CCEA GCSE SCIENCE: DOUBLE AWARD (NON-MODULAR)

SCIENCE



EXAM QUESTION PACK

PAPER 3 FOUNDATION TIER G8403 PAPERS

STEMUP

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Double Award (Non-Modular)

Paper 3
Foundation Tier

[G8403]

G8403

FRIDAY 15 JUNE, AFTERNOON

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**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
Total Marks	

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Examiner Only	
Marks	Remark

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

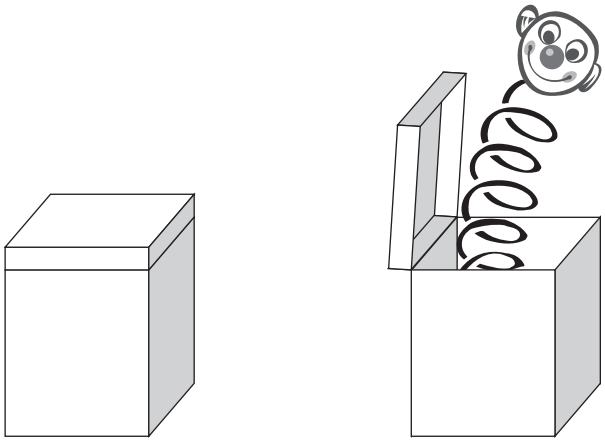
(i) a petrol driven car?



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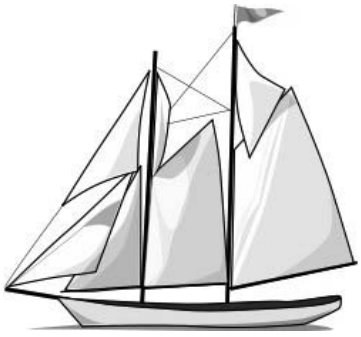
[1]

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



[1]

(iii) a sailing boat?



[1]

Examiner Only

Marks | Remark

2 **(a)** 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]

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

_____ [1]

3 The diagram shows:

A a cyclist

B a racing car



© Hemera / Thinkstock

A



© iStockphoto / Thinkstock

B

(i) Which is more stable?

Answer _____ [1]

(ii) Give two reasons for your answer.

1. _____ [1]

2. _____ [1]

4 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	

Examiner Only

Marks	Remark

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

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

_____ [1]

(c) What is a galaxy?

_____ [1]

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

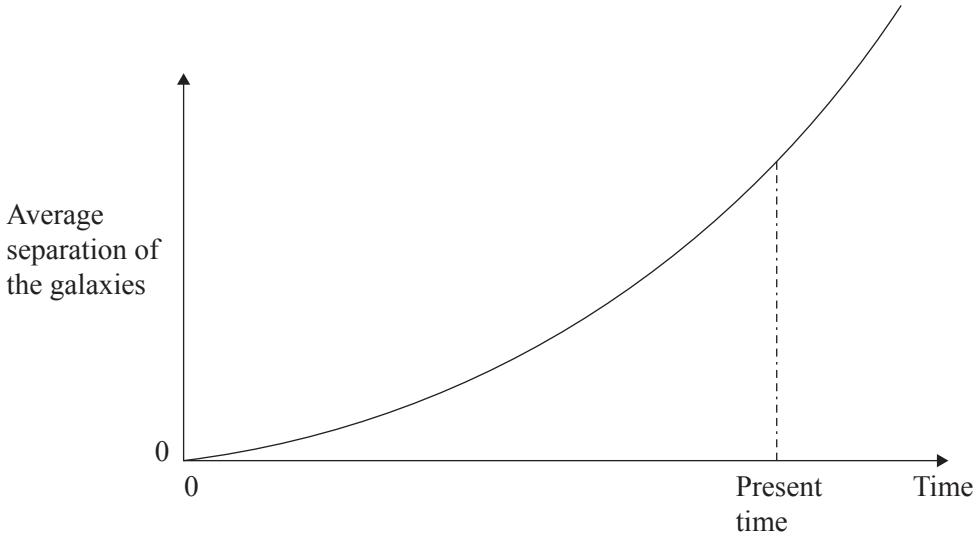
_____ [1]

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5 The Big Bang theory explains the origin and expansion of the universe.

Examiner Only

Marks	Remark



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

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

_____ [1]

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

_____ [1]

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

1. _____

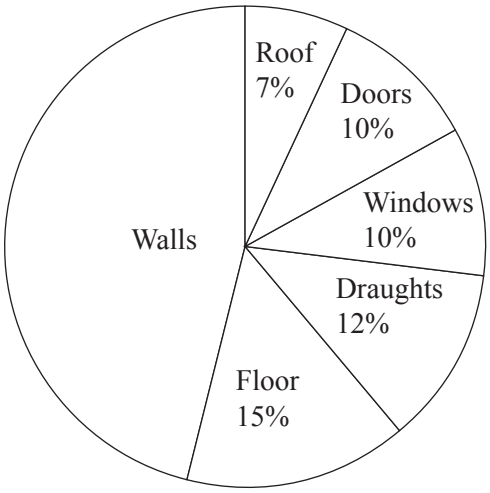
2. _____ [2]

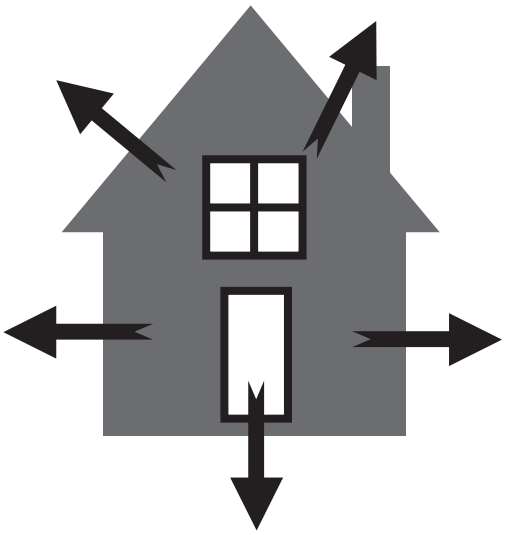
(d) What nuclear process in stars generates energy?

_____ [1]

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6 The pie chart shows the main sources of heat loss from a house which has not been properly insulated.





(a) What is the percentage of heat loss through the walls?

You are advised to show your working out.

_____ % [2]

(b) Name the main method of heat transfer through the walls.

_____ [1]

(c) Explain fully why fibreglass is a suitable material for roof space insulation.

_____

_____ [2]

Double glazing, with a vacuum between the panes, is used to reduce heat loss through the windows.

(d) State the two methods of heat transfer that are reduced.

1. _____

2. _____ [2]

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Marks	Remark

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7 A photograph of a toaster is shown below.



Source: CCEA – Copyright: John Boyd

(a) State the main method of heat transfer from the hot elements of the toaster to the bread.

_____ [1]

(b) Why is the inside of the toaster silvered?

_____ [1]

(c) Explain fully the advantage of having the outsides of toasters silvered rather than matt black.

_____

_____ [2]

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Marks	Remark

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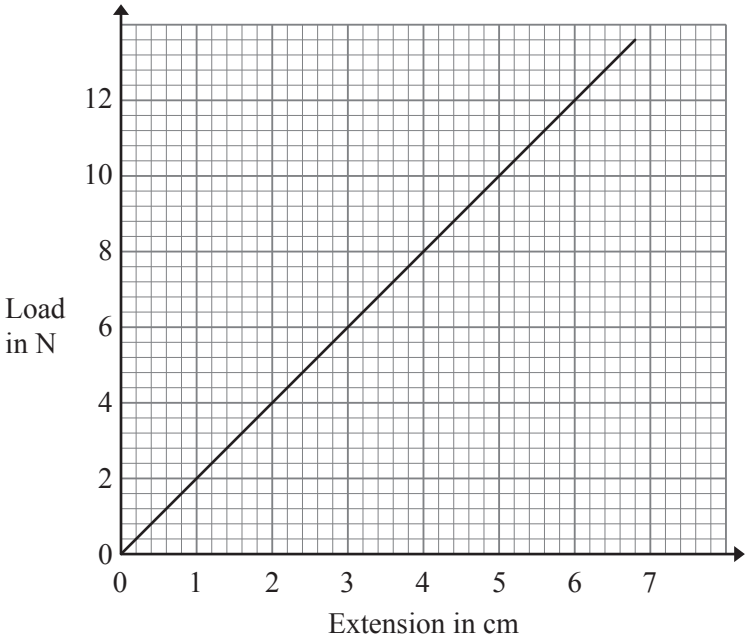
Examiner Only	
Marks	Remark

8 **(a)** State Hooke's Law.

_____

_____ [2]

The load–extension graph for a helical spring is shown below.



The unstretched length of the spring is 7 cm. When a load is hung on the spring its **total length** is 12 cm.

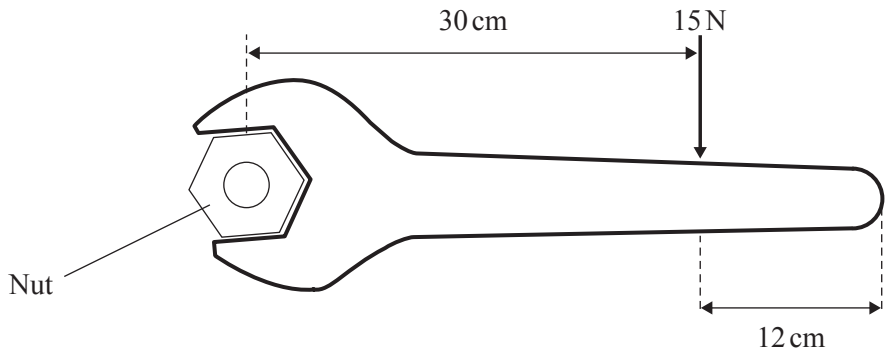
(b) Use the graph to find the load.

You are advised to show your working out.

Load = _____ N [2]

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9 A car mechanic is using a spanner to loosen a nut.



He applies a 15 N force as shown.

(i) Mark the pivot in the diagram with a point labelled P. [1]

(ii) Calculate the moment of the force, in N cm, the mechanic applies.

You are advised to show your working out.

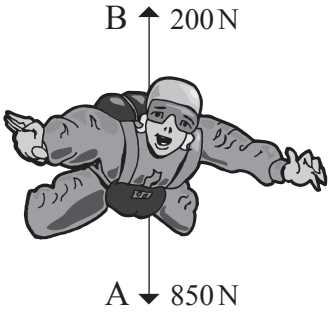
Moment = _____ N cm [3]

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Marks	Remark

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10 A skydiver jumps from a plane. Two forces are shown on the diagram below.



(a) Identify the two forces.

Force A is _____ Force B is _____ [2]

Initially force A is 850 N and force B is 200 N.

(b) Describe the motion of the skydiver.

_____ [1]

Later in the fall, force B increases to 850 N and force A remains at 850 N.

(c) Describe the motion of the skydiver when the two forces are equal.

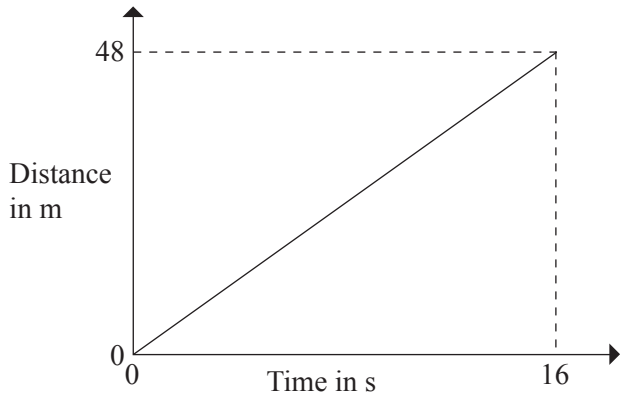
_____ [1]

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Marks	Remark

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11 The following graph shows how the distance a man walks varies with time.



Use the graph to calculate the speed of the man.

You are advised to show your working out.

Speed = _____ m/s [3]

12 The hot plate on a cooker transfers 840 kJ of heat energy to a saucepan full of water. This requires 1200 kJ of electrical energy.

