitudinal wave.

_____ [1]

- (iii) What do the waves transfer as they move from left to right?

_____ [1]

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Marks	Remark

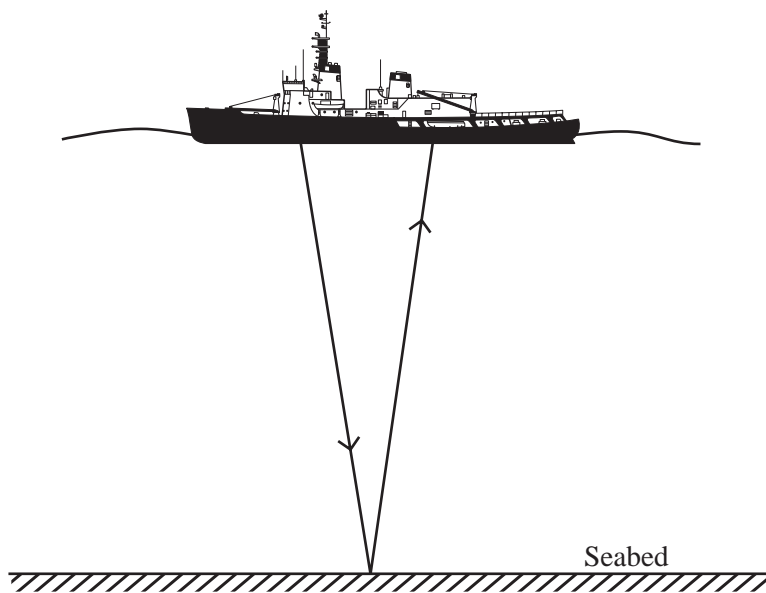
(d) (i) State the lower frequency limit for a child's hearing.

_____ Hz [1]

(ii) What happens to the upper frequency limit of hearing in old age?

_____ [1]

(iii) Ultrasound can be used to determine the depth of the sea. The speed of ultrasound in seawater is 1500 m/s. A pulse of ultrasound, sent out from the ship, is reflected from the seabed and travels back again to the ship in a total time of 0.8 s.



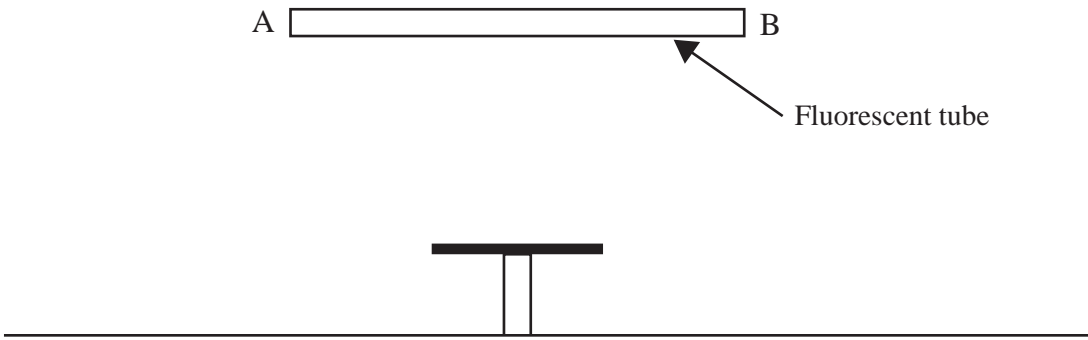
Calculate the distance between the ship and the seabed.

You are advised to show your working out.

