CCEA GCSE SCIENCE: DOUBLE AWARD (NON-MODULAR)

SCIENCE



EXAM QUESTION PACK

PAPER 3 HIGHER TIER G8406 PAPERS

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Double Award (Non-Modular)

Paper 3
Higher Tier

[G8406]

G8406

FRIDAY 15 JUNE, AFTERNOON

TIME

1 hour 45 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 twelve** questions.

INFORMATION FOR CANDIDATES

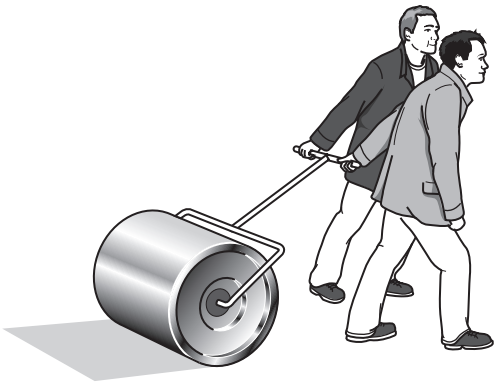
The total mark for this paper is 120.
Quality of written communication will be assessed in question **11(a)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

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

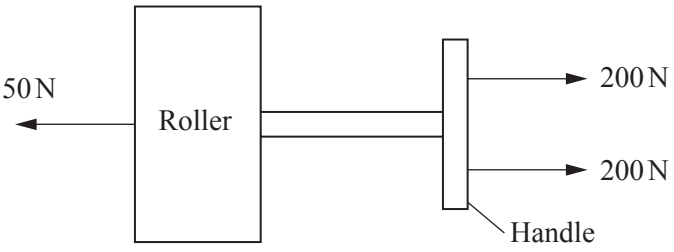
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Examiner Only	
Marks	Remark

1 Two men pull a roller over a football pitch.



The diagram below represents the forces that are exerted.



The men exert a force of 200 N each and the opposing forces add up to 50 N.

Calculate the acceleration of the roller if its mass is 500 kg.

You are advised to show your working out.

Acceleration = _____ m/s^2 [4]

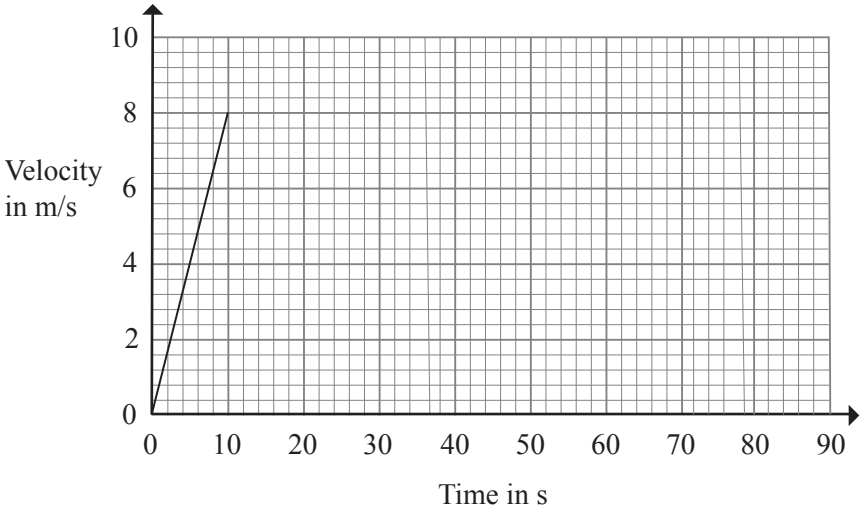
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Examiner Only	
Marks	Remark

2 A train travels on a short journey from rest.

The train reaches a velocity of 8 m/s after 10 seconds.

It travels at a constant velocity of 8 m/s for another 40 seconds and then decelerates uniformly to rest in a further 20 seconds.



(i) Part of the graph has been drawn for you. Complete the graph for the journey. [2]

(ii) Calculate the acceleration of the train during the first 10 seconds of its journey.

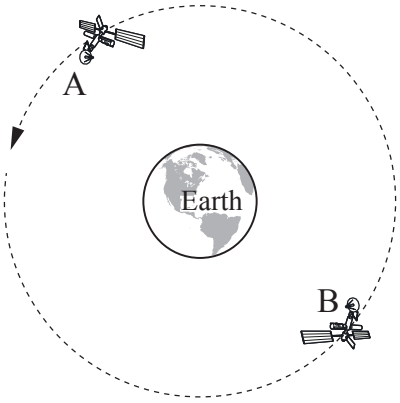
You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

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Examiner Only	
Marks	Remark

3 The diagram shows two satellites A and B orbiting the Earth on the same circular path and in the same direction.



(a) Draw an arrow on satellite A to show the direction of the force acting on it due to the Earth. [1]

(b) Satellite B has a greater mass than satellite A. How does the force on satellite A compare with the force on satellite B?

Tick (✓) the correct answer.

The force on A is greater than the force on B.	
The force on A is equal to the force on B.	
The force on A is less than the force on B.	

[1]

(c) Name the force on the satellites which keeps them moving in a circle.

_____ [1]

(d) The radius of satellite A's orbit is reduced. How will this affect the force between satellite A and the Earth?

Tick (✓) the correct answer.

The force on A will decrease.	
The force on A will remain the same.	
The force on A will increase.	

[1]

(e) Draw an arrow on satellite B to show the direction of its velocity. [1]

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4 The Sun is a star.

(a) What is the name given to a collection of stars?

_____ [1]

(b) There are four stages in the formation of a star.

Use the numbers 1, 3 and 4 to complete the order in which the stages occur.

Gas ball begins to spin	2
Hydrogen particles are pulled together by gravitational forces	
The star generates energy	
The temperature rises	

[2]

(c) State two types of radiation emitted by a star.

1. _____

2. _____ [2]

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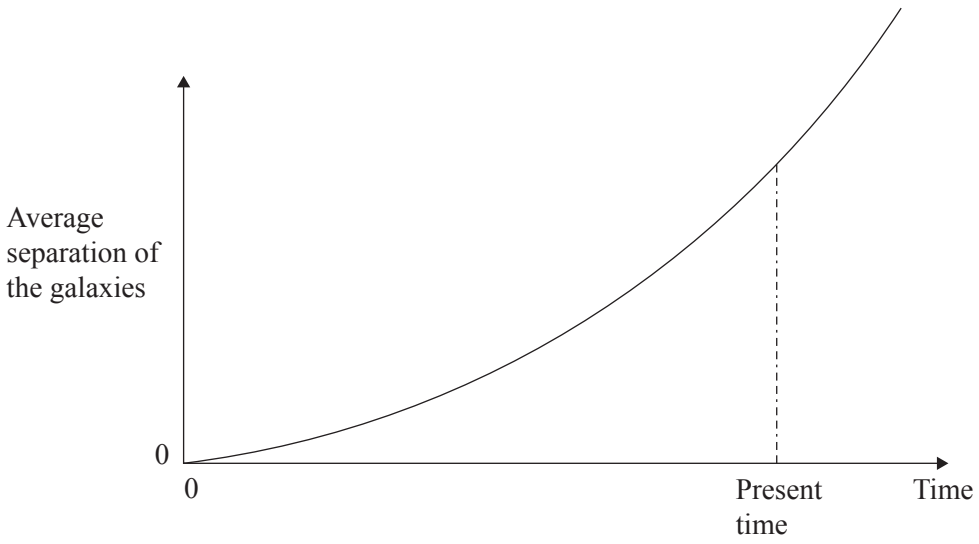
Marks	Remark

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

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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 **(a)** State the Principle of Moments.

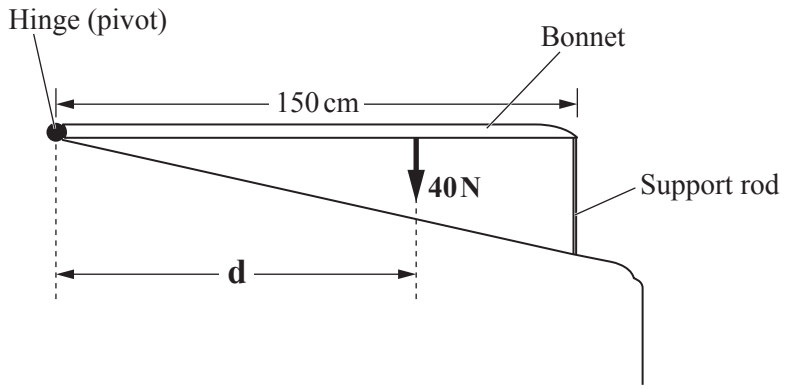
Examiner Only

Marks	Remark

_____

_____ [2]

(b) The bonnet of a truck is held in a horizontal position by a support rod.



The support rod exerts an upward force of 24 N and the bonnet has a weight of 40 N. Calculate the distance **d** of the centre of gravity of the bonnet from the hinge.

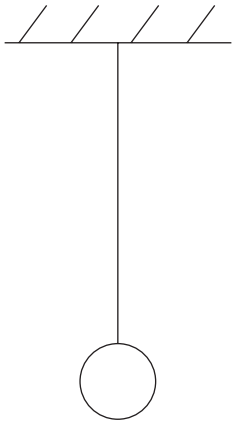
You are advised to show your working out.

Distance = _____ cm [4]

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Marks	Remark

7 An experiment on heat transfer is carried out in the laboratory. A metal ball is heated until it is red hot and then suspended as shown.



(a) Which one of the following statements is correct?

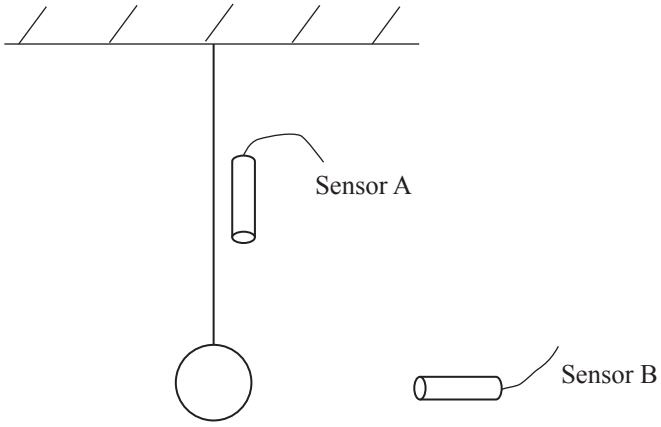
Tick (✓) the correct box.

We see both the infrared and the red light. ☐

We feel the infrared and see the red light. ☐

We feel both the infrared and the red light. ☐ [1]

Two heat sensors are placed at equal distances from the red hot ball as shown below.



(b) Explain fully why sensor A gives a higher reading than sensor B.

_____

_____ [2]

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(c) The experiment is now repeated but this time the apparatus is placed in a vacuum.

(i) How does the reading of sensor A now compare with the reading of sensor B?

_____ [1]

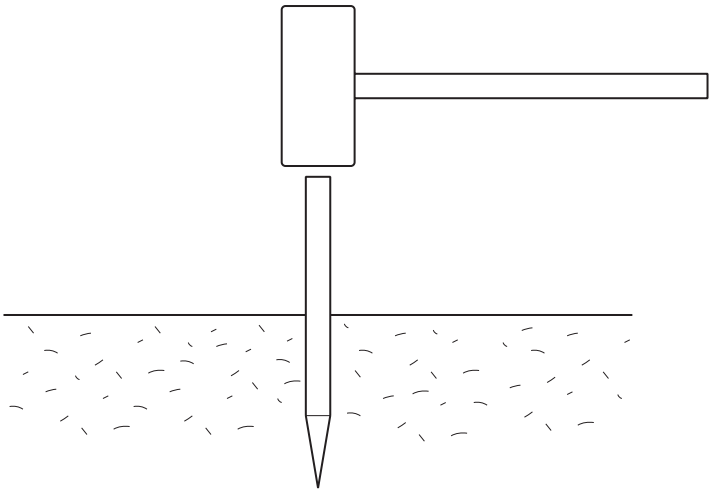
(ii) Explain your answer.

_____ [1]

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Marks	Remark

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8 A hammer is used to drive a stake into the ground.



One strike of the hammer drives the stake a distance of 0.2 m into the ground. The average resistance force exerted by the ground is 320 N.

(i) Show that the work done on the stake is 64 J.

[2]

(ii) Assume that the kinetic energy of the hammer is 64 J at the point of impact and that the mass of the hammer is 0.5 kg.

Calculate the velocity of the hammer at impact.

You are advised to show your working out

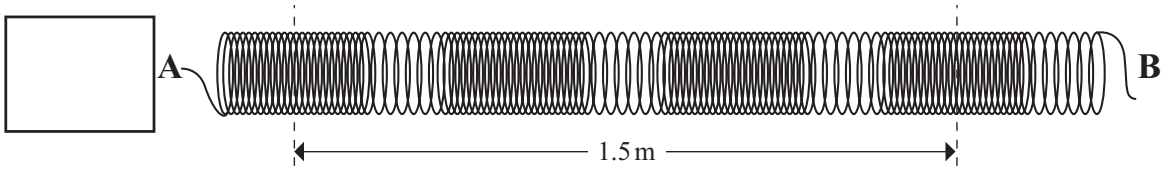
Velocity = _____ m/s [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 **(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.