(a) What, if any, is the unit for the efficiency?

_____ [1]

(b) Calculate the efficiency of the hotplate.

You are advised to show your working out.

Efficiency = _____ [3]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

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



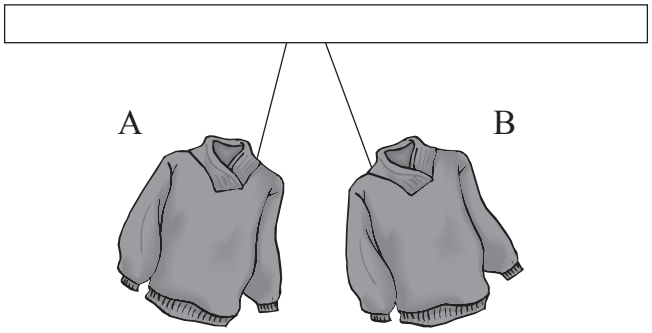
(i) Explain fully in terms of charge movement how the sweater became charged.

_____

_____ [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?

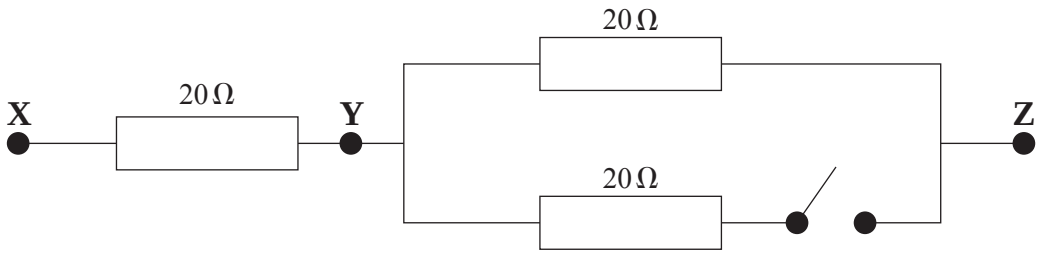
_____ [1]

(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]

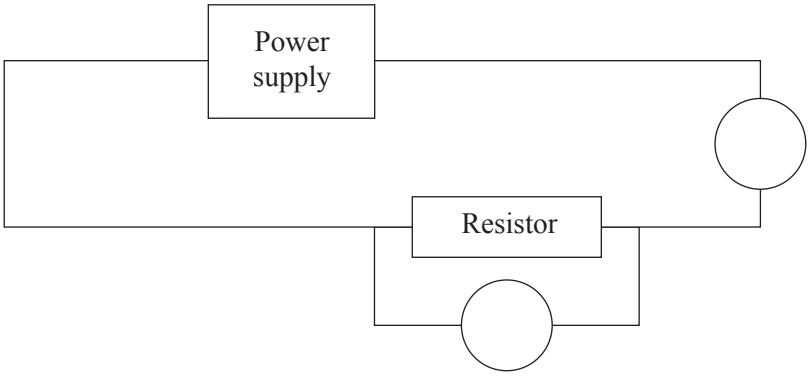
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

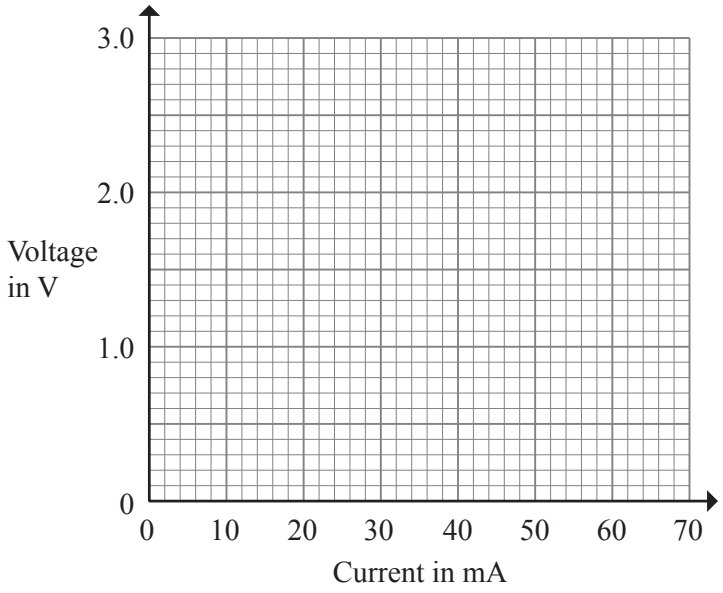
(d) James uses the following circuit to investigate the variation of current with voltage for a resistor.



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

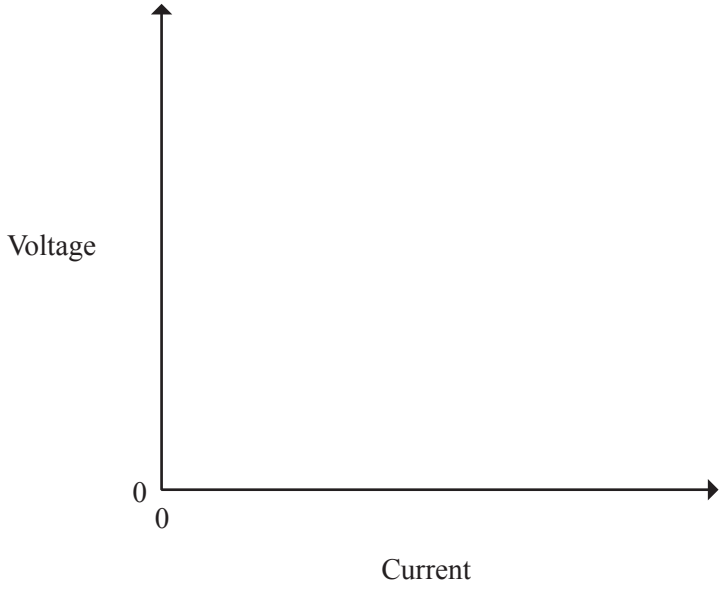
Current = _____ A [1]

(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.



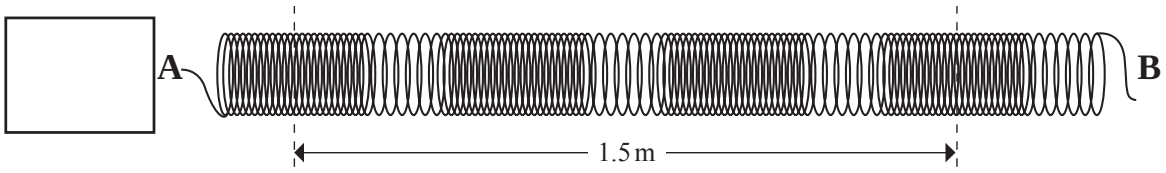
[2]

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Marks	Remark

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14 (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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Marks | Remark

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

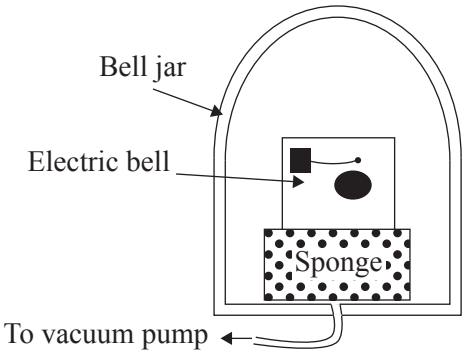
(i) How would the vibrations of the slinky spring be different if Shauna made a transverse wave?

_____ [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]

Examiner Only

Marks	Remark

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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]

Examiner Only	
Marks	Remark

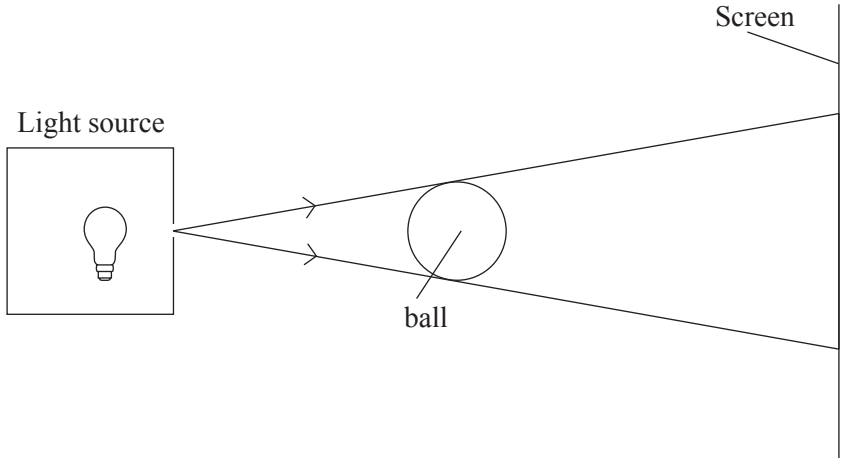
Examiner Only
Marks | Remark

15 (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.

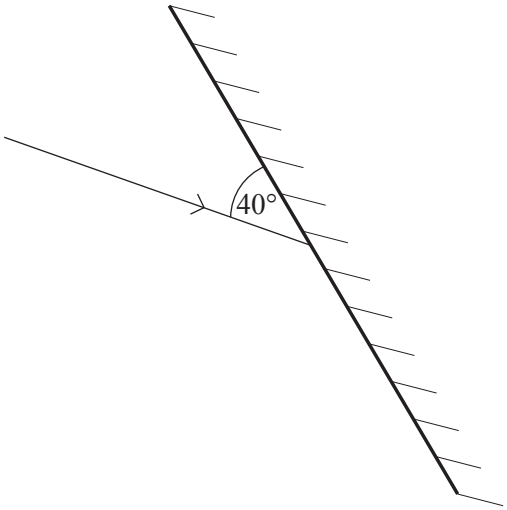
B The shadow contains partial shadow AND uniformly black shadow.

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.



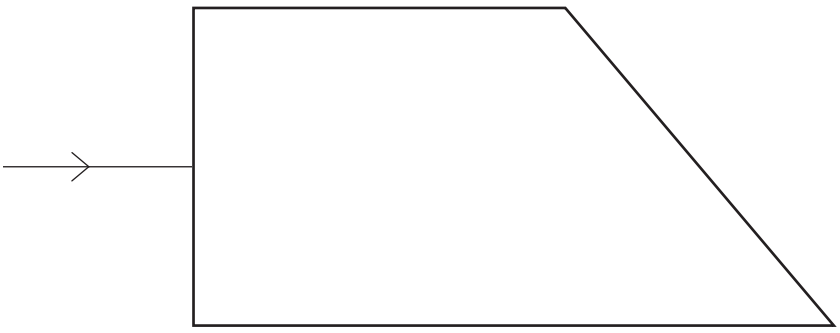
(b) (i) Draw and label the normal. [1]

(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?

