CCEA GCSE PHYSICS (2003 SPECIFICATION)

PHYSICS



EXAM QUESTION PACK

PAPER 1 FOUNDATION TIER G7602 PAPERS

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Physics

Paper 1
Foundation Tier

[G7602]

G7602

FRIDAY 15 JUNE, AFTERNOON

TIME

1 hour 15 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 five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Quality of written communication will be assessed in Question **5(b)(iii)**.
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 with numerical answers where appropriate.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** The diagram shows one solar panel consisting of a number of sections.
The solar panel is made up of a number of photocells.
The photocells produce electricity directly from sunlight.
Solar panels are placed on the roof of a house.



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On a cloudless summer day the solar power shining on the panel is 6000 W.

(i) How much energy per second is shining on the solar panel?

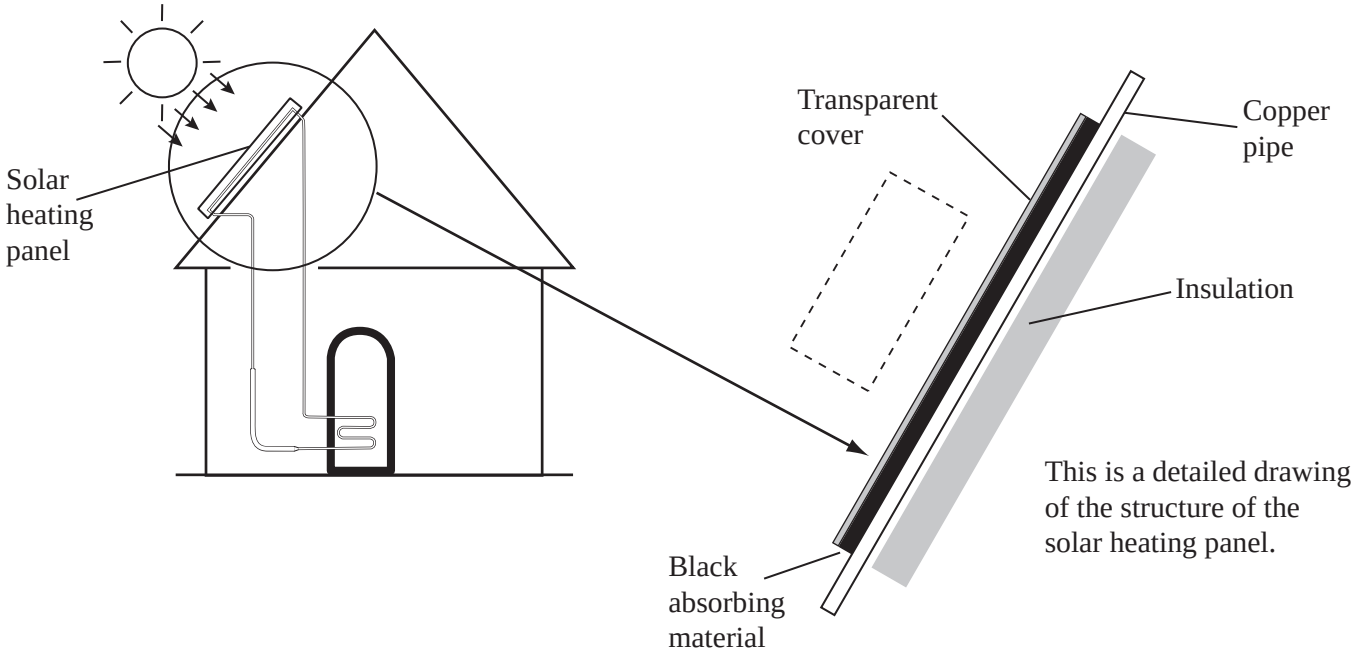
Energy per second = _____ J [1]

(ii) The efficiency of the solar panel is 0.2 or 20%.
Calculate the output electrical energy every second from the solar panel.
You are advised to show clearly how you get your answer.

Output electrical energy = _____ J [3]

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(b) Sunlight can also be used to provide domestic hot water.
A typical solar heating panel is shown below.



Examiner Only	
Marks	Remark

(i) Why is the material used to absorb sunlight black?

_____ [1]

(ii) **Expanded** polystyrene is often used as the insulating material.
What property of **expanded** polystyrene makes it a good insulator?

_____ [1]

(iii) On the diagram of the enlarged view show, by placing an arrow in the dashed box, the direction of water flow through the solar heating panel. [1]

(iv) Name the type of electromagnetic wave in sunlight that is responsible for this heating effect.

_____ [1]

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(c) The diagram shows weightlifting equipment found in most gyms.

Examiner Only	
Marks	Remark



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(i) When using the equipment John lifts a weight of 200 N through a distance of 1.5 m.
Calculate the amount of work that John does.
You are advised to show clearly how you get your answer.

Work = _____ J [3]

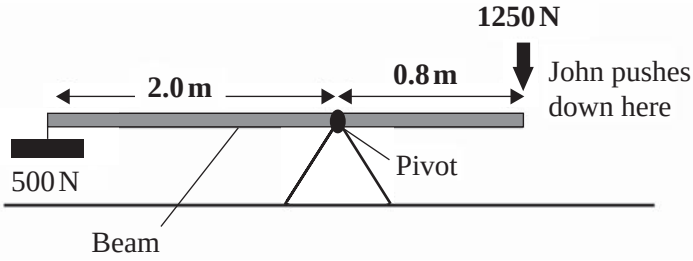
(ii) John repeats the exercise. He does 10 complete lifts in a time of 30 seconds.
Calculate the power John produces during this time.
Remember to include the unit for power.
You are advised to show clearly how you get your answer.

Power = _____ [4]

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Examiner Only	
Marks	Remark

(d) John builds a simple weightlifting device as shown below.
The pivot can be moved along the beam.



(i) For the arrangement of weight and distances shown above calculate the moment of the force that John exerts.
You are advised to show clearly how you get your answer.

Moment = _____ Nm [2]

(ii) To reduce the force that John exerts but keep the same moment, he moves the pivot.
In what direction should he move it?
Explain your answer.

_____

_____

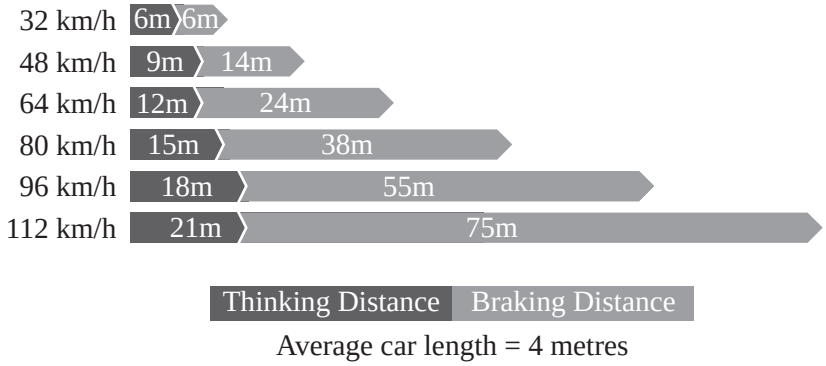
_____

_____ [3]

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Examiner Only	
Marks	Remark

2 **(a)** The **stopping distance** of a car is the **thinking distance** added to the **braking distance**.
The chart below shows the results of a study of stopping distance by an alert driver, on a dry day using a car with good tyres and good brakes.



Average car length = 4 metres

(i) The **braking distance** is the distance the car travels from where the brakes were first applied to where the car stops.
For a car travelling along a level road, state **two** factors, not related to the driver, that would result in an increase in the braking distance.

_____

_____

_____

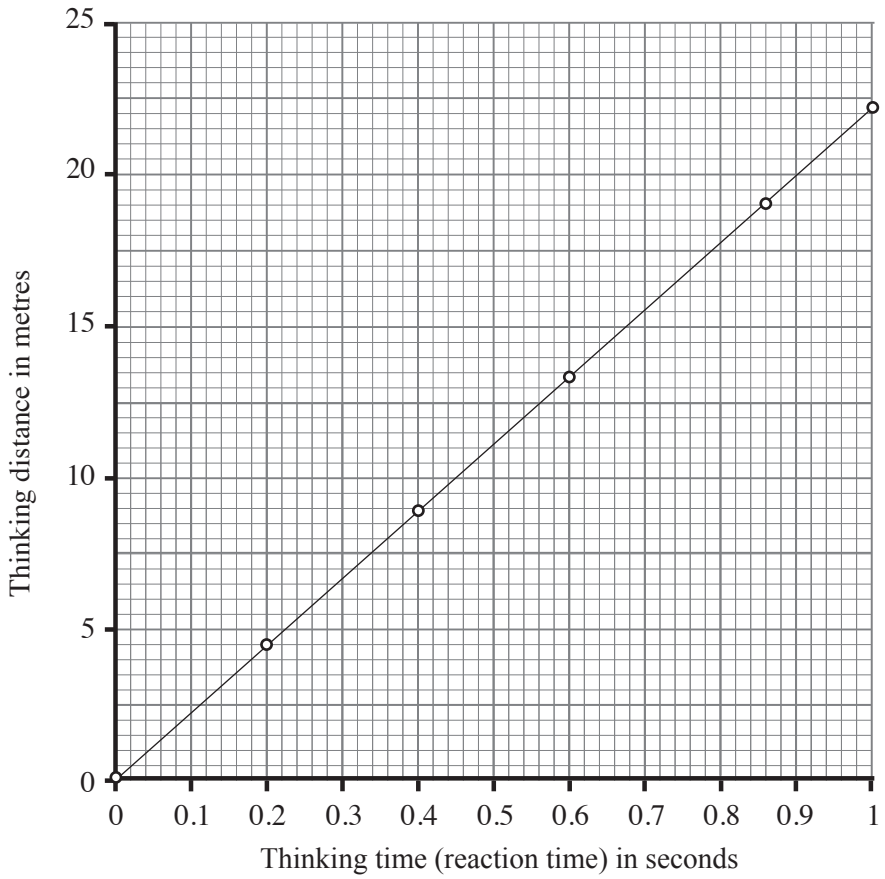
_____ [2]

(ii) Show clearly that a speed of 80 km/h is equal to a speed of 22.2 m/s.

[3]

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The graph below shows how thinking distance and thinking time (reaction time) are related for a car travelling at 80 km/h (22.2 m/s).



(iii) Using the graph above and the chart opposite, determine the thinking time (reaction time) for this driver.

Thinking time (reaction time) = _____ s [2]

(iv) On the graph above draw a straight line to show how the thinking distance and thinking time (reaction time) would be related for a car travelling **faster** than 80 km/h. [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

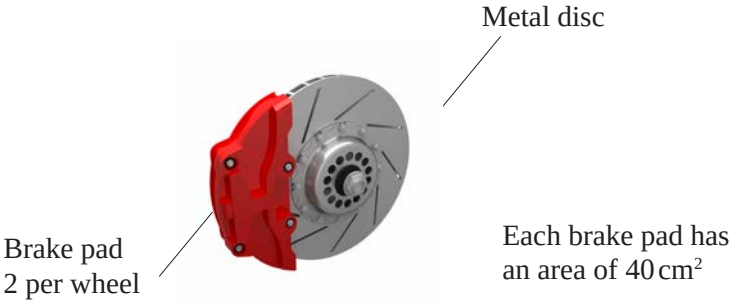
(v) The thinking distance is the distance the car travels at **constant speed** before the driver reacts (reaction time) to a hazard on the road and applies the brakes.
Research has shown that a driver who has taken alcohol and is on the legal limit to drive has a thinking time (reaction time) **twice** its normal value.
Using the information above and the chart on page 6 determine what this driver's thinking distance would be when travelling at 80 km/h.

Thinking distance = _____ m [1]

(vi) The speed of two cars following each other on a motorway is 112 km/h.
In case the car in front should suddenly brake it is advisable for the following car to leave a gap. The average length of a car is 4 m.
Use the data from the chart to calculate the size of the required gap.
Give your answer in complete car lengths.
You are advised to show clearly how you get your answer.

Required gap = _____ complete car lengths [3]

(b) The braking force needed to slow a car is provided by friction.
The brake pads are forced against rotating metal discs attached to the wheels.

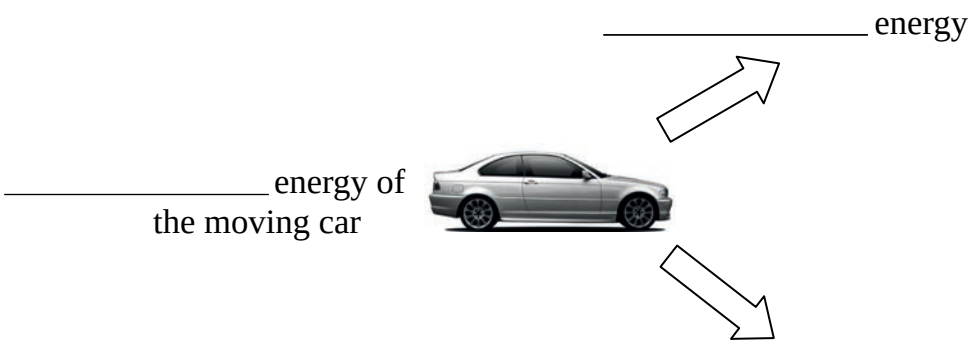


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(i) To slow the car down a braking force of 2000 N is applied to each wheel.
Calculate the pressure that each brake pad exerts on the metal disc.
Remember each wheel has two brake pads acting on the metal disc.
You are advised to show clearly how you get your answer.

Pressure = _____ N/cm^2 [5]

(ii) Complete the diagram below to show the energy changes that happen when the brakes are used to slow the car down.



[3]

Examiner Only

Marks	Remark

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Examiner Only

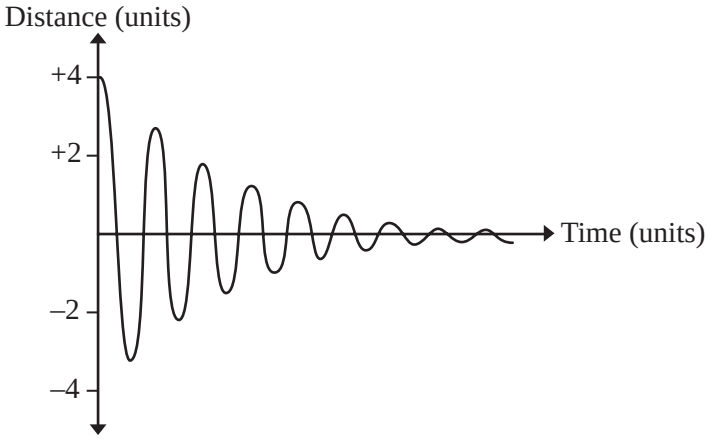
Marks	Remark

3 **(a)** Waves can be classified according to the direction of the vibrations. Complete the table below to illustrate this method of classification. Some entries in the table have already been completed for you.

Wave	Direction of vibrations	Type of wave
Light wave	Perpendicular to the direction of energy transfer	
Sound wave		
Water wave		Transverse

[4]

(b) The graph below shows an earthquake's shock wave.



(i) Write down the **maximum** amplitude of the wave.

Amplitude = _____ units [1]

(ii) How many **complete** waves are shown above?

_____ [1]

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(iii) How can you tell **from the graph** that the frequency of the wave is constant?

_____ [1]

The frequency of the shock wave was 50 Hz.

