CCEA GCSE SCIENCE: DOUBLE AWARD (MODULAR)

SCIENCE



EXAM QUESTION PACK

PAPER 3 FOUNDATION TIER G8203 PAPERS

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Double Award (Modular)

Paper 3
Foundation Tier

[G8203]

G8203

FRIDAY 15 JUNE, AFTERNOON

TIME

1 hour.

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 four** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.
Quality of written communication will be assessed in question **2(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
1	
2	
3	
4	
Total Marks	

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Examiner Only	
Marks	Remark

1 What is the energy **input** in each of the following:

(a) (i) a petrol driven car?

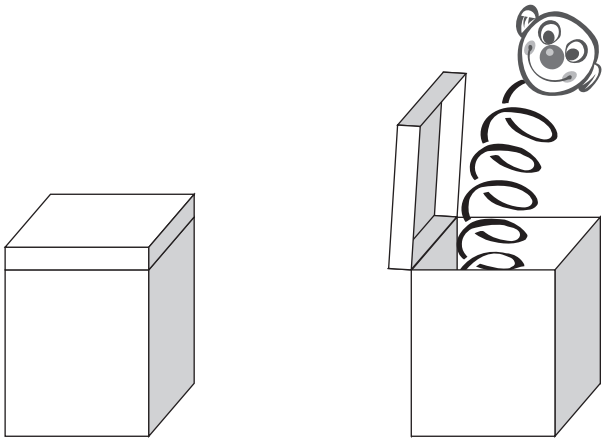


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_____

[1]

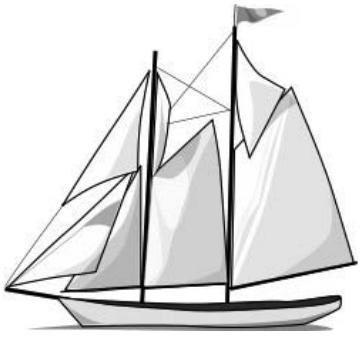
(ii) a "jack in the box" toy?



_____

[1]

(iii) a sailing boat?



_____

[1]

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Examiner Only	
Marks	Remark

(b) (i) In the table below tick (✓) the boxes to show whether the energy resource is renewable or non-renewable.

Energy resource	Renewable	Non-renewable
Gas		
Geothermal		
Nuclear		

[3]

(ii) One of the energy resources above is a fossil fuel. Which one?

_____ [1]

(c) The diagram shows:

A a cyclist

B a racing car



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A



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B

(i) Which is more stable?

Answer _____ [1]

(ii) Give two reasons for your answer.

1. _____ [1]

2. _____ [1]

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(d) The table shows the planets in order of their distance from the Sun.

1	Mercury
2	
3	Earth
4	
5	
6	Saturn
7	Uranus
8	

(i) Complete the table by naming the missing planets. [2]

(ii) What is at the centre of the Solar System?

_____ [1]

(iii) What is a galaxy?

_____ [1]

(iv) The Sun is a member of a galaxy. What is the name of this galaxy?

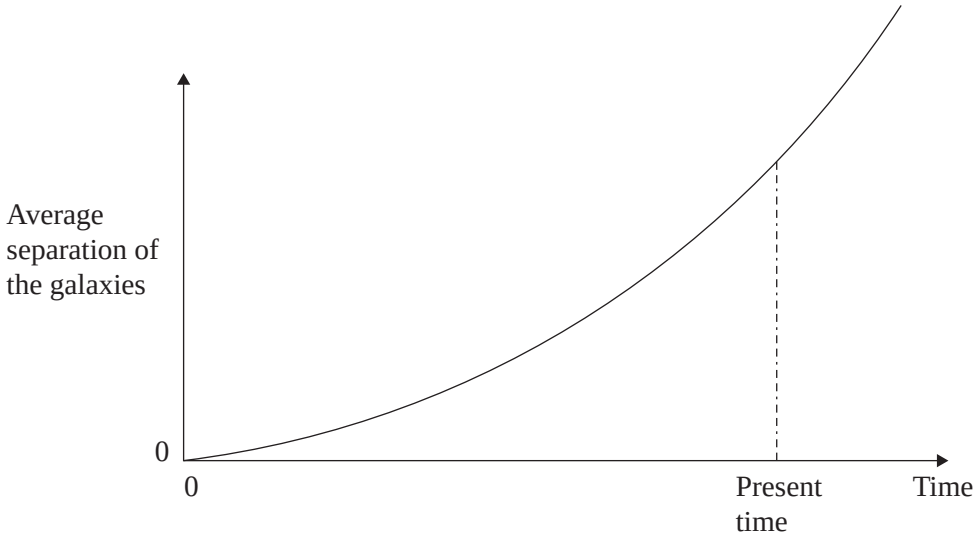
_____ [1]

Examiner Only

Marks	Remark

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(e) The Big Bang theory explains the origin and expansion of the universe.



The graph above shows how the average separation of the galaxies has increased over time, according to the Big Bang theory.

(i) What other feature of the graph supports the Big Bang theory?

_____ [1]

(ii) Name the other scientific theory which attempts to explain the origin of the universe.

_____ [1]

(iii) State two reasons, not related to cost, why it is difficult to send a manned spacecraft to another planet outside our solar system.

1. _____

2. _____ [2]

(iv) What nuclear process in stars generates energy?

_____ [1]

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Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** James was wearing a woollen sweater and a nylon shirt. When he removes the sweater he sees a spark.



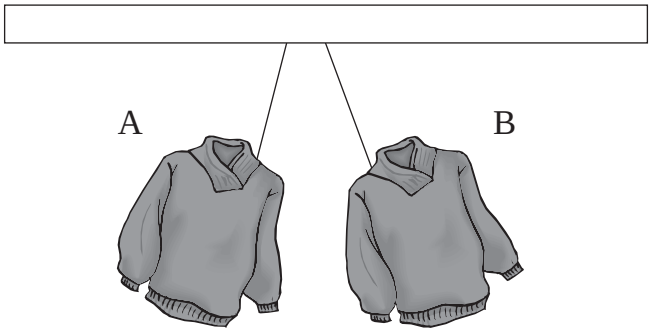
(i) Explain fully in terms of charge movement how the sweater became charged.

_____

_____ [2]

Quality of written communication [1]

When two charged sweaters (A and B) were suspended on threads they moved apart as shown below.



(ii) What does this indicate about the charges on the sweaters?

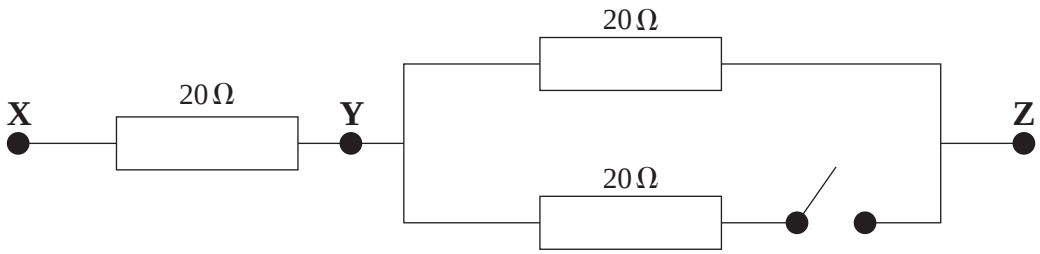
_____ [1]

(iii) Explain your answer to part **(ii)**.

_____ [1]

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(b) Three 20 Ω resistors are connected as shown below.



Complete the following table to show the total resistance between the different points for the switch settings indicated.

Points	Switch	Resistance in Ω
Y and **Z**	Closed	
X and **Z**	Open	
X and **Z**	Closed	

[3]

(c) **(i)** The power rating of an electric hob is 1.5 kW. How much energy is used (in kWh) if it is switched on for 2 hours?

Electric energy = _____ kWh [1]

(ii) What is the cost of switching on the hob for 2 hours if one kWh of electricity costs 13p?

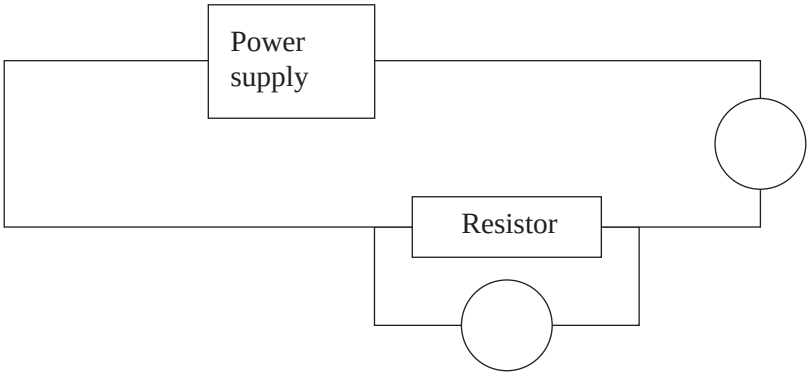
Cost = _____ p [1]

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Marks	Remark

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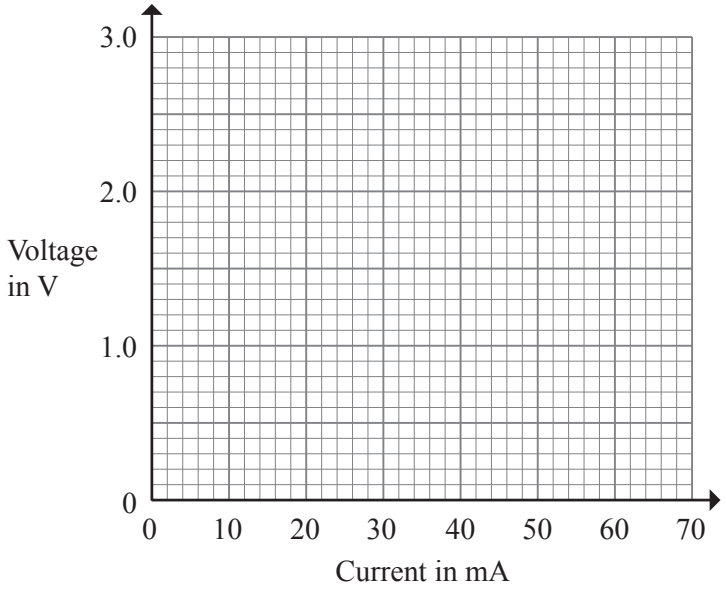
(d) James uses the following circuit to investigate the variation of current with voltage for a resistor.



Label the ammeter and voltmeter with the correct symbols. [2]

(e) The results are given below.