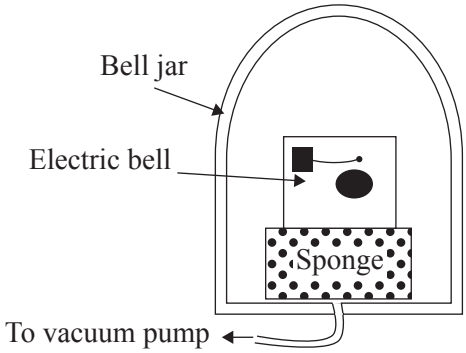
(i) How would the vibrations of the slinky spring be different if Shauna made a transverse wave?

_____ [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]

Examiner Only	
Marks	Remark

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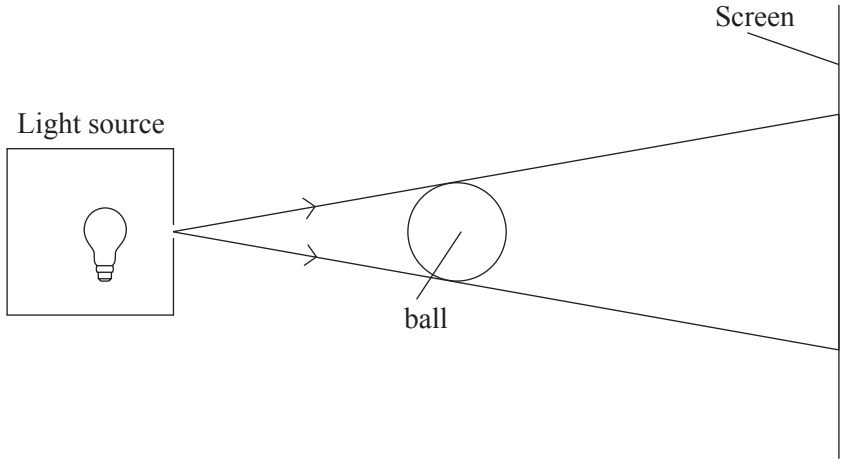
Marks	Remark

10 (a) (i) Indicate with a tick (✓) on 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.

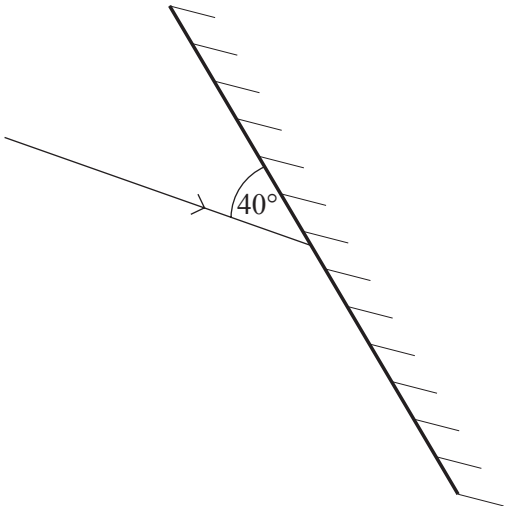
B The shadow contains partial shadow AND uniformly black shadow.

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.



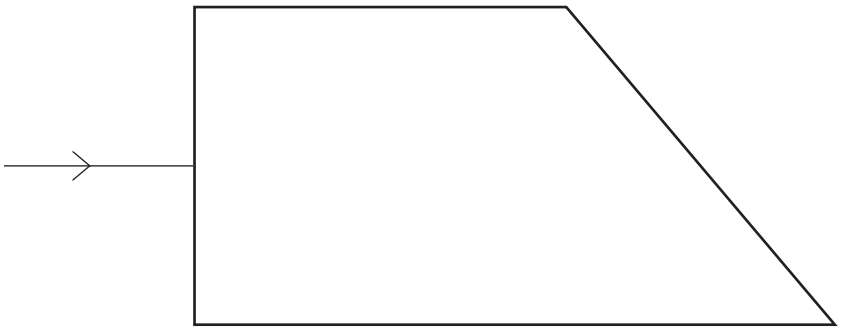
(b) (i) Draw and label the normal. [1]

(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?

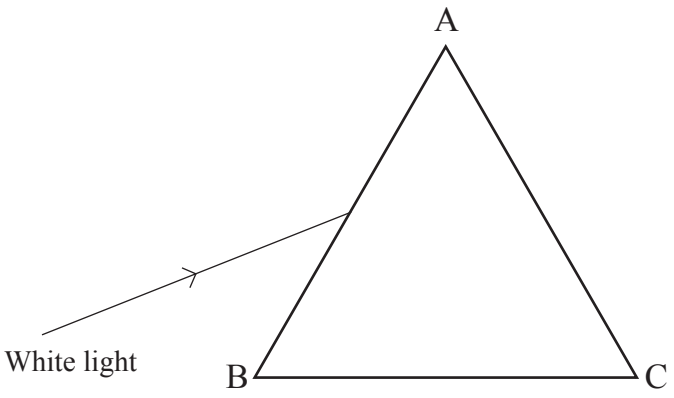
_____ [1]

Examiner Only

Marks	Remark

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White light enters a prism.



A prism may be 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]

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Marks	Remark

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Marks	Remark

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



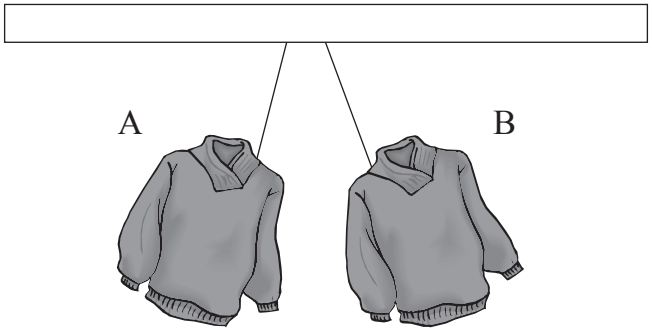
(i) Explain fully in terms of charge movement how the sweater became charged.

_____

_____ [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]

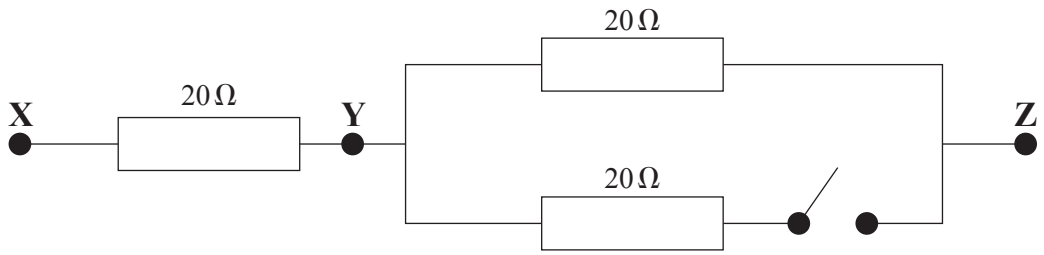
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(b) A charge of 0.6 C is transferred from a charged sweater through a conductor in 0.2 seconds.
What current flows through the conductor?

You are advised to show your working out.

Current = _____ A [3]

(c) 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]

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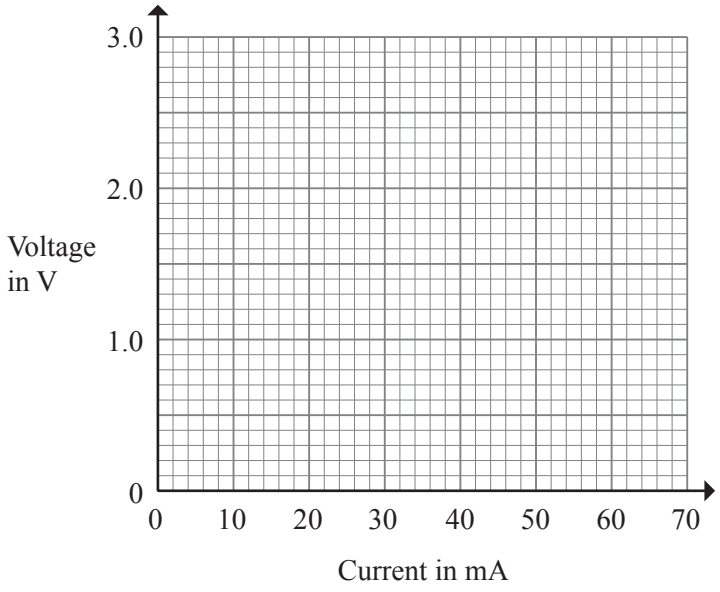
Marks	Remark

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Marks	Remark

(d) A pupil investigates the variation of current with voltage for a resistor. The results are given below.

Voltage in V	0	0.8	1.2	1.8	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]

(iii) Use your graph to find the voltage when the current is 60 mA

Voltage = _____ V [1]

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

Current = _____ A [1]

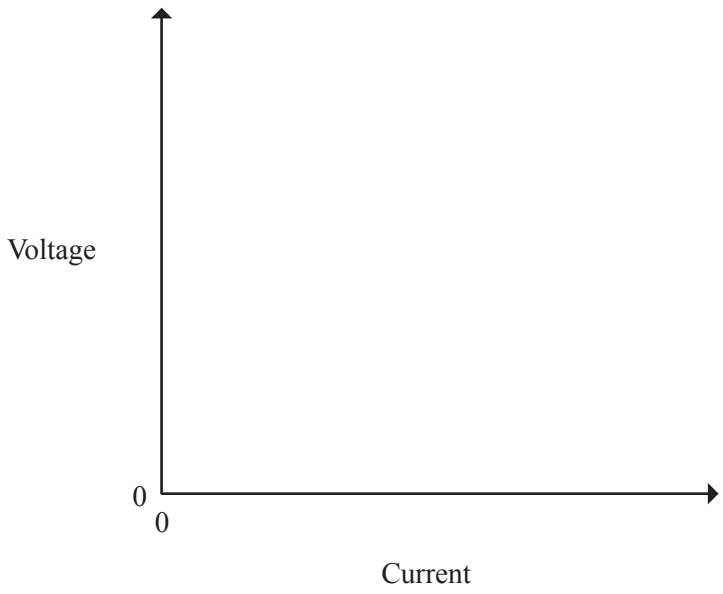
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(v) Use your answer to parts **(iii)** and **(iv)** to calculate the resistance of the resistor.

You are advised to show your working out.

Resistance = _____ Ω [3]

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



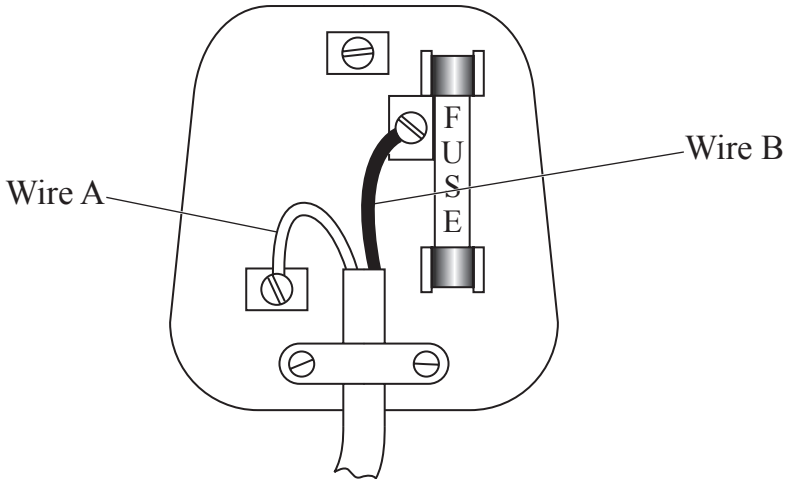
[2]

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Marks	Remark

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12 The diagram shows the wiring in an electrical plug.



(a) (i) Which terminal has no wire connected?

_____ [1]

Identify the two wires, A and B, and give their colours.

(ii) Wire A is the _____ wire and it is a _____ colour. [1]

(iii) Wire B is the _____ wire and it is a _____ colour. [1]

(iv) Why is the fuse connected to wire B in the plug?

_____ [1]

When the plug shown above is connected to a hairdryer, it is still safe for use.

(v) What property of the hairdryer makes this possible?

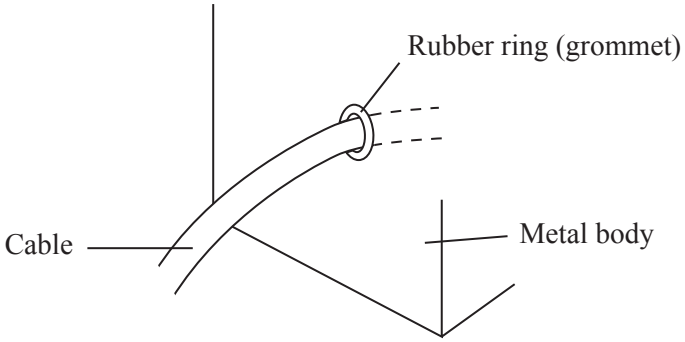
_____ [1]

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Marks	Remark

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When a **three core** electrical cable passes through the metal body of an electrical appliance a rubber ring (grommet) is inserted in the entry hole. This is done as a precaution to protect the cable from the sharp edge of the hole.