Distance = _____ m [4]

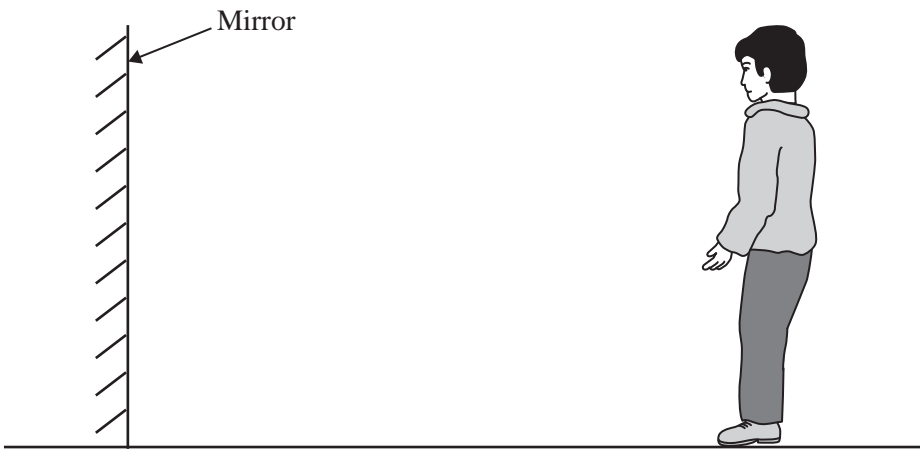
Examiner Only	
Marks	Remark

15 Light from a fluorescent tube forms a shadow of a table on the floor below.



- (a) (i) Draw four rays, two from each end (A and B) of the fluorescent tube, to show how the shadow is formed. [4]
- (ii) Label a region of partial shadow with the letter P. [1]

Nathan observes his shoes in a mirror.



- (b) (i) Draw an incident ray from the tip of the shoe to the mirror and the reflected ray into Nathan's eye. [4]
- Remember to include the normal and arrows to indicate the direction of the rays.

Nathan observes his hand in the mirror.

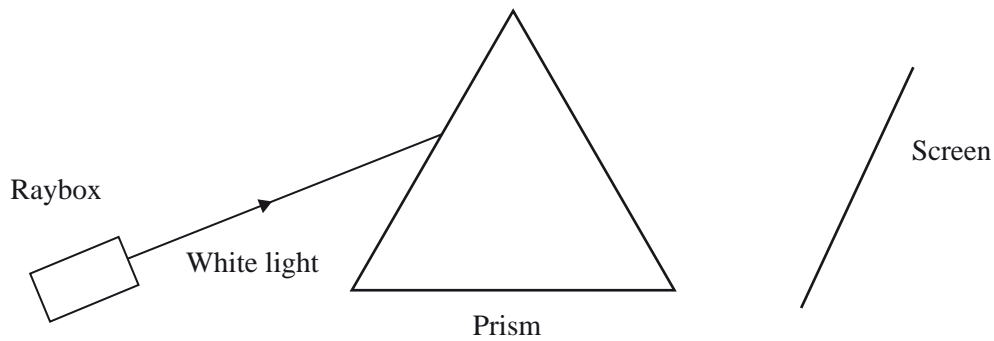
- (ii) Will the angle of incidence in this case be less than, equal to, or greater than the angle of incidence for his shoe? [1]
- _____

Examiner Only	
Marks	Remark
○	○

(c) (i) Explain fully what dispersion of light means.

[2]

The incomplete diagram below shows the apparatus that can be used to demonstrate dispersion.



(ii) Indicate exactly with a point labelled P where dispersion begins. [1]

(iii) Indicate a region where the light travels at a smaller speed. Label the region with the letter Q. [1]

(iv) In what direction does the light travel when it emerges from the prism? Choose from the statements below.

Place a tick (✓) in the correct box.

- It travels along the normal
- It bends towards the normal
- It bends away from the normal

[1]

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Marks	Remark

A diagram of the electromagnetic spectrum is shown.

Gamma rays		Ultra-violet rays	Visible rays	Infra-red rays	Micro-waves	Radio waves
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(d) (i) Name the missing member of the electromagnetic spectrum by writing its name in the box. [1]

(ii) All the members of this spectrum are electromagnetic waves. Give two other properties which they all have in common.

1. _____
2. _____ [2]

(iii) Apart from radio waves, give two other regions of the spectrum which can be used for communication purposes.

1. _____
2. _____ [2]

THIS IS THE END OF THE QUESTION PAPER

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Marks	Remark

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