Voltage in V	0	0.8	1.2	1.6	2.0	2.8
Current in mA	0	20	30	40	50	70



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

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

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Marks	Remark

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(iii) Convert 60 mA to A. Remember 1 mA = 0.001 A

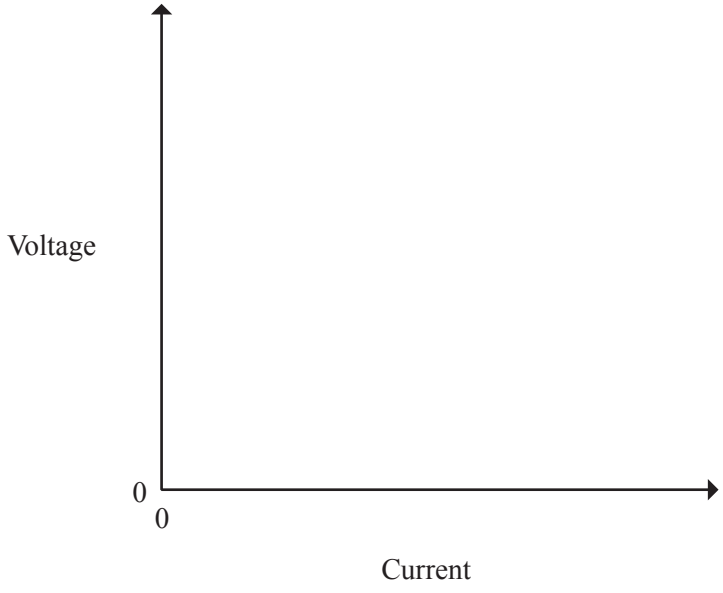
Current = _____ A [1]

(iv) When the voltage across the resistor is 2.4 V, the current through it is 60 mA. Use your answer to part **(iii)** to calculate the resistance of the resistor.

You are advised to show your working out.

Resistance = _____ Ω [3]

(f) Sketch below a graph to show how voltage varies with current for an electric light bulb.



[2]

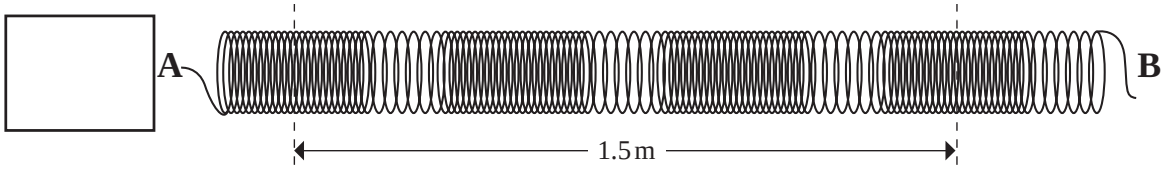
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Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** Shauna uses a stretched slinky to make longitudinal waves.



(i) What do the longitudinal waves transfer from **A** to **B**?

_____ [1]

(ii) In the box, draw a double-headed arrow to indicate the direction Shauna would have to move end **A** to make longitudinal waves. [1]

(iii) Shauna sends 18 waves along the slinky in 6 seconds.
How many waves does she make in 1 second?

_____ [1]

(iv) Use your answer to part **(iii)** to state the frequency of the waves.

Frequency = _____ Hz [1]

(v) What is the wavelength of the longitudinal waves?

Wavelength = _____ m [1]

(vi) Use your answers to parts **(iv)** and **(v)** to calculate the speed of the longitudinal waves.

You are advised to show your working out.

Speed = _____ m/s [3]

(vii) Give another example of a longitudinal wave.

_____ [1]

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Examiner Only	
Marks	Remark

(b) Transverse waves can also be made with a slinky spring.

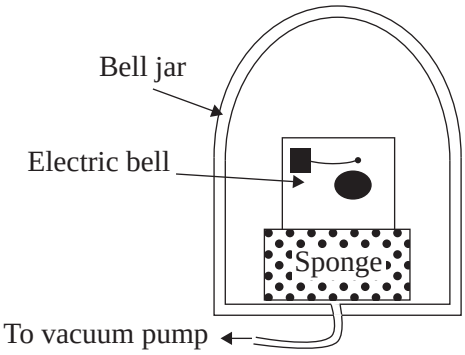
(i) How would the vibrations of the slinky spring be different if Shauna made a transverse wave?

_____ [1]

(ii) Give another example of a transverse wave.

_____ [1]

(c) An electric bell is set ringing inside a bell jar.



When the hammer strikes the gong, sound is produced.

(i) Why is sound produced by the gong?

_____ [1]

(ii) What happens to the loudness of the sound from the gong when the vacuum pump is switched on?

_____ [1]

(iii) What does this experiment demonstrate about sound waves?

_____ [1]

(iv) If the experiment is repeated without the sponge, the sound of the electric bell can always be heard. Explain why this is so.

_____

_____ [1]

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(d) What are the frequency limits of human hearing?

(i) Lower limit = _____ Hz [1]

(ii) Upper limit = _____ Hz [1]

(iii) How, if at all, does the upper limit change with increasing age?

_____ [1]

(iv) What damage can long exposure to loud sound cause to the ears?

_____ [1]

(v) How can people who operate very noisy machines reduce damage to their ears?

_____ [1]

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Marks	Remark

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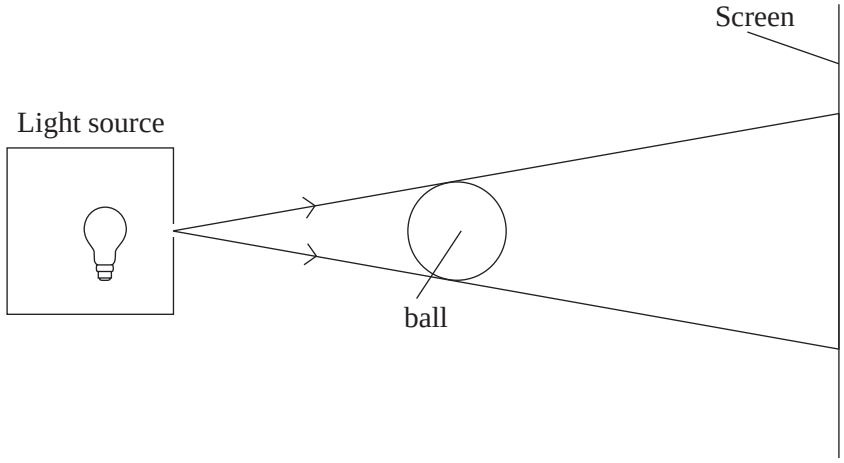
Examiner Only
Marks | Remark

4 (a) (i) Indicate with a tick (✓) in the table below whether the object is luminous or non-luminous.

Object	Luminous	Non-luminous
Star		
Moon		
Planet		
White paper		

[4]

The diagram below shows a shadow of a ball being formed on a screen by a point source of light.



(ii) Which statement below best describes the shadow formed on the screen?

A The shadow is uniformly black.

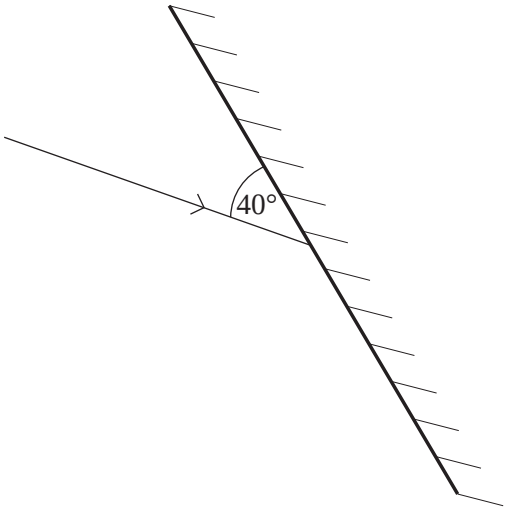
B The shadow contains partial shadow AND uniformly black shadow.

C The entire shadow is partial shadow.

Answer _____ [1]

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A ray of light is incident on a plane mirror as shown.



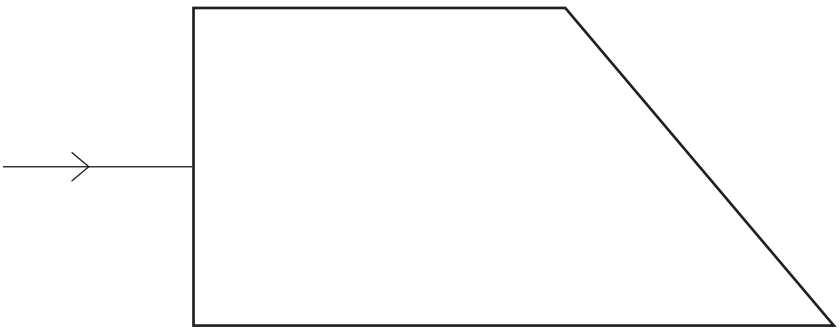
(b) (i) Draw and label the normal. [1]

(ii) What size is the angle of reflection?

Angle of reflection = _____ ° [1]

Different shapes of glass prism are often used to change the direction of light rays.

(c) (i) Continue the path of the ray shown until it emerges into the air.



[3]

(ii) Does the speed of light increase, decrease or remain the same as it enters the glass?

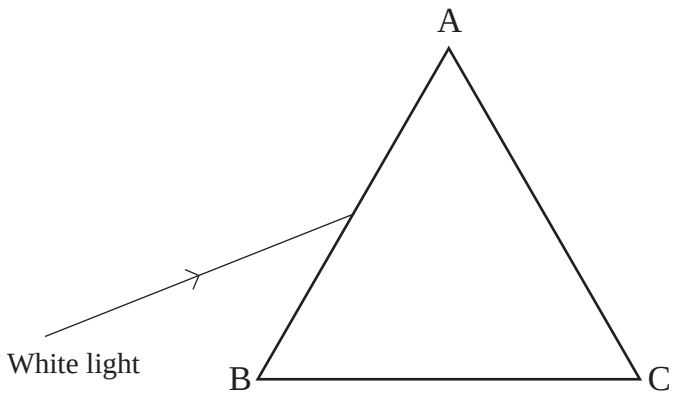
_____ [1]

Examiner Only

Marks	Remark

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White light enters a prism.



The prism is used to split white light into its component colours.

(d) (i) What is this process called?

_____ [1]

(ii) List the component colours produced **beginning with** the colour nearest the corner C.

_____ [2]

(iii) What name is given to this group of colours?

_____ [1]

Examiner Only

Marks	Remark

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The box contains the names of some electromagnetic waves.

Ultraviolet	Gamma rays	Microwaves	Radio waves	Infrared

(e) **(i)** Which one has the shortest wavelength?

_____ [1]

(ii) Which one comes from a coal fire?

_____ [1]

(iii) Which one can be used to sterilise medical equipment?

_____ [1]

(iv) Which one can cause skin cancer?