With use this grommet can wear away and the edge of the metal body can cut through the insulation in the electric cable.

(b) (i) What makes this dangerous?

_____ [1]

(ii) Explain fully how earthing reduces the danger.

_____

_____

_____

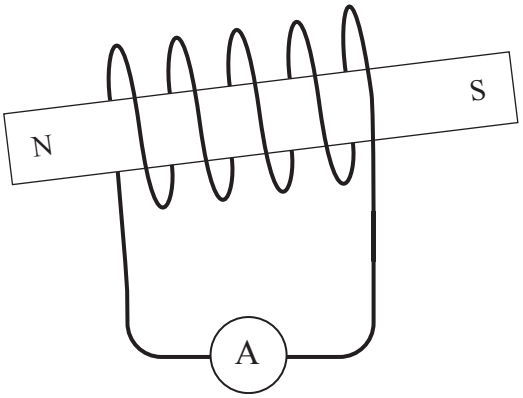
_____ [3]

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Marks	Remark

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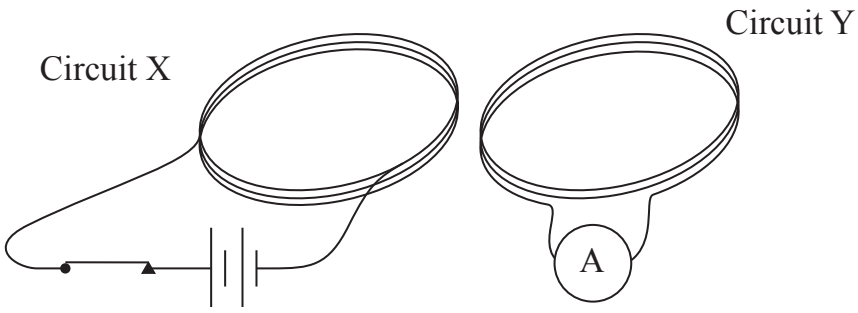
A coil of wire is connected to a very sensitive ammeter and a magnet is at rest inside the coil.



(c) (i) Why does no current flow in the coil?

_____ [1]

Another arrangement is shown below. No current flows in Circuit Y.



(ii) State three practical ways that a current can be induced in Circuit Y.

1. _____

2. _____

3. _____ [3]

Examiner Only

Marks	Remark

Step-up transformers are used in electricity transmission.

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Marks	Remark

(d) (i) What quantity is "stepped up" by such a transformer?
Circle the correct answer.

current

power

energy

voltage [1]

(ii) Explain why such a transformer is used in electricity transmission.

_____

_____ [2]

A transformer changes the voltage from 132 kV to 25 kV. The 132 kV supply is connected to one side of the transformer which has 10 560 turns.

(e) How many turns has the other coil?

You are advised to show your working out.

Number of turns = _____ [4]

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Double Award (Non-Modular)

Paper 3
Higher Tier

[G8406]

FRIDAY 15 JUNE, AFTERNOON

MARK SCHEME

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				AVAILABLE MARKS
1		$F_R = ma$ [1] [1] $350 = 500 \times a$ [1] $a = 0.7\ (m/s^2)$ [1]	[4]	4
2	**(i)**	[1] for constant velocity line to 50 seconds [1] for deceleration line to 70 seconds	[2]	
	(ii)	$a = \frac{\Delta v}{t}$ **or** equivalent (**or** gradient) [1] $= \frac{8}{10}$ [1] $= 0.8\ (m/s^2)$ [1]	[3]	5
3	**(a)**	Arrow from A towards centre of Earth	[1]	
	(b)	The force on A is less than the force on B (Third box ticked)	[1]	
	(c)	Gravity/centripetal (force)/gravitational/weight	[1]	
	(d)	The force on A will increase (Third box ticked)	[1]	
	(e)	Tangent to circle going through B	[1]	5
4	**(a)**	Galaxy	[1]	
	(b)	1 [1], 4, 3 [1]	[2]	
	(c)	Any two named e.m.s. members [1] each	[2]	5
5	**(a)**	Universe has a starting point	[1]	
	(b)	Steady State **or** String	[1]	
	(c)	Lack of sufficient fuel [1] logistics [1] time required [1] (any **two**)	[2]	
	(d)	Fusion	[1]	5
6	**(a)**	For a body in equilibrium **or** balanced [1] clockwise moment(s) = anticlockwise moment(s) [1]	[2]	
	(b)	CM = ACM [1] [1] $40 \times d = 24 \times 150$[1] $d = 90$ (cm) [1]	[4]	6

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					AVAILABLE MARKS
7	**(a)**	We feel the infrared and see the red light (Middle box ticked)	[1]		
	(b)	Sensor A receives energy by convection [1] and B does not [1]	[2]		
	(c)	**(i)** Readings the same	[1]		
		(ii) Sensors receiving radiation only **or** convection no longer acting	[1]		5
8		**(i)** $W = F \times d$ [1] $W = 320 \times 0.2$ [1] $(W = 64\ J)$	[2]		
		(ii) $KE = \frac{1}{2} mv^2$ [1] $\frac{1}{2} \times 0.5 \times v^2 = 64$ [1] $v = 16$ (m/s) [1]	[3]		5
9	**(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) = $f \times \lambda$ [1] $= 3 \times 0.5$ [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]		

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				AVAILABLE MARKS
(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

10 **(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) Decreases [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

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					AVAILABLE MARKS
11	**(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)		Charge (Q) = Current (I) × time (t) [1] $0.6 = I \times 0.2$ **or** $I = 0.6/0.2$ } Correct substitutions [1] $= 3$ (A) [1]	[3]	
	(c)		10 [1] 40 [1] 30 [1]	[3]	
	(d)	**(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)	Voltage = 2.4 ± 0.1 (V) **or** e.c.f. from **(ii)**	[1]	
		(iv)	Current = 0.06 (A)	[1]	
		(v)	R = V/I [1] = 2.4/0.06 [1] e.c.f. from **(iii)** and **(iv)** = 40 (Ω) [1]	[3]	
	(e)		Curve with increasing positive gradient [1] through (0,0) [1]	[2]	20

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					AVAILABLE MARKS
12	**(a)**	**(i)**	Earth	[1]	
		(ii)	Neutral – blue Both required	[1]	
		(iii)	Live – brown Both required	[1]	
		(iv)	It is the live wire **or** It is the high voltage wire	[1]	
		(v)	Double insulated	[1]	
	(b)	**(i)**	Metal body can become "live"	[1]	
		(ii)	(Metal) body is connected to earth wire Low resistance path (to earth)/current flows to **earth** Large current flows Fuse blows Any **three**	[3]	
	(c)	**(i)**	No (relative) movement	[1]	
		(ii)	Switch circuit off [1] Move circuit X **or** Y [1] Replace with a.c. supply [1]	[3]	
	(d)	**(i)**	Voltage circled	[1]	
		(ii)	To step down the current [1] **and** save energy (or heat) losses [1]	[2]	
	(e)		$\frac{N_p}{N_s} = \frac{V_p}{V_s}$ [1] **or** equivalent formula $\frac{10560}{N_s}$ [1] = $\frac{132}{25}$ [1] $N_s = 2000$ [1]	[4]	20
				Total	**120**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Double Award (Non-Modular)

Paper 3
Higher Tier

[G8406]

G8406

WEDNESDAY 25 MAY, MORNING

TIME

1 hour 45 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 twelve** questions.

INFORMATION FOR CANDIDATES

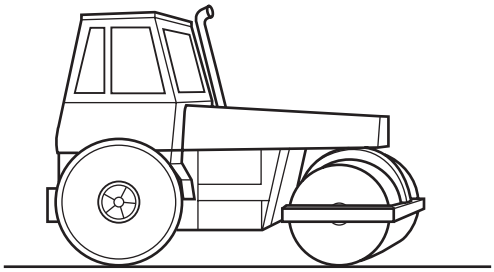
The total mark for this paper is 120.
Quality of written communication will be assessed in questions **10(c)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated 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	
Total Marks	

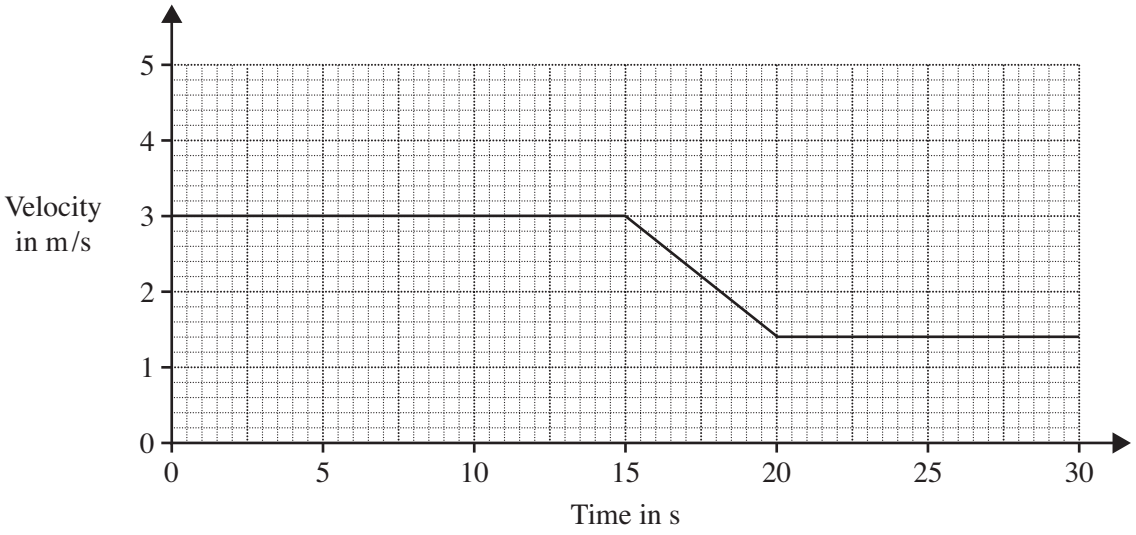
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Marks	Remark

1 A steam roller is used to smooth a newly laid road surface.



A graph of velocity against time for the steam roller is shown.



(a) How far does the roller travel during the first 15 seconds?
You are advised to show your working out.

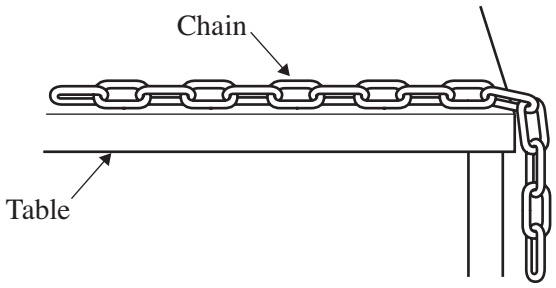
Distance = _____ m [3]

(b) The steam roller has a mass of 3000 kg. Use the graph to calculate its **minimum** momentum.
Remember to include the unit.
You are advised to show your working out.

Minimum momentum = _____ [4]

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2 A stationary chain hangs over the end of a table as shown.



(a) Explain, in terms of forces, why the chain does not move.

_____[1]

The weight of the links hanging over the edge is increased to 0.8 N and the frictional force exerted by the table is 0.2 N.

(b) If the mass of the whole chain is 0.3 kg calculate the initial acceleration of the chain.
You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

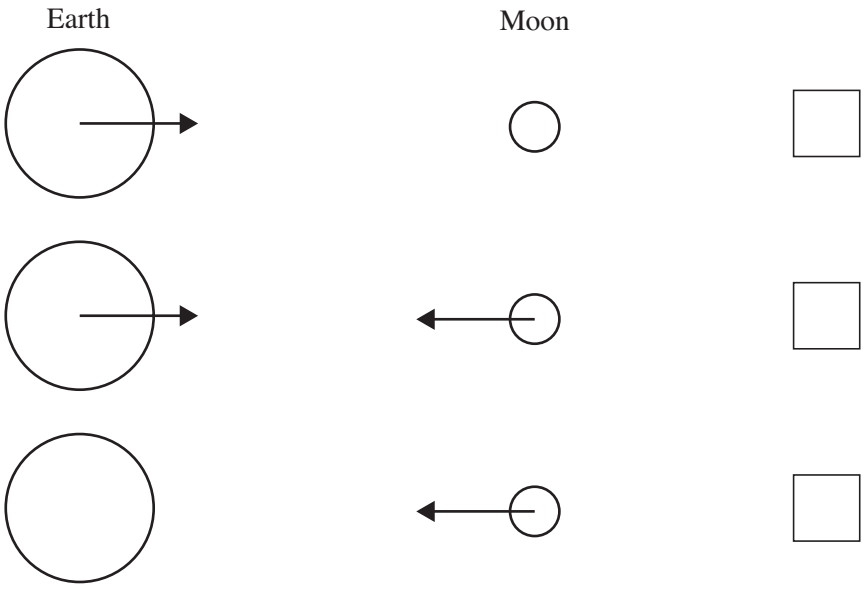
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Marks | Remark

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Examiner Only	
Marks	Remark

3 Gravitational forces act between astronomical bodies.

(a) Which of the diagrams below best illustrates the gravitational forces between the Earth and the Moon? Tick (✓) the correct box.