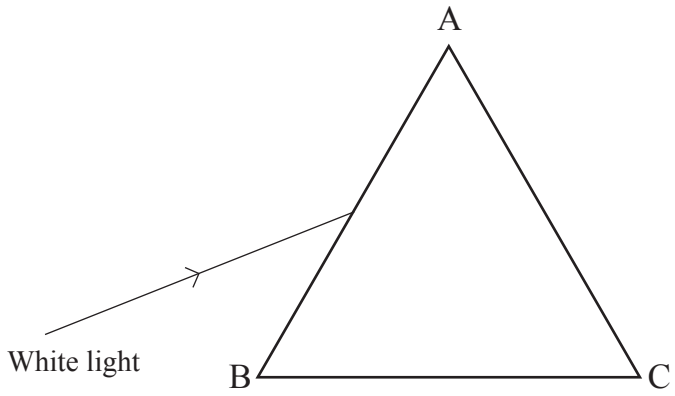
_____ [1]

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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]

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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

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Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Double Award (Non-Modular)

Paper 3
Foundation Tier

[G8403]

FRIDAY 15 JUNE, AFTERNOON

MARK SCHEME

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				AVAILABLE MARKS
1	**(i)**	Chemical	[1]	
	(ii)	Elastic/Strain	[1]	
	(iii)	Kinetic/Wind	[1]	3
2	**(a)**	Non-renewable [1] Renewable [1] Non-renewable [1]	[3]	
	(b)	Gas	[1]	4
3	**(i)**	Car B	[1]	
	(ii)	1. Wider base (dependent marking from **(i)**) 2. Lower c of g	[1] [1]	3
4	**(a)**	Venus, Mars, Jupiter, Neptune [$\frac{1}{2}$] each (round up)	[2]	
	(b)	Sun	[1]	
	(c)	A collection of stars	[1]	
	(d)	Milky Way	[1]	5
5	**(a)**	Universe has a starting point	[1]	
	(b)	Steady State **or** String	[1]	
	(c)	Lack of sufficient fuel **or** food **or** time required (any **two**)	[2]	
	(d)	Fusion	[1]	5
6	**(a)**	54% [1] 46% [1]	[2]	
	(b)	Conduction	[1]	
	(c)	It traps air [1] which is a good insulator **or** poor conductor [1]	[2]	
	(d)	Conduction and convection – marked separately	[2]	7

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				AVAILABLE MARKS
7	**(a)**	Radiation	[1]	
	(b)	To reflect radiation (back to the bread)	[1]	
	(c)	Silver colour is a poor emitter (of radiation) [2] or [0] **or** black is a good emitter [2] or [0]	[2]	4
8	**(a)**	Extension and load (directly) proportional [1] up to (elastic) limit [1]	[2]	
	(b)	Extension = 5 **cm** [1] 5 **cm** for partial credit ∴ Load = 10 (N) [1]	[2]	4
9	**(i)**	Pivot labelled	[1]	
	(ii)	Moment = F × d [1] = 15 × 30 [1] = 450 (N cm) [1]	[3]	4
10	**(a)**	A is weight/gravity **or** gravitational force [1] B is air resistance/drag/friction [1] **not** "Wind resistance"	[2]	
	(b)	Accelerates	[1]	
	(c)	Constant velocity/speed	[1]	4
11		Speed = Distance/time or speed = grad [1] = 48/16 [1] = 3 (m/s) [1]	[3]	3
12	**(a)**	No units	[1]	
	(b)	Efficiency = $\frac{\text{Energy out}}{\text{Energy in}}$ [1] Efficiency = $\frac{840}{1200}$ [1] Efficiency = 0.7 [1]	[3]	4

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					AVAILABLE MARKS
13	**(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) 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)	Straight line through (0, 0) ($\pm \frac{1}{2}$ square)	[1]	
		(iii)	Current = 0.06 (A)	[1]	
		(iv)	R = V/I [1] **or** equivalent = 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
14	**(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]	

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				AVAILABLE MARKS
(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

15 **(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
Deduct [1] if correct but reversed [2]

(iii) Spectrum [1]

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(e)	**(i)** Gamma **or** γ	[1]	AVAILABLE MARKS
	(ii) Infrared **or** IR	[1]	
	(iii) Gamma **or** γ	[1]	
	(iv) Ultraviolet **or** UV	[1]	
	(v) Radio waves	[1]	20
		Total	**110**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Double Award (Non-Modular)

Paper 3
Foundation Tier

G8403

[G8403]

WEDNESDAY 25 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 **15(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	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
Total Marks	

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Examiner Only	
Marks	Remark

1 The table gives a list of renewable and non-renewable energy sources. For each source tick (✓) the box to show whether it is renewable or non-renewable. The first one has been done for you.

Energy source	Renewable	Non-renewable
Nuclear		✓
Wind		
Biomass		
Coal		
Hydroelectric		

[4]

2 A football travelling through the air has two main types of energy.



Ground

(i) What are these two types of energy?

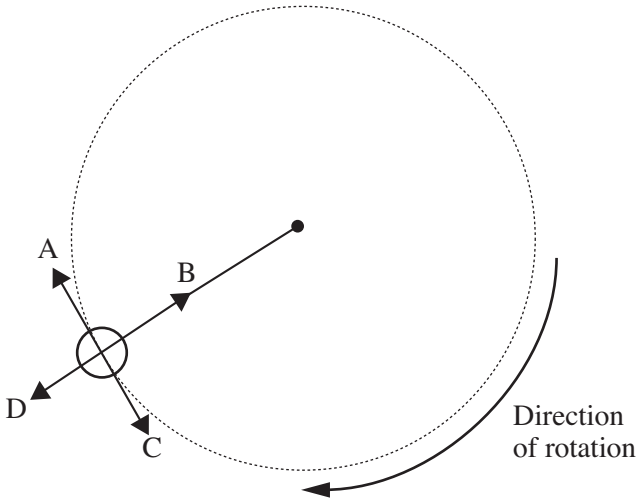
_____ energy and _____ energy. [2]

(ii) When the ball hits the ground some of its energy is changed into sound energy and some into another type of energy.
What is this other type of energy?

_____ energy. [1]

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3 The diagram shows a bird's eye view of a conker being whirled in a horizontal circle.



Four directions, A, B, C and D are shown on the diagram.

(i) Which letter A, B, C or D gives the direction of the force which keeps the conker moving in a circle?

Letter _____ [1]

(ii) Which letter A, B, C or D gives the direction of the conker's velocity at the position shown?

Letter _____ [1]

(iii) In which direction A, B, C or D will the conker move if the string breaks?

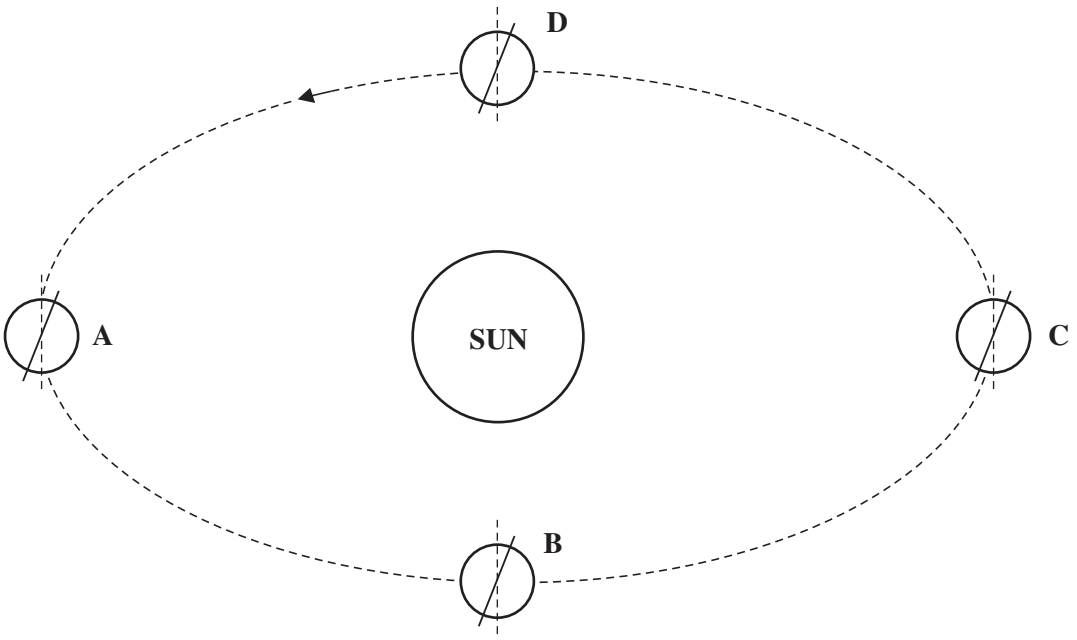
Letter _____ [1]

Examiner Only

Marks	Remark

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4 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]

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

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

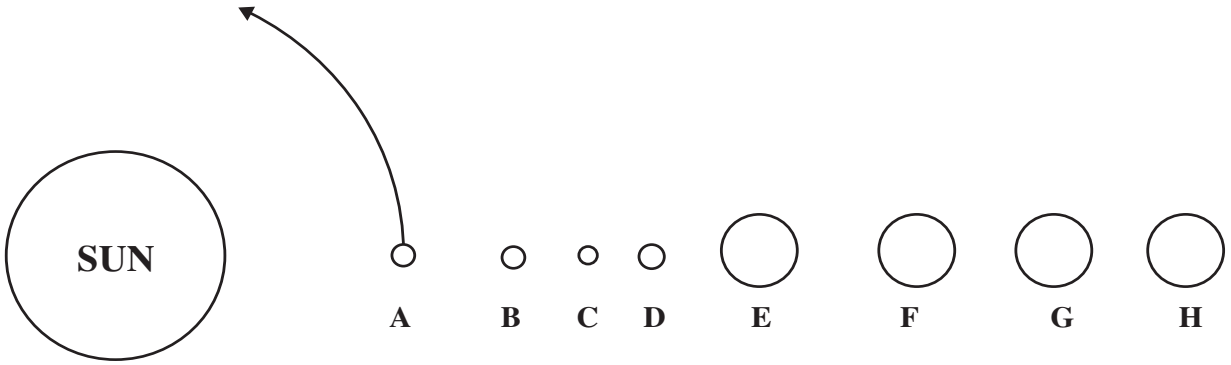
Force is called _____ [1]

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Marks	Remark

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



Examiner Only

Marks	Remark

(a) Name planets **B** and **H**.

B _____ **H** _____ [2]

(b) 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.

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

_____ [1]

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

_____ [1]

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

_____ [1]

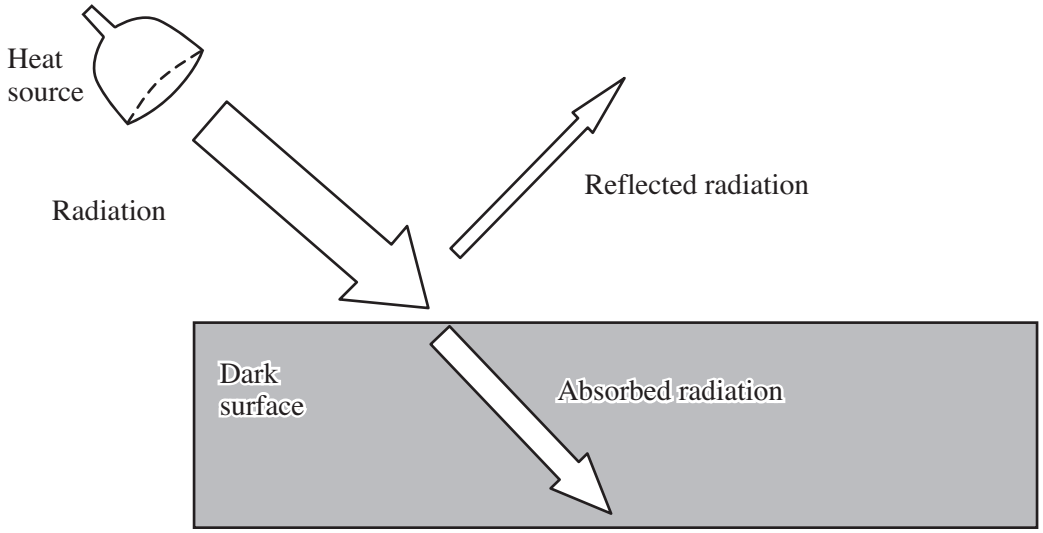
(e) Our Sun is a member of a galaxy. What is the name of this galaxy?

_____ [1]

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Examiner Only	
Marks	Remark

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



37% of the radiation is reflected.

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

_____ % [1]

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

_____ [1]

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

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

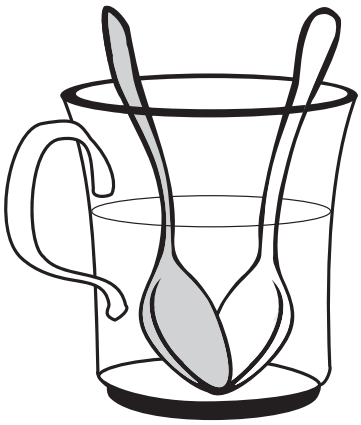
_____ [1]

(ii) Why is this material suitable?