_____ [1]

(v) Which one has the longest wavelength?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only

Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Double Award (Modular)

Paper 3
Foundation Tier

[G8203]

FRIDAY 15 JUNE, AFTERNOON

MARK SCHEME

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					AVAILABLE MARKS
1	**(a)**	**(i)**	Chemical	[1]	
		(ii)	Elastic/Strain	[1]	
		(iii)	Kinetic/Wind	[1]	
	(b)	**(i)**	Non-renewable [1] Renewable [1] Non-renewable [1]	[3]	
		(ii)	Gas	[1]	
	(c)	**(i)**	Car B/racing car	[1]	
		(ii)	1. Wider base (dependent marking from **(i)**) 2. Lower c of g	[1] [1]	
	(d)	**(i)**	Venus, Mars, Jupiter, Neptune [$\frac{1}{2}$] each (round up)	[2]	
		(ii)	Sun	[1]	
		(iii)	A collection of stars	[1]	
		(iv)	Milky Way	[1]	
	(e)	**(i)**	Universe has a starting point	[1]	
		(ii)	Steady State **or** String	[1]	
		(iii)	Lack of sufficient fuel **or** food **or** time required (any **two**)	[2]	
		(iv)	Fusion	[1]	20

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					AVAILABLE MARKS
2	**(a)**	**(i)**	Electrons move [1] due to friction/rubbing [1]	[2]	
			Quality of written communication	[1]	
		(ii)	Charges are similar	[1]	
		(iii)	Similar charges repel	[1]	
	(b)		10 [1] 40 [1] 30 [1]	[3]	
	(c)	**(i)**	Electric energy = 3 (kWh)	[1]	
		(ii)	Cost = 39 (p) Allow e.c.f. from **(i)**	[1]	
	(d)		Ammeter [1] and voltmeter [1] correctly labelled	[2]	
	(e)	**(i)**	5 correct points ($\pm \frac{1}{2}$ square)	[1]	
		(ii)	Best fit straight line through (0, 0) ($\pm \frac{1}{2}$ square)	[1]	
		(iii)	Current = 0.06 (A)	[1]	
		(iv)	R = V/I [1] **or** V = IR $R = \frac{V}{C}$ for Partial Credit = [0] = 2.4/0.06 [1] = 40 Ω [1] Allow e.c.f. from **(iii)**	[3]	
	(f)		Curve with positive increasing gradient [1] through (0,0) [1]	[2]	20

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				AVAILABLE MARKS
3	(a)	(i)	Energy [1]	
		(ii)	←→ [1]	
		(iii)	3 [1]	
		(iv)	3 Allow e.c.f. from **(iii)** [1]	
		(v)	0.5 (m) [1]	
		(vi)	v (or speed) = f × λ [1] = 3 × 0.5 [1] = 1.5 (m/s) [1] Allow e.c.f. from **(iv)** and **(v)** [3]	
		(vii)	Sound **or** Ultrasound [1]	
	(b)	(i)	Vibrations are at right angles/perpendicular [1]	
		(ii)	Light **or** (any named member of e.m.s.) **or** water waves [1]	
	(c)	(i)	The gong vibrates [1]	
		(ii)	It decreases [1]	
		(iii)	Sound waves require a medium **or** Sound waves do not travel through a vacuum [1]	
		(iv)	Vibrations/sound will travel through the glass [1]	
	(d)	(i)	20 (Hz) [1]	
		(ii)	20 000 (Hz) **or** 20 **k**Hz [1]	
		(iii)	It decreases [1]	
		(iv)	Damage to eardrums [1]	
		(v)	Use ear protection/ear plugs/defenders [1]	20

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					AVAILABLE MARKS
4	(a)	(i)			

Object	Luminous	Non-Luminous
Star	✓	
Moon		✓
Planet		✓
White paper		✓

[1] each [4]

(ii) A [1]

(b) **(i)** Normal, correctly drawn [1]

(ii) 50° [1]

(c) **(i)** Undeviated ray at first interface [1]
refracted [1]
correctly [1] [3]

(ii) Slows down [1]

(d) **(i)** Dispersion [1]

(ii) Violet, Indigo, Blue, Green, Yellow, Orange, Red [2]
Deduct [1] if correct but reversed

(iii) Spectrum [1]

(e) **(i)** Gamma **or** γ [1]

(ii) Infrared **or** IR [1]

(iii) Gamma **or** γ [1]

(iv) Ultraviolet **or** UV [1]

(v) Radio waves [1] 20

Total **80**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Double Award (Modular)

Paper 3
Foundation Tier

[G8203]

WEDNESDAY 25 MAY, MORNING

G8203

TIME

1 hour.

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 four** questions.

INFORMATION FOR CANDIDATES

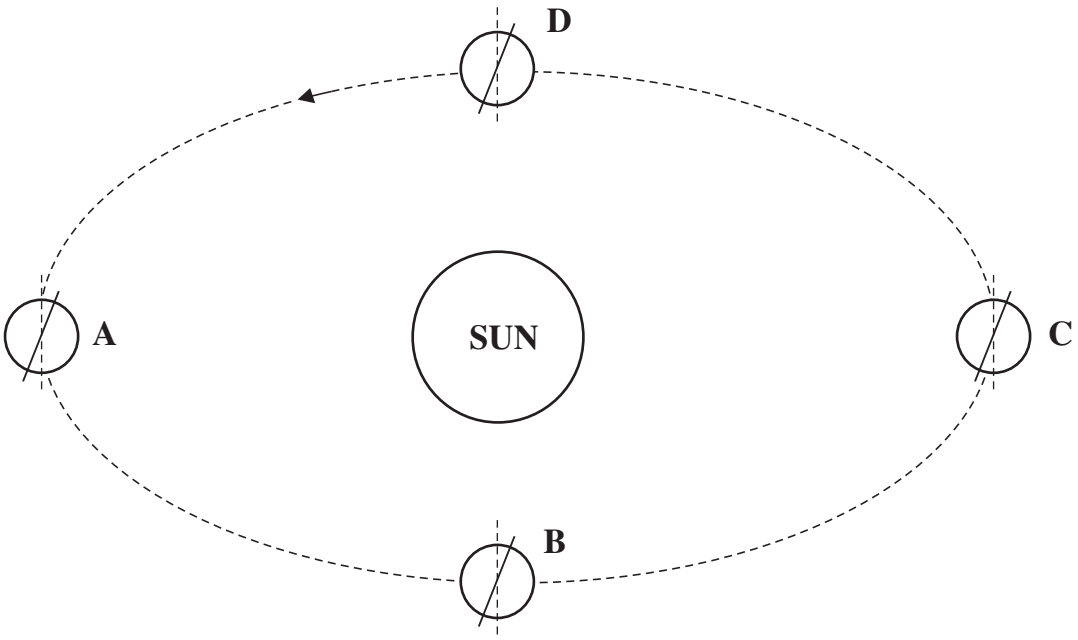
The total mark for this paper is 80.
Quality of written communication will be assessed in Question **4(c)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
Total Marks	

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Examiner Only	
Marks	Remark

1 The orbit of the Earth round the Sun is shown in the following diagram.



(a) (i) In which position **A**, **B**, **C**, or **D** is winter experienced in the Northern hemisphere?

_____ [1]

(ii) Give a reason for your answer to **(i)**.

_____ [1]

(iii) Shade the part of the Earth that is in darkness in position **A**. [1]

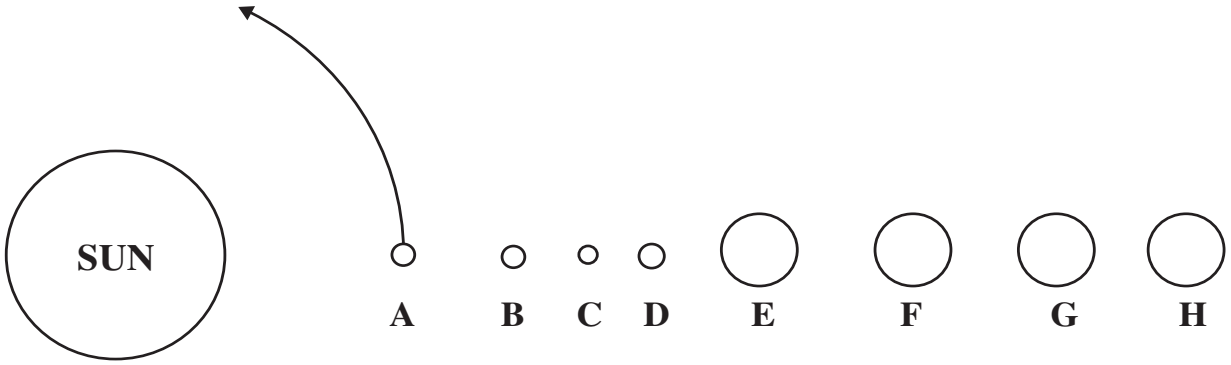
(iv) What is the name of the force which causes the Earth to orbit the Sun?

Force is called _____ [1]

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Below is a diagram of the Solar System. It is not to scale.

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Marks	Remark



(b) (i) Name planets **B** and **H**.

B _____ **H** _____ [2]

(ii) Draw a curved arrow to indicate the direction of motion of planet **C** round the Sun. [1]

Planet **A** has a "year" equal to 88 days and a "day" equal to 58.6 days.

(iii) What does planet **A** do every 88 days?

_____ [1]

(iv) What does planet **A** do every 58.6 days?

_____ [1]

(v) The above diagram shows the present model of the Solar System. What scientific theory existed before the Sun-centred model?

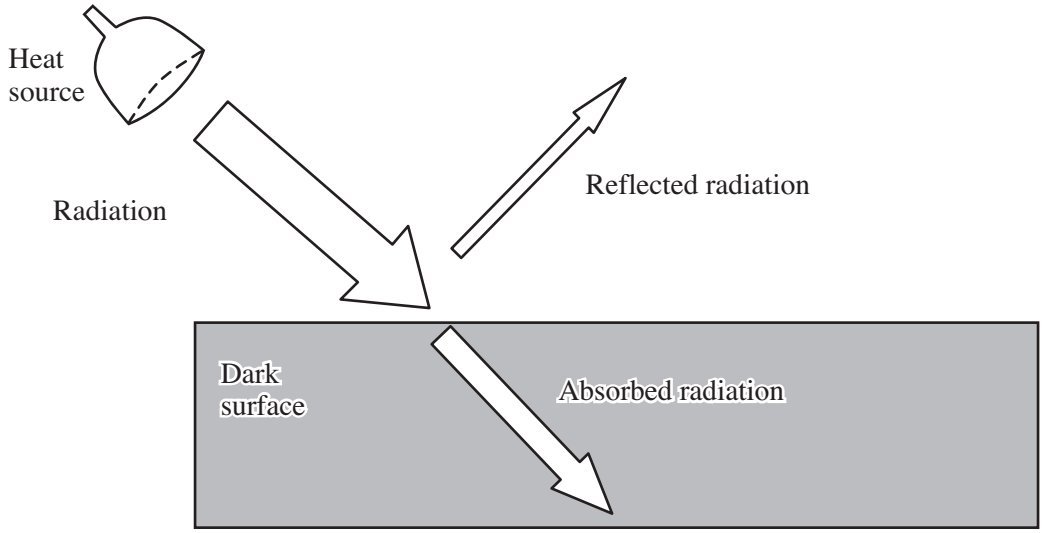
_____ [1]

(vi) Our Sun is a member of a galaxy. What is the name of this galaxy?

_____ [1]

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The following diagram shows radiation from a hot object striking a dark surface.



37% of the radiation is reflected.

(c) (i) What percentage of radiation is absorbed by the dark surface?

_____ % [1]

(ii) How would the percentage of reflected radiation change if the dark surface were replaced by a light coloured surface of the same material?

_____ [1]

Underground hot water pipes are often insulated to prevent heat loss.

(d) (i) Name a suitable material for insulating the water pipes.

_____ [1]

(ii) Why is this material suitable?