[1]

Historically, two theories have been put forward for the structure of our Solar System.

(b) Name these two theories.

_____ and _____ [2]

(c) Which two of the following statements correctly describes our ideas about the universe?

Tick (✓) the correct boxes.

The universe consists of the Sun and 8 planets. ☐

The universe is expanding. ☐

Stars are colder than planets. ☐

Some comets orbit the Sun. ☐

[2]

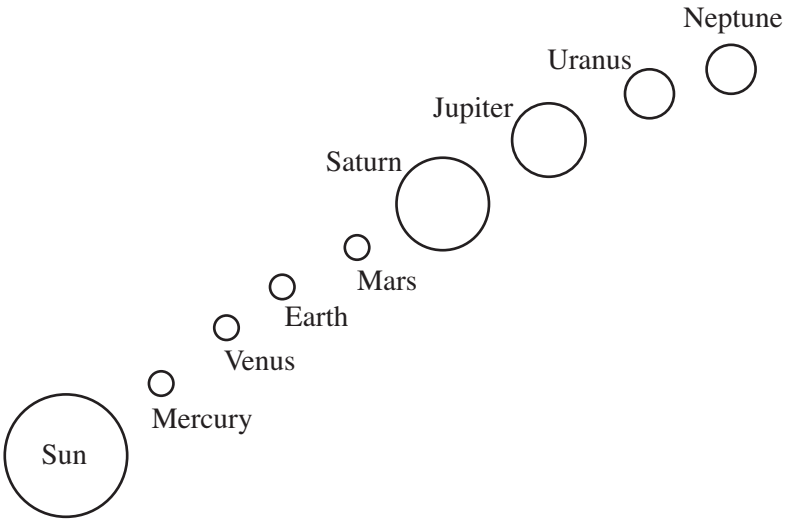
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4 Complete the following sentences.

(a) **(i)** The _____ is the name of the Galaxy which contains our Solar System. [1]

(ii) The _____ is made up of many millions of galaxies. [1]

(b) Our Solar System is represented below but two planets have been interchanged. The diagram is not to scale.



Identify these two planets.

_____ and _____ [2]

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Marks	Remark

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5 The incomplete statements below describe the formation of a star.

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Marks	Remark

(a) Complete each sentence.

Clouds of dust and gas, which we call nebulae, come together because of a force called _____ . [1]

As a result of this coming together there is an increase in _____ . [1]

Eventually the star forms and gives out energy, powered by a nuclear process called _____ . [1]

(b) Suggest two reasons why it is possible to see a star but not a planet outside our Solar System.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

6 A fork lift truck raises a load of 500 N to a height of 3 m.

(a) How much work is done in lifting the load?
You are advised to show your working out.

Work done = _____ J [3]

(b) The efficiency of the fork lift truck is 0.6 (60%).
How much energy does the truck require to do 2400 J of work?
You are advised to show your working out.

Energy required = _____ J [3]

7 When a cricket ball is struck by a bat it is compressed, regains its full size and speeds off in the opposite direction.

(a) What type of energy is gained by the ball as it is being compressed?

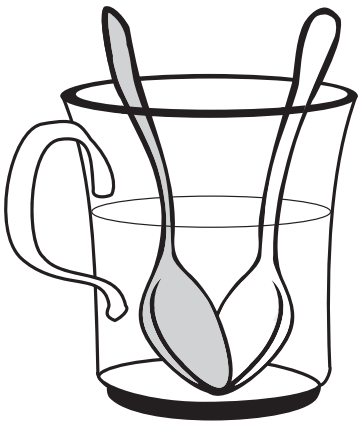
_____ [1]

(b) The speed of the cricket ball is 30 m/s.
If the mass of the ball is 0.5 kg, what is its kinetic energy?
You are advised to show your working out.

Kinetic energy = _____ J [3]

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8 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]

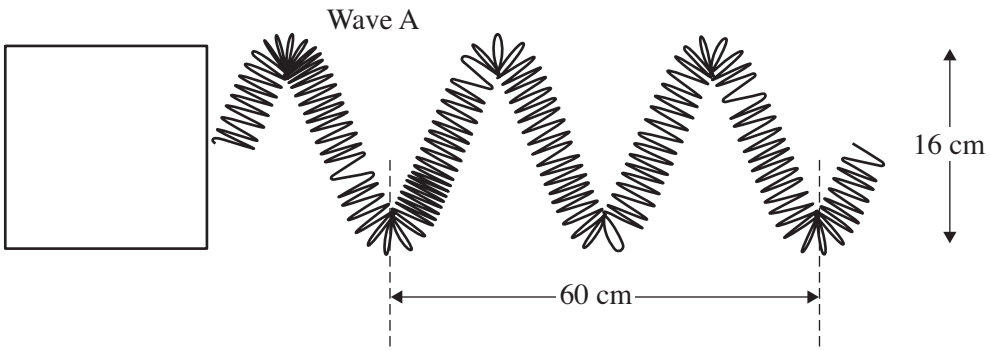
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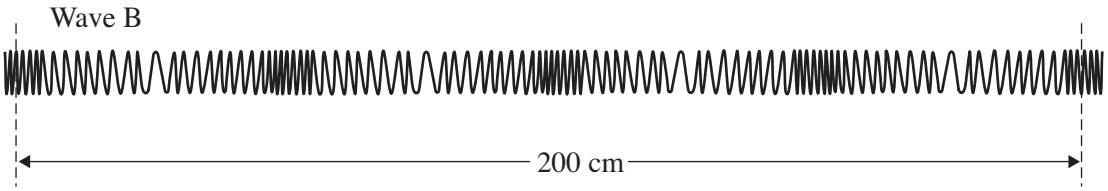
Marks	Remark

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Marks	Remark

9 **(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]

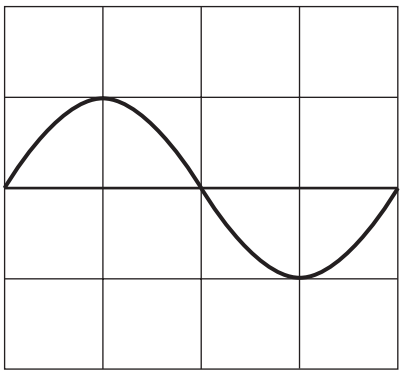
(viii) What is the frequency of vibration of wave B?

_____ Hz [1]

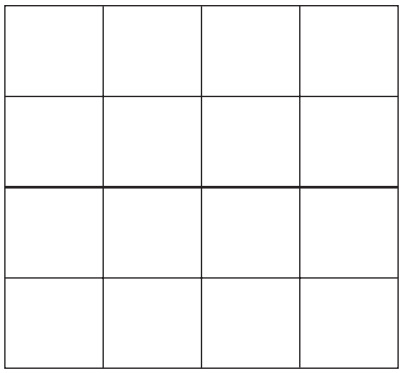
(b) A wave has a frequency of 6 Hz and a wavelength of 0.4 m.
Calculate the speed of the wave.
You are advised to show your working out.

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?

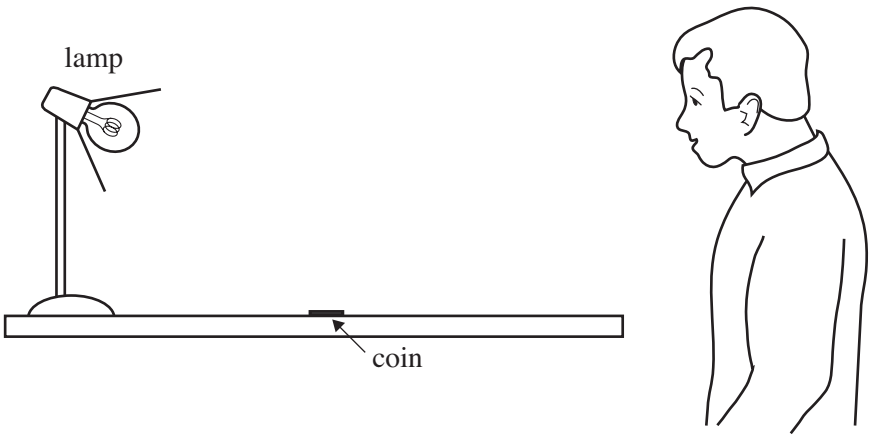
_____ [1]

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Marks	Remark

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10 John observes a coin sitting on a table.

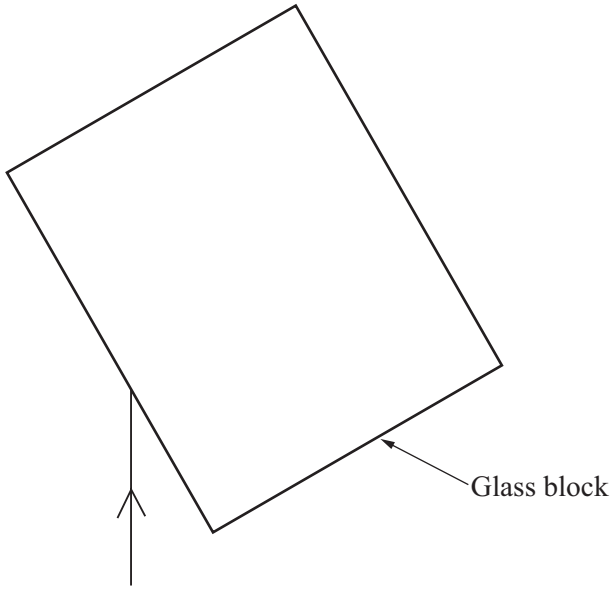


(a) (i) Draw an incident ray and a reflected ray to show how John sees the coin. Include an arrow to show the direction of the light. [3]

(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.



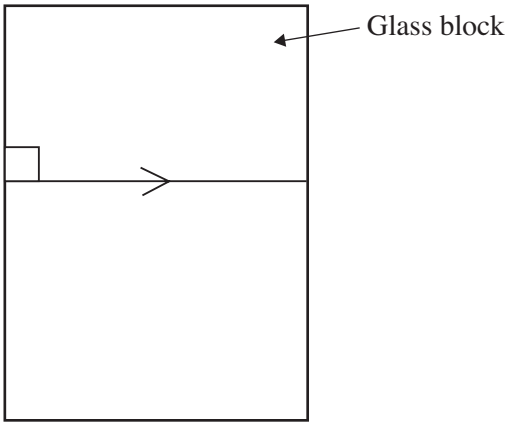
(b) (i) Draw in the normal and show the refracted ray inside the glass. [3]

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Marks	Remark

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(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]

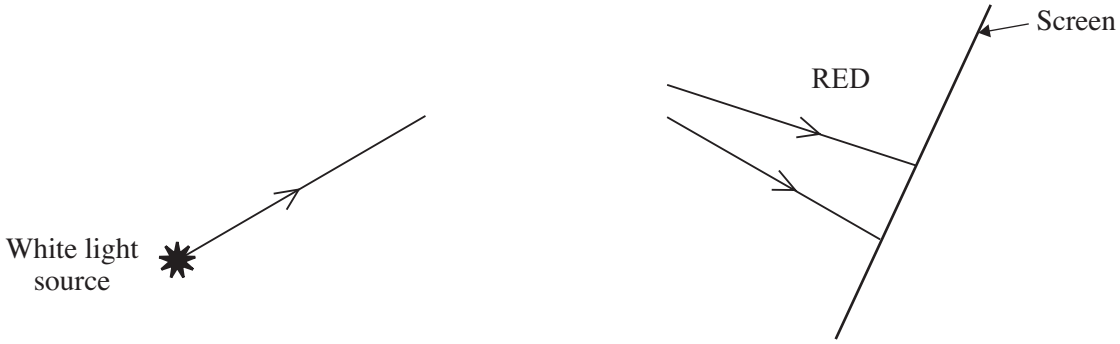
Quality of written communication [1]

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Marks	Remark

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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]

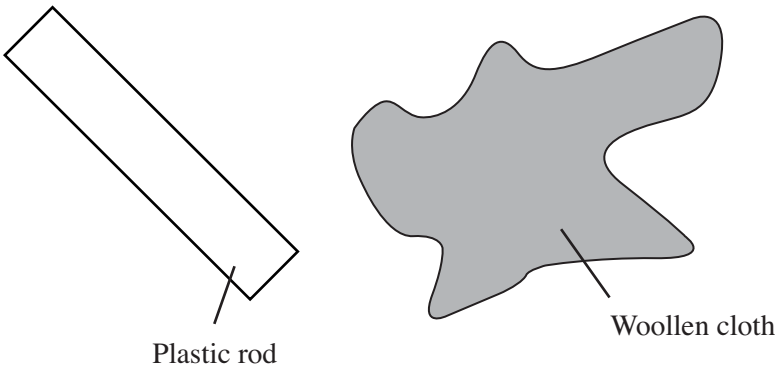
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Marks	Remark

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Examiner Only	
Marks	Remark

11 **(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".