_____ [1]

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



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

_____ [1]

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

_____ [1]

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

_____

_____ [2]

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

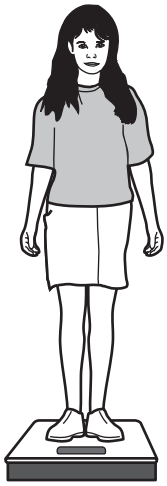
_____ [1]

Examiner Only

Marks	Remark

8 Beth stands on a set of bathroom scales which gives a reading of 82 kg.

Examiner Only	
Marks	Remark



(i) What is Beth's weight?

Weight = _____ N [1]

The total area of Beth's feet in contact with the bathroom scales is 164 cm^2.

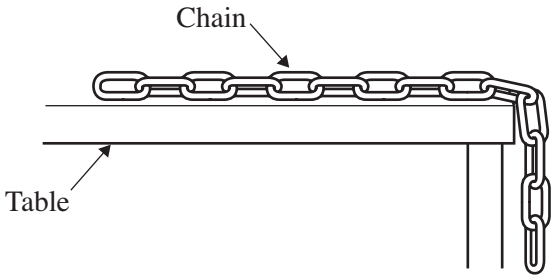
(ii) Calculate the pressure Beth exerts on the bathroom scales.
Remember to include the unit.
You are advised to show your working out.

Pressure = _____ [4]

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Examiner Only	
Marks	Remark

9 A chain hangs at rest over the edge of a table. The links hanging over the edge produce a force which tries to pull the chain off the table.



(a) What is the name of the force trying to pull the chain off the table?

Name of force _____ [1]

The chain remains at rest because another force is acting.

(b) (i) What is the name of this force?

Name of force _____ [1]

(ii) What is the direction of the force? Circle the correct direction.

Force is to the right

Force is downwards

Force is to the left

Force is upwards [1]

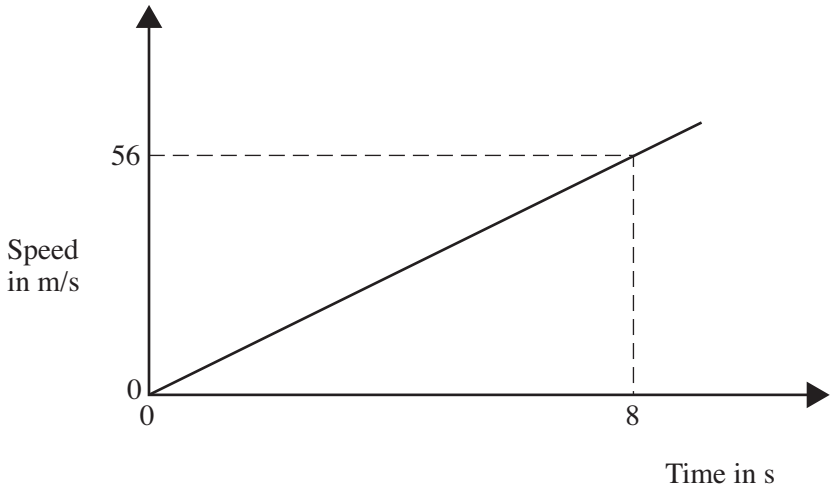
The total weight of the links hanging over the edge of the table is 0.8N.

(c) What is the size of the force you have named in **(b)(i)**?

Force = _____ N [1]

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10 The following graph of speed against time shows the movement of a racing car as it starts from rest.



What is the acceleration of the car?
You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

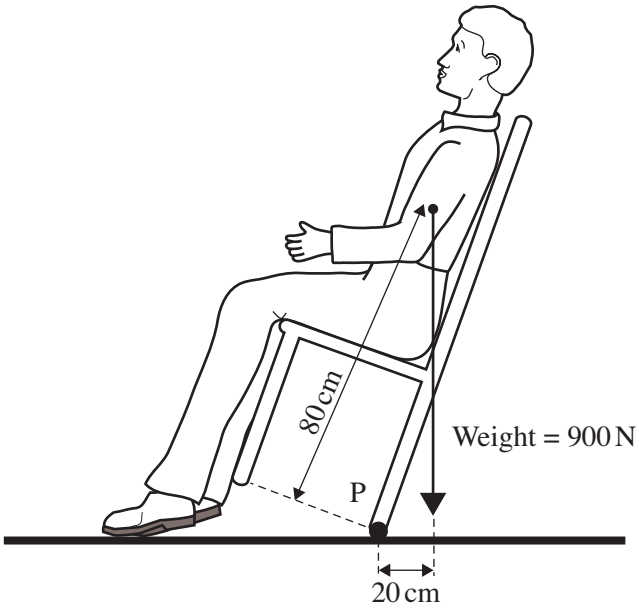
11 A fork lift truck is used to lift a load of 500 N to a height of 3 m.
How much work is done in lifting the load?
Remember to include the unit.
You are advised to show your working out.

Work done = _____ [4]

Examiner Only
Marks | Remark

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12 Roy leans back in his chair as shown.



Roy's weight of 900 N produces a moment about the point P which tends to tip him over.

(i) What is the direction of the moment caused by Roy's weight about the point P?

_____ [1]

Two distances are shown on the diagram.

(ii) Choose the correct distance and calculate this moment about point P.
You are advised to show your working out.

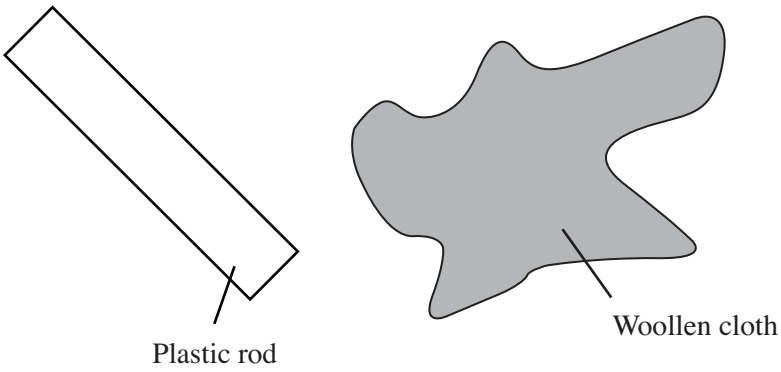
Moment = _____ Ncm [3]

Examiner Only
Marks | Remark

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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) 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.

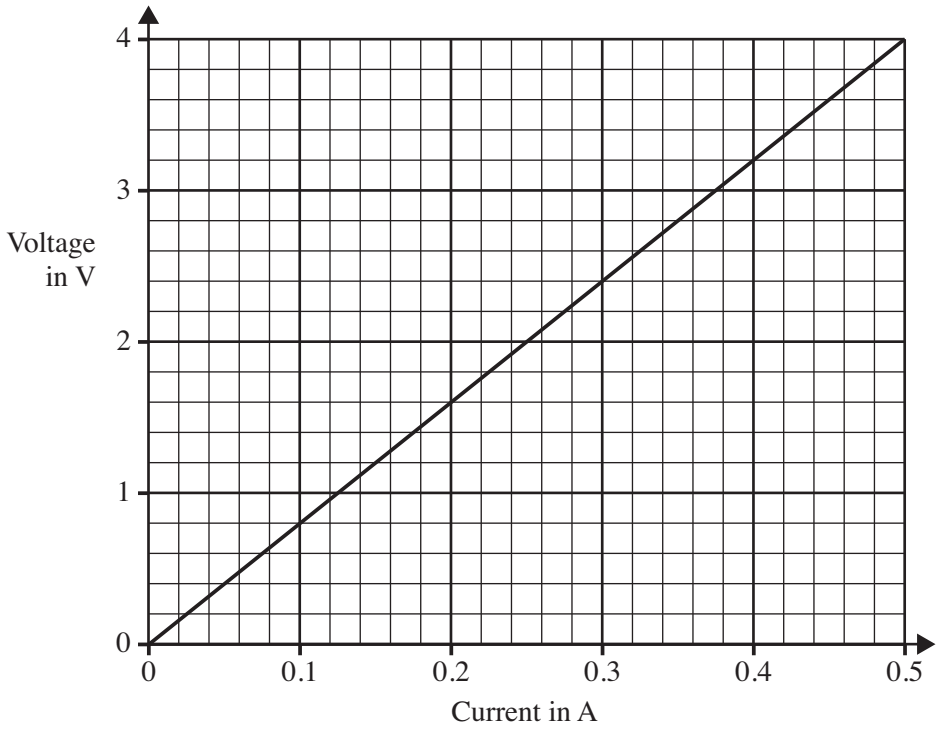
_____

_____ [2]

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(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]

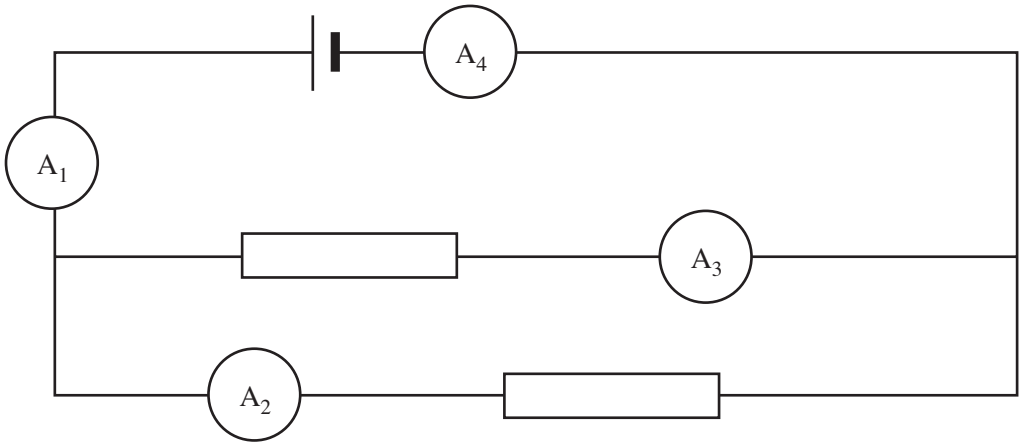
(iii) Which two features of the graph show that the voltage is directly proportional to the current?

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]

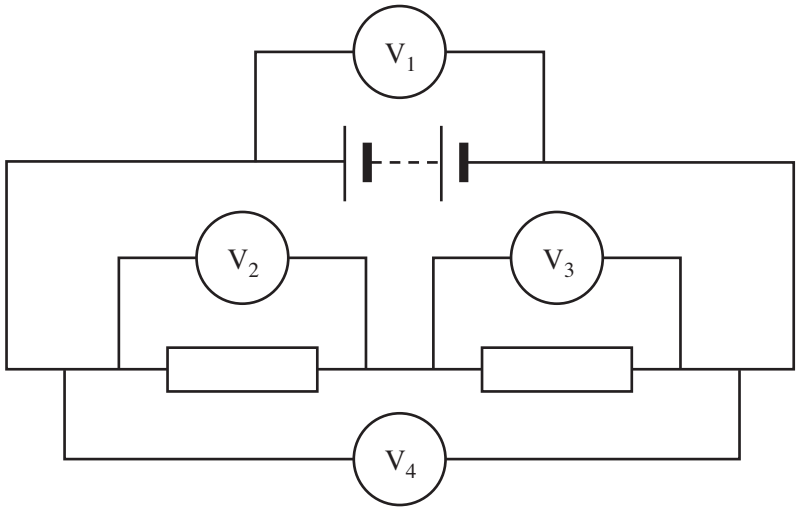
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(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.