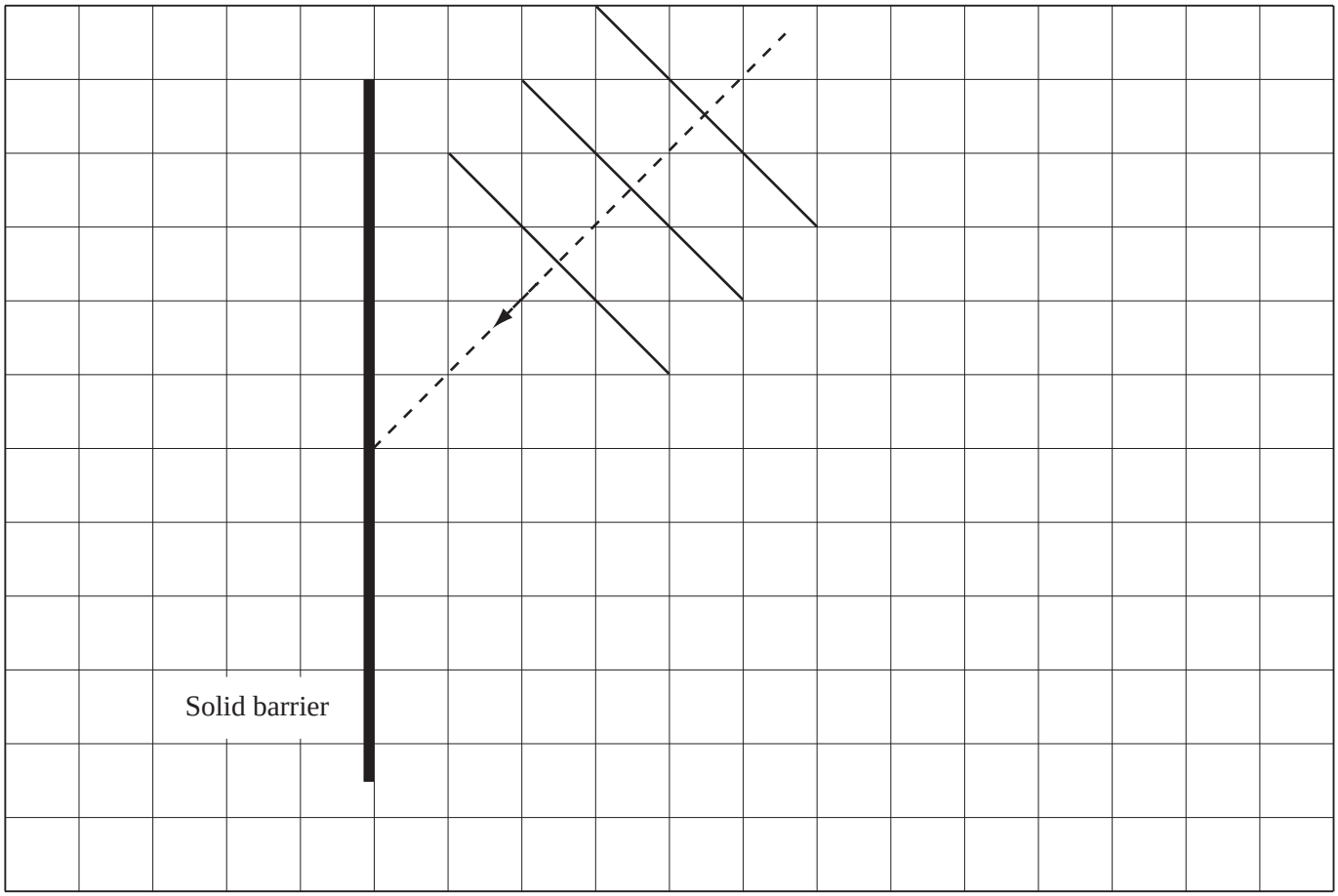
(iv) Explain what a frequency of 50 Hz means.

_____ [1]

Examiner Only	
Marks	Remark

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(c) Water waves can be studied in a laboratory using a ripple tank.
Below is a **full-scale** diagram showing the movement of water waves in a ripple tank towards a solid barrier.



Examiner Only	
Marks	Remark

(i) Use a ruler to measure accurately the wavelength of the water waves.

Wavelength = _____ mm [1]

(ii) What is being transferred by the waves?

_____ [1]

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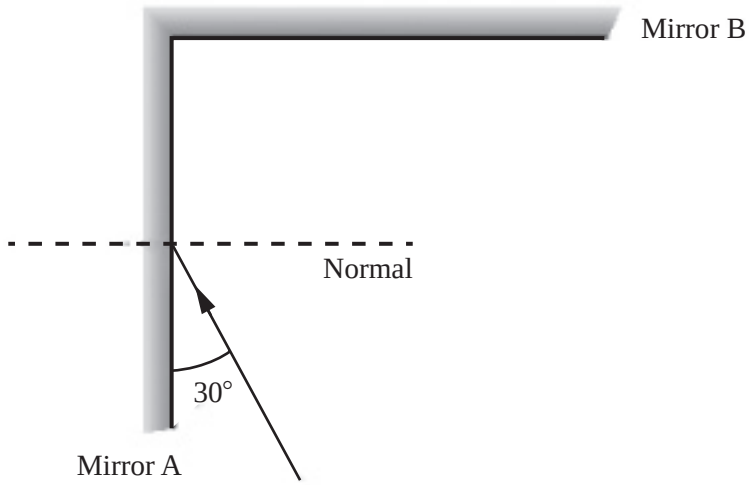
(iii) Using a ruler, carefully complete the diagram opposite to show the reflection of the water waves from the solid barrier.
Your diagram should show:

- an arrow showing the direction of the reflected waves and
- three reflected waves [5]

(iv) Is the frequency of the reflected waves greater than, smaller than or equal to the frequency of the incident waves? Ring the correct answer.

Greater than **Smaller than** **Equal to** [1]

(d) Two mirrors, A and B, are at right angles to each other.
A ray of light strikes Mirror A as shown below. The normal is drawn.



(i) What is the angle of incidence at Mirror A?

Angle = _____ ° [1]

(ii) What is the angle of reflection at Mirror A?

Angle = _____ ° [1]

(iii) Carefully continue the ray to show how it is reflected off **both** mirrors. [1]

(iv) Calculate the angle of incidence at Mirror B.

Angle = _____ ° [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** **(i)** Using the correct symbols draw a circuit diagram of a series circuit showing a battery of three cells, two resistors, an ammeter and an open switch.

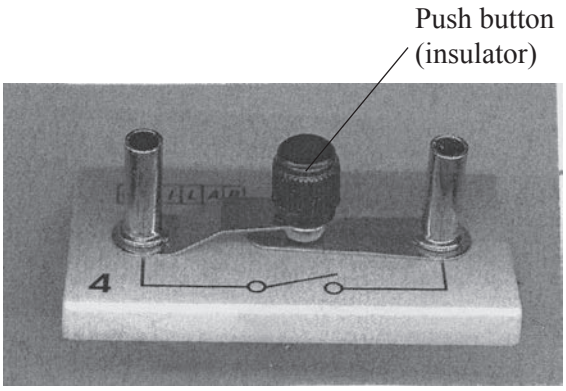
[5]

(ii) On your diagram, mark clearly, with an arrow the direction of the flow of electrons in your circuit when the switch is closed. [1]

(iii) What would be noticed if the current is measured at a number of points around the circuit?

_____ [1]

The picture below shows a simple electrical switch.



(iv) Label those parts of the switch that conduct electricity and the part of the switch that is an insulator, other than the push button. [2]

Currents flowing in electrical circuits produce heat.

(v) Where is the **most** heat produced in the circuit you have drawn?

_____ [1]

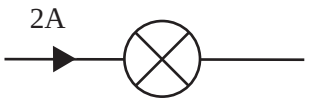
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Examiner Only	
Marks	Remark

(vi) Using the **correct symbol** show, on your diagram, how a voltmeter should be connected to measure the voltage across **one** of the resistors. [1]

(vii) Mark on the diagram the positive terminal of the voltmeter. [1]

(b) The diagram below represents a lamp carrying a current of 2 A.
The voltage across the lamp is 12 volts.



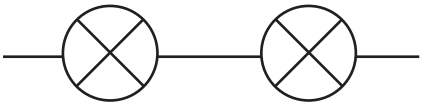
(i) Calculate the resistance of the lamp.
Remember to give the unit for resistance.
You are advised to show clearly how you get your answer.

Resistance = _____ [4]

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Examiner Only	
Marks	Remark

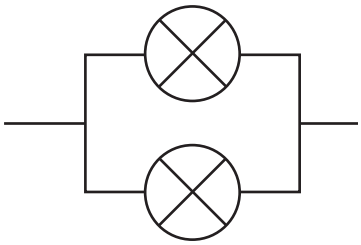
(ii) Calculate the combined resistance of two such lamps connected in **series**.



You are advised to show clearly how you get your answer.

Combined resistance = _____ [2]

(iii) Calculate the combined resistance when the two lamps are connected in **parallel**.



You are advised to show clearly how you get your answer.

Combined resistance = _____ [2]

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Examiner Only	
Marks	Remark

5 **(a)** Complete the table below, naming the three different radiations emitted by radioactive substances and stating the nature of each.

Name of radiation emitted	Nature of radiation (electromagnetic wave or particle)

[6]

(b) Even out in the open, away from any man-made radioactive sources, radioactivity can be detected.

(i) What is this kind of radioactivity called?

_____ [1]

(ii) Where does such radioactivity come from?

_____ [1]

(iii) Describe how you would measure the radioactivity that you would find out in the open.

_____

_____

_____

_____

_____

_____ [2]

Quality of written communication [1]

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(c) A radioactive substance has a half-life of **12 years**.
Which of the following statements is/are true?
Write your answer in the space provided.

For a sample of this substance **after 12 years**:

Statement	True or False
Its activity will be half of what it was at the start.	
Its activity will be double what it was at the start.	
Its activity will be zero.	

For a sample of this substance **after 24 years**:

Statement	True or False
All of the radioactive nuclei will have decayed.	
Its activity will be zero.	
Its activity will be $\frac{1}{4}$ of what it was at the start.	

[3]

(d) The full symbol for a nucleus of carbon-14 is $^{14}_{6}\mathrm{C}$

Complete the table below by naming the particles in a nucleus of carbon-14 and give the number of each in a nucleus of carbon-14.

Particle	Number in the nucleus

[4]

Examiner Only

Marks	Remark

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(e) Four unknown nuclei are labelled *W*, *X*, *Y* and *Z*.
Their full symbols are given below.

$$^{30}_{15}W \qquad ^{30}_{16}X \qquad ^{32}_{17}Y \qquad ^{33}_{16}Z$$

(i) Which, if any, of these nuclei are isotopes of the same element?

_____ [1]

(ii) Explain your answer.

_____

_____ [1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Physics

Paper 1
Foundation Tier

[G7602]

FRIDAY 15 JUNE, AFTERNOON

MARK SCHEME

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Subject-specific instructions

1 In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2 Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3 The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer/unit mark.

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					AVAILABLE MARKS
1	(a)	(i)	6000 joules every second	[1]	
		(ii)	Efficiency = useful output energy/total input energy [1] 0.2 = output/6000 **or** output = 0.2 × 6000 [1] Output electrical energy = 1200 (J) [1]	[3]	
	(b)	(i)	Black is the best absorber of heat	[1]	
		(ii)	It contains trapped air	[1]	
		(iii)	Arrow up	[1]	
		(iv)	Infrared	[1]	
	(c)	(i)	Work = force × distance moved [1] = 200 × 1.5 [1] = 300 (J) [1]	[3]	
		(ii)	Total work in 10 seconds = 300 × 10 = 3000 [1] Power = work/time = 3000/30 **or** = 300/3 [1] = 100 = 100 [1] W **or** J/s W **or** J/s [1]	[4]	
	(d)	(i)	Moment = force × distance from pivot = 1250 × 0.8 } [1] = 1000 (Nm) [1]	[2]	
		(ii)	To the left or away from him [1] 500 N has a smaller moment [2] worth 2 marks its distance from pivot is less [1] **or** He can exert a smaller force to give same moment since its distance from pivot is greater	[3]	20

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						AVAILABLE MARKS
2	**(a)**	**(i)**	Poor brakes, worn tyres, wet road Any **two**		[2]	
		(ii)	80 km = 80 000 m Give [1] if no further credit possible 1 hr = 60 × 60 = 3600 s Give [1] if no further credit possible 80 km/hr = 80 000/3600 = (22.2 m/s) This line is worth [3]		[3]	
		(iii)	From the graph 0.67 to 0.69 Evidence of a horizontal line at 15 m award [1]		[2]	
		(iv)	Straight line of greater slope through origin		[1]	
		(v)	30 m		[1]	
		(vi)	21/4 or 5.25	[2]		
			round up to 6 car lengths	[1]	[3]	
	(b)	**(i)**	P = F/A	[1]		
			= 2000/80	[3]		
			= 25 (N/cm^2)	[1]	[5]	
		(ii)	Kinetic (energy) to heat and sound [1] each		[3]	20

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AVAILABLE MARKS

3 **(a)**

Wave	Direction of vibrations	Type of wave
Light wave	Perpendicular to the direction of energy transfer	Transverse
Sound wave	Parallel to the direction of energy transfer or same direction	Longitudinal
Water wave	Perpendicular to the direction of energy transfer	Transverse

[4]

(b) **(i)** 4 [1]

(ii) 8 [1]

(iii) The time between one wave and the next (**or** the period) is constant [1]

(iv) 50 waves/wavelengths/vibrations pass in 1 second [1]

(c) **(i)** 14 (mm) (Allow 13–15 mm) [1]

(ii) Energy [1]

(iii) Arrow from P at 45° to horizontal [1]
With 3 wavefronts crossing arrow [1]
Perpendicular to arrow [1]
Wavefronts parallel [1]
Wavefront spacing = wavelength of incident waves [1] [5]

(iv) Equal to [1]

(d) **(i)** 60° [1]

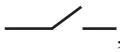
(ii) 60° [1]

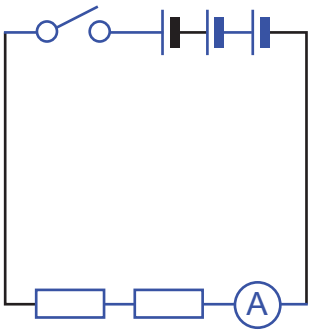
(iii) Reflected ray parallel to incident ray (by eye) [1]

(iv) 30° [1] 20

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AVAILABLE MARKS

4 **(a)** **(i)** Battery , , , , all in series



[5]

(ii) Arrow consistent with their diagram from – to + to [1]

(iii) Current same everywhere [1]

(iv) Contacts and link are conductors [1]
base is insulator [1] [2]

(v) In the resistor(s) [1]

(vi) Voltmeter in parallel with one resistor [1]

(vii) Correct location of + sign even if (U) in series [1]

(b) **(i)** R = V/I [1]
R = 12/2 [1]
R = 6 [1]
ohms [1] [4]

(ii) R = 6 + 6 [1] = 12 ohms [1] ecf from **(i)** [2]
$R = R_1 + R_2$ [1] if no further

(iii) $R_{comb} = R/2$ [1] = 3 ohms [1] allow ecf from **(b)(i)**

or

$$\frac{1}{R_{comb}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{6} + \frac{1}{6}$$

$$= \frac{2}{6}$$

$R_{comb} = 3$ ohms [2] 20

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		AVAILABLE MARKS
5	**(a)** alpha, particle beta, particle gamma, em radiation [6]	
	(b) **(i)** Background (radiation) or natural [1]	
	(ii) rocks/ground/air/plants/people/cosmic ray [1]	
	(iii) Switch on detector/record the count [1] **or** use rate meter For a specified period of time [1] take reading Divide count by time (to get count rate) [1] Any **two** Maximum [2] [2]	
	Quality of written communication [1]	

Response	**Mark**
Candidates describe in detail using good spelling, punctuation and grammar the main points shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	[1]
Response not worthy of credit	[0]

	(c) True False False False False True [$\frac{1}{2}$] each, round down [3]	
	(d) Protons 6 [1] Neutrons 8 [1] Name of particle [1] Numbers correct [1] each [4]	
	(e) **(i)** X and Z both needed [1]	
	(ii) Both have same number of protons/atomic number [1]	20
	Total	**100**

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2011

Science: Physics

Paper 1
Foundation Tier

[G7602]

G7602

WEDNESDAY 25 MAY, MORNING

TIME

1 hour 15 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 five** questions.

INFORMATION FOR CANDIDATES

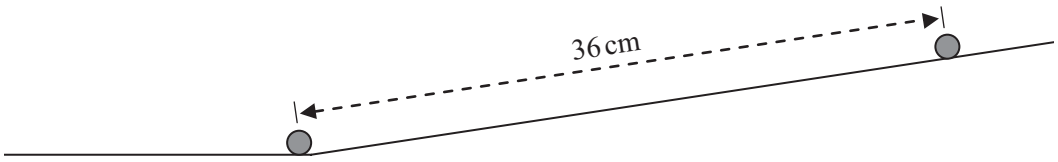
The total mark for this paper is 100.
Quality of written communication will be assessed in question **3(d)(iii)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated with numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
Total Marks	

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Examiner Only	
Marks	Remark

1 (a) A marble is rolled up a slope as shown in the diagram below.



From the moment it leaves the person's hand it takes 3 seconds to come to **rest**.
In this time it travels a distance of 36 cm.

(i) Calculate the average speed of the marble.

You are advised to show clearly how you get your answer.

Average speed = _____ cm/s [3]

(ii) How, if at all, do each of the following change as the marble moves up the slope?
Record your answer by placing a tick (✓) in the appropriate box.

	Increases	**Stays the same**	**Decreases**
The kinetic energy of the marble			
The potential energy of the marble			
The weight of the marble			

[3]

(iii) Name one of the forces which slow the marble down as it moves up the slope.

_____ [1]

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(iv) The marble has a mass of 75 g. What is its mass in kg?

Mass = _____ kg [2]

(v) At one point in its motion the marble has a speed of 0.2 m/s.
Calculate the momentum of the marble at this point.
Remember to state the correct unit for momentum.

You are advised to show clearly how you get your answer.