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

_____

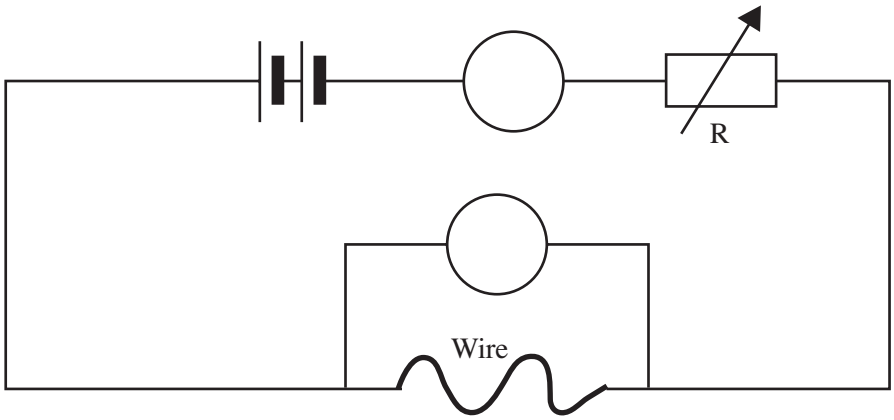
_____ [2]

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(c) What charge passes through a 50 Ω resistor if a current of 0.24 A flows for 5 **minutes**?
Remember to include the unit for charge.
You are advised to show your working out.

Charge = _____ [4]

(d) A pupil sets up a circuit to investigate the relationship between voltage and current for a length of resistance wire.



(i) Use the letters A and V to label the ammeter and voltmeter in the above diagram. [1]

(ii) What is the purpose of the rheostat (variable resistor) R?

_____

_____ [1]

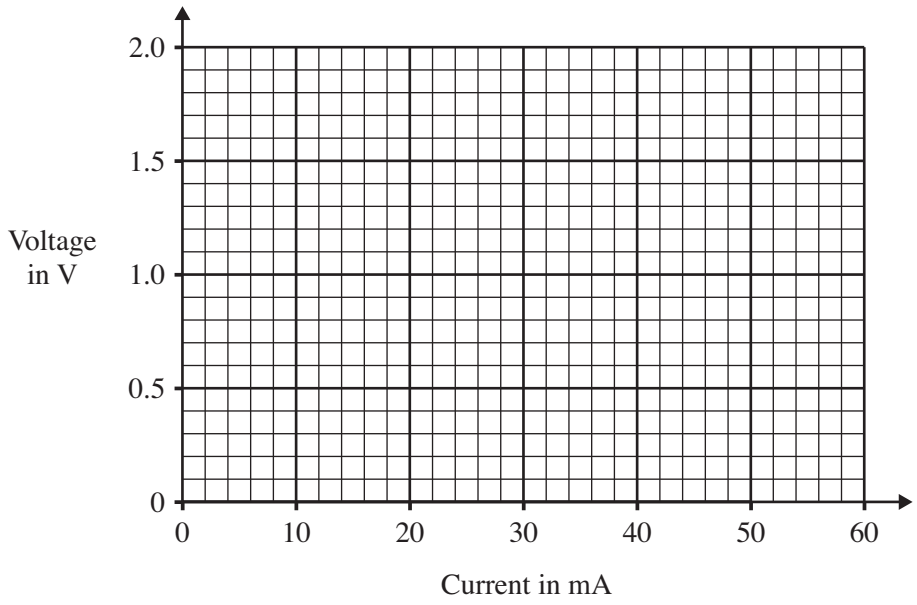
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Marks	Remark

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The results of the investigation are given below.

Voltage in V	0	0.5	1.0	1.5	2.0
Current in mA	0	12	26	40	54



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

(iv) Draw the line of best fit. [1]

(v) Use the graph to find the current in mA when the voltage is 0.8 V.

Current = _____ mA [1]

(vi) Convert your answer to **(d)(v)** to amperes.
Remember 1 mA = 0.001 A.

Current = _____ A [1]

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Marks	Remark

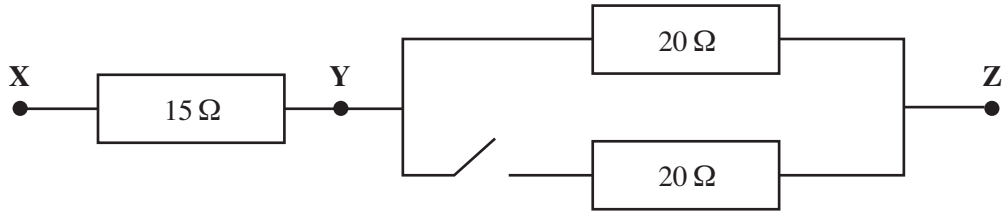
(vii) Use your answer to **(d)(vi)** to calculate the resistance of the wire when the voltage is 0.8V.
You are advised to show your working out.

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Marks	Remark

Resistance = _____ Ω [3]

(e) Three resistors are connected between **X** and **Z** as shown below.



(i) What is the resistance between **X** and **Z** with the switch open?

Resistance = _____ Ω [1]

(ii) What is the resistance between **Y** and **Z** with the switch closed?

Resistance = _____ Ω [1]

(iii) What is the resistance between **X** and **Z** with the switch closed?

Resistance = _____ Ω [1]

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12 A hairdryer is double insulated.

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Marks	Remark

(a) (i) Explain what this means.

_____

_____ [2]

(ii) Which wire is missing from the hairdryer?

_____ [1]

(b) A circuit breaker may be included in a circuit as a safety device. Give two advantages, not related to cost, of the circuit breaker compared to a fuse.

1. _____

2. _____ [2]

(c) (i) Explain what is meant by alternating current (a.c.).

_____

_____ [2]

(ii) Some electrical appliances use alternating current (a.c.) and some use direct current (d.c.).
Indicate which type is used in the following:

transformer, _____ [1]

car battery, _____ [1]

electric cooker. _____ [1]

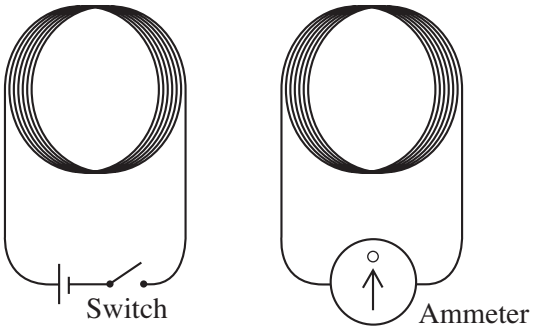
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Marks	Remark

(d) For each of the following arrangements decide which statement, A, B or C, best describes the deflection of the ammeter.

A	No deflection.
B	Continuous (steady) deflection.
C	Deflection followed by a return to zero.

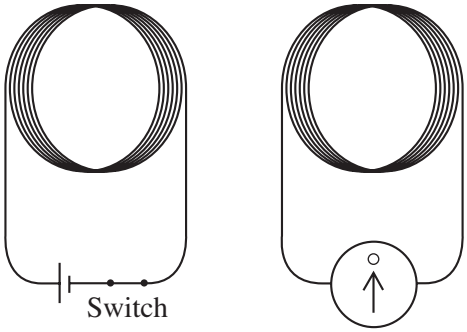
(i)



A student **closes** the switch.

Letter _____ [1]

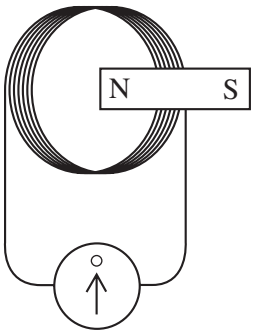
(ii)



A student **opens** the switch.

Letter _____ [1]

(iii)



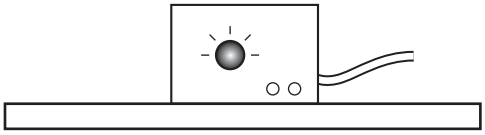
A student holds a magnet **at rest** inside a coil.

Letter _____ [1]

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Examiner Only	
Marks	Remark

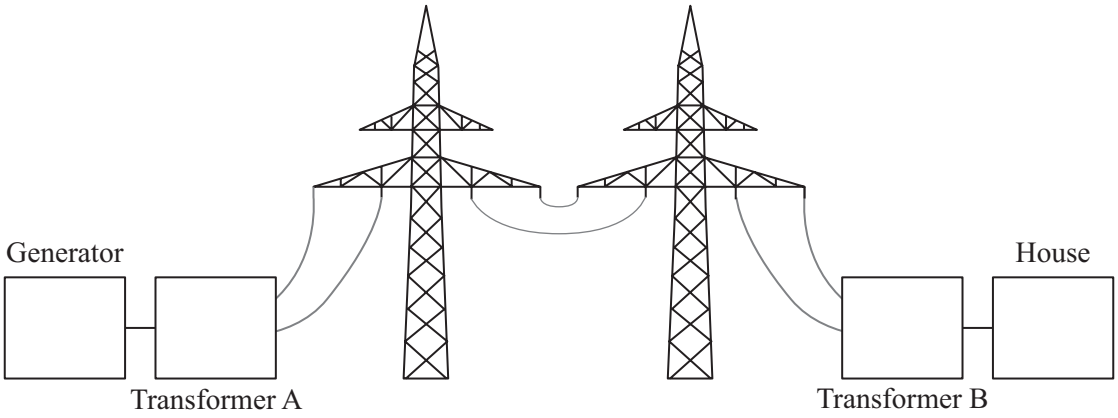
(e) A power pack used in a school laboratory contains a step-down transformer. The transformer changes the mains voltage from 240 V to a much safer level.



The primary coil of the transformer has 3600 turns and it is connected to the mains voltage. Calculate the number of turns in the secondary coil if the student has selected a voltage of 12 V.
You are advised to show your working out.

Number of turns = _____ [4]

The diagram below represents the electricity transmission system.



(f) **(i)** Explain fully the function of transformer A.

_____

_____ [2]

(ii) What is the purpose of transformer B?

_____ [1]

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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
Higher Tier

[G8406]

WEDNESDAY 25 MAY, MORNING

MARK SCHEME

STEMUP.CO.UK

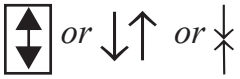
					AVAILABLE MARKS
1	**(a)**	Distance = area under graph *or* d = v × t *or* d = s × t	[1]		
		= 3 × 15	[1]		
		= 45 (m)	[1]	[3]	
	(b)	Momentum = m × v *or* p = mv	[1]		
		= 3000 × 1.4	[1]		
		= 4200	[1]		
		kg m/s or Ns [1] Free-standing unit mark	[1]	[4]	7
2	**(a)**	Forces must be balanced/Weight = Friction		[1]	
	(b)	F = ma or RF = ma	[1]		
		0.6 = 0.3 × a	[1]		
		a = 2 (m/s^2)	[1]	[3]	4
3	**(a)**	2nd box (✓)		[1]	
	(b)	Geocentric [1] and heliocentric [1] either order		[2]	
	(c)	Responses 2 and 4 Mark positively then subtract [1] for each extra (✓)		[2]	5
4	**(a)**	**(i)** Milky Way		[1]	
		(ii) Universe		[1]	
	(b)	Jupiter and Saturn – either order		[2]	4
5	**(a)**	Gravity	[1]		
		Temperature *or* density *or* HEAT *or* thermal energy	[1]		
		Fusion	[1]	[3]	
	(b)	(Star) emits light	[1]		
		(Star) is bigger/massive	[1]	[2]	5

					AVAILABLE MARKS
6	**(a)**	Work done = Force × Distance moved or WD = F × s [1] = 500 × 3 [1] = 1500 (J) [1]	[3]		
	(b)	Efficiency = $\frac{\text{Energy Out}}{\text{Energy In}}$ [1] 0.6 = 2400/Input Energy Energy Input = 2400/0.6 either [1] = 4000 (J) [1]	[3]		6
7	**(a)**	Strain or Elastic	[1]		
	(b)	KE = $\frac{1}{2}mv^2$ [1] = $\frac{1}{2} \times 0.5 \times 30^2$ [1] = 225 (J) [1]	[3]		4
8	**(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 marking	[2]		
	(d)	Use a lid/cover	[1]		5

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AVAILABLE MARKS

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

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

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

(iv) 30 (cm) [1]

(v) 50 (cm) [1]

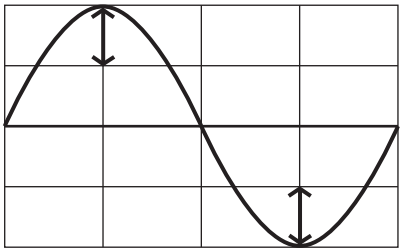
(vi) 8 (cm) [1]

(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) Both amplitudes must be $1 <$ amplitude $\leqslant 2$ squares



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 for each 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] [3]

20

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						AVAILABLE MARKS
10	**(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 [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