_____ [1]

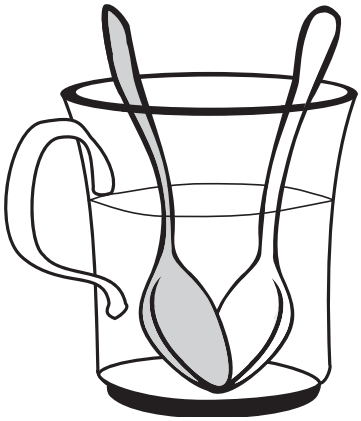
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Marks	Remark

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Coffee can be stirred with a metal spoon or a plastic spoon.

Examiner Only	
Marks	Remark



(e) (i) Name the method of heat transfer through these spoons.

_____ [1]

(ii) Which particles are mainly responsible for the transfer of heat along the metal spoon?

_____ [1]

(iii) Describe how heat passes through the plastic spoon.

_____

_____ [2]

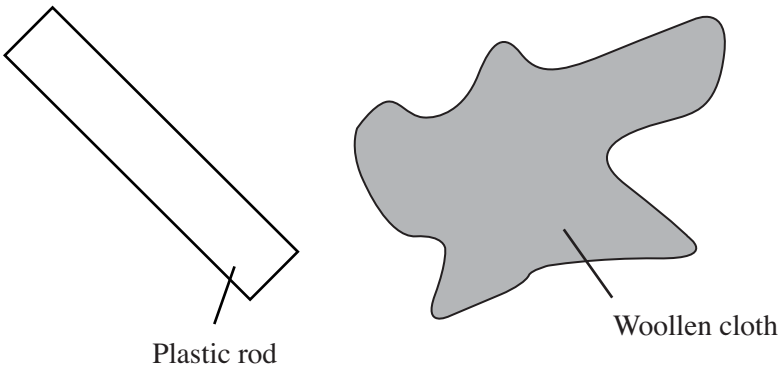
(iv) How can heat loss from the top surface of a cup of coffee be reduced?

_____ [1]

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Examiner Only	
Marks	Remark

2 **(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) What charged particles move from the woollen cloth to the plastic rod?

_____ [1]

(ii) What charge is left on the woollen cloth?

_____ [1]

(b) Before a racing car is refuelled, a conducting metal strip is connected between the car and the ground.
This is called "earthing".



© Toyota Motorsport GmbH

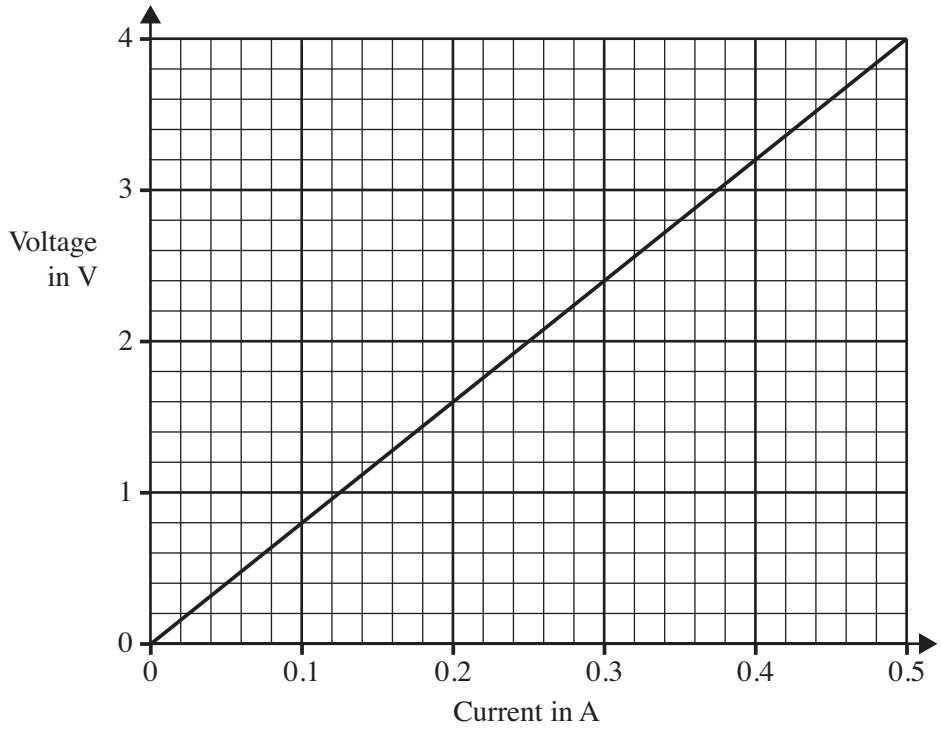
Explain why it is essential to earth the racing car when refuelling.

_____

_____ [2]

(c) A pupil plots a graph of voltage against current for a metal wire.

Examiner Only	
Marks	Remark



(i) What is the voltage across the wire when the current flowing through it is 0.3 A?

_____ V [1]

(ii) Calculate the resistance of the wire when the current is 0.5A.

You are advised to show your working out

Resistance = _____ Ω [3]

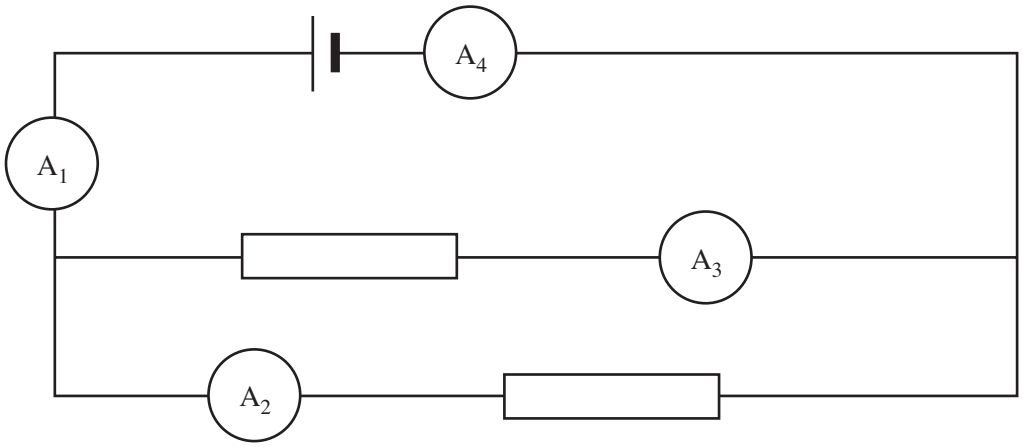
(iii) Which two features of the graph show that the voltage is directly proportional to the current?

1. _____

2. _____ [2]

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(d) A pupil sets up the following circuit to measure currents through **identical** resistors.



Ammeter A_1 reads 40 mA. What are the readings on the other ammeters?

(i) Ammeter A_2 reads _____ mA

(ii) Ammeter A_3 reads _____ mA

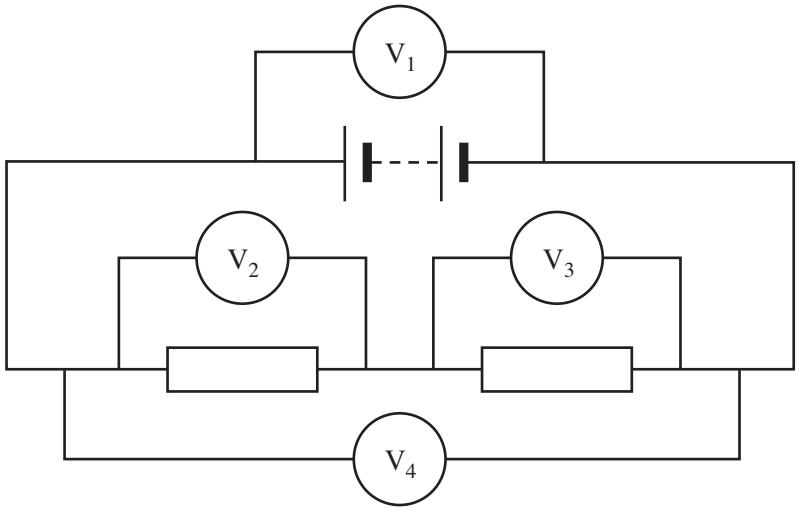
(iii) Ammeter A_4 reads _____ mA [3]

Examiner Only

Marks	Remark

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(e) The pupil now measures voltages across **identical** resistors.



Voltmeter V_1 reads 8.0 volts. What are the readings on the other voltmeters?

(i) Voltmeter V_2 reads _____ V

(ii) Voltmeter V_3 reads _____ V

(iii) Voltmeter V_4 reads _____ V [3]

(f) **(i)** The power of a vacuum cleaner is 1.25 kW.
Calculate the number of units of electrical energy in kWh used by the vacuum cleaner in 2 hours.

You are advised to show your working out.

Energy used = _____ kWh [3]

(ii) How much does it cost to operate the vacuum cleaner for 2 hours if 1 unit of electricity costs 12p?

Cost = _____ p [1]

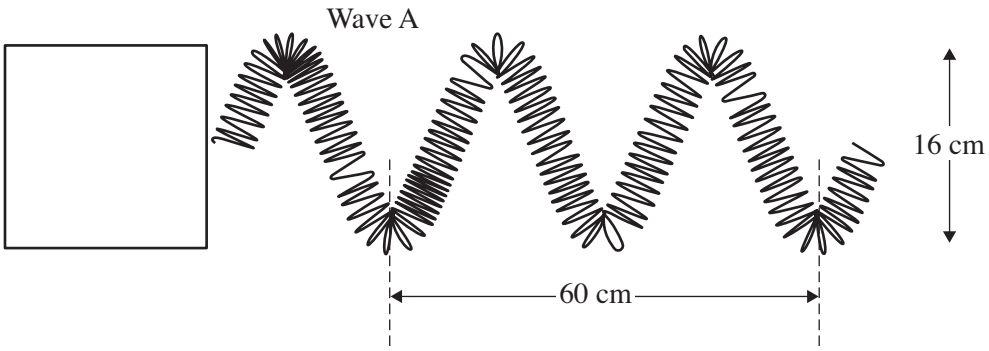
Examiner Only

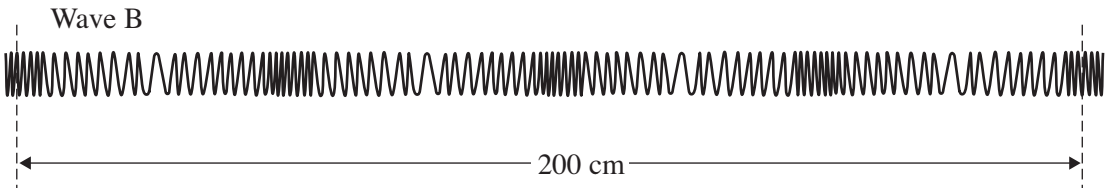
Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** A stretched slinky spring can be used to demonstrate waves.





(i) What do both waves transfer as they move from left to right?

_____ [1]

(ii) In the box to the left of wave A indicate the direction of vibration of a particle in the spring. [1]

(iii) What types of wave are A and B?