Momentum of the marble = _____ [4]

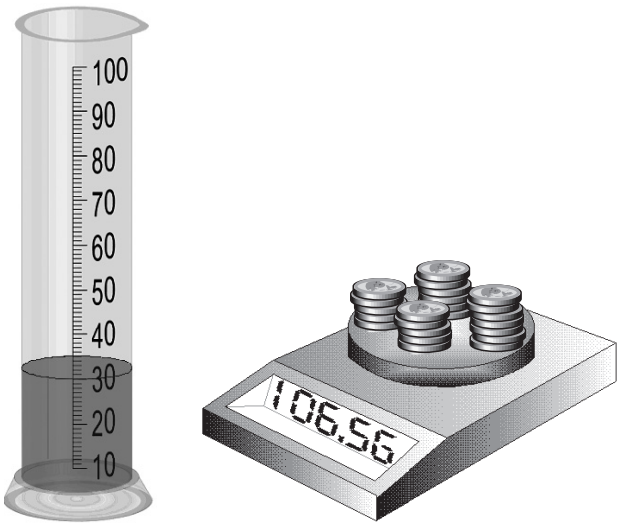
Examiner Only	
Marks	Remark

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(b) (i) Write down, in words, the equation to calculate density.

Density = [1]

You are provided with some 1 pence coins, an electronic balance and a graduated cylinder which already contains some water as shown below.



(ii) Describe, **in detail**, what you would do and what measurements you would take in order to calculate the density of the metal used for 1 pence coins.

[6]

Examiner Only

Marks	Remark

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Examiner Only

Marks	Remark

2 (a) (i) Explain what is meant by a renewable energy source.

_____

_____ [1]

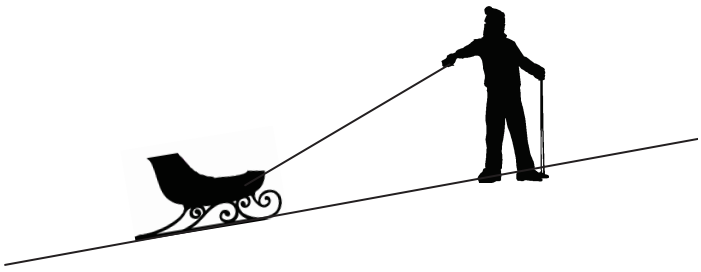
The table below gives a list of renewable and non-renewable energy sources.

(ii) Indicate those which are renewable and those which are non-renewable by placing a tick (✓) in the appropriate box.

Energy source	Renewable	Non-renewable
Coal		
Nuclear		
Hydroelectric		
Geothermal		
Biomass		

[3]

(b) Desmond and his sleigh have a total mass of 90 kg. He does 14 580 J of useful work pulling his sleigh and raising himself to the top of a snow covered hill.



(i) Write down the gravitational potential energy of Desmond and his sleigh, at the top of the hill.

Gravitational potential energy = _____ J [1]

(ii) Desmond sits on the sleigh and returns to the bottom of the hill. During the descent, most of the gravitational potential energy is converted into useful kinetic energy, but some of the energy is wasted.
State **two** forms in which energy is wasted in the descent.

1. _____ 2. _____ [1]

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Examiner Only	
Marks	Remark

(c) Several identical metal balls are heated until they are very hot and all at the same temperature. However, each ball is a different colour as shown below.



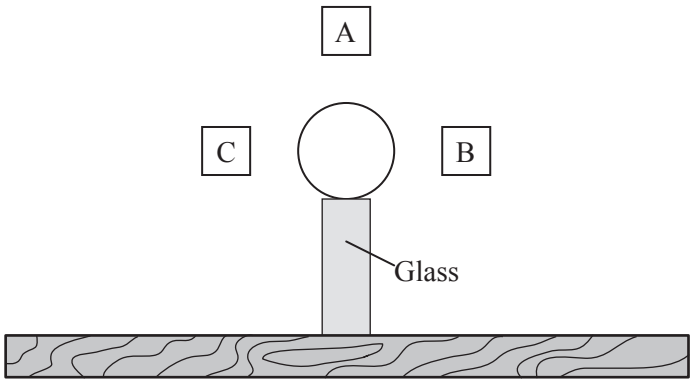
(i) Which ball gives out most heat radiation in one second?

_____ [1]

(ii) To which part of the electromagnetic spectrum does the heat radiation belong?

_____ [1]

One very hot ball is then placed on a glass support as shown below. Three heat sensors, A, B and C, are now positioned around the ball. Each sensor is the same distance from the ball.



(iii) Explain fully why the reading on sensor A is highest.

_____

_____ [2]

(iv) What feature of this arrangement of sensors makes it a fair test?

_____ [1]

Examiner Only	
Marks	Remark

(d) Hot takeaway food is often placed in a container made of aluminium foil. The aluminium foil is shiny on both the inside and the outside surfaces.



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(i) Explain how having the **outside** of the container shiny keeps the food hot.

_____

_____ [1]

(ii) Explain how having the **inside** of the container shiny keeps the food hot.

_____

_____ [1]

(e) Copper is a good conductor of heat. Glass is a poor conductor of heat.

electron, neutron, proton, molecule, air particle

(i) From the list of particles above, which one is mainly responsible for the conduction of heat in **copper**?

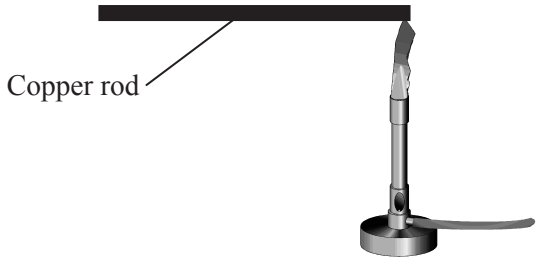
_____ [1]

(ii) From the list of particles above, which one is mainly responsible for the conduction of heat in **glass**?

_____ [1]

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The diagram below shows one end of a copper rod being heated in a Bunsen flame.



(iii) Describe how heat energy is conducted along the copper rod.

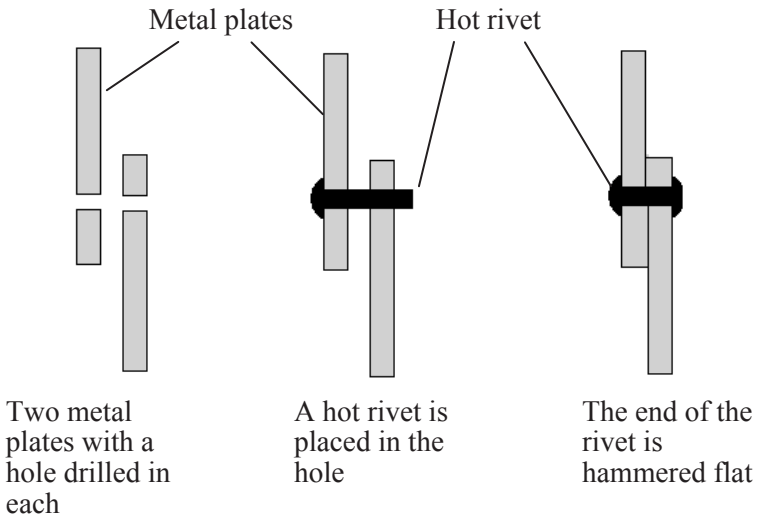
_____

_____

_____

_____ [2]

(f) To hold two metal plates together a very hot rivet is placed in a hole drilled in both plates and its end is hammered flat.



(i) Explain, briefly, why when the rivet cools, the two plates are held very tightly together.

_____

_____ [1]

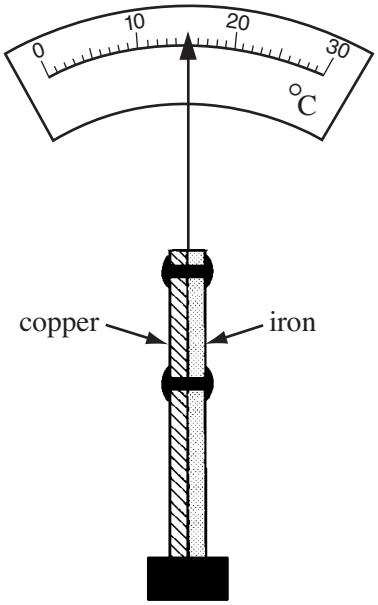
Examiner Only

Marks	Remark

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For the same rise in temperature, **copper expands more than iron**.

The diagram shows one type of thermometer in which a strip of copper has been riveted to a strip of iron to form a bimetal strip.



(ii) Describe and explain, **in detail**, how this type of thermometer works.
You may find it useful to sketch, in the space above, the appearance of the bimetal strip when the temperature **rises**.

_____

_____

_____

_____

_____ [2]

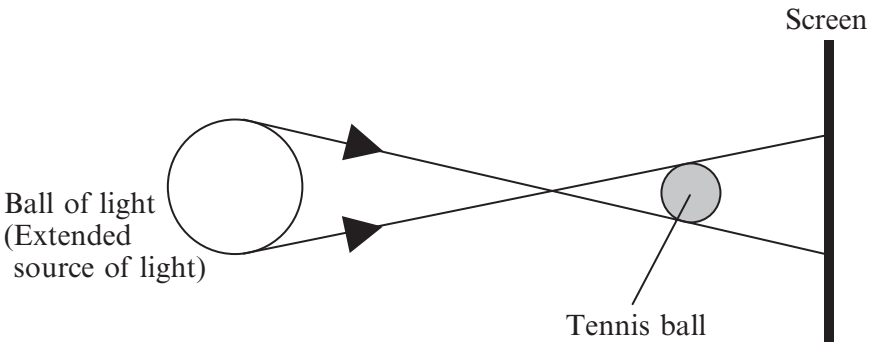
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** The diagram shows a bright ball of light. A tennis ball is placed in front of the light as shown. Two rays of light have been drawn.



(i) Why was a ruler used to draw the light rays?

_____

_____

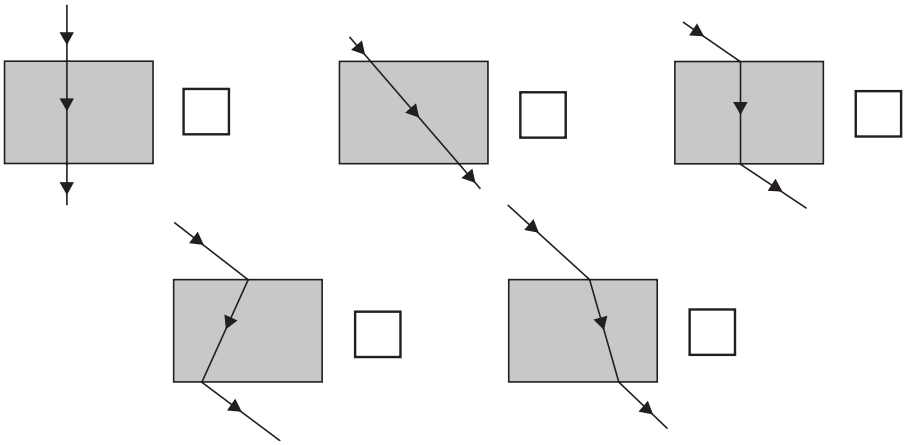
_____ [1]

(ii) Mark clearly, on the diagram, two points to the right of the tennis ball which are not in shadow. [2]

(iii) Draw two more rays to show the region where no light from the light source can reach. Shade this region. [2]

(b) Below are five diagrams showing the paths of light rays as they pass through rectangular blocks of glass. Some of the diagrams are incorrect.

Place a tick (✓) beside those diagrams that are **incorrect**.

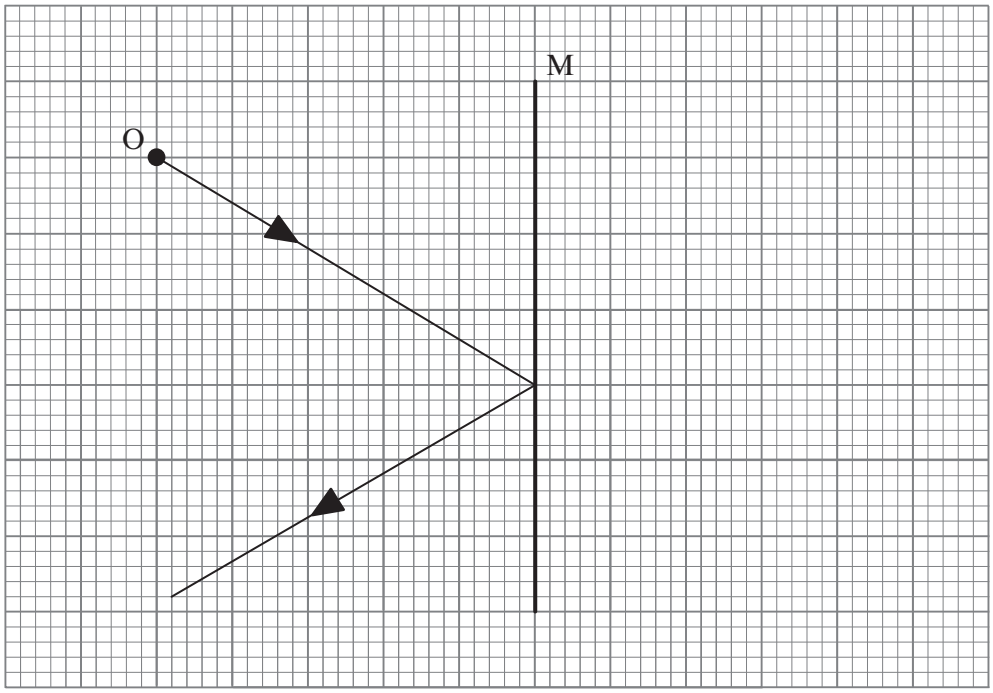


[3]

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Examiner Only	
Marks	Remark

(c) A ray of light from the object O is reflected from a plane mirror M as shown in the diagram below.

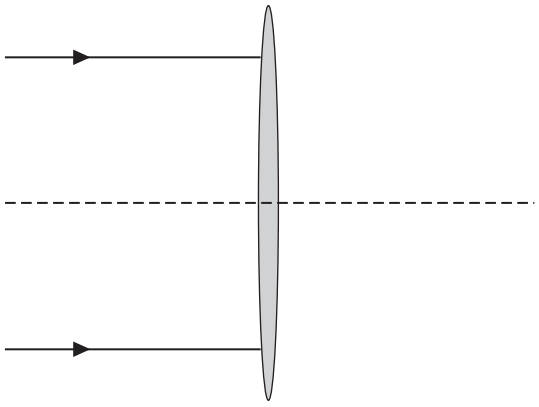


On the diagram:

(i) Mark, as accurately as you can, the position of the image of the object O.
Label the image I. [1]

(ii) Draw a second ray of light from O to show how the image is formed by the mirror. [2]

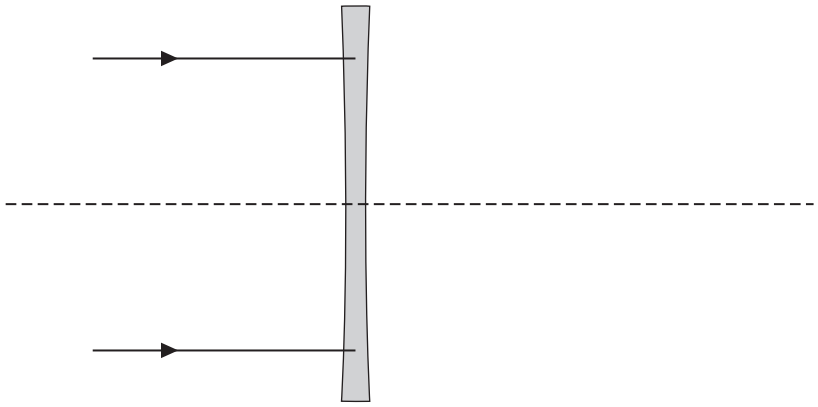
(d) **(i)** Complete the diagram below to show the meaning of the focal length of a converging (convex) lens.



[2]

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(ii) Complete the diagram below to show how parallel rays of light are refracted by a diverging (concave) lens.



[1]

(iii) Describe how you would measure the focal length of a converging (convex) lens using a distant object.

[4]

Quality of written communication [2]

Examiner Only	
Marks	Remark

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4 **(a)** After walking across a carpet, John became positively charged.

(i) What force played a role in John becoming charged?

_____ [1]

(ii) Explain how John gained a **positive** charge.

_____

_____ [1]

John experienced a small spark when he put his finger to a metal door knob.



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Which one of the following statements is correct? Tick the correct one.

(1) The spark was due to electrons jumping from John to the door knob. ☐

(2) The spark was due to electrons jumping from the door knob to John. ☐ [1]

(iv) A comb is made of plastic which is an electrical insulator.
In terms of particles, explain the difference between an electrical insulator and an electrical conductor such as copper.