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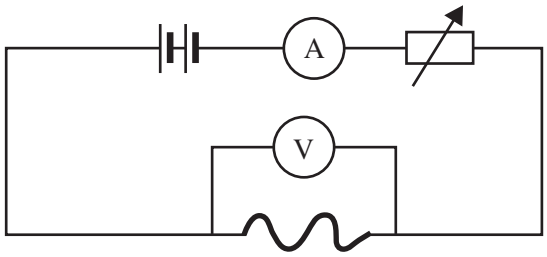
11 (a) (i) Electrons [1]

(ii) Positive [1]

(b) To stop charge building up [1] } Dependent
to prevent a spark [1] } marking [2]

(c) $Q = It$ [1]
$= 0.24 \times 300$ [1]
$= 72$ [1]
C Free-standing unit mark [1] [4]

(d)



(i) Both correct [1]

(ii) Change the current [1]

(iii) All points correct [1]

(iv) Best fit straight line [1]

(v) 20 mA (±2) [1]

(vi) 0.02 A (allow ecf from **(v)**) [1]

(vii) $R = V/I$ or $V = IR$ or equivalent [1]
$R = 0.8/0.02$ [1]
$R = 40\ \Omega$ ecf from **(vi)** i.e. for current only [1] [3]

(e) (i) 35 (Ω) [1]

(ii) 10 (Ω) [1]

(iii) 25 (Ω) [1]

AVAILABLE MARKS

20

					AVAILABLE MARKS
12	**(a)**	**(i)**	A layer (or 2 layers) of insulation/plastic [1] Covering live parts [1]	[2]	
		(ii)	Earth (wire)	[1]	
	(b)		Quicker (response)/Safer [1] Easier to reset [1]	[2]	
	(c)	**(i)**	Changes *direction* } dependent [1] Continuously/periodically } marking [1]	[2]	
		(ii)	a.c. or alternating [1] d.c. direct [1] a.c. alternating [1]	[3]	
	(d)	**(i)**	C	[1]	
		(ii)	C	[1]	
		(iii)	A	[1]	
	(e)		$\frac{N_P}{N_S} = \frac{V_P}{V_S}$ (or equivalent) [1] [1] $\frac{3600}{N_S} = \frac{240}{12}$ [1] [2] $N_S = 180$ [1]	[4]	
	(f)	**(i)**	Increases the voltage/decrease current [1] Reduce the energy lost [1]	[2]	
		(ii)	Voltage is stepped down/Make safe	[1]	20
				Total	**120**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 3
Higher Tier

[G8406]

G8406

FRIDAY 28 MAY, MORNING

TIME

1 hour 45 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 twelve** questions.

INFORMATION FOR CANDIDATES

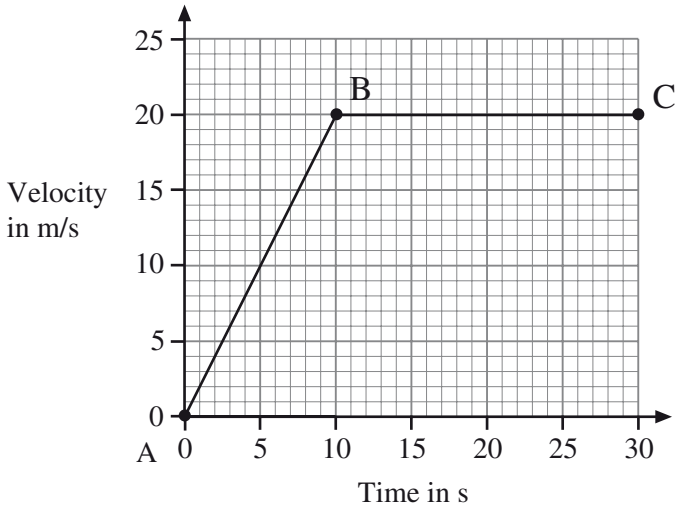
The total mark for this paper is 120.
Quality of written communication will be assessed in questions **4(c)** and **11(a)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where apropriate.

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

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Examiner Only	
Marks	Remark

1 The velocity–time graph for part of a bus journey is shown below.



(i) From the statements below, choose the correct statement about the journey. Give your answer by placing a tick (✓) in the correct box.

The distance travelled in the region AB is given by the gradient of the line AB. ☐

The bus is at rest during BC. ☐

The acceleration is constant during the region AB. ☐

[1]

The bus has a mass of 3000 kg.

(ii) Calculate the **maximum** momentum of this bus during its journey. Remember to include the correct unit.

You are advised to show your working out.

Maximum momentum = _____ [4]

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Examiner Only	
Marks	Remark

2 On a test track, a car skids on water when the brakes are applied. The force exerted by the brakes is 60 N and the distance travelled before coming to rest is 150 m.



(a) (i) Calculate the work done by the brakes.

You are advised to show your working out.

Work done = _____ J [3]

(ii) How much kinetic energy does the car lose over the 150 m braking distance?

Kinetic energy lost = _____ J [1]

(b) The weight of the car is 14 250 N.
What is the mass of the car?

Mass = _____ kg [1]

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Examiner Only	
Marks	Remark

3 **(a)** **(i)** What is at the centre of the solar system?

_____ [1]

Name the planet which is:

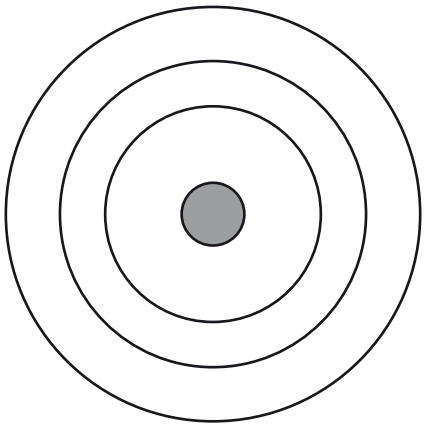
(ii) closest to the centre of the solar system.

_____ [1]

(iii) most distant from the centre of the solar system.

_____ [1]

In ancient times a theory was put forward to describe the structure of the solar system.



(b) According to this ancient theory, what was at the centre of the solar system?

_____ [1]

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4 The universe is made up of a number of galaxies.

(a) What is a galaxy?

_____ [1]

(b) What is the name of our galaxy?

_____ [1]

(c) Give one reason, other than cost, why it is unlikely that a manned spacecraft will ever visit a planet outside our solar system.

_____

_____ [1]

Quality of written communication [1]

Examiner Only

Marks	Remark

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5 **(a)** **(i)** Name the gas which is required for the formation of a star.

_____ [1]

(ii) What force pulls the particles together?

_____ [1]

(iii) What happens to the particles when they are compressed?

_____ [1]

(iv) Name the nuclear reaction that takes place within a star.

_____ [1]

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

_____ [1]

(b) Name the two theories for the formation of the universe.

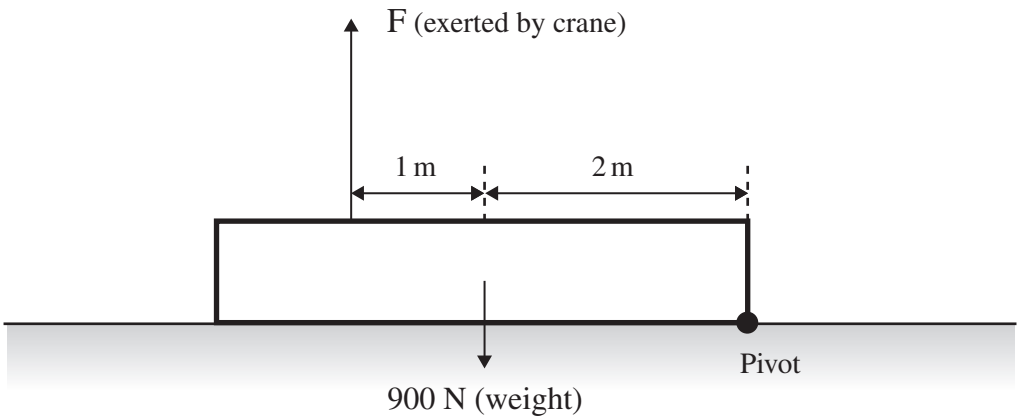
1. _____ 2. _____ [2]

Examiner Only

Marks	Remark

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6 A crane is used to lift one end of a steel beam of weight 900 N. The weight of the beam is marked on the diagram.



The crane exerts a force, F, to lift the end of the steel beam off the ground.

(i) Use the principle of moments to calculate the smallest force F, needed to lift the left end of the beam off the ground.

You are advised to show your working out.

Force F = _____ N [4]

(ii) In what direction is the moment of the force F exerted by the crane about the pivot?

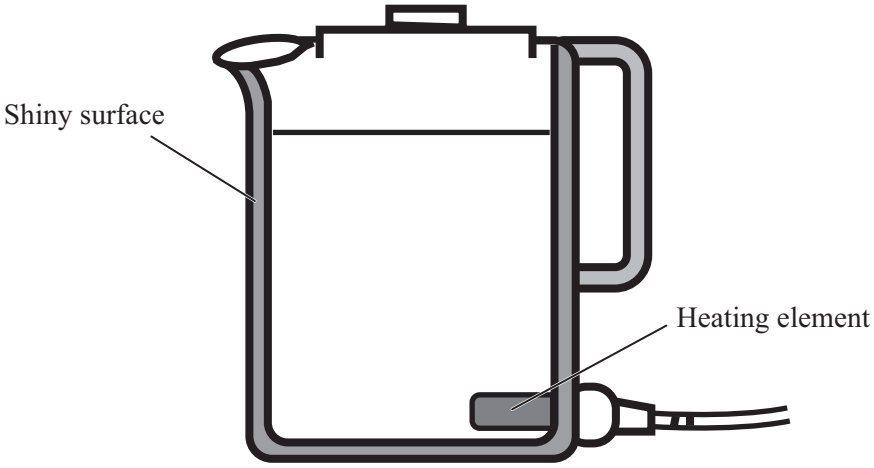
_____ [1]

Examiner Only
Marks | Remark

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Examiner Only	
Marks	Remark

7 The diagram shows an electric kettle.



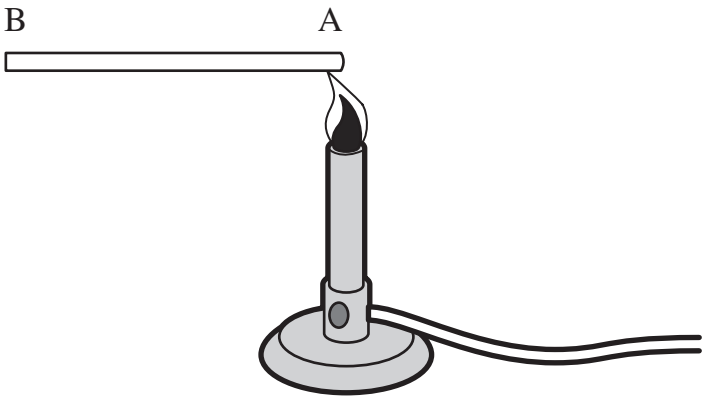
(a) (i) Draw a convection current starting at the heating element and show its direction. [2]

(ii) Explain why the outer surface of the kettle is a shiny colour rather than a dull black surface.

_____

_____ [2]

One end of a glass rod is heated as shown.



(b) (i) Complete the statement to compare the behaviour of the molecules at end A with the molecules at end B.

The molecules at end A _____

_____ [1]

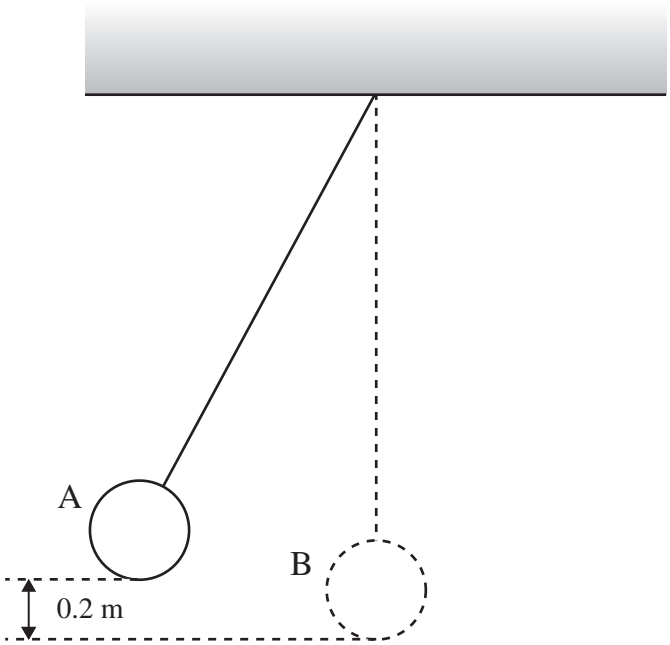
(ii) How is the heat energy transferred along the rod?

_____ [1]

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Examiner Only	
Marks	Remark

8 The diagram shows a large pendulum, which has been pulled to one side and held at position A. Shown dotted is the position of the pendulum as it swings through the mid-point, position B.



(i) Complete the following sentence.

As the pendulum swings from position A to position B, gravitational potential energy changes to

_____ energy. [1]

(ii) The pendulum, which has a mass of 3 kg, is released. Use the principle of conservation of energy to calculate its velocity when it reaches point B.