Wave A _____ Wave B _____ [2]

(iv) What is the wavelength of wave A?

_____ cm [1]

(v) What is the wavelength of wave B?

_____ cm [1]

(vi) What is the amplitude of wave A?

_____ cm [1]

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The end of wave B vibrates 40 times in 10 seconds.

(vii) How many times does the end of wave B vibrate in one second?

_____ [1]

(viii) What is the frequency of vibration of wave B?

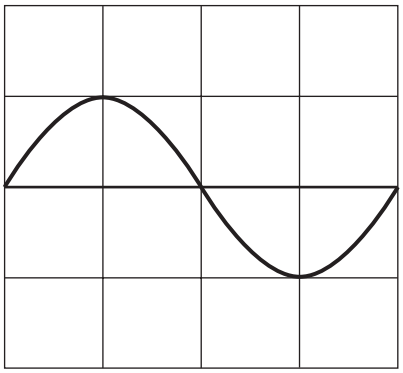
_____ Hz [1]

(b) A wave has a frequency of 6 Hz and a wavelength of 0.4 m.
Calculate the speed of the wave.

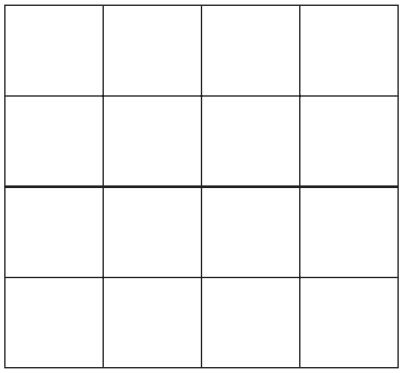
You are advised to show your working out.

Speed = _____ m/s [3]

(c) The sound wave produced by a tuning fork is displayed on a CRO.



In the space below draw the sound wave produced by a tuning fork of greater loudness and the same frequency.



[2]

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Marks	Remark

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(d) For each statement tick (✓) the box to show whether it is true or false.

Statement	True	False
Sound and light travel at the same speed in air.		
Light can travel through a vacuum.		
Sound is a longitudinal wave motion.		

[3]

(e) **(i)** What damage can a long exposure to loud sound cause to the ears?

_____ [1]

(ii) What precaution can people who operate very noisy machines take to reduce damage to their ears?

_____ [1]

(iii) What happens to the upper frequency limit of hearing with increasing age?

_____ [1]

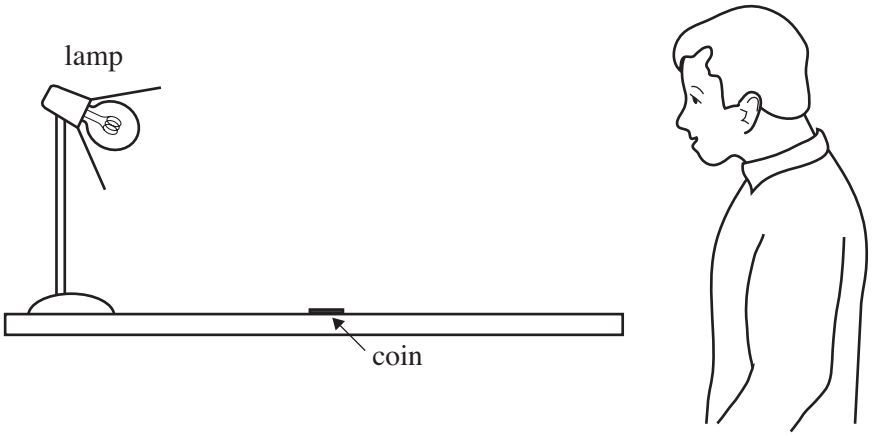
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

4 John observes a coin sitting on a table.

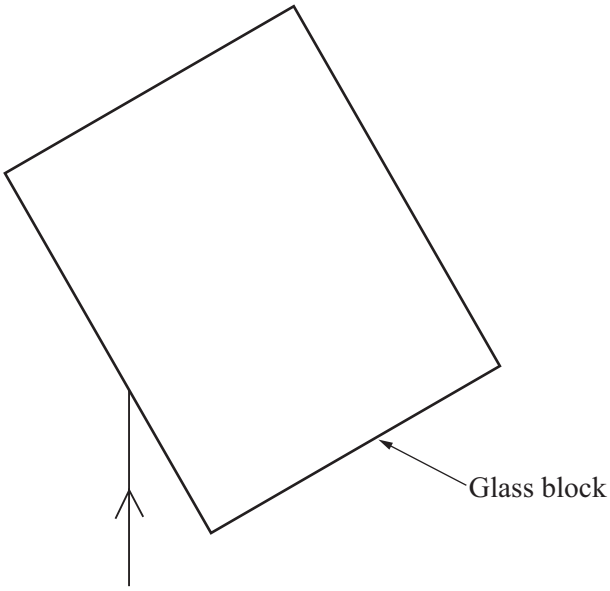


(a) (i) Draw an incident ray and a reflected ray to show how John sees the coin. Include an arrow to show the direction of the light. [3]

(ii) John sees the coin because of reflected light. Other objects are seen by the light they emit. Give an example of an object seen because of the light it emits.

Name of object _____ [1]

A ray of light travels from air into glass. The incident ray is shown.

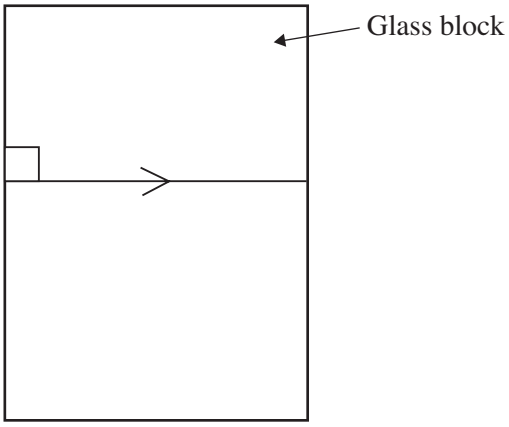


(b) (i) Draw in the normal and show the refracted ray inside the glass. [3]

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Marks	Remark

(ii) Draw in the incident ray which produces the ray inside the glass block as illustrated below.



[1]

(iii) Choose the correct statement below to show what happens to light when it travels from air into glass. Tick (✓) the correct box.

The light travels faster in glass than in the air. ☐

The light travels at the same speed in air and glass. ☐

The light travels faster in air than in glass. ☐ [1]

(c) (i) Explain fully the meaning of the term **dispersion**.

_____

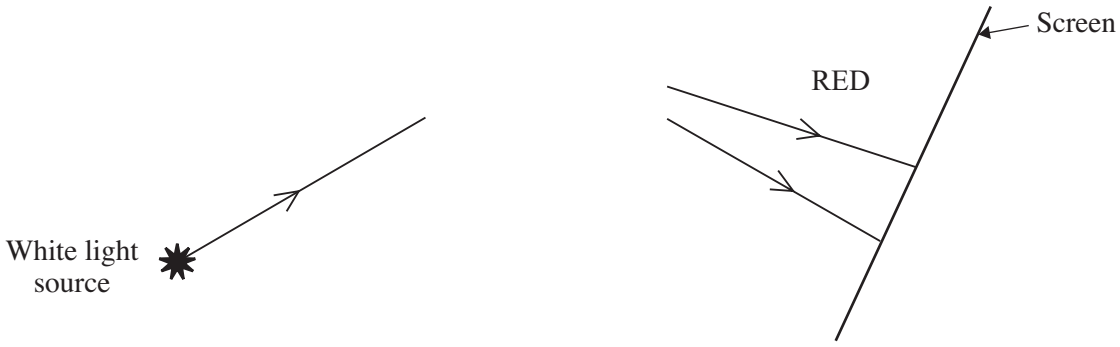
_____

_____ [2]

Quality of written communication [1]

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The diagram shows part of an arrangement which is used to demonstrate dispersion.



(ii) What piece of apparatus is missing?

_____ [1]

(iii) What is the name of the band of colours produced on the screen?

_____ [1]

(iv) State the colours, in order, starting with red in the diagram above.

Red, _____ [1]

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Marks	Remark

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Freda attempts to list the parts of the electromagnetic spectrum in order of increasing wavelength. However, one part is missing and another two parts have been interchanged.

X-Rays	Gamma Rays		Visible	Infra-red	Micro-waves	Radio

Increasing wavelength →

(d) (i) Which part is missing?

_____ [1]

(ii) Which two parts have been interchanged?

_____ and _____ [1]

Different parts of the spectrum have different uses. Identify the following parts from the information given.

(e) (i) This part is used to check for broken bones.

_____ [1]

(ii) This part is used in communication when two people wave to each other.

_____ [1]

(iii) This part is emitted from hot bodies.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2011

Science: Double Award (Modular)

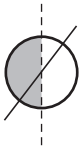
Paper 3
Foundation Tier

[G8203]

WEDNESDAY 25 MAY, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	(i)	**C**	[1]	
		(ii)	Axis of Earth is pointing away from the Sun	[1]	
		(iii)		[1]	
		(iv)	Gravity/Centripetal	[1]	
	(b)	(i)	**B** Venus **H** Neptune ([1] each)	[2]	
		(ii)	Same sense as arrow at A	[1]	
		(iii)	Orbits the Sun	[1]	
		(iv)	Makes *one* complete rotation on its axis	[1]	
		(v)	Geocentric	[1]	
		(vi)	Milky Way	[1]	
	(c)	(i)	63%	[1]	
		(ii)	It would increase	[1]	
	(d)	(i)	Fibre glass/insulating foam/polystyrene/rockwool	[1]	
		(ii)	Contains trapped air	[1]	
	(e)	(i)	Conduction	[1]	
		(ii)	(free) electrons	[1]	
		(iii)	Particles (atoms) in plastic (near the hot coffee) vibrate *more* [1] The vibration passes along the plastic/ jostle/particles collide [1] } mark independently	[2]	
		(iv)	Use a lid/cover	[1]	20

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				AVAILABLE MARKS
2	**(a)** **(i)** Electrons	[1]		
	(ii) Positive	[1]		
	(b) To stop charge building up [1] to prevent a spark [1] } dependent marking	[2]		
	(c) **(i)** 2.4 (V)	[1]		
	(ii) R = V/I or equivalent formula	[1]		
	R = 4/0.5	[1]		
	R = 8 [1] (Ω)	[1]	[3]	
	(iii) straight line [1] through (0,0) [1]	[2]		
	(d) **(i)** 20 (mA)	[1]		
	(ii) 20 (mA)	[1]		
	(iii) 40 (mA)	[1]		
	(e) **(i)** 4 (V)	[1]		
	(ii) 4 (V)	[1]		
	(iii) 8 (V)	[1]		
	(f) **(i)** E = P × t [1]			
	E = 1.25 × 2 [1]			
	E = 2.5 (kWh) [1]	[3]		
	(ii) 30 (p) to nearest penny, allow e.c.f. from **(i)**	[1]		20

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AVAILABLE MARKS

3 **(a)** **(i)** Energy [1]

(ii)  or or [1]

(iii) **A** Transverse **B** Longitudinal [2]