_____

_____ [1]

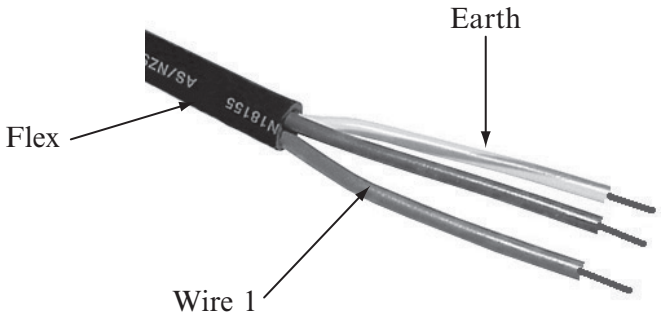
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(b) Electrical conductors and insulators play an important role in the use of electricity in the home.
The cable (flex) which is connected to a steam iron is shown in the diagram below.
The diagram shows the cable with the plug removed so that the three wires inside the cable are seen.



(i) Label, **carefully**, the part of wire 1 which is a conductor, and the part which is an insulator. [2]

(ii) Why are the wires different colours?

_____

_____ [1]

(iii) What is the purpose of the outer covering on the flex?

_____

_____ [1]

(iv) The earth wire is labelled in the diagram. What colour is it?

_____ [1]

(v) To which part of the steam iron should the earth wire be connected?

_____ [1]

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(c) When a bulb is connected to a 1.5 V cell it is lit to normal brightness.

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Marks	Remark

(i) When the bulb is lit to normal brightness the current passing through it is 0.25 A.
Calculate the resistance of the bulb.

You are advised to show clearly how you get your answer.

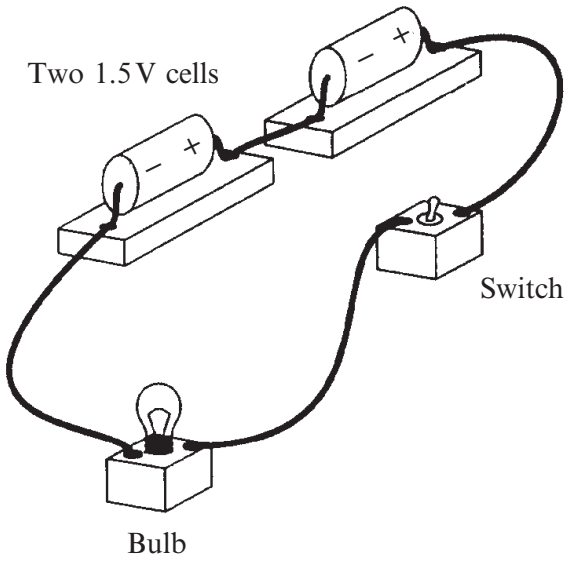
Resistance = _____ Ω [3]

(ii) In the space below, draw a circuit diagram to show how two such identical bulbs can be lit to normal brightness using **one** 1.5 V cell. Include in your circuit a single switch that can be used to turn **both** bulbs on or off.
Use the correct symbols for the cell, the bulbs and the switch.

[4]

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Another circuit is made using one of the bulbs and two 1.5 V cells as shown below.



Examiner Only	
Marks	Remark

(iii) Draw on the diagram the symbol —(V)— to show how a voltmeter should be connected to measure the voltage across the bulb. [1]

(iv) Draw on the diagram the symbol —(A)— to show where an ammeter should be connected to measure the current flowing in the circuit. [1]

(v) How does the brightness of the bulb in the circuit above compare to the original brightness when one 1.5 V cell was used?
Give a brief reason for your answer.

_____

_____

_____ [1]

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Examiner Only

Marks	Remark

5 **(a)** The table below lists the particles that make up a **neutral** atom of the isotope of oxygen $^{17}_{8}O$.

(i) Complete the table showing the mass, charge, number and location of the particles within the atom. Some information has been added to the table.

Particle	Mass	Charge	Number	Location
Electron	$\frac{1}{1840}$			
Neutron				
Proton				

[6]

(ii) Oxygen has three isotopes. In terms of the particles shown in the table above, what are isotopes?

_____ [2]

(iii) Radon is a radioactive gas and emits alpha (α) particles. In terms of the particles named in the table above, what is an α particle?

_____

_____ [2]

(iv) Explain the danger of breathing radon gas into the lungs.

_____

_____

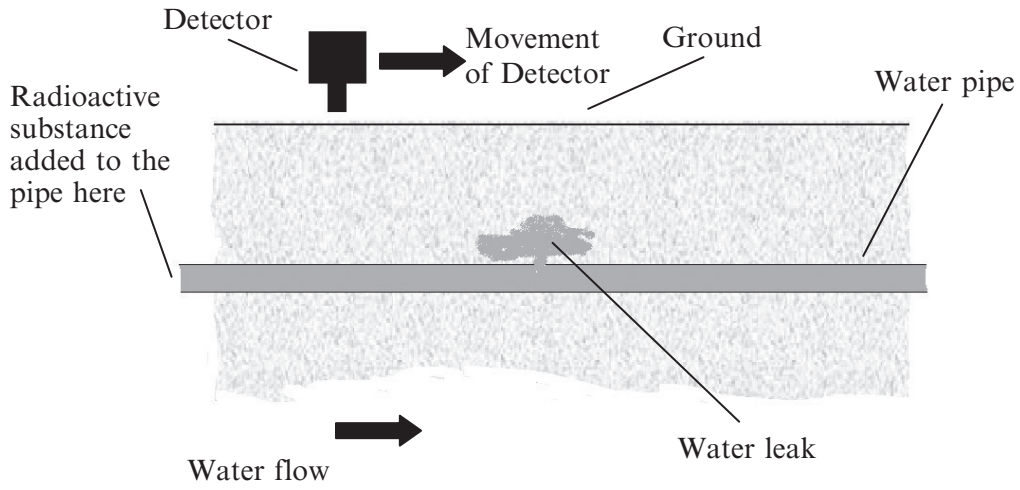
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(b) To help detect leaks in underground water pipes, radioactive substances are sometimes used. The radioactive substance is added to the water in the pipe.
A detector is moved along the ground as shown in the diagram below.



(i) How will the person using the detector know when the leak is directly below?

_____

_____

_____ [1]

(ii) What type of radiation must the radioactive substance emit if it is to be detected? Explain your answer.

Type of radiation _____

Explanation _____

_____

_____ [2]

(iii) The radioactive substance used has a half-life of 15 hours.
Explain the meaning of half-life.

_____

_____

_____ [2]

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(iv) Why is it important to use a substance with a half-life of 15 hours rather than one with a half-life of 1 minute or one with a half-life of 1 year?

[3]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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111058

Rewarding Learning

General Certificate of Secondary Education
2011

Science: Physics

Paper 1
Foundation Tier

[G7602]

WEDNESDAY 25 MAY, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	(i)	Average speed = distance/time	[1]	
			= 36/3	[1]	
			= 12 (cm/s)	[1]	
		(ii)	Kinetic energy – decreases	[1]	
			Potential energy – increases	[1]	
			Weight – stays the same	[1]	
		(iii)	Friction or weight/gravity	[1]	
		(iv)	0.075 kg	[2]	
			Give 1 mark if 1 kg identified as 1000 g		
		(v)	Momentum = mass × velocity (speed)	[1]	
			= 0.075 × 0.2	[1]	
			= 0.015 allow ecf for mass	[1]	
			kg m/s	[1]	
	(b)	(i)	Density = mass/volume	[1]	
		(ii)	Use the balance to find the mass of number of coins	[1]	
			Read the volume of water in the graduated cylinder	[1]	
			Add the coins to the water	[1]	
			Note the new volume	[1]	
			Subtract the two volumes to find volume of the coins	[1]	
			Use the formula to find density	[1]	20

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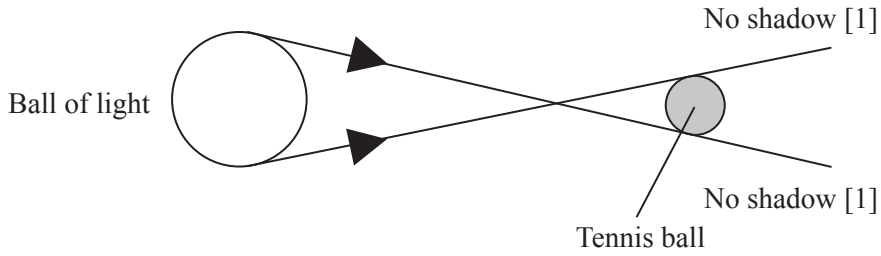
					AVAILABLE MARKS
2	**(a)**	**(i)**	Renewable – limitless/infinite supply/replaced in a lifetime can be used again and again [0]	[1]	
		(ii)	Coal – non-renewable Nuclear – non-renewable Hydroelectric – renewable Geothermal – renewable Biomass – renewable ½ each round up	[3]	
	(b)	**(i)**	14580 J	[1]	
		(ii)	Heat and sound (both needed for the mark)	[1]	
	(c)	**(i)**	Black	[1]	
		(ii)	Infra-red	[1]	
		(iii)	It receives heat by convection and radiation B and C by radiation only	[1] [1]	
		(iv)	Same distance from ball	[1]	
	(d)	**(i)**	Shiny outside Poor emitter of radiation/heat	[1]	
		(ii)	Shiny inside Good reflector/poor absorber of radiation/heat	[1]	
	(e)	**(i)**	electron	[1]	
		(ii)	molecule	[1]	
		(iii)	Electrons and collide with atoms/molecules/ions	[1] [1]	
	(f)	**(i)**	Rivets contract as they cool	[1]	
		(ii)	Strip bends with copper on the outside Needle moves across the scale to the right	[1] [1]	20

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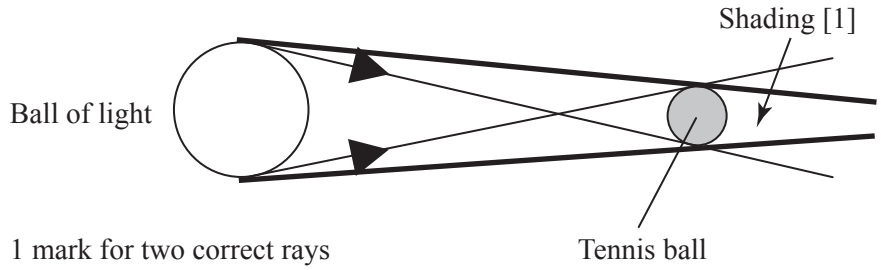
AVAILABLE MARKS

3 **(a)** **(i)** Light travels in straight lines or for accuracy [1]

(ii) No shadow above or below the drawn rays [2]



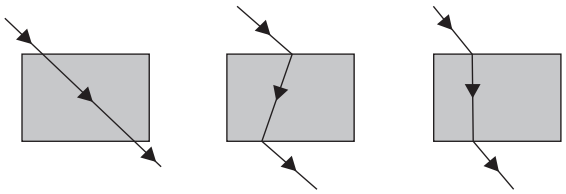
(iii)



[2]

1 mark for two correct rays

(b)



[3]

(c) **(i)** I same distance behind mirror as O in front ±1 div.
accept an unlabelled dot or cross [1]

(ii) Ray from O to mirror [1]
Reflected ray comes from I no ecf for position of I [1]

(d) **(i)** Parallel rays converge to a point to the right of lens on P axis [1]
Focal length marked distance from lens to this point [1]

(ii) Both parallel rays diverge from R axis after passing through lens [1]

(iii) Place lens in front of a screen
Move toward/away from screen or adjust position
Until sharp image seen/image in focus
Measure distance from lens to screen/lens to image [4]

QWC [2]

20

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Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar the main points shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	2
Candidates make some reference to the main points shown above using satisfactory spelling, punctuation and grammar. The form and style is of a satisfactory standard and they have made some reference to specialist terms.	1
Candidates make little reference to the main points shown above using limited spelling, punctuation and grammar. The form and style is of a limited standard and they have made no use of specialist terms.	0

AVAILABLE MARKS

4 **(a)** **(i)** Friction [1]

(ii) He lost electrons [1]

(iii) Statement 2 is correct [1]

(iv) Only in the metal are the electrons free to move or converse [1]

(b) **(i)** Covering marked as insulator [1]
End (copper) marked as conductor [1]

(ii) To identify them [1]

(iii) To protect the wires [1]

(iv) Green and yellow (both needed) [1]

(v) Metal part/casing/sole [1]

(c) **(i)** R = V/I [1]
= 1.5/0.25 [1]
= 6 (Ω) [1]

(ii) Bulbs in parallel [1]
Battery in series with bulbs [1]
Switch in series with battery [1]
ALL symbols correct accept –⊗– or –◠– [1]

(iii) Voltmeter in parallel with bulb [1]

(iv) Ammeter in series [1]

(v) Brighter – more current (both needed)/more energy supplied/second
more energy supplied [0] [1]

20

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								AVAILABLE MARKS
5	**(a)**	**(i)**	Electron	(1/1840)	–1	8	Outside nucleus	
			Neutron	1	0	9	In the nucleus	[6]
			Proton	1	+1	8	In the nucleus	
			½ each round up					
		(ii)	Nuclei with same number of protons					[1]
			Different number of neutrons					[1]
		(iii)	Nucleus if no further [1]					
			A particle consisting of 2 protons and 2 neutrons					[2]
		(iv)	Alpha particles					[1]
			Damages cells/causes cancer					[1]
			Dangerous [0]					
	(b)	**(i)**	The reading/count rate will reach a max/increase/will start					[1]
		(ii)	Gamma					[1]
			Only one that can penetrate the ground					[1]
			or Radiation needs to penetrate the ground					
		(iii)	Time for the activity to					[1]
			half its initial value					[1]
		(iv)	15 hrs long enough <u>to be detected</u>					[1]
			1 minute too short <u>to be detected</u>					[1]
			1 year <u>dangerous</u> radiations for too long					[1]
								20
							Total	**100**

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Physics

Paper 1
Foundation Tier

[G7602]

G7602

FRIDAY 28 MAY, MORNING

TIME

1 hour 15 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 five** questions.

INFORMATION FOR CANDIDATES

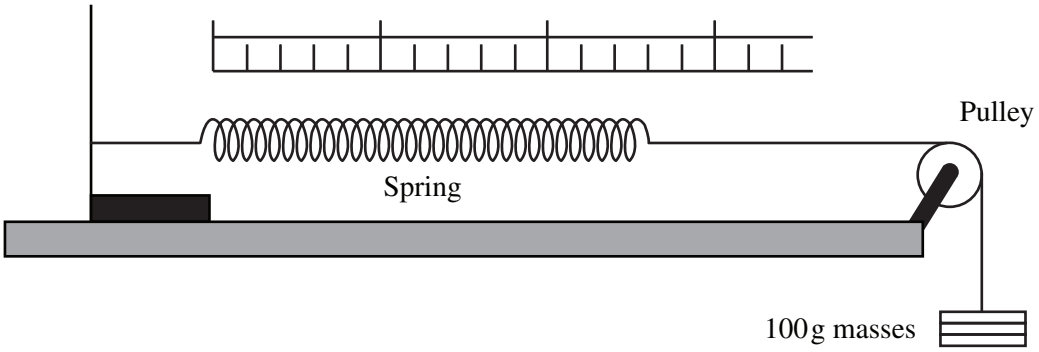
The total mark for this paper is 100.
Quality of written communication will be assessed in question **1(c)(iv)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated with numerical answers where appropriate.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

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Examiner Only	
Marks	Remark

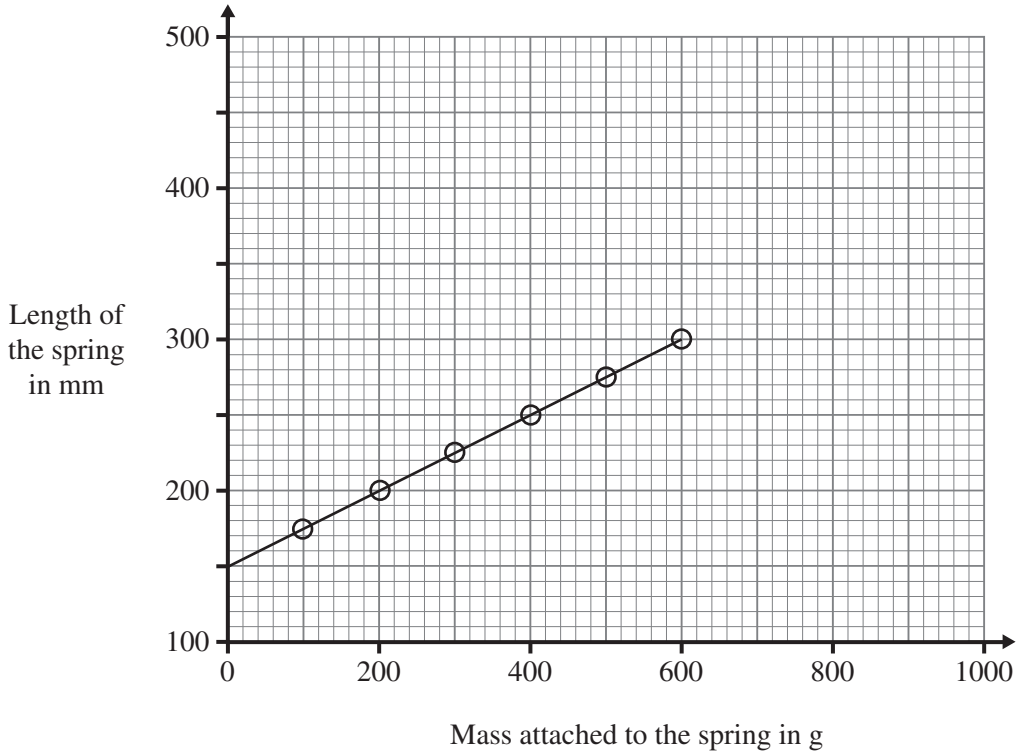
1 **(a)** John sets up the apparatus shown below. He uses it to discover how the length of the spring changes as he increases the force stretching it. He changes this force by adding 100 g masses to a length of string attached to the spring.