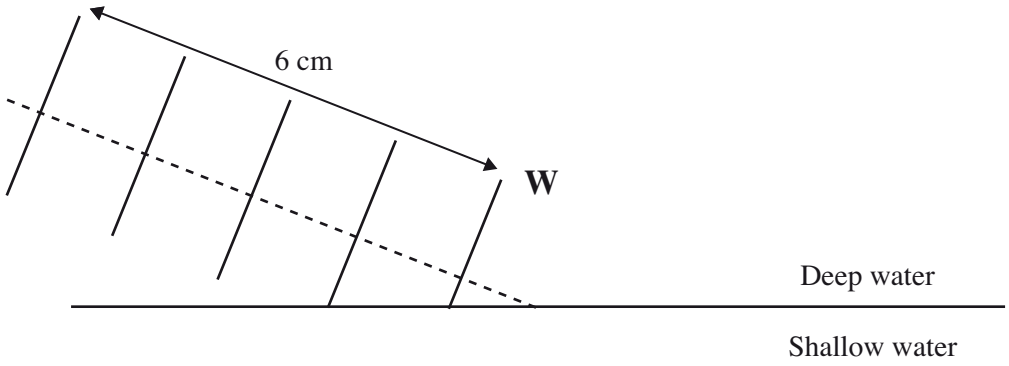
You are advised to show your working out.

Velocity at B = _____ m/s [4]

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Examiner Only	
Marks	Remark

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



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

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

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

Remember the diagram is not drawn to scale.

Wavelength = _____ cm [1]

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

Frequency = _____ Hz [1]

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

Give your answer in cm/s

You are advised to show your working out.

Speed = _____cm/s [3]

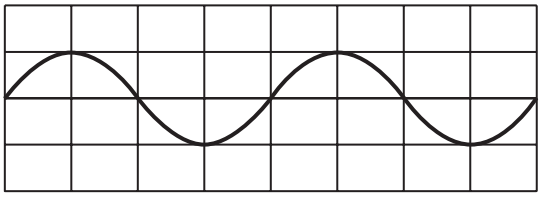
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Marks	Remark

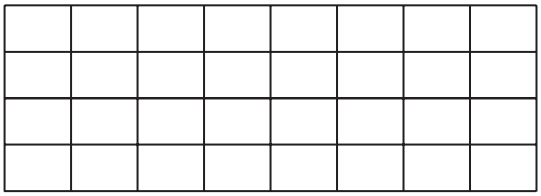
(v) What, if anything, happens to the wavelength of the water waves as they leave deep water and enter shallow water?

_____ [1]

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



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



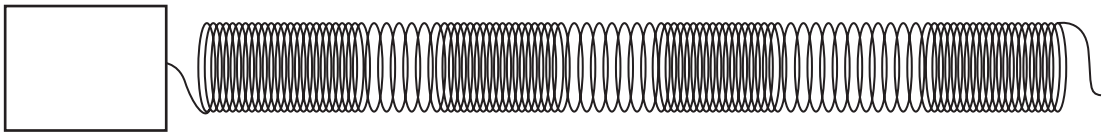
[2]

(ii) Water waves are classified as transverse waves.

Give two more examples of transverse waves.

1. _____ 2. _____ [2]

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



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

(ii) Give another example of a longitudinal wave.

_____ [1]

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

_____ [1]

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Marks	Remark

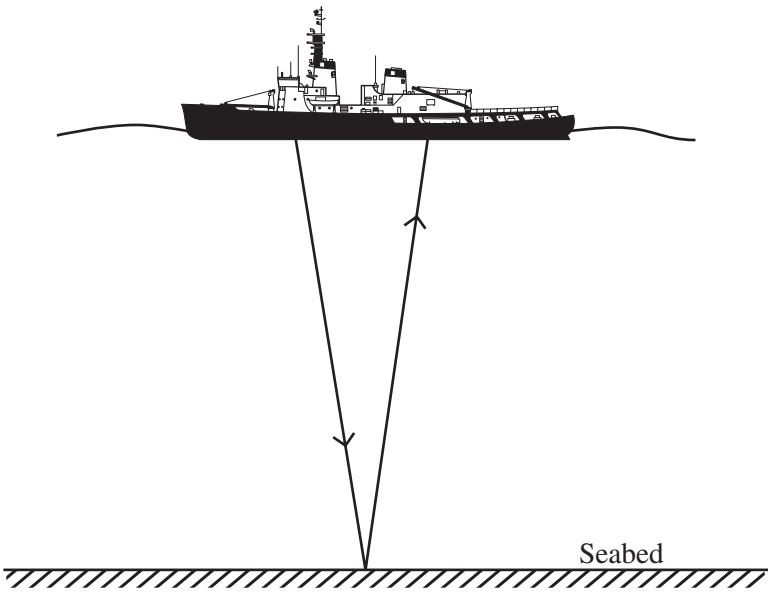
(d) (i) State the lower frequency limit for a child's hearing.

_____Hz [1]

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

_____[1]

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



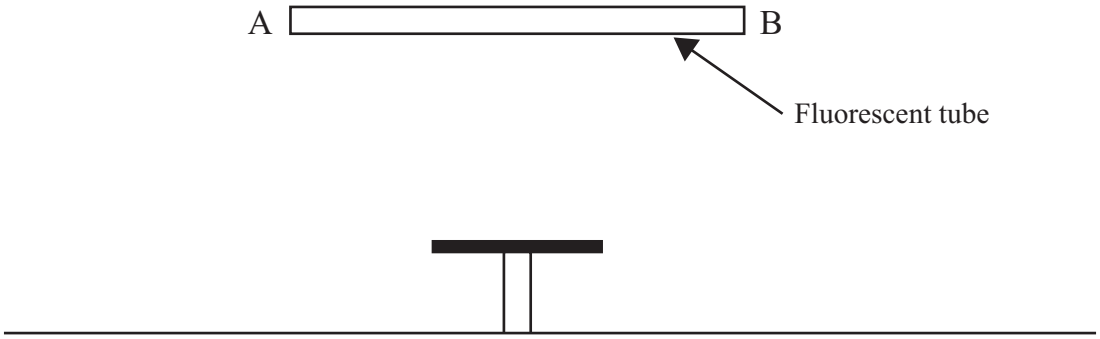
Calculate the distance between the ship and the seabed.

You are advised to show your working out.

Distance = _____ m [4]

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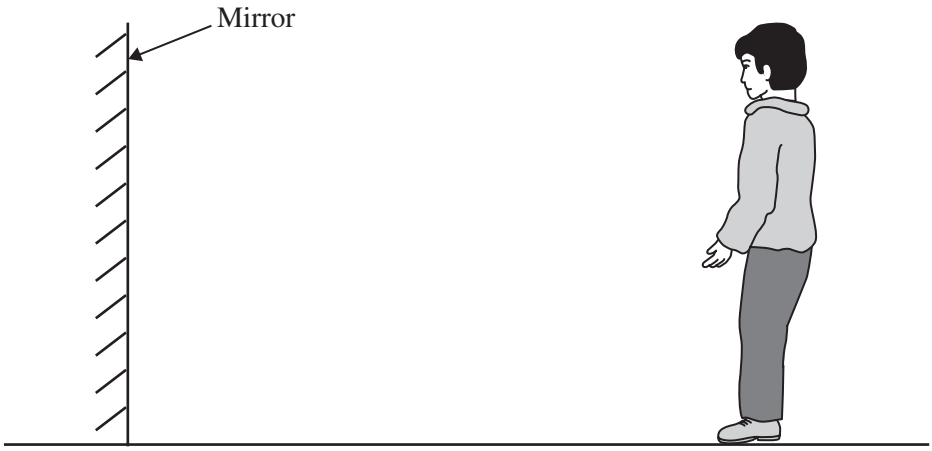
10 Light from a fluorescent tube forms a shadow of a table on the floor below.



(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]

Examiner Only

Marks	Remark

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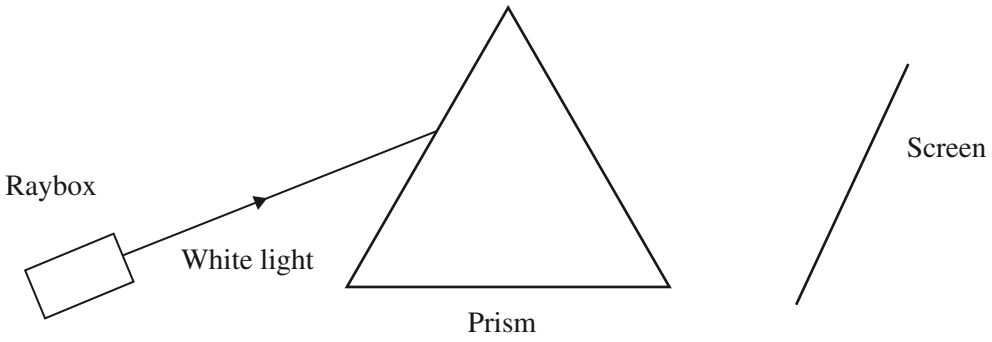
Examiner Only	
Marks	Remark

(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]

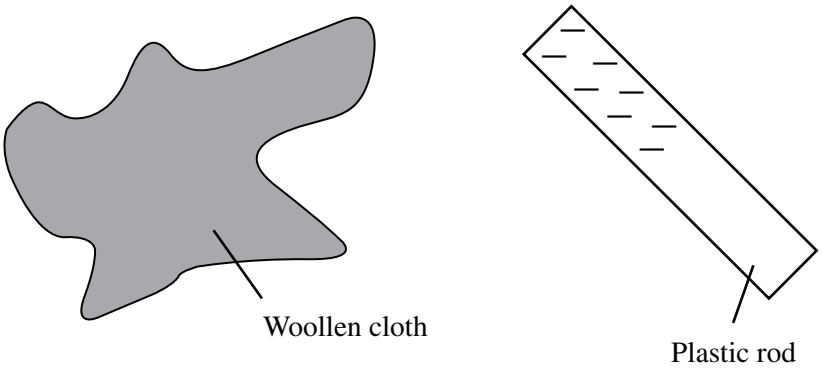
Examiner Only

Marks	Remark

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11 (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 current of 0.2 A flows through a resistor. How much charge passed in five **minutes**?

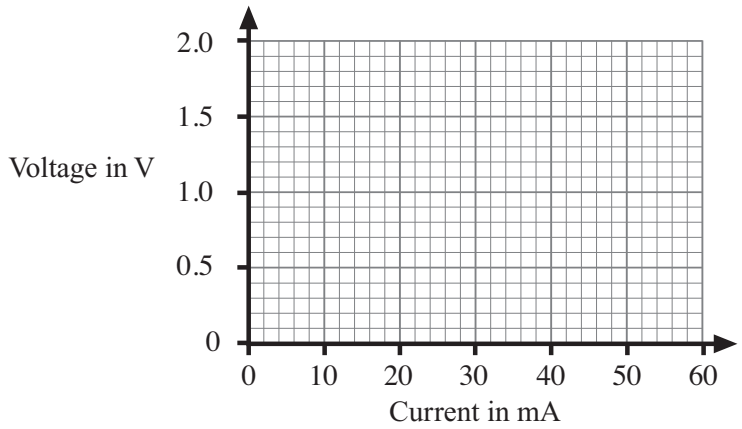
Remember to include the correct unit for charge.

You are advised to show your working out.

Charge = _____ [4]

(c) A pupil investigated the variation of voltage with current for a bulb. The results are given below.

Voltage in V	0	0.1	0.3	0.5	0.8	2.0
Current in mA	0	10	20	30	40	60



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

(ii) Draw a smooth curve through the points. [1]

(iii) Use the graph to find the current in milliamps when the voltage is 1.3 V.

Current = _____ mA [1]

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(iv) Convert your answer in **(c)(iii)** to amperes.

Remember 1 mA = 0.001 A.

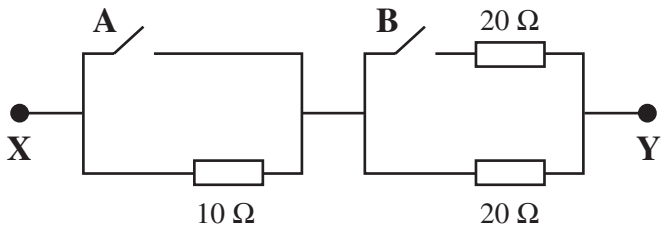
Current = _____ A [1]

(v) Use your answer to **(c)(iv)** to calculate the resistance of the bulb when the voltage is 1.3 V.

You are advised to show your working out.

Resistance = _____ Ω [3]

(d) Three 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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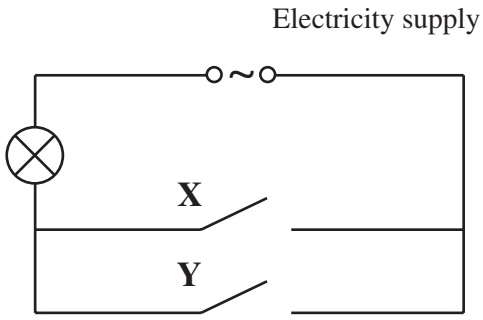
Marks	Remark

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Examiner Only	
Marks	Remark

12 Sarah is attempting to construct a two-way switch so that a light in a long hallway can be switched on or off from either end of the hallway.