(iv) 30 (cm) [1]

(v) 50 (cm) [1]

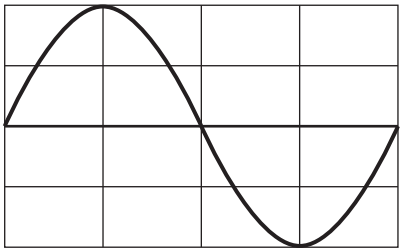
(vi) 8 (cm) [1]

(vii) 4 [1]

(viii) 4 (Hz) (allow ecf from **(vii)**) [1]

(b) $v = f \times \lambda$ [1]
$= 6 \times 0.4$ [1]
$= 2.4$ (m/s) [1] [3]

(c) $1 <$ Amplitude $\leqslant 2$ on LHS and RHS



loudness [1]
frequency [1]
} independent marking

[2]

(d)

Statement	True	False
Sound and light travel at the same speed in air		✓
Light can travel through a vacuum	✓	
Sound is a longitudinal wave motion	✓	

Mark by row [3]

(e) **(i)** Can cause loss of hearing **or** damage to ear drum or deafness [1]

(ii) Wear ear protectors/muffle the machine/ear muffs ear defenders/ear protection/ear plugs/ [1]

(iii) Decreases [1]

20

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					AVAILABLE MARKS
4	**(a)**	**(i)**	Incident ray from bulb to coin [1] Reflected ray into eye [1] Correct direction on either ray [1]	[3]	
		(ii)	Any named luminous object	[1]	
	(b)	**(i)**	Normal ⊥ to block at point of incidence, on both sides (in air and glass) [1] Bending of ray on correct side of normal [1] Bending in correct sense i.e. $\hat{i} > \hat{r}$ [1] (straight by eye)	[3]	
		(ii)	Incident ray normal to glass block i.e. collinear with incident ray on LHS	[1]	
		(iii)	The light travels faster in air than in glass (✓)	[1]	
	(c)	**(i)**	Splitting of light [1] into (different) colours/wavelengths/spectrum [1] (dependent marking)	[2]	
			Quality of written communication	[1]	
		(ii)	(Triangular) prism	[1]	
		(iii)	Spectrum	[1]	
		(iv)	(R) O Y G B I V (in words) and in correct order	[1]	
	(d)	**(i)**	Ultraviolet or UV	[1]	
		(ii)	X rays, gamma rays – either order	[1]	
	(e)	**(i)**	X-rays	[1]	
		(ii)	Visible	[1]	
		(iii)	Infra-red or IR	[1]	20
				Total	**80**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Double Award (Modular)

Paper 3
Foundation Tier

[G8203]

FRIDAY 28 MAY, MORNING

G8203

TIME

1 hour.

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 four** questions.

INFORMATION FOR CANDIDATES

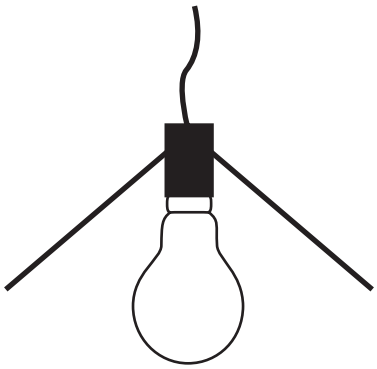
The total mark for this paper is 80.
Quality of written communication will be assessed in question **2(a)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
Total Marks	

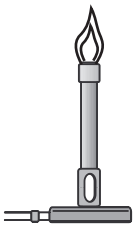
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Marks	Remark

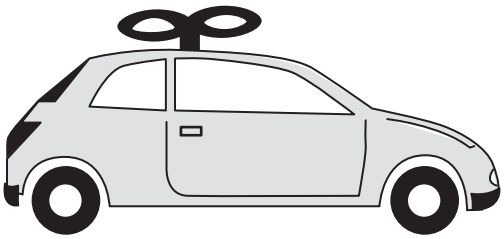
1 **(a)** A bulb is designed to change electrical energy to light energy.



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

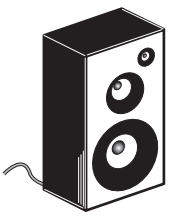


(i) A Bunsen burner changes **chemical** energy to _____ energy. [1]



(ii) A wound up spring in a toy car changes **strain** energy to

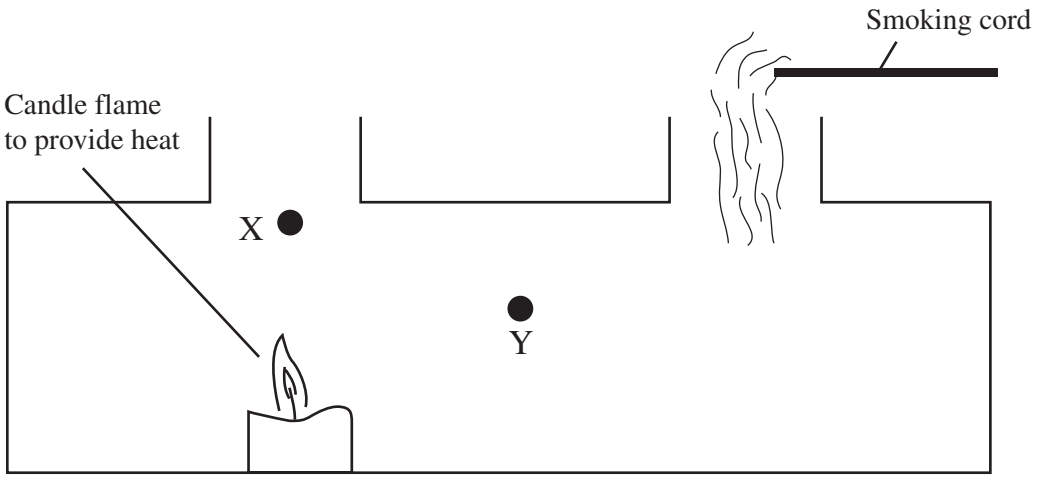
_____ energy. [1]



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

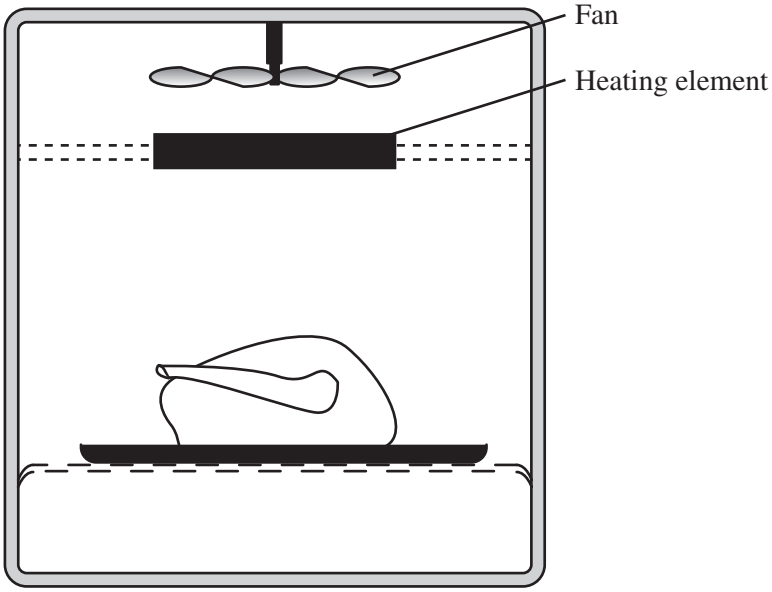
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(b) The apparatus shown is used to demonstrate convection currents in air.



(i) 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.



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

_____ [1]

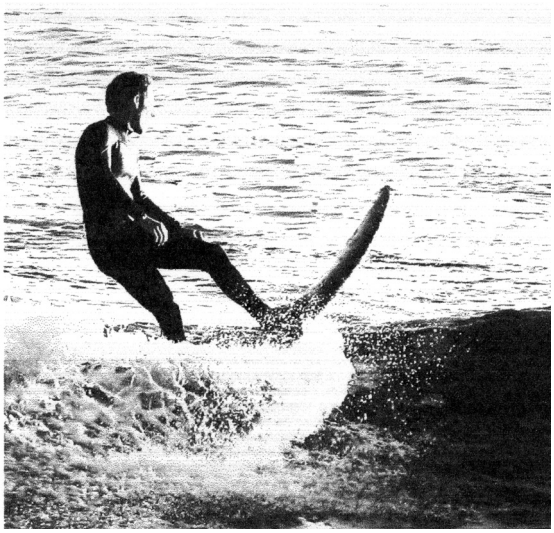
Examiner Only

Marks	Remark

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(c) A surfer "rides" the waves on a surfboard.

Examiner Only	
Marks	Remark



CCEA – Copyright: John Boyd

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

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

_____ [1]

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

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

_____ [1]

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

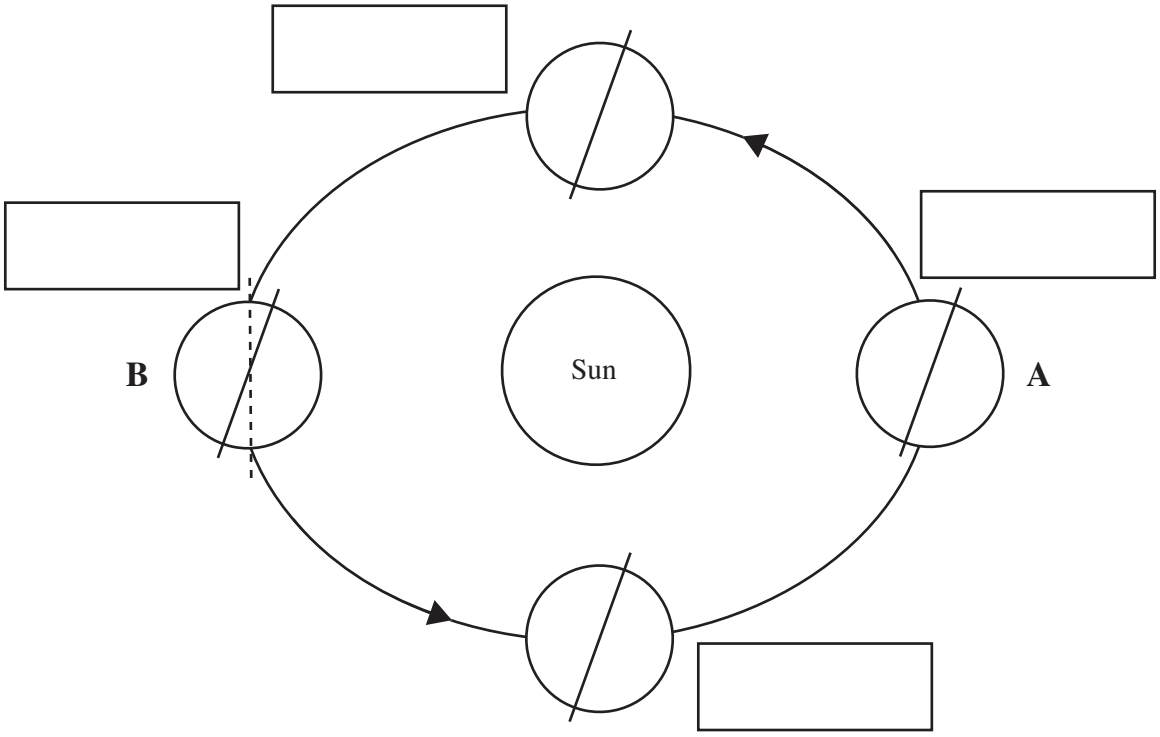
_____ [1]

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

_____ [1]

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(d) The following diagram shows the Earth's orbit round the Sun.