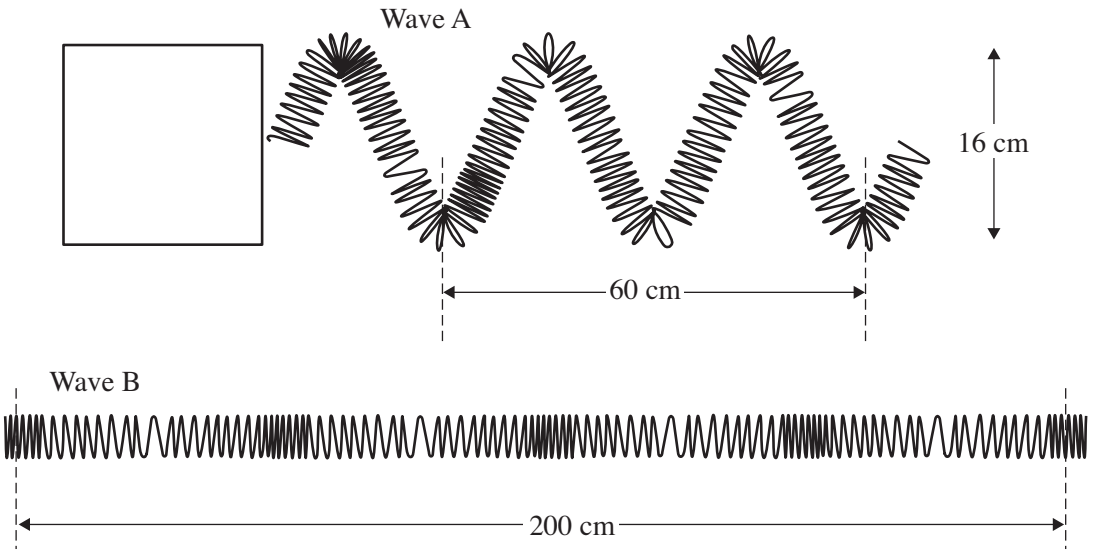
Energy used = _____ kWh [3]

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

Cost = _____ p [1]

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14 (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]

Examiner Only

Marks	Remark

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]

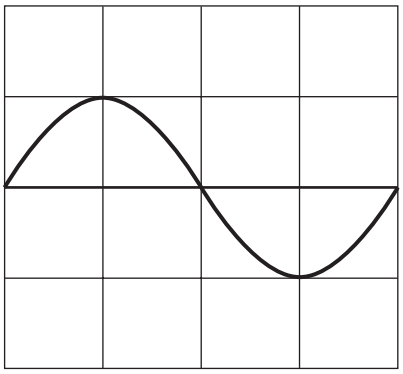
(viii) What is the frequency of vibration of wave B?

_____ Hz [1]

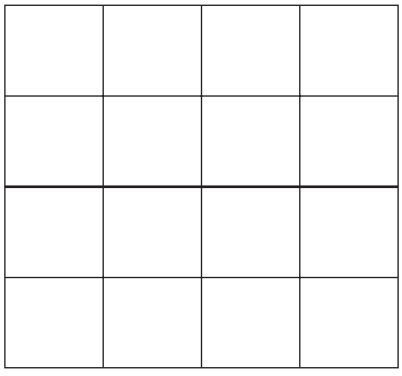
(b) A wave has a frequency of 6 Hz and a wavelength of 0.4 m.
Calculate the speed of the wave.
You are advised to show your working out.

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?

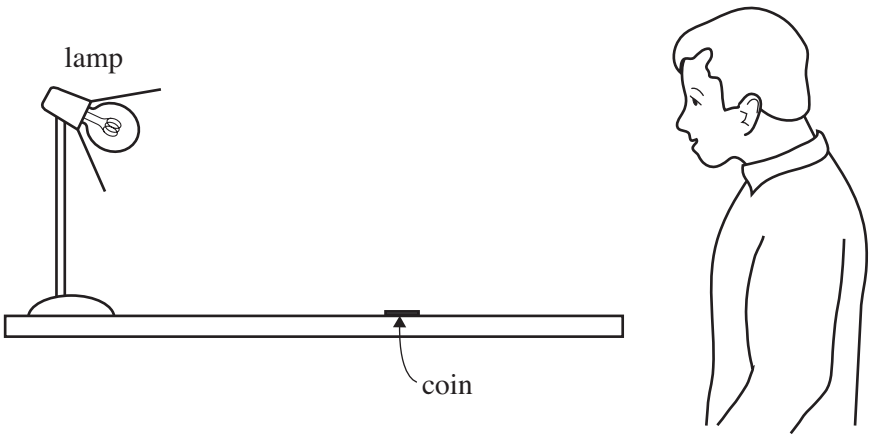
_____ [1]

Examiner Only

Marks	Remark

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15 John observes a coin sitting on a table.

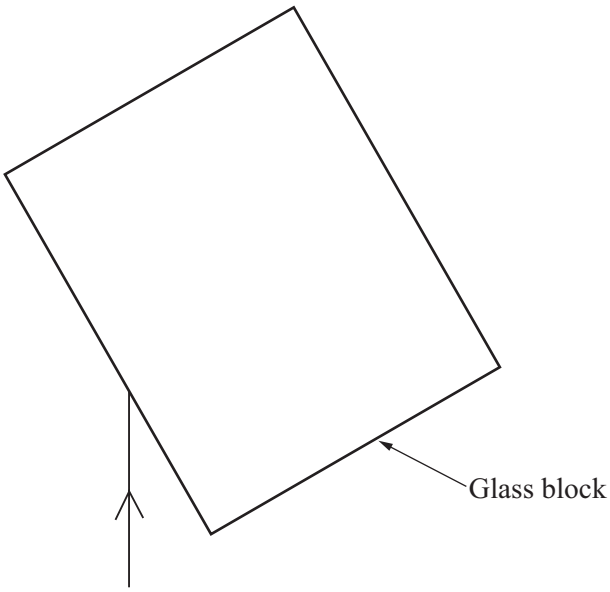


(a) (i) Draw an incident ray and a reflected ray to show how John sees the coin. Include an arrow to show the direction of the light. [3]

(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.



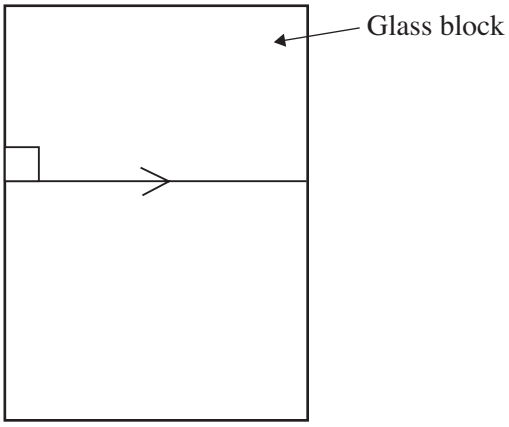
(b) (i) Draw in the normal and show the refracted ray inside the glass. [3]

Examiner Only
Marks | Remark

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Examiner Only	
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**.

_____

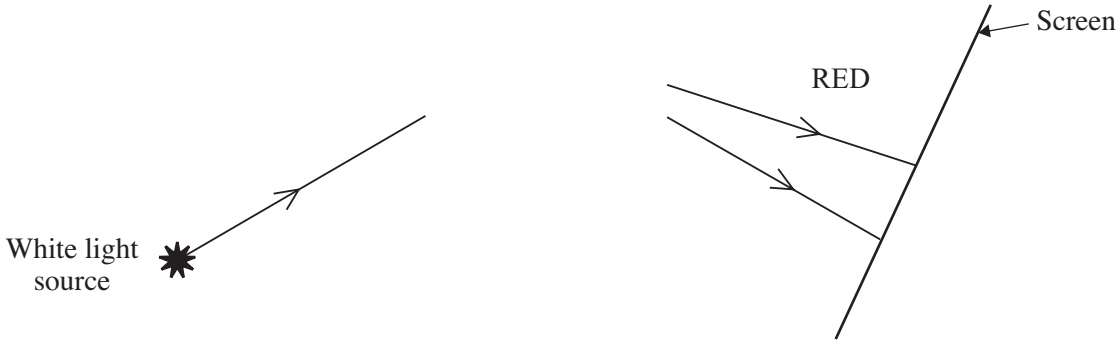
_____

_____ [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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Rewarding Learning

General Certificate of Secondary Education
2011

Science: Double Award (Non-Modular)

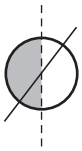
Paper 3
Foundation Tier

[G8403]

WEDNESDAY 25 MAY, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	Wind – renewable Biomass – renewable Coal – non-renewable Hydroelectric – renewable	mark for each row [1]	[1] [1] [1] [1]	[4]	4
2	**(i)** Kinetic and potential			[2]	
	(ii) Heat/Thermal			[1]	3
3	**(i)** B			[1]	
	(ii) A			[1]	
	(iii) A			[1]	3
4	**(a)** **(i)** **C**			[1]	
	(ii) Axis of Earth is pointing away from the Sun			[1]	
	(b) 			[1]	
	(c) Gravity/Centripetal			[1]	4
5	**(a)** **B** Venus **H** Neptune	([1] each)		[2]	
	(b) Same sense as arrow at A			[1]	
	(c) **(i)** Orbits the Sun			[1]	
	(ii) Makes ONE complete rotation (on its axis)			[1]	
	(d) Geocentric			[1]	
	(e) Milky Way			[1]	7

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				AVAILABLE MARKS
6	**(a)** 63%	[1]		
	(b) It would increase	[1]		
	(c) **(i)** Fibre glass or Insulating foam or Polystyrene or Rockwool	[1]		
	(ii) Contains trapped air	[1]		4
7	**(a)** Conduction	[1]		
	(b) (free) electrons	[1]		
	(c) Particles (atoms) in plastic (near the hot coffee) vibrate *more* [1] The vibration passes along the plastic/ jostle/particles collide [1] } independent marks	[2]		
	(d) Use a lid/cover	[1]		5
8	**(i)** 820 (N)	[1]		
	(ii) $P = \frac{W}{A}$ or $\frac{F}{A}$	[1]		
	$= \frac{820}{164}$ allow e.c.f. from **(i)**	[1]		
	$= 5$	[1]		
	N/cm^2 Free-standing unit mark	[1]	[4]	5
9	**(a)** Weight/gravity	[1]		
	(b) **(i)** Friction	[1]		
	(ii) to left	[1]		
	(c) 0.8 (N)	[1]		4

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				AVAILABLE MARKS
10	Acceleration = Speed (change)/time taken or Acceleration = gradient			
	or $a = \frac{v - u}{t}$	[1]		
	$= 56/8$	[1]		
	$= 7\,(m/s^2)$	[1]	[3]	3
11	Work done = Force × Distance moved			
	WD = F × d	[1]		
	= 500 × 3	[1]		
	= 1500 [1] J [1]	[2]	[4]	4
12	**(i)** Clockwise		[1]	
	(ii) Moment = F × distance	[1]		
	= 900 × 20	[1]		
	= 18 000 (Ncm)	[1]	[3]	4
13	**(a)** **(i)** Electrons		[1]	
	(ii) Positive or +		[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]	

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(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)** $E = P \times t$ [1]

$E = 1.25 \times 2$ [1]

$E = 2.5$ (kWh) [1] [3]

(ii) 30 (p) to the nearest penny, allow ecf from **(i)** [1]

AVAILABLE MARKS

20

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

(ii)  [1]

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

(iv) 30 (cm) [1]

(v) 50 (cm) [1]

(vi) 8 (cm) [1]

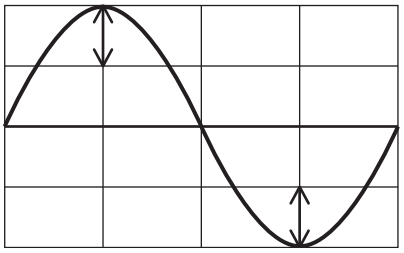
(vii) 4 [1]

(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]

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(c) But both amplitudes must be $1 < \text{amplitude} \leqslant 2$



loudness [1]
frequency [1]
} independent marks

[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	✓	

One 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 [1]

(iii) Decreases [1]

20

AVAILABLE MARKS

						AVAILABLE MARKS
15	**(a)**	**(i)**	Incident ray to coin from bulb [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]		[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		**110**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 3
Foundation Tier

[G8403]

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

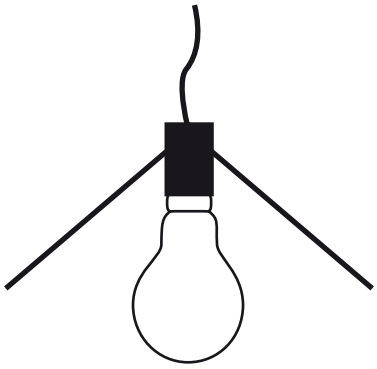
The total mark for this paper is 110.
Quality of written communication will be assessed in question **13(a)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
Total Marks	

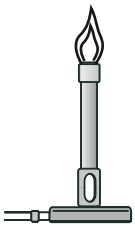
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Marks	Remark

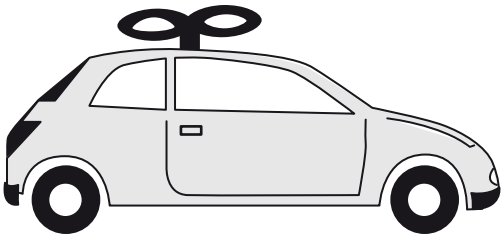
1 A bulb is designed to change electrical energy to light energy.