Sarah considers the circuit below.

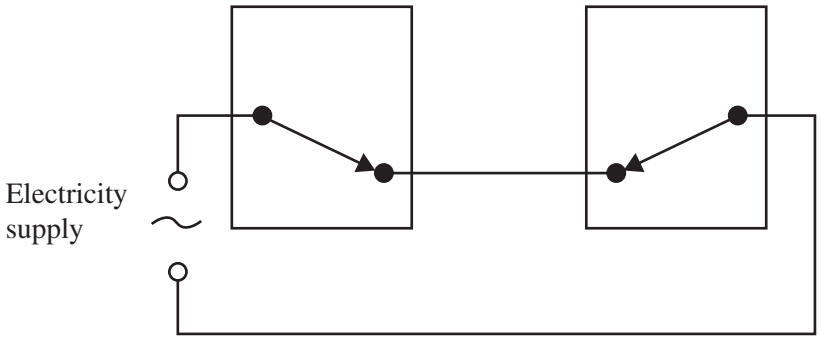


(a) (i) Explain why this circuit will not work as a two-way switch.

_____

_____ [1]

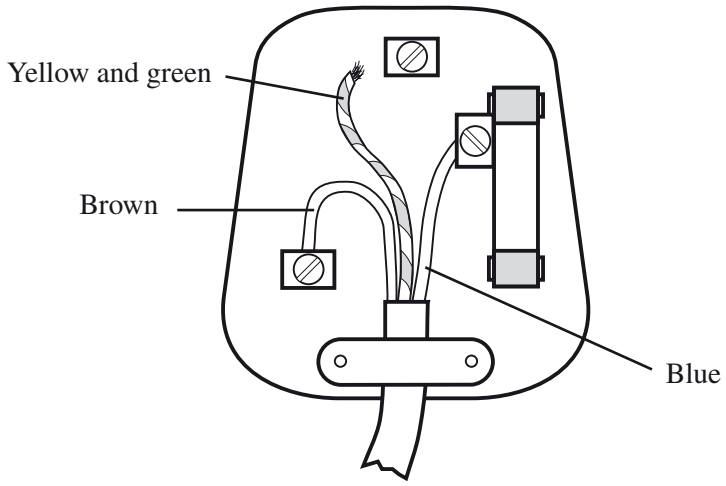
The circuit shown below is incomplete for a two-way switch. For it to work, a bulb must be added and the switch completed.



(ii) Complete the circuit diagram and draw in the bulb. [2]

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Arabella suspects that a plug connected to her hairdryer is faulty and so removes the cover. What she finds is shown below.



(b) (i) Apart from the cover being off, what two faults do you notice in the plug?

1. _____

2. _____ [2]

(ii) Which two wires carry the same current when the appliance is working normally?

_____ and _____ [1]

(c) A fuse is a safety device which works by creating an incomplete circuit.

(i) Name another safety device which works by creating an incomplete circuit.

_____ [1]

(ii) State two ways, other than cost, in which this device is better than a fuse.

1. _____

2. _____ [2]

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Marks	Remark

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A transformer transfers electrical energy from the primary coil to the secondary coil.

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Marks	Remark

(d) (i) What is the name of this process?

_____ [1]

(ii) What type of current flows in the coils of a transformer? Choose your answer by placing a tick (✓) in the correct box.

direct current ☐

alternating current ☐

direct current **or** alternating current ☐ [1]

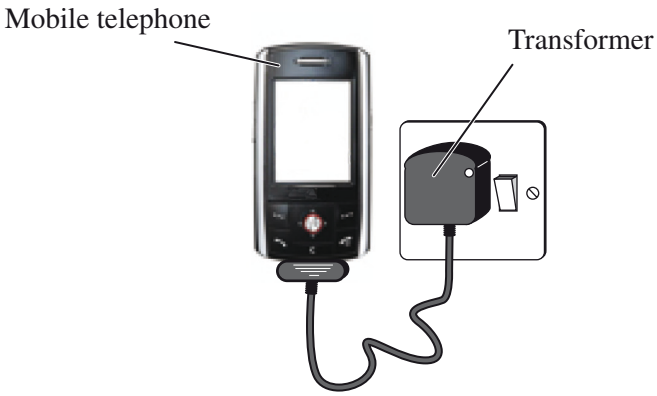
Bathrooms use a particular type of transformer called an isolating transformer. In this transformer, the voltage in the secondary coil is the **same** as the voltage in the primary coil.

(iii) How does the number of turns in the primary coil compare with the number of turns in the secondary coil?

_____ [1]

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A mobile telephone is charged from the mains supply using a transformer. The mains supply is 240 V and the telephone needs 6 V to charge it. The secondary coil has 200 turns.



(e) Calculate the number of turns in the primary coil.

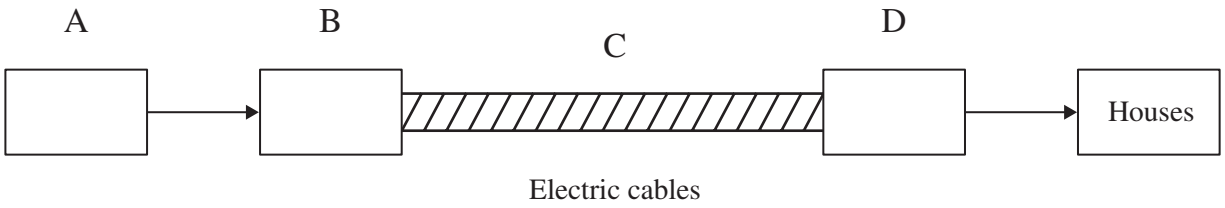
You are advised to show your working out.

Number of turns = _____ [4]

Examiner Only	
Marks	Remark

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A block diagram of an electricity transmission system is shown below. Each block represents a different component in the transmission system.



(f) (i) Which component, A, B, C or D is included for safety reasons?

Component _____ [1]

(ii) Which component, A, B, C or D has fewer secondary turns than the primary?

Component _____ [1]

(iii) It is important that energy losses in the electric cables are kept to a minimum. Which component, A, B, C or D is mainly responsible for this?

Component _____ [1]

Examiner Only

Marks	Remark

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
Higher Tier

[G8406]

FRIDAY 28 MAY, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	**(i)**	Acceleration is constant during AB (✓)		[1]	
	(ii)	Momentum = mass × velocity **or** p = mv	[1]		
		= 3000 × 20	[1]		
		= 60 000	[1]		
		= kg m/s **or** Ns	[1]	[4]	5
2	**(a)**	**(i)** W.D. = Force × distance	[1]		
		= 60 × 150	[1]		
		= 9000 (J)	[1]	[3]	
		(ii) 9000 J (**e.c.f.** **(a)(i)**)	[1]	[1]	
	(b)	Mass = 1425 (kg)		[1]	5
3	**(a)**	**(i)** Sun		[1]	
		(ii) Mercury		[1]	
		(iii) Neptune		[1]	
	(b)	Earth **or** Planet Earth		[1]	4
4	**(a)**	(Collection of) **stars**		[1]	
	(b)	Milky Way		[1]	
	(c)	Problem with time **or** fuel **or** logistics **or** distance		[1]	
		QWC		[1]	4

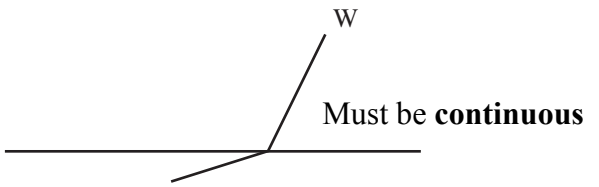
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						AVAILABLE MARKS
5	**(a)**	**(i)**	Hydrogen Reject: Nebula	[1]		
		(ii)	Gravity/gravitational	[1]		
		(iii)	Temperature rises/gets hotter/density increases/begin to spin	[1]		
		(iv)	(Nuclear) fusion	[1]		
		(v)	Any named em radiations/heat	[1]	[5]	
	(b)		Steady State Theory and Big Bang Theory		[2]	7
6	**(i)**		CWM = ACWM F × 3 [1] = 900 × 2 [1] F = 600 (N)	$F_1 \times d_1 = F_2 \times d_2$ [1] CM = ACM [2] [1]		
	(ii)		Clockwise	[1]	[5]	5
7	**(a)**	**(i)**	Anticlockwise current with arrows ↓ ↑	[2]		
		(ii)	Shiny surface is a bad [1] radiator [1]/bad [1] emitter [1]	[2]	[4]	
	(b)	**(i)**	Greater k.e./velocity/amplitude/vibrate more/faster		[1]	
		(ii)	Molecules jostle/molecules collide **or** Conduction		[1]	6
8	**(i)**		Kinetic (energy) **or** Movement energy		[1]	
	(ii)		Any combination of PE = mgh = 3 × 10 × 0.2 = 0.6	[1]		
			Any combination of KE = ½ mv^2 = ½ × 3 × v^2	[1]		
			Applying Principle of Conservation of energy KE = PE **or** 6 = ½ × 3 v^2 v = 2	[1] [1]	[4]	5

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AVAILABLE MARKS

9 **(a)** **(i)**



[1]

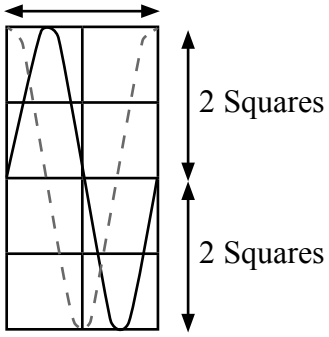
(ii) Wavelength = 1.5 (cm) [1]

(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 (cm/s) [1]

(v) Smaller [1] [7]

(b) **(i)** 2 Squares



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** P-waves [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]

(Total) distance = 1500 × 0.8 [1]

= 1200 m or = 1500 × 0.4 [2] [1]

Distance = 600 (m) = 600 (m) [1] [1] [6]

20

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							AVAILABLE MARKS
10	**(a)**	**(i)**	Four correct rays	Dotted lines OK See handout Straight by eye	[4]		
		(ii)	Correct label		[1]	[5]	
	(b)	**(i)**	**1st mark – 2** rays, one from shoe to mirror and the other from mirror to eye **2nd mark** – only 1 correct arrowhead needed **3rd mark** – point of incidence must be between 4th and 6th hatch mark from ground **4th mark** – NORMAL must be mostly on RHS of mirror.				
		(ii)	Less		[1]	[5]	
	(c)	**(i)**	Splitting of light into different colours/wavelengths		[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) definition of Transverse wave travel in vacuum transverse can be polarised		[2]		
		(iii)	Two from: infra-red microwaves visible/light Reject: Radio, Gamma, X-rays, UV		[2]	[5]	20

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						AVAILABLE MARKS
11	**(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)		Charge = Current × time or Q = It Charge = 0.2 × 5 × 60 Charge = 60 [1] C [1]	[1] [1] [2]	[4]	
	(c)	**(i)**	5 correct points, ± ½	[1]		
		(ii)	A smooth curve through the points Reject: Not starting at (0, 0) Thick curve or tramlines 'Joining the dots' with ruler	[1]		
		(iii)	Current = 50 mA [±2 mA]	[1]		
		(iv)	0.05 (A) e.c.f. from **(iii)**	[1]		
		(v)	$R = \frac{V}{I}$ [1] or V = IR or equivalent $R = \frac{1.3}{0.05}$ [1] e.c.f. from **(iv)** $= 26\ (\Omega)$ [1]	[3]	[7]	
	(d)		30 Ω 20 Ω 20 Ω 10 Ω	[1] [1] [1] [1]	[4]	20

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						AVAILABLE MARKS
12	**(a)**	**(i)**	If switch is closed, other will not turn lamp off.		[1]	
		(ii)	Switch completed Bulb added	[1] [1]	[2]	
	(b)	**(i)**	Live wire not connected to fuse or Live connected to neutral or Neutral in wrong place or live is in wrong place or Earth wire not connected/bare wires at Earth Earth must be one of the choices	[2]		
		(ii)	Live and neutral/(brown and blue)	[1]		
	(c)	**(i)**	Circuit breaker/Trip switch/RCB/RCD/RCCB	[1]		
		(ii)	Faster response/safer No need to replace } Dependent marking from (c) (i)	[1] [1]	[6]	
	(d)	**(i)**	(Electromagnetic) induction/EMI	[1]		
		(ii)	Alternating current	[1]		
		(iii)	Equal or same	[1]	[3]	
	(e)		$\frac{Np}{Ns} = \frac{Vp}{Vs}$ or equivalent	[1]		
			$\frac{Np}{200}$ [1] = $\frac{240}{6}$ [1] Must include "="	[2]		
			Np = 8000 (turns)	[1]	[4]	
	(f)	**(i)**	D	[1]		
		(ii)	D	[1]		
		(iii)	B	[1]	[3]	19
					Total	**120**

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