(i) What is the force provided by attaching a 100 g mass to the string?

Force = _____ N [2]

The graph below shows some of John's results.



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(ii) Use the graph to find the unstretched length of the spring.

_____ mm [1]

(iii) Use the graph to find the extension of the spring for each 100 g mass added.

Extension for each 100 g mass = _____ mm [1]

(iv) The 100 g masses are removed and replaced by an object. The length of spring is then measured as 250 mm. Use the graph to read off the mass of this object.

Mass = _____ g [2]

(v) State Hooke's law.

_____

_____

_____ [2]

(vi) John discovers that the spring obeys Hooke's law for masses up to a maximum of 800 g. On the grid, continue the graph to show its shape up to 800 g and from 800 g to 1000 g. [2]

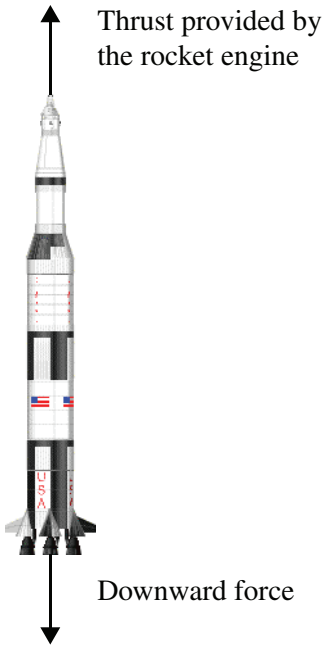
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(b) The diagram below shows a space rocket and two of the forces acting on it a short time after its launch.



(i) What provides the downward force on the rocket?

_____ [1]

(ii) The upward thrust force is **greater** than the downward force. Tick (✓) the statement below which best describes the upward motion of the rocket.

The rocket is slowing down. ☐

The rocket is moving with constant speed. ☐

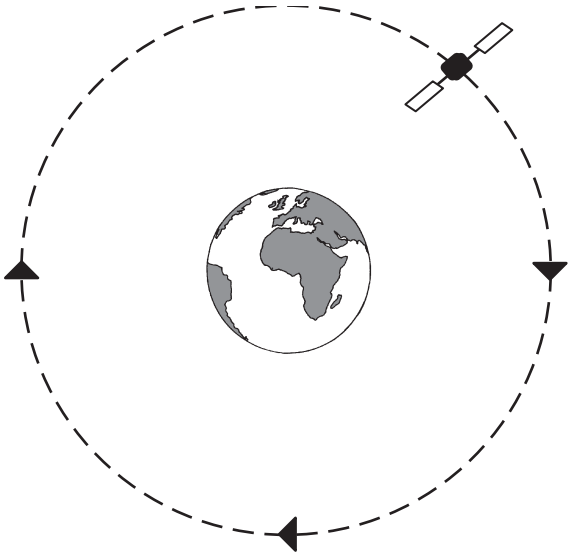
The rocket is speeding up. ☐ [1]

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Examiner Only	
Marks	Remark

(c) Rockets of this type are used to place satellites in orbit around the Earth.

(i) On the diagram below, draw an arrow to show the direction of the centripetal force acting on the satellite that is orbiting the Earth. **Make sure you label this arrow F.** [1]



(ii) What provides this centripetal force?

_____ [1]

(iii) On the diagram above, draw an arrow to show the direction of the satellite's velocity. **Make sure you label this arrow V.** [1]

(iv) Explain why a satellite's velocity is different from its speed.

_____

_____ [1]

Quality of written communication [1]

(v) This satellite takes 1.5 hours to complete one orbit.
The distance it travels in one orbit is 40 000 km. Calculate its average speed in kilometres per hour.

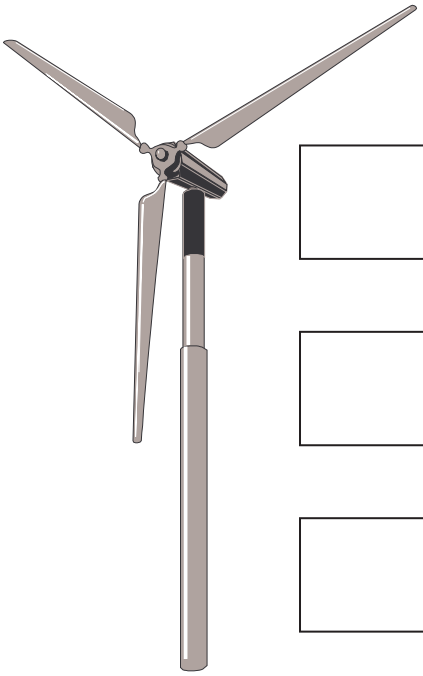
Speed = _____ km/h [3]

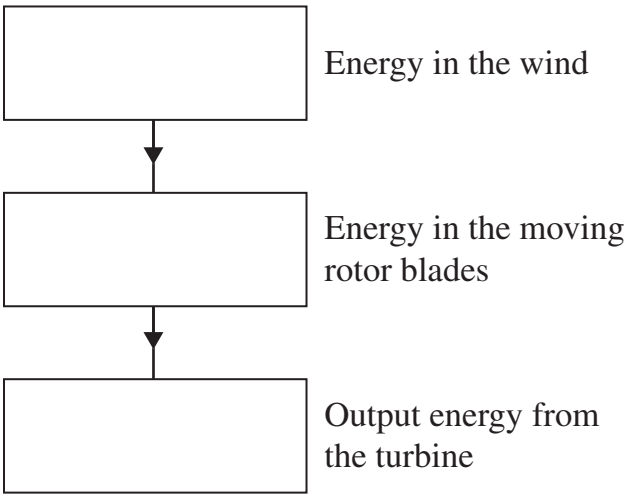
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Examiner Only	
Marks	Remark

2 **(a)** The use of wind turbines is on the increase.

(i) Complete the boxes below naming the main energy changes taking place in a wind turbine.





[3]

(ii) Name two unwanted forms of energy that result from the use of wind turbines.

1. _____ 2. _____ [2]

(iii) Apart from environmental concerns, what is the main disadvantage of wind turbines compared with the use of fossil fuels?

_____

_____[1]

(iv) The efficiency of a wind turbine is 0.3 (30%). Explain carefully what this means.

_____

_____

_____[2]

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(b) Global warming is seen by many as a major threat to many countries and peoples.

Examiner Only	
Marks	Remark

(i) What human activity is seen as a major contributor to global warming?

_____

Describe briefly how it contributes to global warming.

_____

_____ [2]

(ii) Nuclear power is seen by some as a solution to the problem of global warming. Explain briefly why this is.

_____

_____

_____ [1]

(iii) Why is the waste resulting from the use of nuclear power considered to be dangerous?

_____ [1]

(iv) What element is used as the fuel in nuclear power stations?

_____ [1]

(v) Nuclear power is a **non-renewable** source of energy.
Explain why it is described in this way.

_____

_____

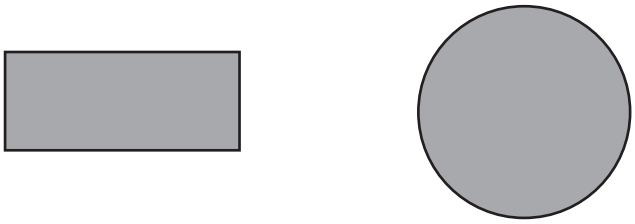
_____ [1]

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Examiner Only	
Marks	Remark

(c) The diagrams show a cardboard rectangle and circle.

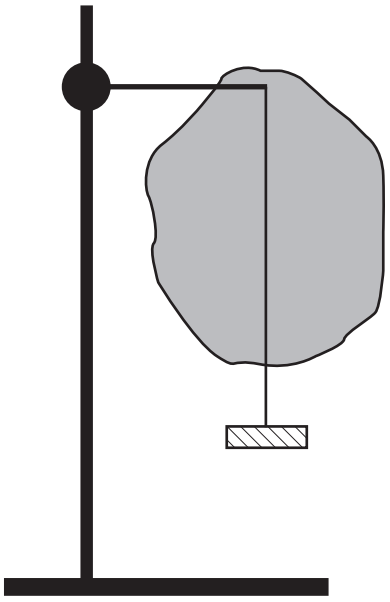
(i) Label the centre of mass (centre of gravity) of each with an X.



[2]

Clare is given a piece of cardboard with an irregular shape as shown below.
She suspends the cardboard from a retort stand using a pin so that it can swing freely.
When it comes to rest she hangs a plumbline (a length of string with a weight attached) from the pin as shown in the diagram.

(ii) Mark on the diagram where you think the centre of mass of the cardboard might be. Use an X.



[1]

(iii) Describe what Clare needs to do to find accurately the position of the centre of mass of the cardboard.

_____

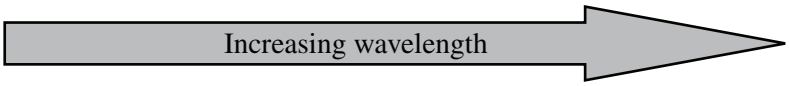
_____

_____ [3]

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3 **(a)** The electromagnetic spectrum is a set of transverse waves.
Three members of the electromagnetic spectrum are shown below.

(i) Write the names of the other four members of the electromagnetic spectrum in the appropriate boxes.



Gamma rays			Visible light		Microwaves	

[4]

(ii) State a property unique to electromagnetic waves.

_____[1]

(b) Which member of the electromagnetic spectrum is used:

(i) to sterilize medical instruments _____

(ii) to heat food quickly _____

(iii) in sunbeds to give a tan? _____[3]

(c) **(i)** Explain what a luminous object is.

_____[1]

(ii) Give an example of a luminous object.

_____[1]

(iii) Explain what a non-luminous object is.

_____[1]

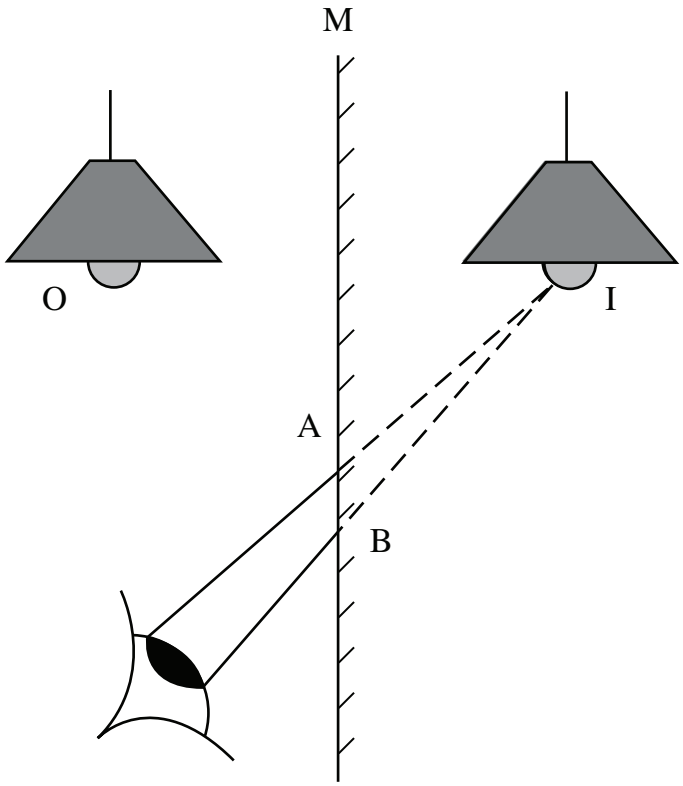
(iv) Give an example of a non-luminous object.

_____[1]

Examiner Only	
Marks	Remark

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(d) The incomplete ray diagram below shows the image I of a lamp O, in a plane mirror M.



Draw on the diagram;

(i) the normals at points A and B. [1]

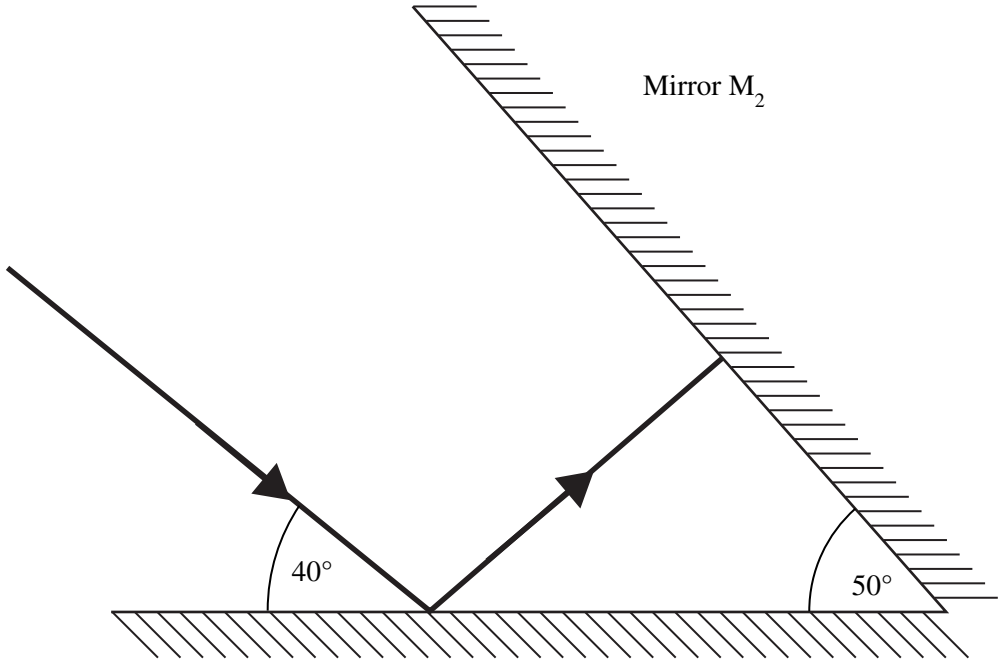
(ii) the corresponding incident rays. [1]

(iii) arrows to show the direction of the incident rays. [1]

Examiner Only	
Marks	Remark

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(e) Two plane mirrors, M_1 and M_2 are inclined at 50° to each other as shown in the diagram below. A ray of light strikes M_1, so that the angle between the mirror and the ray is 40°.



(i) Calculate the angle of incidence at M_1.

Angle of incidence at M_1 = _____ [1]

(ii) State the angle of reflection at M_1.

Angle of reflection at M_1 = _____ [1]

(iii) Calculate the angle of incidence at M_2.

Angle of incidence at M_2 = _____ [2]

(iv) Draw on the diagram an arrow to show the path of the reflected ray from M_2. [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

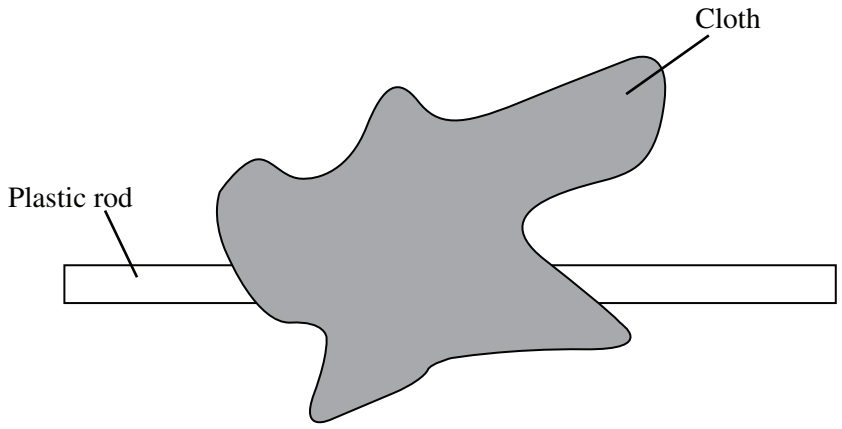
4 **(a)** Atoms contain electric charges.

(i) Explain how an atom can be neutral.

_____

_____ [1]

A cloth is rubbed on a plastic rod. This makes electrons move from the cloth to the rod.



(ii) What kind of electric charge does an electron have?