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

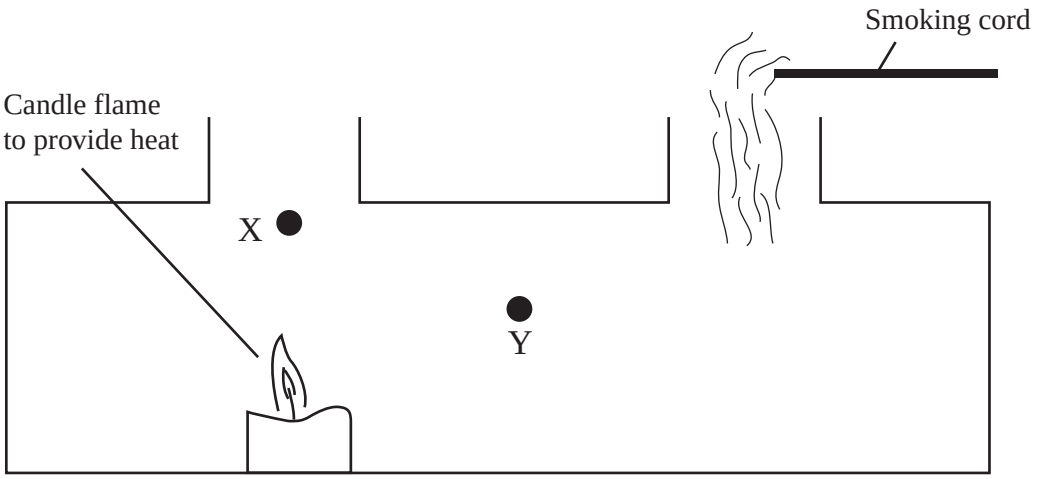
_____ energy. [1]



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

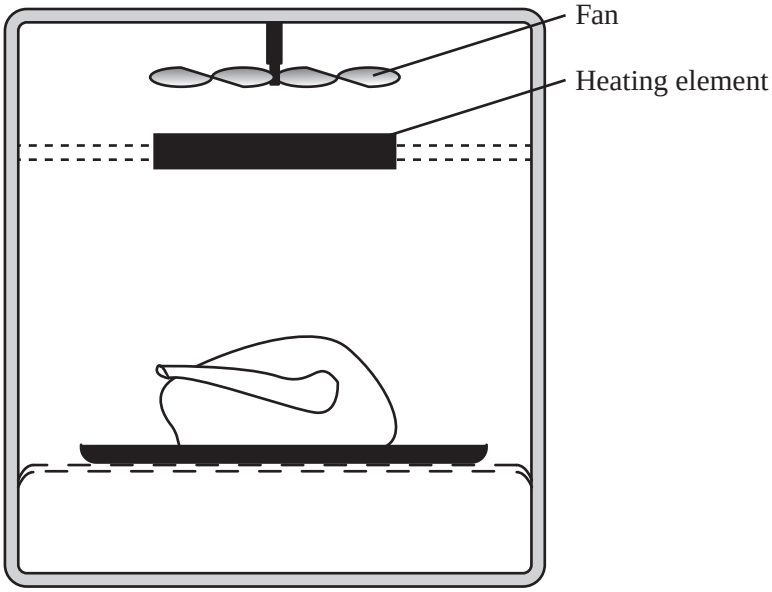
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2 The apparatus shown is used to demonstrate convection currents in air.



(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.

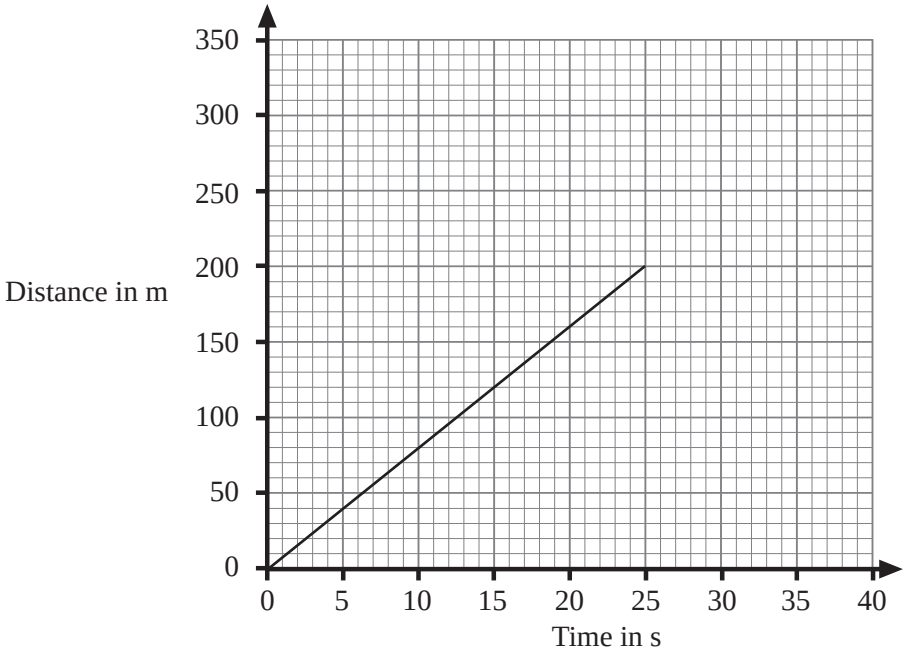
_____ [1]

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Marks	Remark

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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.

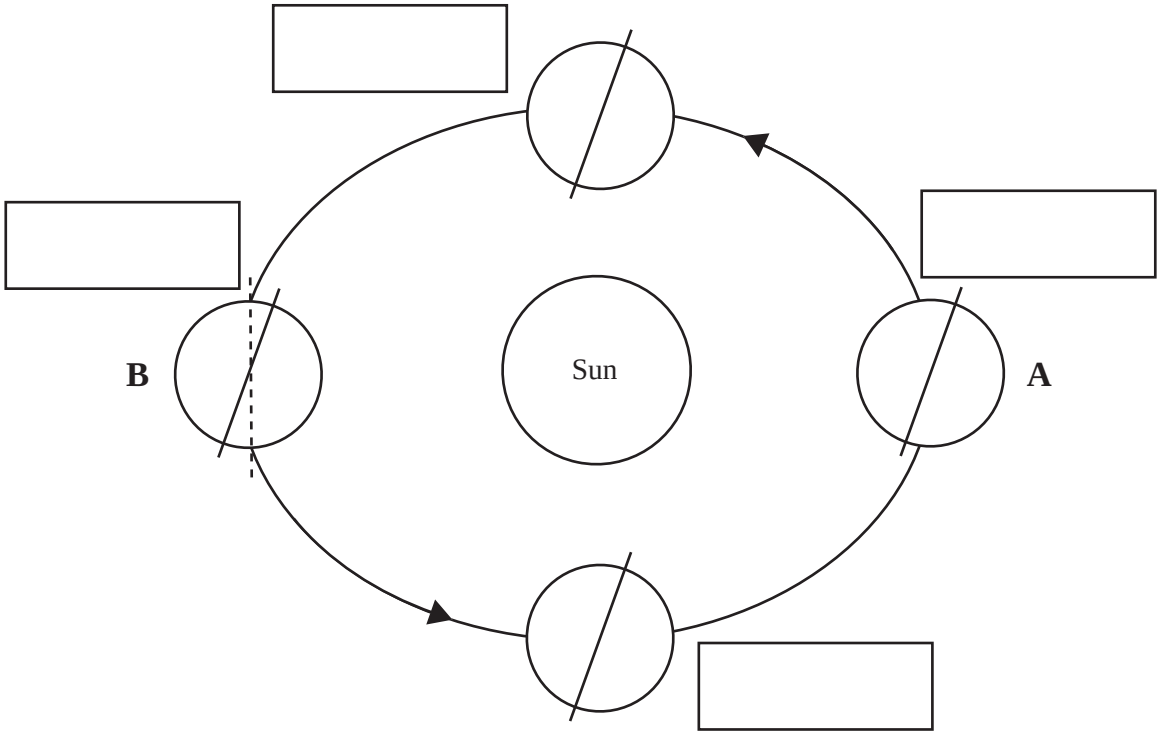
You are advised to show your working out.

Speed = _____ m/s [3]

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Marks	Remark

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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]

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Marks	Remark

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5 When a star is formed, matter is pulled together.

Examiner Only	
Marks	Remark

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

_____ [1]

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

_____ [1]

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

_____ [1]

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

_____ [1]

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

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

_____ [1]

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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?

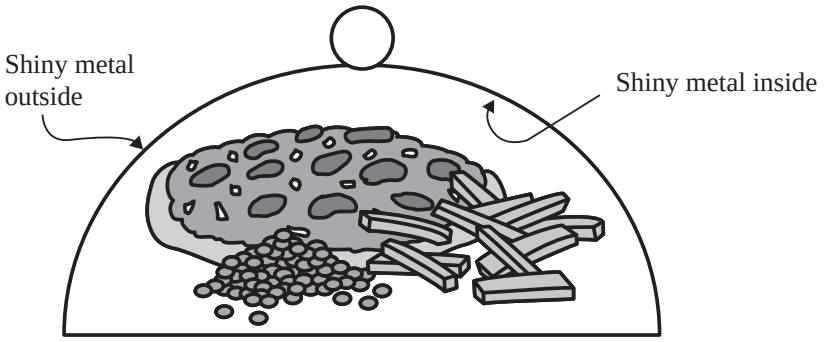
_____[1]

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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.

_____

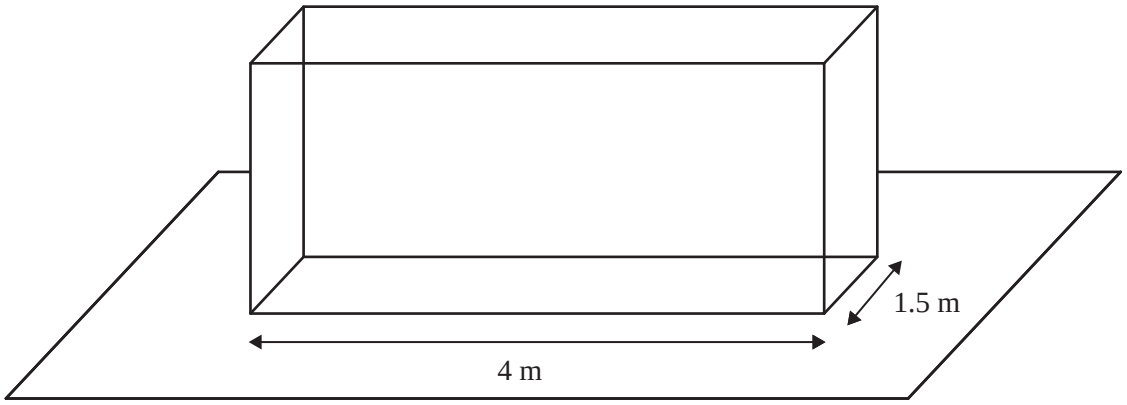
_____[2]

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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.