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

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

_____ months [1]

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

_____ hours [1]

(iv) 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

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(e) When a star is formed, matter is pulled together.

Examiner Only	
Marks	Remark

(i) Name the force that pulls the matter together.

_____ [1]

(ii) What happens to the matter as it becomes compressed?

_____ [1]

(iii) What nuclear reaction takes place in a star?

_____ [1]

(iv) Name a type of energy released by a star which reaches the Earth.

_____ [1]

(v) Which of the following planets is nearest to the Sun?

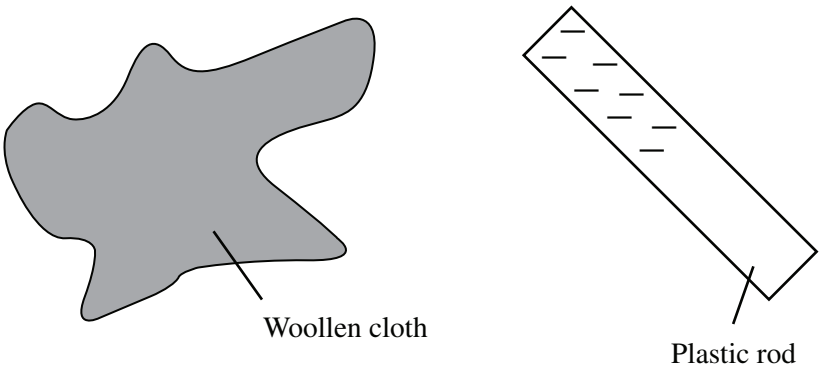
Earth **Saturn** **Venus** **Jupiter**

_____ [1]

Examiner Only	
Marks	Remark

2 **(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?

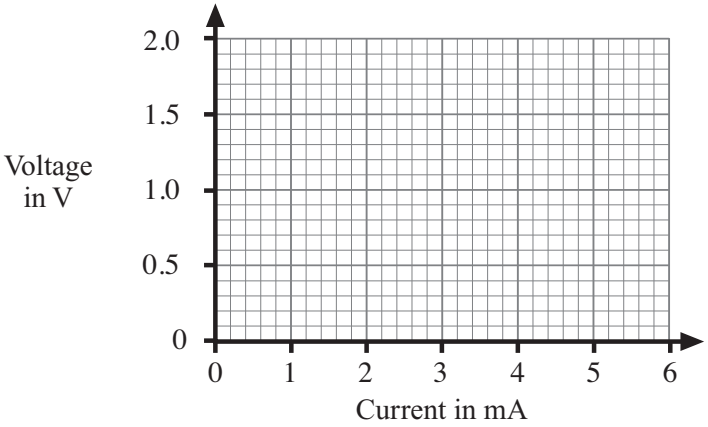
_____ [1]

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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]

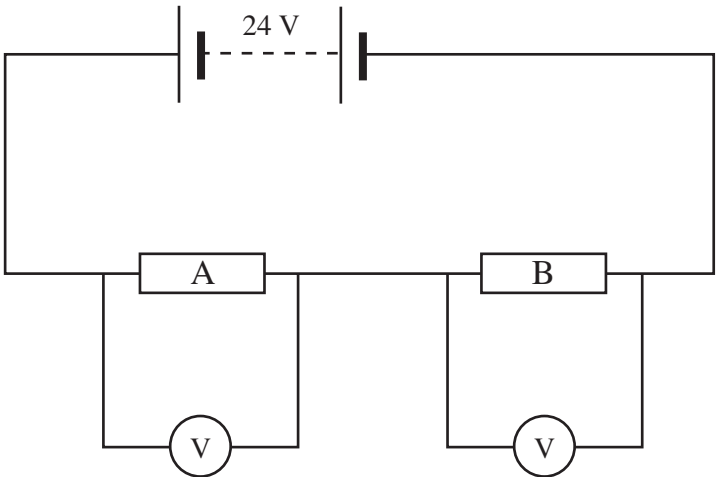
(v) Use your answers to parts **(iii)** and **(iv)** to calculate the resistance of the resistor.

You are advised to show your working out.

Resistance = _____ Ω [3]

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

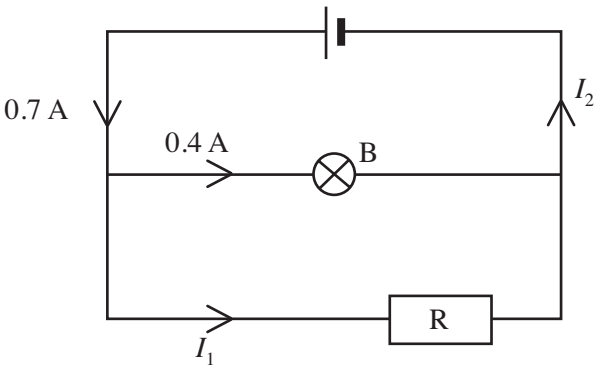


What are the voltmeter readings across the resistors?

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?

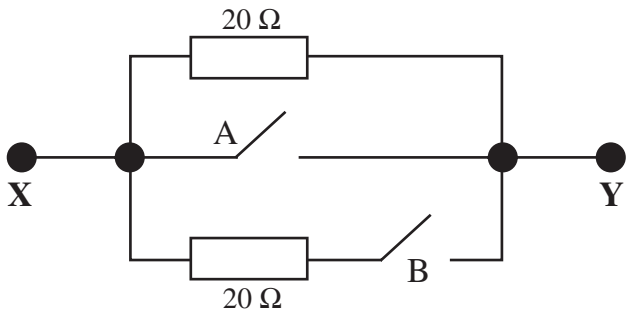
I_2 = _____ A [2]

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(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]

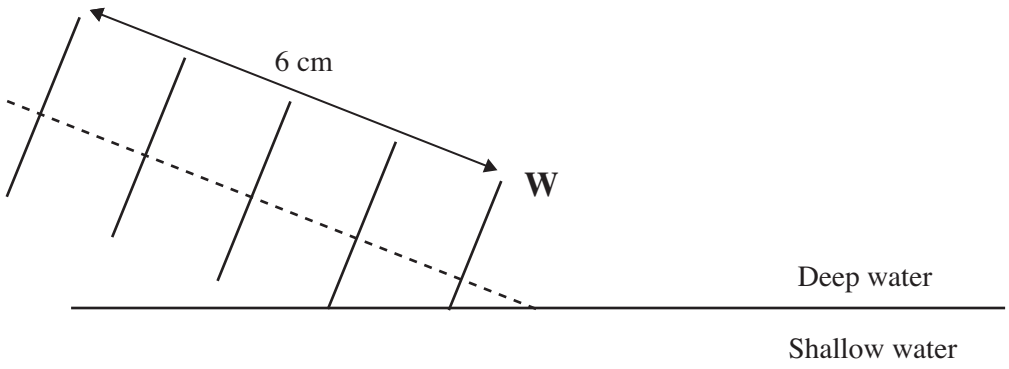
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3 **(a)** The following diagram (not to scale) shows water waves travelling through deep water.



(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]

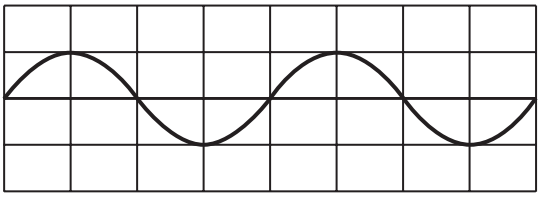
(v) What, if anything, happens to the wavelength of the water waves as they leave deep water and enter shallow water?

_____ [1]

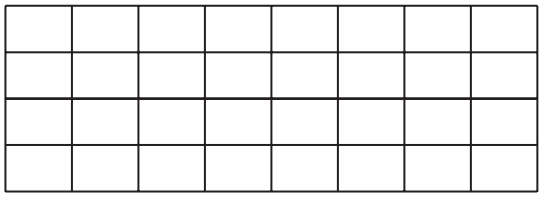
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(b) The outline of water waves is shown below.



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

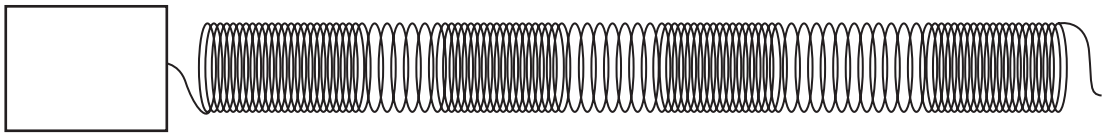


[2]

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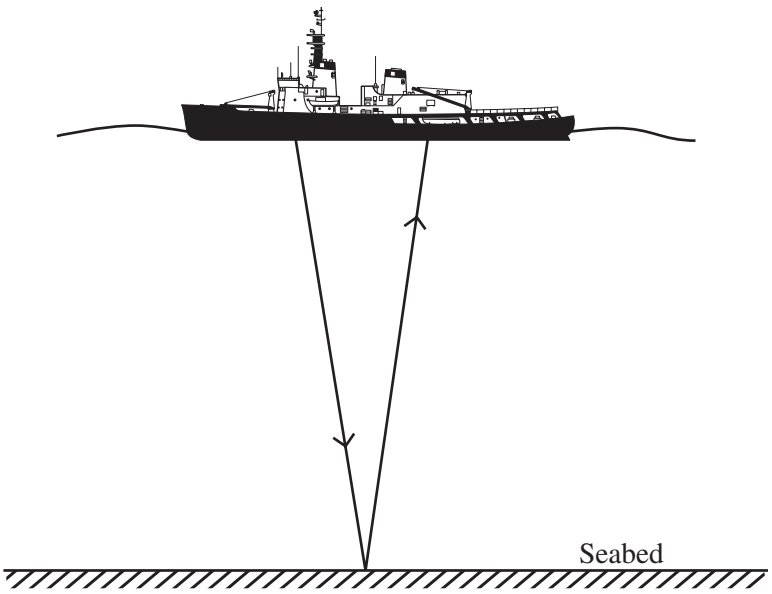
(d) (i) State the lower frequency limit for a child's hearing.