_____ [1]

(iii) What effect does the movement of the electrons have on the charge of the cloth and the charge of the plastic rod?

_____

_____

_____

_____ [2]

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Marks	Remark

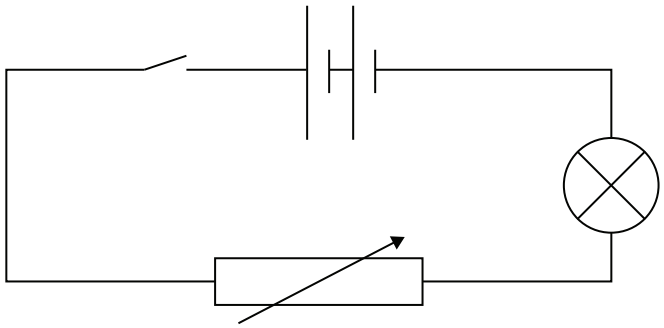
(b) (i) Name the instrument used to measure the electric current in a circuit.

_____ [1]

(ii) What is the unit of electric current?

_____ [1]

The current can be changed in the circuit shown below.



(iii) How will it be possible to know whether the current is being increased or decreased or staying the same in this circuit?

_____

_____

_____ [2]

On the diagram **above** mark the following.

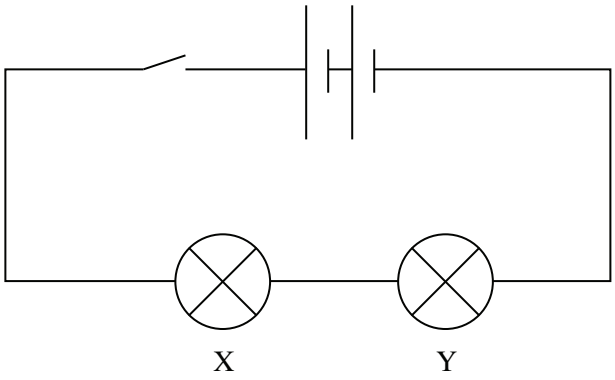
(iv) The positive terminal of the battery, using a + sign. [1]

(v) The direction of electron flow in this circuit, using an arrow. [1]

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Examiner Only	
Marks	Remark

(c) Two lamps are connected as shown below.



(i) What name is given to the way the lamps are connected in this circuit?

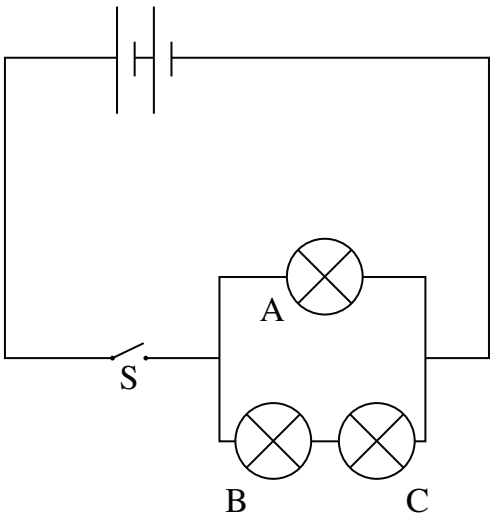
_____ [1]

When the switch is closed, the current flowing in bulb Y is 0.25 A.

(ii) Is the current flowing through the switch smaller than, equal to or greater than 0.25 A?

_____ [1]

(d) The circuit shown in the diagram below is set up.



(i) On the circuit diagram, using the correct symbol, show how a voltmeter should be connected to measure the voltage across lamp A. [1]

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When the switch is closed, it is found that the current flowing in lamp A is 0.2 A and the current flowing in lamp B is 0.15 A.

(ii) What is the current flowing through the switch S?
You are advised to show clearly how you get your answer.

Current = _____ A [1]

Lamps B and C are **identical**. The voltage across lamp B is 1.4 V.

(iii) What is the voltage across lamp C?

Voltage = _____ V [1]

(iv) What is the voltage across lamp A?
You are advised to show clearly how you get your answer.

Voltage = _____ V [2]

(v) What is the resistance of lamp A?
You are advised to show clearly how you get your answer.

Resistance = _____ Ω [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

5 **(a)** **(i)** Name the three particles that make up an **atom**.

_____

_____

_____ [3]

(ii) Name the particles that are together in the **nucleus** of an atom.

_____

_____ [1]

A nucleus has an atomic number 3 and mass number 7.

(iii) What does this tell you about the particles that make up the nucleus?

_____

_____ [2]

(b) **(i)** What is a beta particle?

_____ [1]

(ii) What part of the atom emits a beta particle?

_____ [1]

(iii) Name the two other radiations that can be emitted by a radioactive substance.

_____ [2]

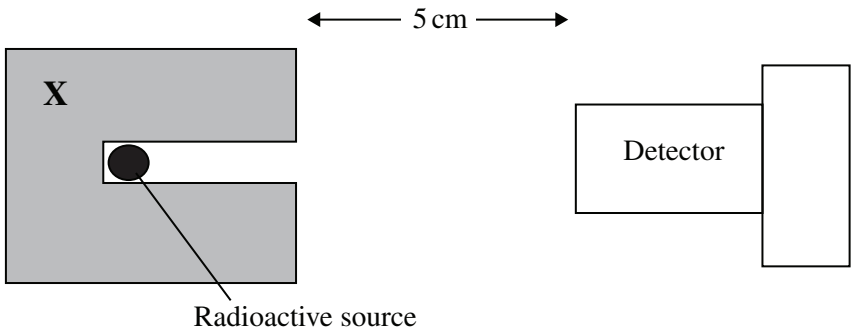
(iv) A sheet of paper can stop **one** of these three radiations. Which one?

_____ [1]

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Marks	Remark

(c) A beta-emitting radioactive source is placed 5 cm from a detector, as shown in the diagram below. The radioactive source is surrounded by a substance **X** on all sides, except for a narrow opening on the right.



(i) Name the substance **X** surrounding the source.

_____[1]

(ii) Give two reasons why the substance **X** is used in this way.

1. _____

_____

2. _____

_____[2]

(iii) Give one reason why even a weak radioactive source should be handled using tongs.

_____

_____[1]

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You are provided with a number of aluminium squares, each 1 mm thick.

(iv) Describe, briefly, how you would use the equipment shown opposite and the aluminium squares, to measure the range of the beta particles in aluminium.

_____

_____

_____

_____

_____

_____

_____

_____[5]

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Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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GCSE

Science: Physics

Summer 2010

Mark Schemes

Issued: October 2010

STEMUP.CO.UK

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Physics

Paper 1
Foundation Tier

[G7602]

FRIDAY 28 MAY, MORNING

MARK SCHEME

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Subject-specific instructions

1 In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2 Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3 The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer/unit mark.

					AVAILABLE MARKS
1	**(a)**	**(i)**	[wt = mg or wt = $\frac{100}{1000}$ × 10 [1]/[2] force = 1 (N) [2]/[2]	[2]	
		(ii)	150 mm	[1]	
		(iii)	200 g gives an ext 200 – 150 = 50 mm 100 g gives an ext $\frac{50}{2}$ = 25 mm	[1]	
		(iv)	Evidence on graph of attempt to find load at 250 mm	[1]	
			Mass = 400 (g)	[1]	
		(v)	The extension is proportional to the load	[1]	
			Provided the elastic limit is not exceeded	[1]	
		(vi)	Straight line from 600 g to 800 g	[1]	
			Upward curve from 800 g to 1000 g	[1]	
	(b)	**(i)**	Weight or gravity or drag	[1]	
		(ii)	The rocket is speeding up	[1]	
	(c)	**(i)**	Arrow labelled F from satellite to centre of Earth	[1]	
		(ii)	The gravitational pull of the Earth or simply gravity	[1]	
		(iii)	Arrow labelled V at a **tangent to orbit**, **clockwise**. (both needed)	[1]	
		(iv)	Velocity is a vector, speed is not		
			Or velocity depends on direction, speed does not	[1]	
			QWC	[1]	
		(v)	Speed = distance/time	[1]	
			= 40 000/1.5	[1]	
			= 26 667 (km/h)	[1]	20

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					AVAILABLE MARKS
2	(a)	(i)	KINETIC energy in the wind	[1]	
			KINETIC energy in moving rotor blades	[1]	
			ELECTRICAL output energy from the turbine	[1]	
		(ii)	Noise (sound)	[1]	
			Heat	[1]	
		(iii)	Lack of wind/unreliable	[1]	
		(iv)	30% of input energy appears as electrical energy or 30% of input energy appears as useful output energy or Useful output energy/total input energy = 0.3	[2]	
	(b)	(i)	Burning of fossil fuels/specific examples – using motor cars, etc.	[1]	
			Release of carbon dioxide	[1]	
		(ii)	It does not release carbon dioxide	[1]	
		(iii)	It is radioactive	[1]	
		(iv)	Uranium or plutonium	[1]	
		(v)	There are limited reserves of uranium Or It cannot be replaced in a human lifetime!	[1]	
	(c)	(i)	Rectangle – where diagonals meet (judge by eye)	[1]	
			Centre of circle	[1]	
		(ii)	About the centre but **must** be on the line	[1]	
		(iii)	Mark the current line Suspend from a different point	[2]	
			Re-attach plumb line and mark it – any 2 from these CoM where lines meet – must be present for all 3 marks	[1]	20

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					AVAILABLE MARKS
3	**(a)**	**(i)**	X-rays, Ultraviolet, Infra-red, Radio ([1] each)	[4]	
		(ii)	Travel in a vacuum or all travel at the same speed in a vacuum	[1]	
	(b)	**(i)**	Gamma (γ) rays	[1]	
		(ii)	Microwaves	[1]	
		(iii)	Ultraviolet	[1]	
	(c)	**(i)**	Luminous – emit light	[1]	
		(ii)	example – Sun/stars/flames/filament bulbs/anything with potential to emit light	[1]	
		(iii)	Non-luminous – do not emit their own light/scatter/reflect light or seen by reflecting light	[1]	
		(iv)	example – Moon/Earth/pen/book etc	[1]	
	(d)	**(i)**	Normals at A and B (at 90° to mirror by eye)	[1]	
		(ii)	Incident rays from candle flame to points of reflection at mirror. (Both must come from same point between bottom of bulb or right side.)	[1]	
		(iii)	Arrow(s) on incident rays going towards mirror	[1]	
	(e)	**(i)**	50° No ECF to **(ii)**	[1]	
		(ii)	50°	[1]	
		(iii)	Evidence / Recognition } that incident ray strikes M_2 at 90° [1]/[2] Angle of incidence at M_2 is 0°	[2]	
		(iv)	Reflected ray back along path of incidence	[1]	20

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					AVAILABLE MARKS
4	(a)	(i)	No of protons = no of electrons/ Equal amounts of +ve and –ve charge	[1]	
		(ii)	Negative	[1]	
		(iii)	Rod is –ve [1] cloth is +ve [1]	[2]	
	(b)	(i)	Ammeter	[1]	
		(ii)	Amp or ampere	[1]	
		(iii)	Current increases if lamp brightens Current decreases if lamp dims Current constant if brightness unchanged (Any 2)	[2]	
		(iv)	+ to left of the battery	[1]	
		(v)	Arrow **clockwise**	[1]	
	(c)	(i)	In series	[1]	
		(ii)	Equal to	[1]	
	(d)	(i)	V in parallel with A using ——Ⓥ——	[1]	
		(ii)	0.35	[1]	
		(iii)	1.4	[1]	
		(iv)	$V = V_1 + V_2$ [1]/[2] V = 2.8 [2]/[2] ECF from **(iii)** should be V = 1.4 + Answer to **(iii)** correctly calculated [2]/[2]	[2]	
		(v)	R = V/I	[1]	
			$= \frac{2.8}{0.2}$ ECF from **(iv)**	[1]	
			= 14	[1]	20

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					AVAILABLE MARKS
5	(a)	(i)	electron, proton, neutron ([1] each)	[3]	
		(ii)	proton, neutron (both needed) mention of electron [0]/[1]	[1]	
		(iii)	3 protons and 4 neutrons (ignore references to electrons)	[2]	
	(b)	(i)	an electron	[1]	
		(ii)	the nucleus	[1]	
		(iii)	alpha gamma	[1] [1]	
		(iv)	alpha	[1]	
	(c)	(i)	lead	[1]	
		(ii)	To reduce / absorb } the radiation/protect from radiation/safer	[1]	
			To produce / direct } a narrow beam of beta particles	[1]	
		(iii)	The user is further from the source To reduce contact/exposure/avoid damage to skin	[1]	
		(iv)	Remove source and read the detector or measure background [1] Put Al sheet between source and detector/in front of detector or source [1] Take a reading on detector [1] Add extra sheets of/increase thickness of Al [1] UNTIL READING (if mark for reading not given yet) [1] IS CONSTANT or EQUALS BACKGROUND or is ZERO [1] This thickness equals the range [1] Any five points [(Max [5])]	[5]	20
				Total	**100**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2009

Science: Physics

Paper 1
Foundation Tier

[G7602]

G7602

WEDNESDAY 10 JUNE, AFTERNOON

TIME

1 hour 15 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 five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Quality of written communication will be assessed in question **5(d)(ii)**.
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 with numerical answers where appropriate.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

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Examiner Only	
Marks	Remark

1 (a) (i) Complete the sentence below by choosing words and statements from those in the box.

a form of energy	newtons	joules	a force

Friction is _____

and is measured in _____ [2]

(ii) The diagram shows a car moving along a level road at **constant speed**. The arrows show the two horizontal forces acting on the car. Tick (✓) which statement below, about the size of these forces, is correct.



Force A is greater than force B ☐

Force A is less than force B ☐

The two forces are equal ☐ [1]

(iii) The mass of the car is 750 kg. Calculate its weight.
Make sure you also write down the unit for weight.
You are advised to show clearly how you get your answer.

Weight of the car = _____ [3]

(iv) Explain why the car has weight.

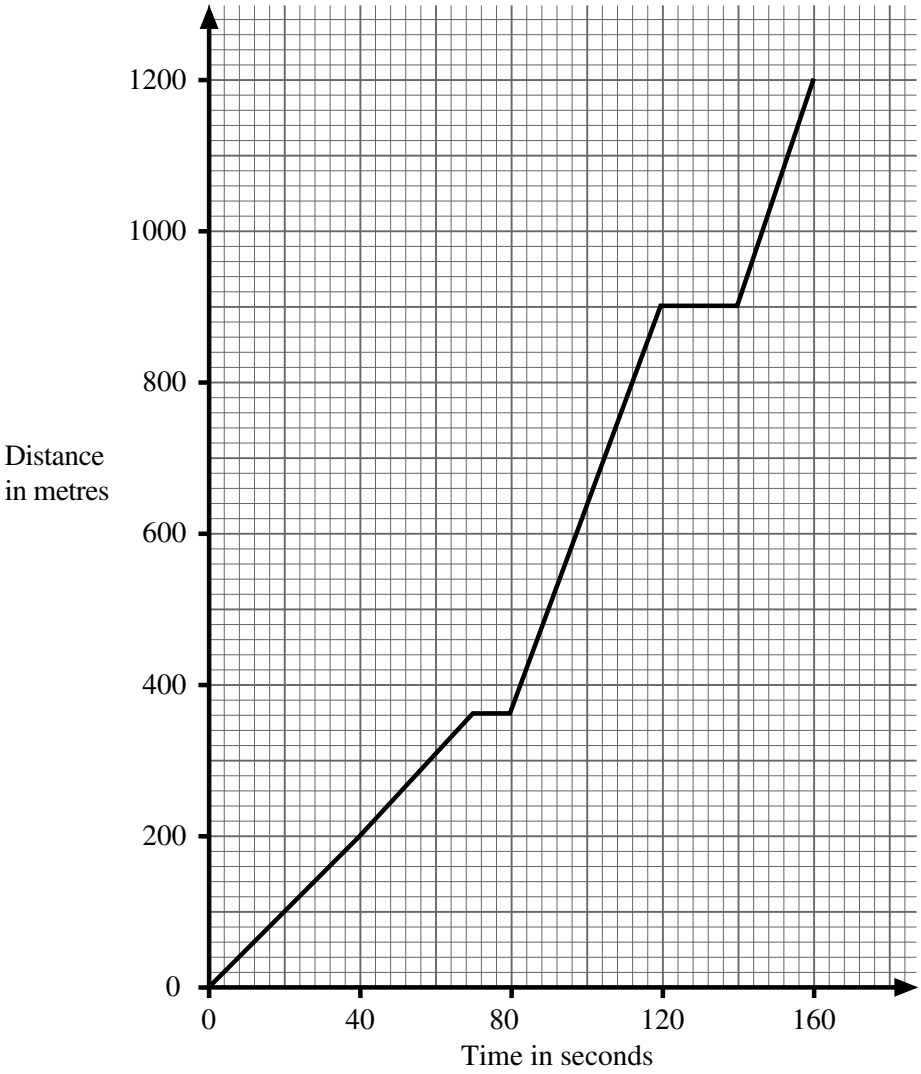
_____

_____ [1]

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Marks	Remark

(b) The driver of the car takes it on a journey.
The distance–time graph for this journey is shown below.