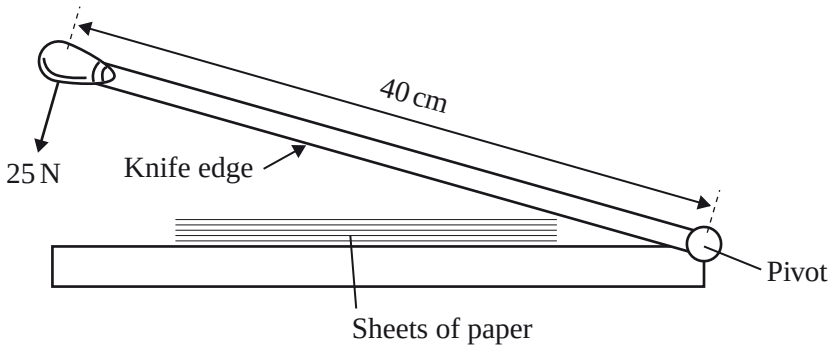
Pressure = _____ [4]

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Marks	Remark

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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	☐

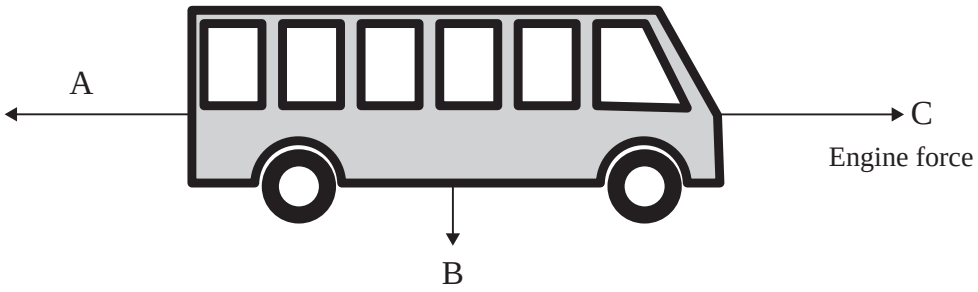
[1]

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Marks	Remark

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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]

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Marks	Remark

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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.

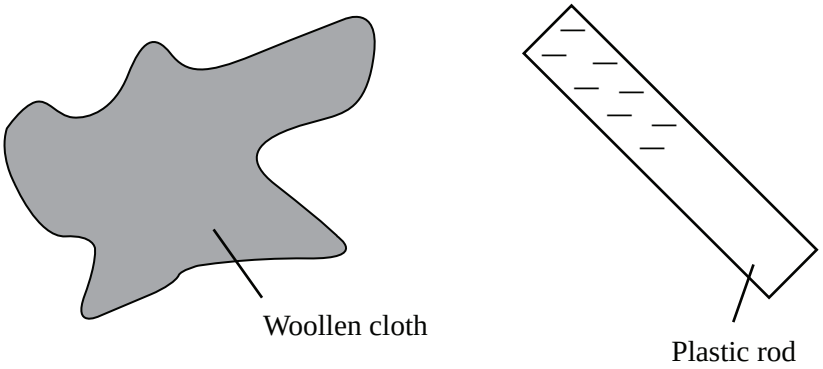
You are advised to show your working out.

Power = _____ [4]

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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]

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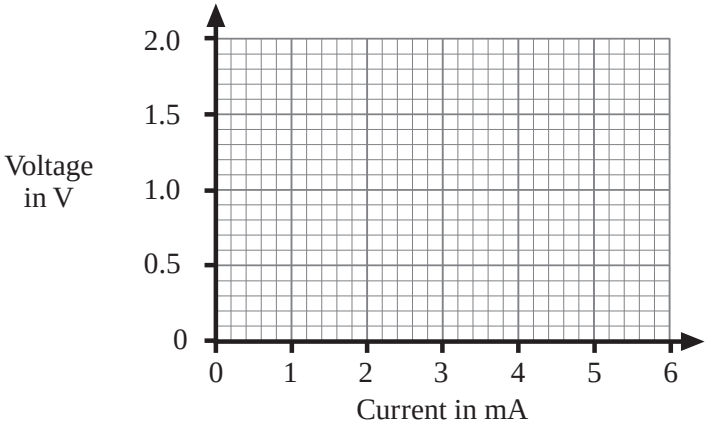
Marks	Remark

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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.

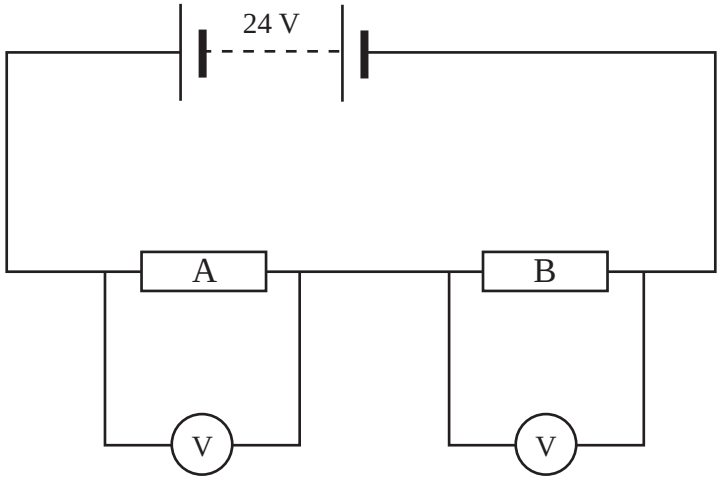
You are advised to show your working out.

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.

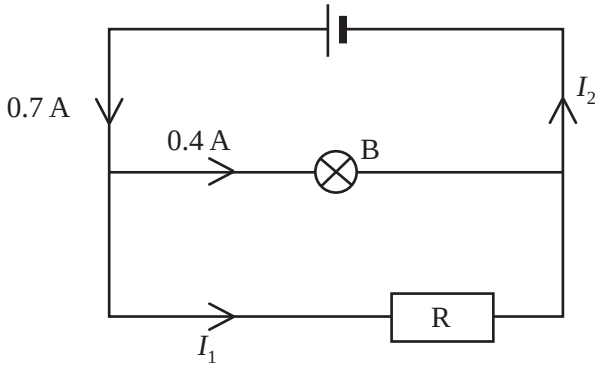


What are the voltmeter readings across the resistors?

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?

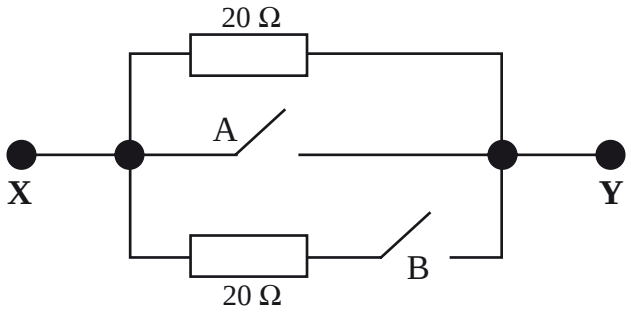
I_1 = _____ A

What is the current I_2?

I_2 = _____ A [2]

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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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Marks	Remark

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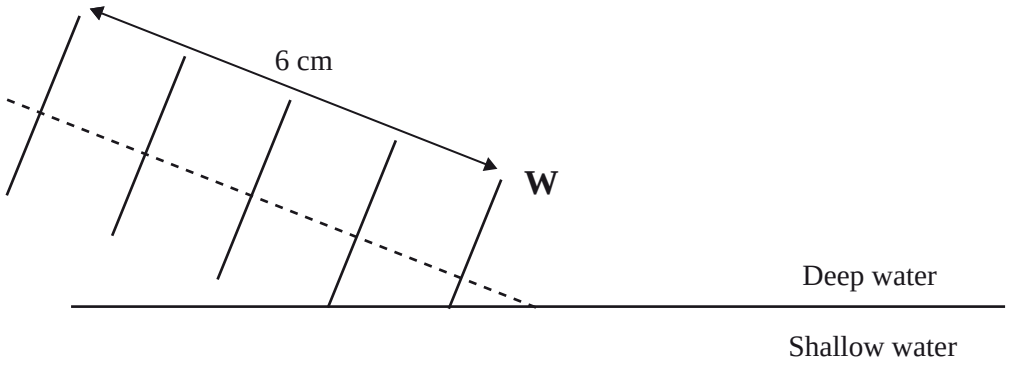
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Marks	Remark

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.

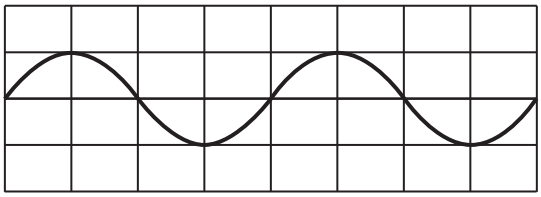
Speed = _____cm/s [3]

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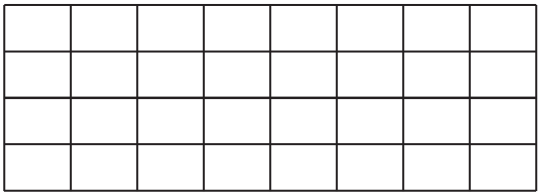
(v) What, if anything, happens to the wavelength of the water waves as they leave deep water and enter shallow water?

_____ [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.

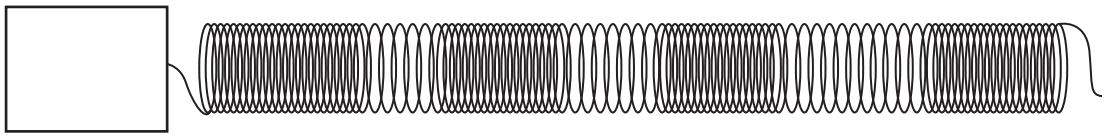


[2]

(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

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Marks	Remark

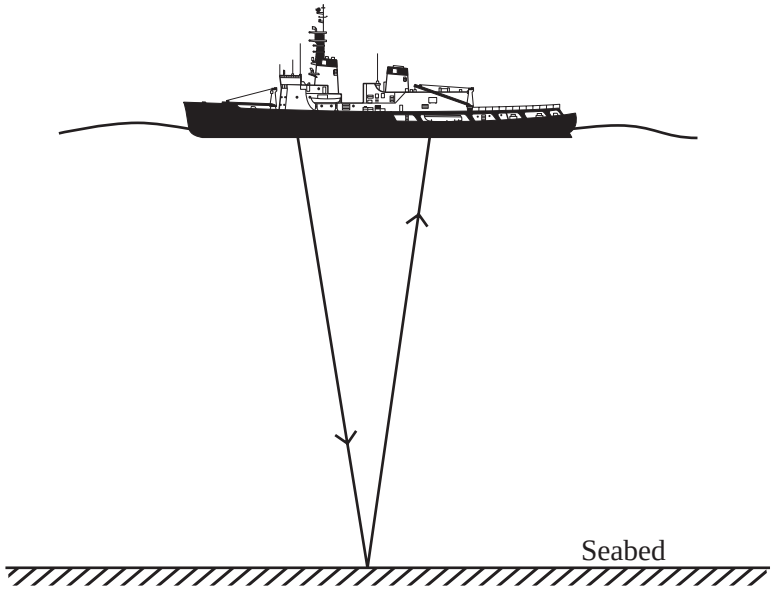
(d) (i) State the lower frequency limit for a child's hearing.

_____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.



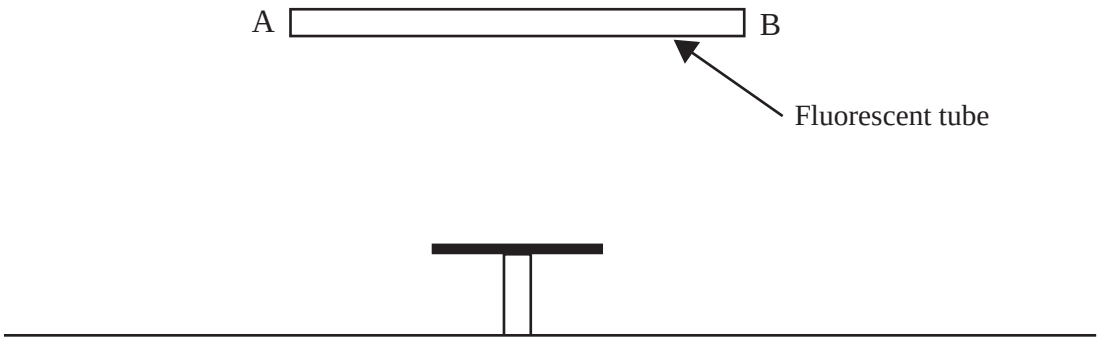
Calculate the distance between the ship and the seabed.