_____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.

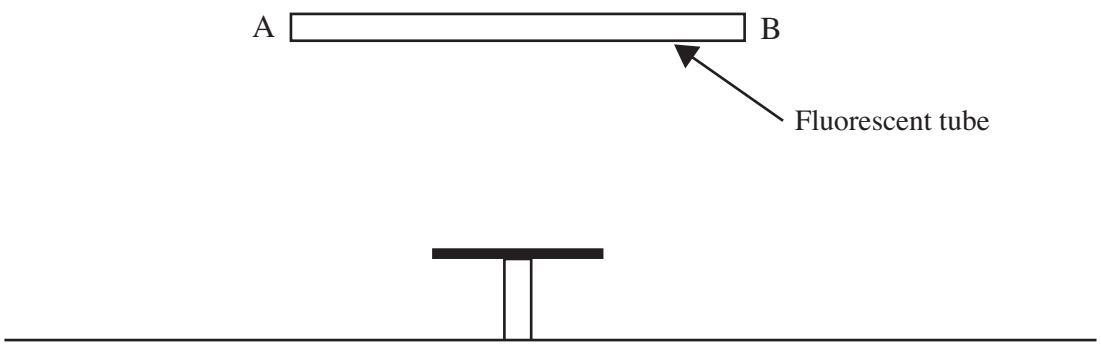
You are advised to show your working out.

Distance = _____ m [4]

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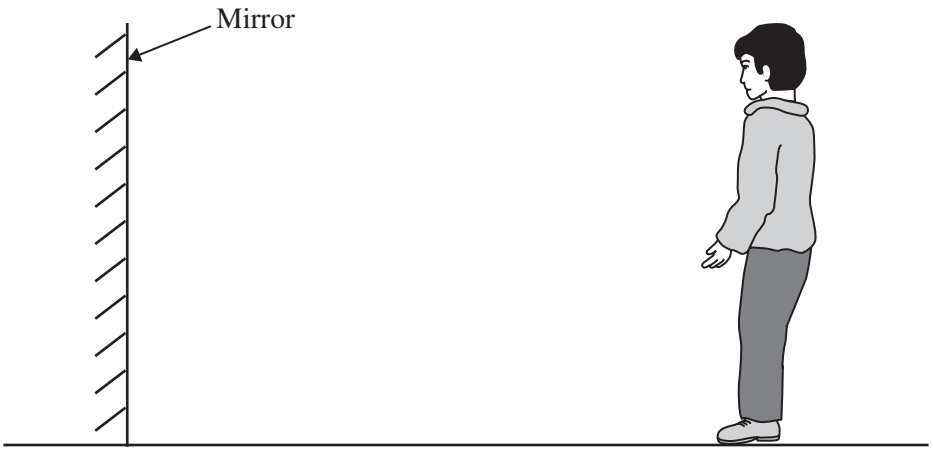
4 Light from a fluorescent tube forms a shadow of a table on the floor below.



(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.

Remember to include the normal and arrows to indicate the direction of the rays. [4]

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]

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

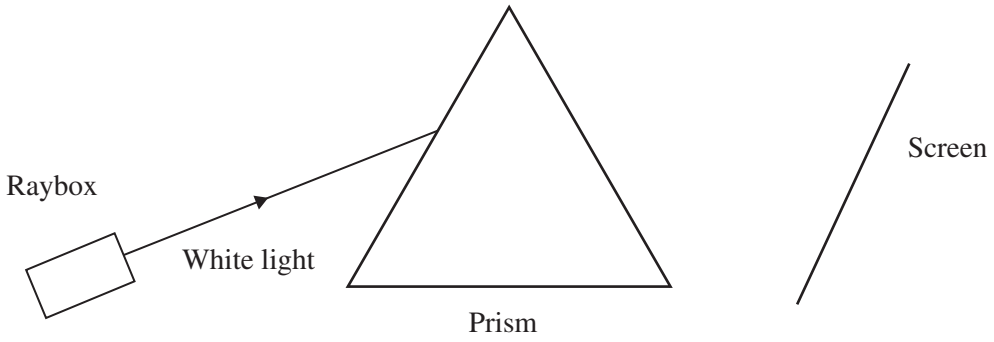
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Marks	Remark

_____

_____ [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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A diagram of the electromagnetic spectrum is shown.

Gamma rays		Ultra-violet rays	Visible rays	Infra-red rays	Micro-waves	Radio waves

(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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110009

GCSE

Science: Double Award (Modular)

Summer 2010

Mark Schemes

Issued: October 2010

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Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Modular)

Paper 3
Foundation Tier

[G8203]

FRIDAY 28 MAY, MORNING

MARK SCHEME

STEMUP.CO.UK

AVAILABLE MARKS

1 **(a)** **(i)** Heat/Thermal [1]

(ii) Kinetic/Movement/Moving [1]

(iii) Sound [1]

(b) **(i)** Correct clockwise arrows [1] each [2]

(ii) even distribution of heat (or equivalent) [1]

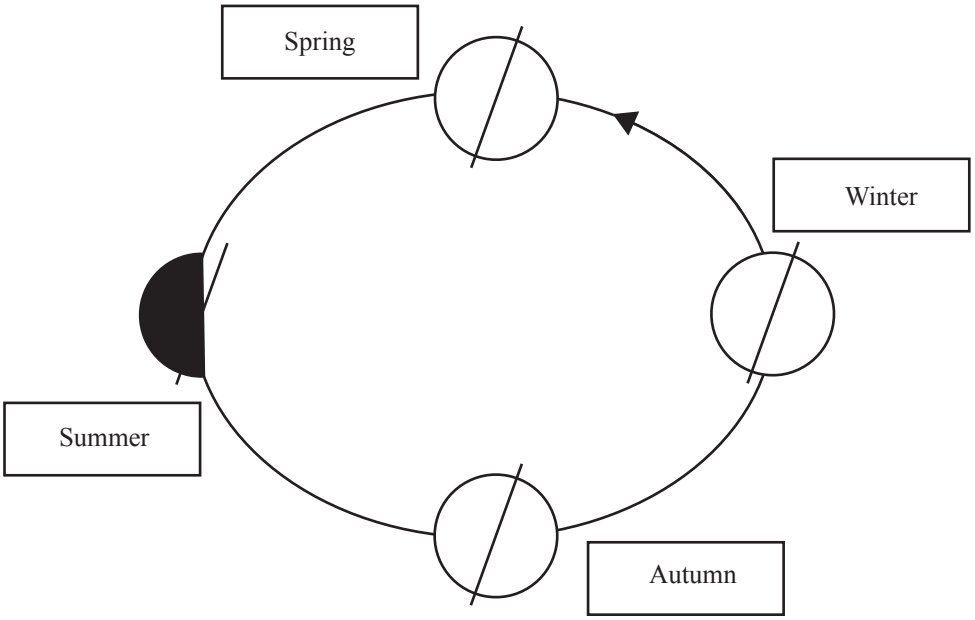
(c) **(i)** Less friction/gets faster [1]

(ii) Higher/rises [1]

(iii) Less stable [1]

(iv) make heavier/wider [1]

(d)



(i) $\frac{1}{2}$ mark per correct answer (round up) [2]

(ii) 6 months [1]

(iii) 24 hours [1]

(iv) As above [1]

			AVAILABLE MARKS
(e)	**(i)** Gravity/Gravitation	[1]	
	(ii) The temperature increased/It got hotter/It spins/Density increases	[1]	
	(iii) (Nuclear) fusion	[1]	
	(iv) Any named em radiation/heat	[1]	
	(v) Venus	[1]	20

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AVAILABLE MARKS

2 **(a)** **(i)** **Electrons** moved [1] from cloth [1]/to the rod [1]
Rod gains electrons [2]
QWC [1] [3]

(ii) Like charges repel [1]

(iii) Attract (the paint) [1] [5]

(b) **(i)** Four correct points ± 0.5 square [1]

(ii) Best fit line [1]

(iii) Voltage = 1.0 (V) **ecf** from (ii) [1]

(iv) 0.002 (A) [1]

(v) $R = \frac{V}{I}$ or V = IR or equivalent [1]

$R = \frac{1}{0.002}$ e.c.f. from **(iii)** and **(iv)** [1]

$= 500(\Omega)$ [1] [7]

(c) A : 12 (V)
B : 12 (V) [2]

(d) 0.3 A
0.7 A [2]

(e)

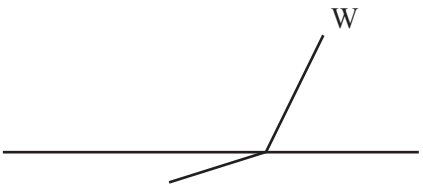
20
10
0
0

[4] 20

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AVAILABLE MARKS

3 **(a)** **(i)**



must be continuous [1]

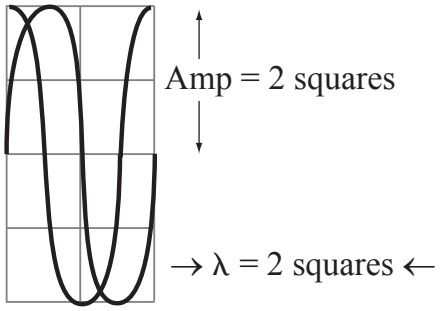
(ii) Wavelength = 1.5 (cm) [1]

(iii) Frequency = 6 [1] (Hz) [1]

(iv) Speed = Frequency × wavelength (or use symbols) [1]
= 6 {e.c.f. from **(iii)**} × 1.5 {e.c.f. from **(ii)**} [1]
= 9.0 (cm/s) [1]

(v) Smaller/Shorter/decreases/less [1] [7]

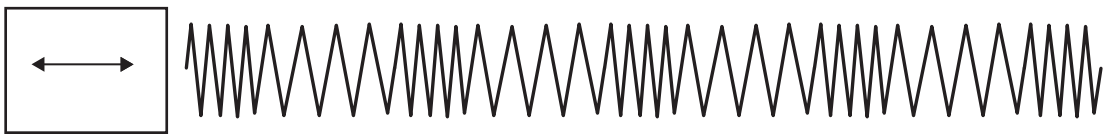
(b) **(i)**



[2]

(ii) Light, any other named em radiation [2] [4]

(c) **(i)**



In the box [1]

(ii) Sound, ultrasound, s-waves [1]

(iii) Energy [1] [3]

(d) **(i)** 20 (Hz) [1]

(ii) lower/decreases/less [1]

(iii) $\text{Speed} = \dfrac{\text{distance}}{\text{time}}$ or distance = speed × time [1]

(Total) distance = 1500 × 0.8 or distance = 15 × 0.4 [2] [1]
= 1200 m [1]
Distance = 600 m = 600 [1] [6]

20

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						AVAILABLE MARKS
4	**(a)**	**(i)**	Four correct arrows (rays) within 1mm	[4]		
		(ii)	Correct label	[1]	[5]	
	(b)	**(i)**	Normal	[1]		
			Incident ray (correct direction)	[1]		
			Reflected ray (into eye)	[1]		
			i = r	[1]		
		(ii)	Less	[1]	[5]	
	(c)	**(i)**	Splitting of light } Independent	[1]		
			into different colours/wavelengths } Marking	[1]		
		(ii)	At point of incidence labelled P	[1]		
		(iii)	Label Q inside prism	[1]		
		(iv)	Away from normal	[1]	[5]	
	(d)	**(i)**	X-rays	[1]		
		(ii)	Two from: same velocity/(speed) travel in vacuum transverse can be polarised	[2]		
		(iii)	Two from: infra-red microwaves visible/light	[2]	[5]	20
					Total	**80**

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