(i) How many times did the driver have to stop on the journey?

_____ [1]

(ii) How far had she travelled after 40 seconds? _____ m [1]

(iii) Calculate the average speed of the car for the whole journey.
You are advised to show clearly how you get your answer.
Remember to include the correct unit in your answer.

Average speed = _____ [4]

(iv) Draw on the grid above, what the distance–time graph would look like if the driver had driven the same journey in the same time, at a **constant speed**. [3]

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(c) When the driver is approaching a road junction the traffic lights change to amber and she applies the brakes.



The distance the car travels before it comes to a stop is known as the **stopping distance**. For each of the examples shown below, indicate with a tick (✓), in the appropriate column, the effect on the stopping distance.

	Effect on the stopping distance		
	Decreases	**Stays the same**	**Increases**
The speed of the car is greater			
The road surface is icy			
The driver has been drinking alcohol			
The driver increases the braking force			

[4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** **(i)** Write down an equation to describe what physicists mean by the word **efficiency**.

Efficiency = [1]

(ii) The useful output energy from an electrical generator is 150 kJ and the **wasted output energy** is 450 kJ. Use your knowledge of the principle of conservation of energy to calculate the total **input** energy.
You are advised to show clearly how you get your answer.

Total input energy = _____kJ [2]

(iii) Use your answers to parts **(i)** and **(ii)** to calculate the efficiency of the generator.
You are advised to show clearly how you get your answer.

Efficiency = _____ [2]

(iv) State **one** of the waste energy forms from an electrical generator.

_____ [1]

(b) **(i)** Below are seven different energy resources.

biomass coal gas geothermal
hydroelectric nuclear wind

Classify these resources by writing the name of each of them in the appropriate column in the table below.

Renewable and dependent on the energy of the Sun	**Renewable and independent of the energy of the Sun**	**Non-renewable**

[4]

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Marks	Remark

(ii) There is increasing interest in the use of bio-fuels for energy. Bio-fuels are frequently obtained from the oil-bearing seeds of crops like rape and maize. What form of energy is stored in bio-fuels?

_____ [1]

(iii) Explain carefully why bio-fuels can be thought of as renewable sources of energy.

_____

_____

_____ [3]

(c) In a swimming competition, an athlete swims 400 m, at a steady speed against an opposing force of 450 N.

(i) Write down an equation which will enable you to calculate the work done by this athlete.

Work done = [1]

(ii) Use the equation in part **(i)** to calculate the work done by the athlete.
You are advised to show clearly how you get your answer.

Work done = _____ J [2]

(iii) The swim lasted 500 seconds. Use your answer to part **(ii)** to calculate the power of the athlete.
You are advised to show clearly how you get your answer.

Power = _____ W [3]

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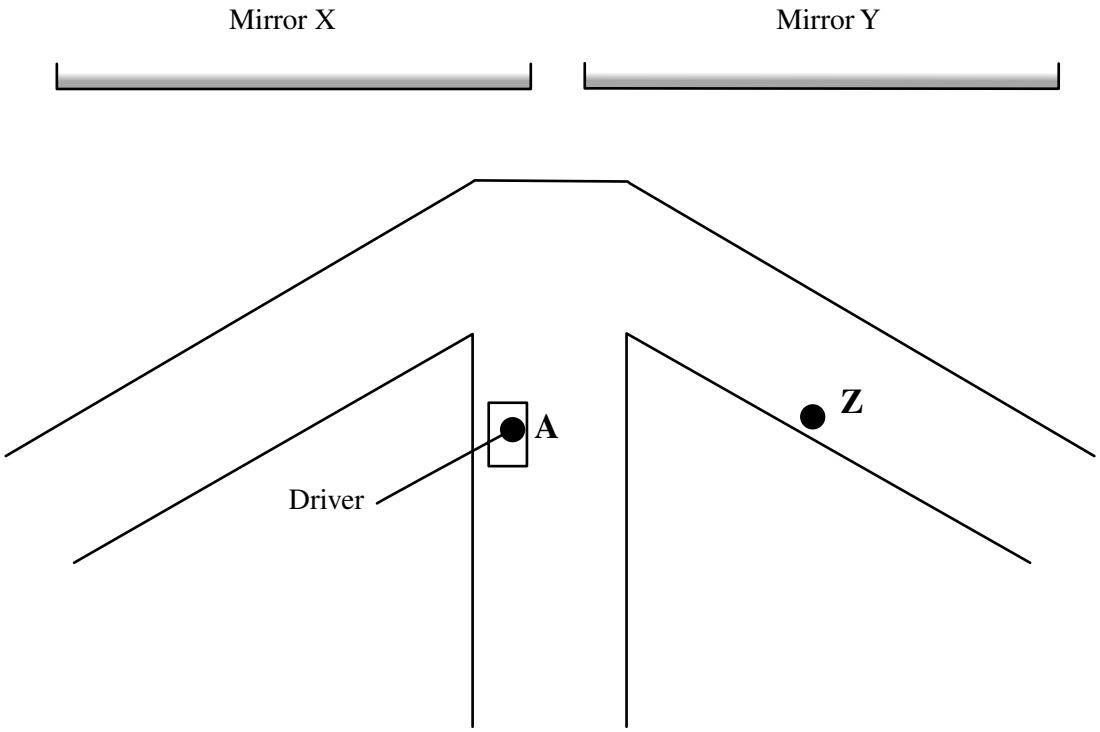
Examiner Only	
Marks	Remark

3 (a) (i) Where is the image in a plane mirror located?

_____

_____ [1]

Blind corners sometimes have mirrors placed to help motorists. The diagram below shows such a situation with three roads meeting.



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(ii) Which mirror would the driver of car **A** look into to see the image of a car at **Z**?

Mirror _____ [1]

(iii) Mark, accurately, on the diagram, the position of the image of the car at **Z**, as seen by **A**. [2]

(iv) On the diagram, draw, accurately, the path of a ray of light from a car at **Z** to the driver in car **A**.
Mark with an arrow, the direction of this ray of light. [3]

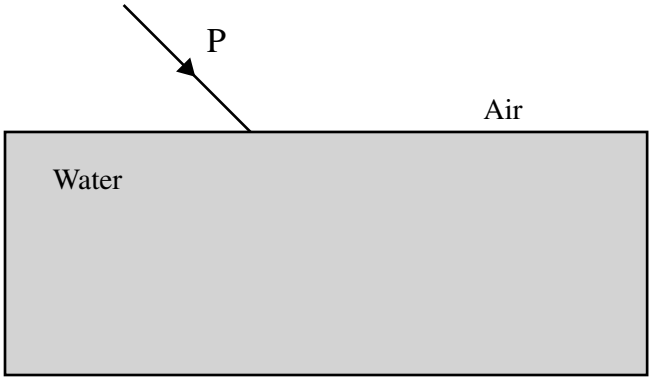
(v) What is the purpose of the mirror **X**?

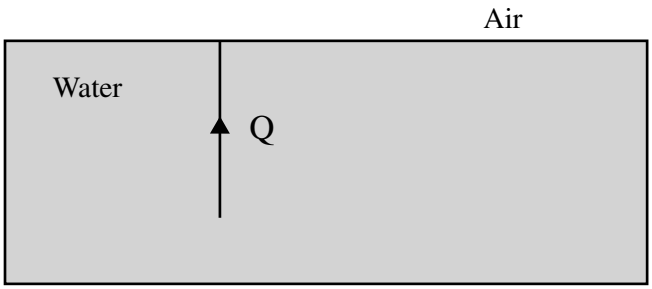
_____ [1]

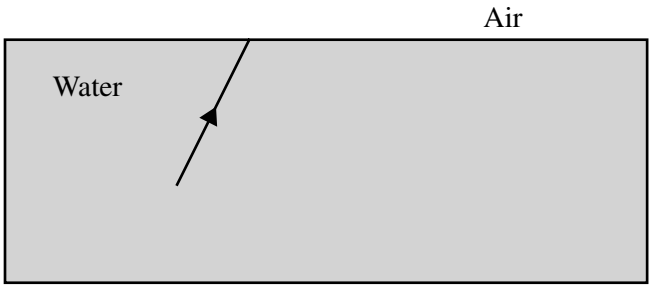
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(b) (i) The diagrams below show rays of light approaching a water surface. Complete the diagrams by continuing each ray to show its path through the surface.







[3]

(ii) How does the speed of light change for the rays P and Q as each moves into a new medium? Circle the correct answer in each case.

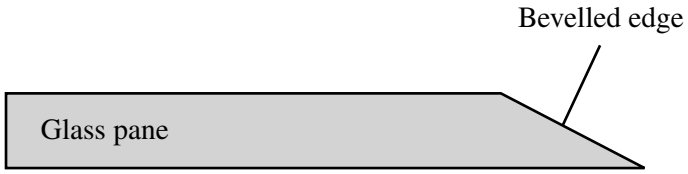
Ray P increases in speed no change in speed decreases in speed

Ray Q increases in speed no change in speed decreases in speed

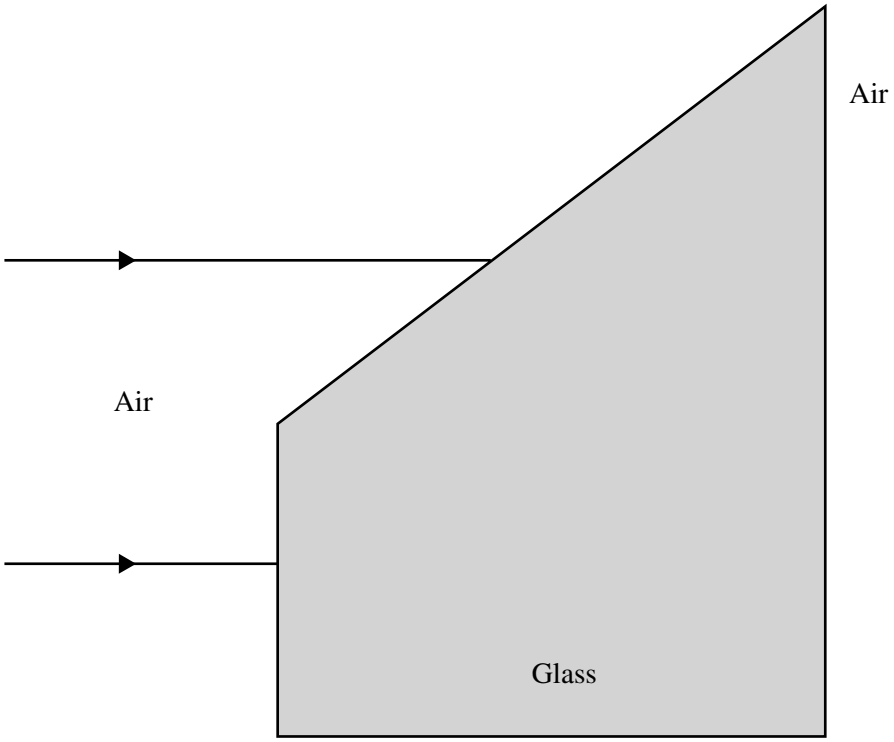
[1]

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(c) A pane of glass is sometimes bevelled at the edges. The diagram below shows what this means.



The next diagram shows an enlarged view of the pane of glass at its bevelled edge. Two rays of white light are shown striking the glass.



Complete the diagram to show how the bevelled edge of the glass can produce a coloured beam of light, while the main pane of glass produces no colours. Label the rays with appropriate colours. [5]

Examiner Only

Marks	Remark

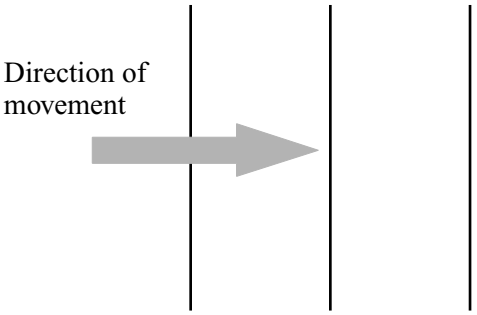
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(d) (i) What is meant by the diffraction of a wave?

_____

_____ [1]

The diagram below represents wavefronts moving from left to right.



(ii) Complete the diagram by drawing an object in the path of the wavefronts, which would make the wave diffract and show the shape of the wavefronts after they have passed through the object. [2]

Examiner Only

Marks	Remark

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

4 **(a)** **(i)** When a polythene rod is rubbed on a cloth, both the cloth and the polythene rod become electrically charged.
Describe, in terms of the movement of charged particles, how the polythene rod becomes negatively charged.

_____

_____

_____ [3]

(ii) Which **one** of the following statements best explains the difference between electrical insulators and conductors?
Indicate your answer by placing a tick (✓) in the appropriate box.

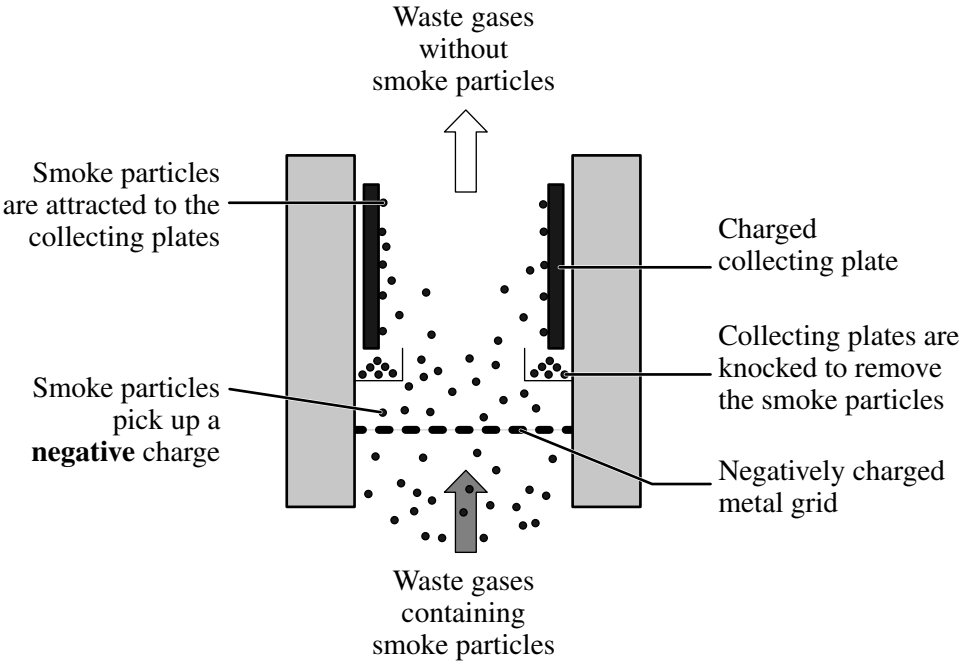
There are no charged particles in electrical insulators	
There are many free moving charged particles in electrical insulators, but almost none in electrical conductors	
There are many more free moving charged particles in electrical conductors than there are in electrical insulators.	

[1]

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Examiner Only	
Marks	Remark

(b) The diagram shows the process which goes on in tall chimneys to remove dangerous smoke particles.
Waste gases rising up the chimney are **charged negatively** when they pass through a charged metal grid.
These charged smoke particles are then attracted to a charged collecting plate.



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(i) What is the polarity (positive or negative) of the collecting plate?

_____ [1]

(ii) Explain the reason for your answer to part **(i)**.

_____

_____ [1]

A large amount of smoke and waste gases is produced by fossil fuel power stations.

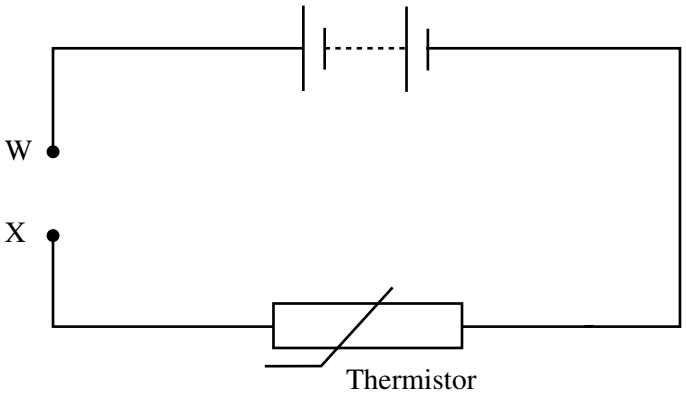
(iii) What is the benefit to the environment of removing the smoke particles from the waste gases in this way?

_____

_____ [1]

Examiner Only	
Marks	Remark

(c) Joyce is investigating how the **resistance** of a **thermistor** depends on its **temperature**.
She uses a power supply, an ammeter, a thermistor, some connecting wire and other pieces of laboratory equipment.
Part of Joyce's circuit is shown below.