You are advised to show your working out.

Distance = _____ m [4]

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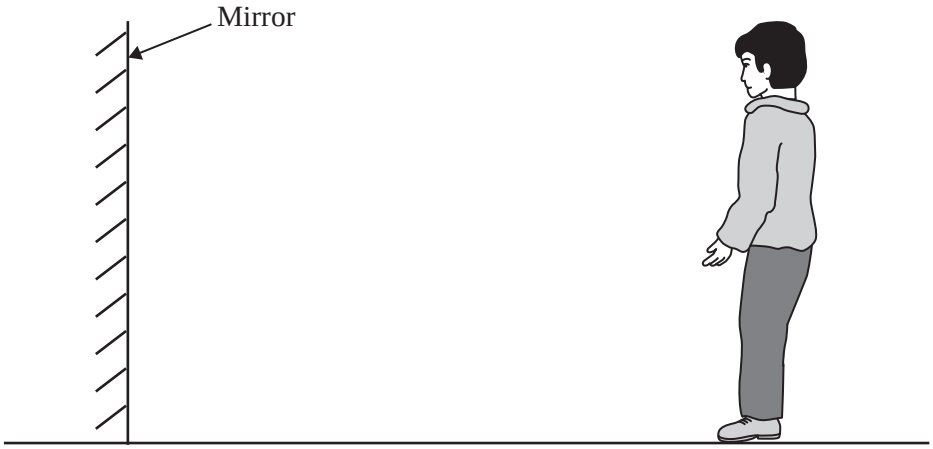
15 Light from a fluorescent tube forms a shadow of a table on the floor below.



(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.

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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Marks | Remark

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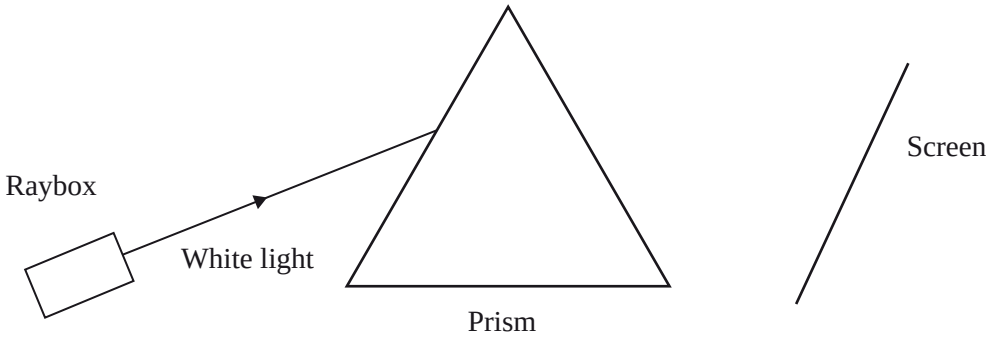
Examiner Only	
Marks	Remark

(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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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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GCSE

Science: Double Award (Non-Modular)

Summer2010

Mark Schemes

Issued: October 2010

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

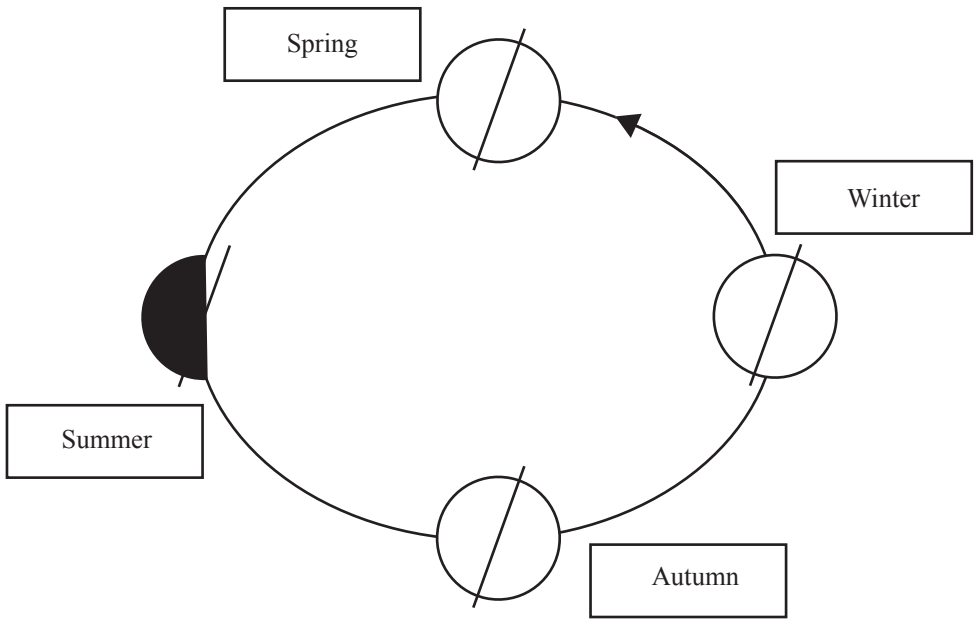
Paper 3
Foundation Tier

[G8403]

FRIDAY 28 MAY, MORNING

MARK SCHEME

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			AVAILABLE MARKS
1	**(i)** Heat or Thermal	[1]	
	(ii) Kinetic/Movement/Moving	[1]	
	(iii) Sound	[1]	3
2	**(a)** Correct clockwise arrows [1] each	[2]	
	(b) even distribution of heat (or equivalent)	[1]	3
3	Speed = grad. or $\frac{\text{dist}}{\text{time}}$	[1]	
	$= \frac{200}{25}$	[1]	
	= 8 (m/s)	[1]	3
4			
	(a) $\frac{1}{2}$ mark per correct answer [round up]	[2]	
	(b) 6 months	[1]	
	(c) 24 hours	[1]	
	(d) As above	[1]	5

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				AVAILABLE MARKS
5	**(a)**	Gravity	[1]	
	(b)	The temperature increased/It got hotter/It spins/Density increases	[1]	
	(c)	(Nuclear) fusion	[1]	
	(d)	Any em radiation/heat	[1]	
	(e)	Venus	[1]	5
6	**(a)**	Less friction/gets faster	[1]	
	(b)	Higher/rises	[1]	
	(c)	Less stable	[1]	
	(d)	Make heavier/wider	[1]	4
7	**(a)**	Shiny surfaces reflect the heat [1] better [1] or Black absorbs [1] better [1]	[2]	
	(b)	Matt black would **emit** [1] the heat **better** [1] than a shiny surface/ **Less** [1] heat is **emitted** [1] (by the shiny surface)	[2]	
	(c)	It has trapped air [1] which makes it a (good) insulator. [1]	[2]	6

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				AVAILABLE MARKS
8	**(i)**	6 (m^2)	[1]	
	(ii)	$P = \frac{\text{Weight}}{\text{Area}} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$ or equivalent f'la	[1]	
		$= \frac{9000}{6}$ **e.c.f. from (i)**	[1]	
		$= 1500$	[1]	
		N/m^2 / Pa Unit mark is free-standing Reject: N/cm^2, N/mm^2	[1]	5
9	**(i)**	Moment = F × d [1]		
		= 25 × 40 [1]		
		= 1000 (Ncm) [1]	[3]	
	(ii)	Anticlockwise	[1]	4
10	**(i)**	A – air resistance/friction/drag [1] B – weight/(force due to) gravity [1]	[2]	
	(ii)	A and C or engine thrust and air resistance	[1]	
	(iii)	Accelerates/speeds up/gets faster	[1]	4
11	**(a)**	**(i)** They never run out/no pollution/less pollution	[1]	
		(ii) Two from: Wind, wave, tidal, HEP, biomass, geothermal, solar, wood, biofuel, sun	[2]	
	(b)	Not enough sun	[1]	4
12		$\text{Power} = \frac{\text{Energy}}{\text{Time}}$ or $\frac{\text{Work}}{\text{Time}}$ or $\frac{E}{T}$ or $\frac{W}{T}$	[1]	
		$= \frac{15\,000}{30}$	[1]	
		= 500 [1] W [1]	[2]	4

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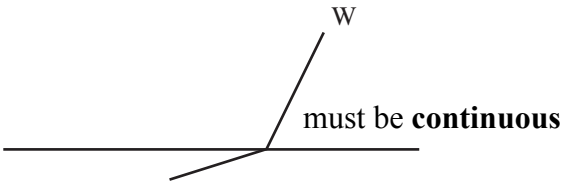
					AVAILABLE MARKS
13	**(a)**	**(i)**	Electrons moved [1] from cloth [1]/to the rod [1] Rod gains electrons [2] QWC [1]	[3]	
		(ii)	Like charges repel	[1]	
		(iii)	Attract (the paint)	[1]	[5]
	(b)	**(i)**	Four correct points, ± ½ square	[1]	
		(ii)	Best fit line	[1]	
		(iii)	Voltage = 1.0 (V) ecf from (ii)	[1]	
		(iv)	0.002 (A)	[1]	
		(v)	$R = \frac{V}{I}$ or V = IR or equivalent $R = \frac{1}{0.002}$ e.c.f. from **(iii)** and **(iv)** $= 500 (\Omega)$	[1] [1] [1]	[7]
	(c)		A : 12 (V) B : 12 (V)		[2]
	(d)		0·3 A 0·7 A		[2]
	(e)		20 10 0 0		[4]

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AVAILABLE MARKS

14 (a) (i)



[1]

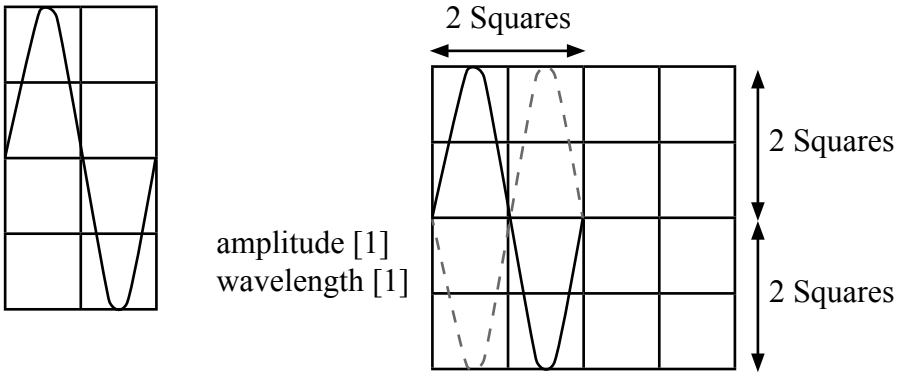
(ii) Wavelength = 1.5 (cm) [1]

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

(iv) Speed = Frequency × wavelength (or use symbols) [1]
= 6 {ecf from **(iii)**} × 1.5 {ecf from **(ii)**} [1]
= 9 (cm/s) [1]

(v) Smaller [1] [7]

(b) (i)

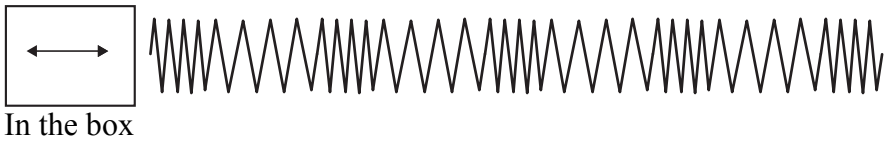


amplitude [1]
wavelength [1]

[2]

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

(c) (i)



In the box

[1]

(ii) Sound or Ultrasound or S [1]

(iii) Energy [1] [3]

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

(ii) lower/decreases/less [1]

(iii) Speed = $\frac{\text{distance}}{\text{time}}$ or distance = speed × time [1]
or 1500 × 0.4 [2]
(Total) distance = 1500 × 0.8 [1]
= 600 [1]
= 1200 m [1]
Distance = 600 (m) [1] [6]

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							AVAILABLE MARKS
15	**(a)**	**(i)**	Four correct rays		[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 into different colours/wavelengths	} Independent marking	[1] [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	**110**

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