(i) Insert the correct symbol for the ammeter between points W and X. [1]

(ii) Mark with an arrow, on the circuit, the direction of the current flow in the circuit. [1]

(iii) When Joyce heats the thermistor, the current in the circuit increases. Explain why.

_____ [1]

(iv) Joyce has measured the current in the circuit. To calculate the resistance of the thermistor she needs to take one more measurement. What does she need to measure?

_____ [1]

(v) Complete the circuit by drawing, in the correct place, and using the correct symbol, the piece of equipment needed to take this measurement. [2]

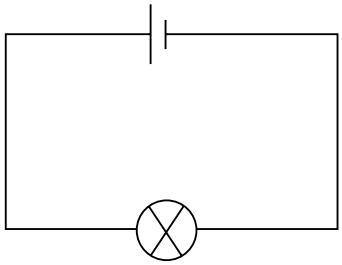
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(vi) When the voltage across the thermistor is 0.75 V, the current passing through it is 0.015 A. Calculate the resistance of the thermistor.
You are advised to show clearly how you obtain your answer.

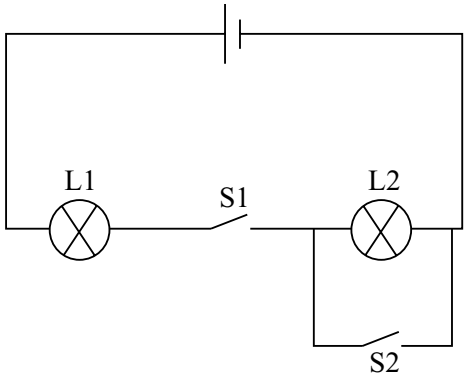
Resistance = _____ Ω [4]

Examiner Only	
Marks	Remark

(d) The diagram shows an electric circuit. A single bulb connected in this way across a single cell glows with **normal brightness**.



Two such bulbs and two switches are used with an identical cell in the circuit below.



Examiner Only	
Marks	Remark

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Complete the table below to show the state of the bulbs **compared with normal brightness** for each condition of the two switches.
Do this by writing the words **Brighter**, **Dimmer**, **Normal** or **Out** in the appropriate boxes in the table.
Each of the four words may be used once, more than once or not at all.
Two have been done for you already.

Switch S1	Switch S2	Bulb	Write only the words **Brighter**, **Dimmer**, **Normal**, or **Out** in each box as appropriate
Open	Open	Bulb L1	***Out***
		Bulb L2	***Out***
Open	Closed	Bulb L1	
		Bulb L2	
Closed	Open	Bulb L1	
		Bulb L2	
Closed	Closed	Bulb L1	
		Bulb L2	

[3]

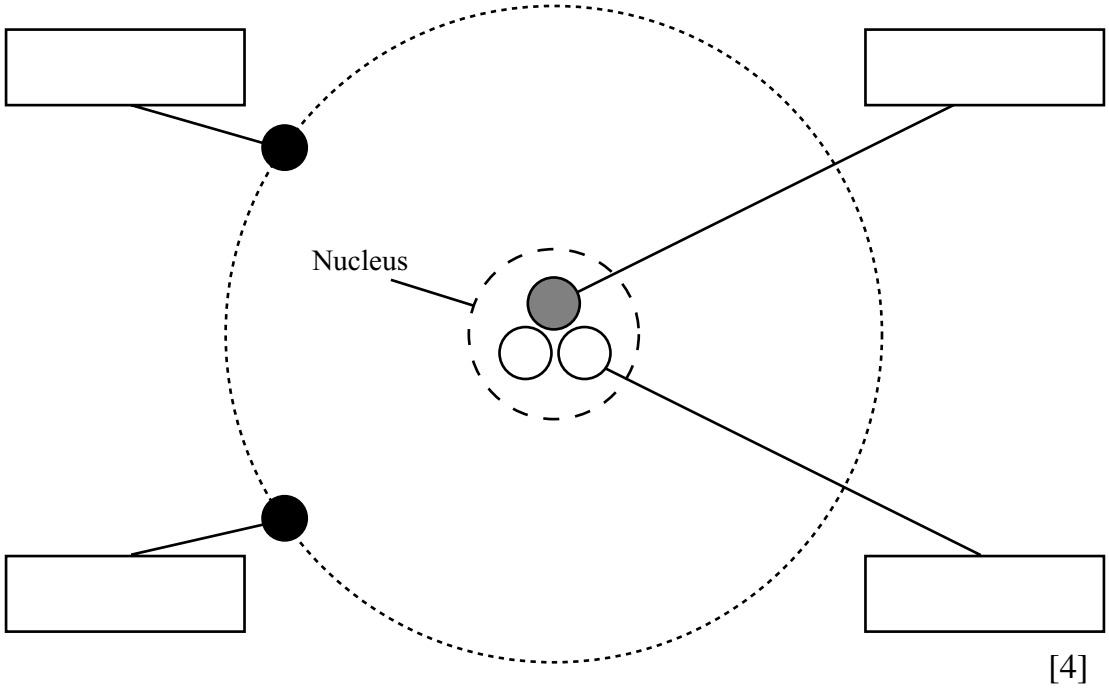
Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** The diagram below represents a neutral atom of a helium isotope. Use words from the list below to write the names of the particles indicated, into the boxes. The nucleus has been marked for you.

Electron	Ion	Proton	Neutron



[4]

(b) The nucleus of an atom of an isotope of sodium (chemical symbol Na) is represented as shown below

$$^{24}_{11}Na$$

(i) What is the mass number of this nucleus?_____[1]

(ii) What information does the mass number give us?

_____

_____ [1]

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(iii) Sodium has several isotopes. In terms of the particles that make up the nucleus, what do they all have in common?

_____ [1]

(c) (i) Some nuclei are unstable and disintegrate.
What name is given to such a nucleus?

_____ [1]

(ii) These unstable nuclei disintegrate by emitting radiation which can be alpha (α), beta (β) or gamma (γ). The nature of each one of these is shown in the box below.
In the empty box beside each description, write the symbol of the radiation being described.

An electromagnetic wave of very short wavelength	
A light particle with a negative electric charge	
A particle with a positive charge, containing two protons and two neutrons.	

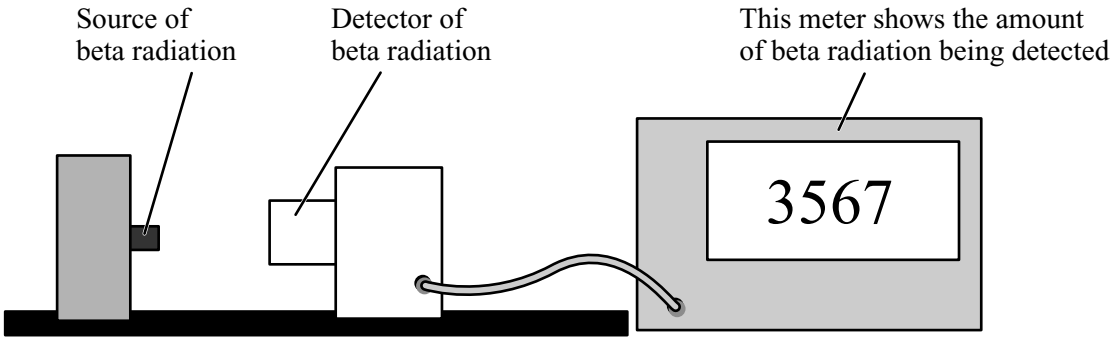
[3]

Examiner Only

Marks	Remark

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A substance, which emits beta radiation, is placed close to a detector as shown below.
You are given a number of aluminium squares each 1 mm thick.
The aim of the investigation is to find out what least thickness of aluminium is needed to prevent the beta radiation reaching the detector.
This thickness is known as the **range**.



(iii) Describe, briefly, how you would carry out this investigation.
How would you know when you have reached the range of beta radiation in aluminium?

_____

_____

_____

_____

_____ [3]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(d) (i) Here are three statements about the half-life of a substance.
Tick (✓) the box opposite the statement that is correct.

The half-life is the time it takes the radioactivity of a substance to completely disappear.	
After one half-life has passed, the radioactivity of a substance has fallen to half its starting value.	
After two half-lives has passed, the radioactivity of a substance is zero	

[1]

The volume of blood in a person's body can be measured using radioactivity.
A small quantity of a radioactive substance is injected into the body. After an hour, a small sample of blood is taken and its radioactivity is measured. The volume of blood can then be calculated.

(ii) Three radioactive substances are available.
One has a half-life of 5 seconds, one has a half-life of 30 minutes and the third has a half-life of 1 year.
Which one is best suited to this technique and why? Explain, briefly, why the other two are not suitable.

_____

_____

_____

_____

_____

_____ [4]

Quality of written communication [1]

THIS IS THE END OF THE QUESTION PAPER

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GCSE

Science: Physics

Summer 2009

Mark Schemes

Issued: October 2009

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Physics

Paper 1
Foundation Tier

[G7602]

WEDNESDAY 10 JUNE, AFTERNOON

MARK SCHEME

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Subject-specific instructions

1 In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2 Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3 The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer/unit mark.

					AVAILABLE MARKS
1	**(a)**	**(i)**	a force [1] newtons [1]	[2]	
		(ii)	Tick at forces are equal	[1]	
		(iii)	$W = mg$ [1] $= 750 \times 10 = 7500$ [1] N [1]	[3]	
		(iv)	Gravity attracts it	[1]	
	(b)	**(i)**	Twice	[1]	
		(ii)	200 m	[1]	
		(iii)	Average speed = distance/time [1] = 1200/160 [1] = 7.5 [1] m/s [1]	no mark for km/hr unless correct numerical answer [4]	
		(iv)	Straight line starting at 0, 0 [2] ending at 160, 1200 [1] Any other line give [0]	[3]	
	(c)		Speed – Increases [1] Icy – Increases [1] Alcohol – Increases [1] Braking force – Decreases [1]	[4]	20

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2 **(a)** **(i)** Efficiency = useful output energy/total input energy
Must be energy/work/power [1]

$\frac{\text{output}}{\text{input}}$ give [0]

(ii) Input energy = 150 + 450 [1]
= 600 (kJ) [1] [2]

(iii) Efficiency = 150/600 (e.c.f. from **(ii)** for total energy input) [1]
= 0.25 [1] [2]
0.25% give [2]/[3]
25 give [2]/[3]

(iv) Heat **or** sound [1]

(b) **(i)**

Renewable and dependent on the energy of the Sun	**Renewable and independent of the energy of the Sun**	**Non-renewable**
Biomass Hydroelectric Wind	Geothermal	Coal Gas Nuclear

[$\frac{1}{2}$] each **round up** [4]

(ii) Chemical [1]

(iii) Sunlight is converted to chemical energy by plants/photosynthesis [2]
Sun is a source of limitless energy [1]
Replacement plants can be grown [1] in a lifetime [1]
Sun allows plants to grow [1] [3]

(c) **(i)** Work = Force × Distance moved [1]

(ii) Work = 450 × 400 [1]
= 180 000 (J) [1] [2]

(iii) Power = work done/time taken [1]
Power = 18 000/500 [1] (e.c.f. from **(ii)** for work)
Power = 360 W [1] [3]

AVAILABLE MARKS

20

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AVAILABLE MARKS

3 **(a)** **(i)** Same distance behind mirror as object in front [1]

(ii) Mirror Y [1]

(iii) Image correct distance behind Y [1]
Line joining image and object perpendicular to mirror [1] [2]

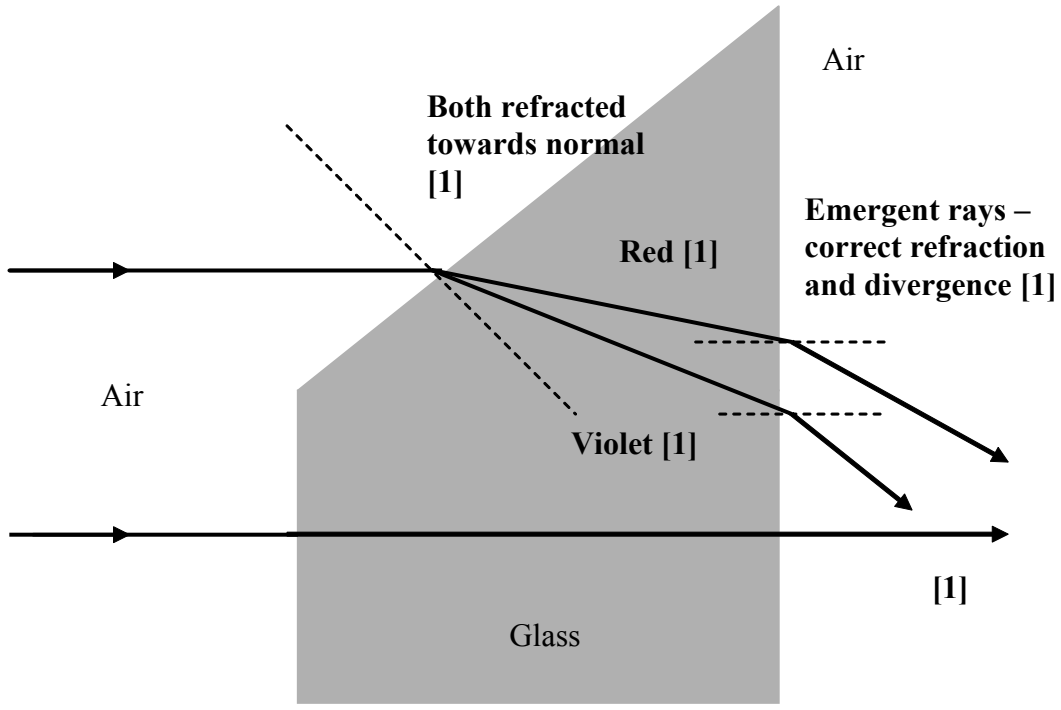
(iv) Ray marked with $i = r$ judged by eye [1]
Ray to eye appears to come from image (e.c.f.) [1]
Arrow from Z/towards A [1] (conflicting arrows [0]) [3]

(v) To enable driver to see down left-hand road [1]

(b) **(i)** Rays bend towards normal [1]
Ray passes out without any deviation [1]
Rays bend away from the normal [1] [3]

(ii) Ray P decreases in speed
Ray Q increases in speed
Both must be correct [1]

(c) Lower ray passes through without dispersion [1]
Top ray – dispersion with two rays refracted correctly [1]
Least refracted correctly labelled with colour [1]
Most refracted correctly labelled with colour [1]
Emergent ray – correct refraction and divergence of both [1] [5]



(d) **(i)** Diffraction – spreading of waves as they pass through a gap/around an obstacle
spreading in an area where a wave would not normally be [1]

(ii) Object correctly drawn – barrier with gap [1]
Waves spreading out on right-hand side of gap [1] [2]

20

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AVAILABLE MARKS

4 **(a)** **(i)** Electrons move [1]
Move from duster to rod [1]
Giving a surplus of electrons on rod [1] [3]

(ii) There are many more free moving charged particles in electrical conductors than there are in electrical insulators (3rd point in table) [1]

(b) **(i)** Positive [1]

(ii) Negative smoke particles are attracted to positive plate [1]

(iii) Reduces atmospheric pollution [1]

(c) **(i)** —Ⓐ— placed between points W and X [1]

(ii) Anti-clockwise [1]

(iii) Resistance decreases [1]

(iv) Voltage [1]

(v) Voltmeter —Ⓥ— [1] across thermistor [1] [2]

(vi) $R = V/I$ [1]
$R = 0.75/0.015$ [2]
$R = 50\ (\Omega)$ [1] [4]

(d)

Switch S_1	Switch S_2	Lamp L_1	Lamp L_2
OPEN	CLOSED	**Out**	**Out**
CLOSED	OPEN	**Dimmer**	**Dimmer**
CLOSED	CLOSED	**Normal**	**Out**

[½] each **round down** [3]

20

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			AVAILABLE MARKS
5	**(a)**	Top right – Neutron [1] Bottom right – Proton [1] Top left – Electron [1] Bottom left – Electron [1] Accept N, P, e [4]	
	(b) **(i)**	24 [1]	
	(ii)	Total of neutrons and protons [1]	
	(iii)	Same number of protons – if electrons also given award [0] [1]	
	(c) **(i)**	Radioactive [1]	
	(ii)	Gamma [1] Beta [1] Alpha [1] [3]	
	(iii)	Place aluminium between source and detector [1] Add more sheets [1] Until count rate falls to zero/background [1] measure background Any **three** [3]	
	(d) **(i)**	Tick statement two [1]	
	(ii)	30 minutes [1] Long enough to mix with the blood/short enough to avoid damage or without causing tissue damage [1] Five seconds too short to mix with blood **or** activity too small to detect [1] One year would cause tissue damage **or** damage body cells [1] [4]	
		Quality of written communication [1]	20
		Total	**100**

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