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	

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]

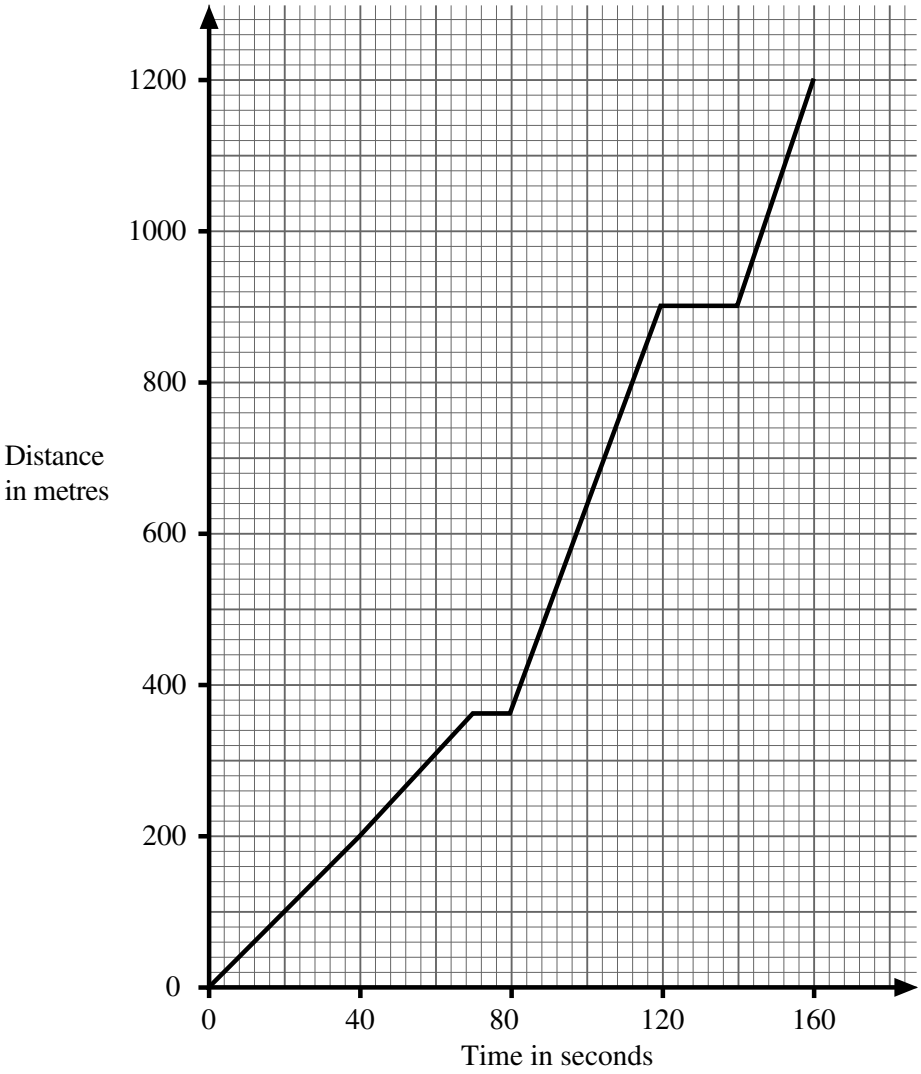
(iv) Explain why the car has weight.

_____

_____ [1]

Examiner Only	
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]

[Turn over

(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]

[Turn over

Examiner Only	
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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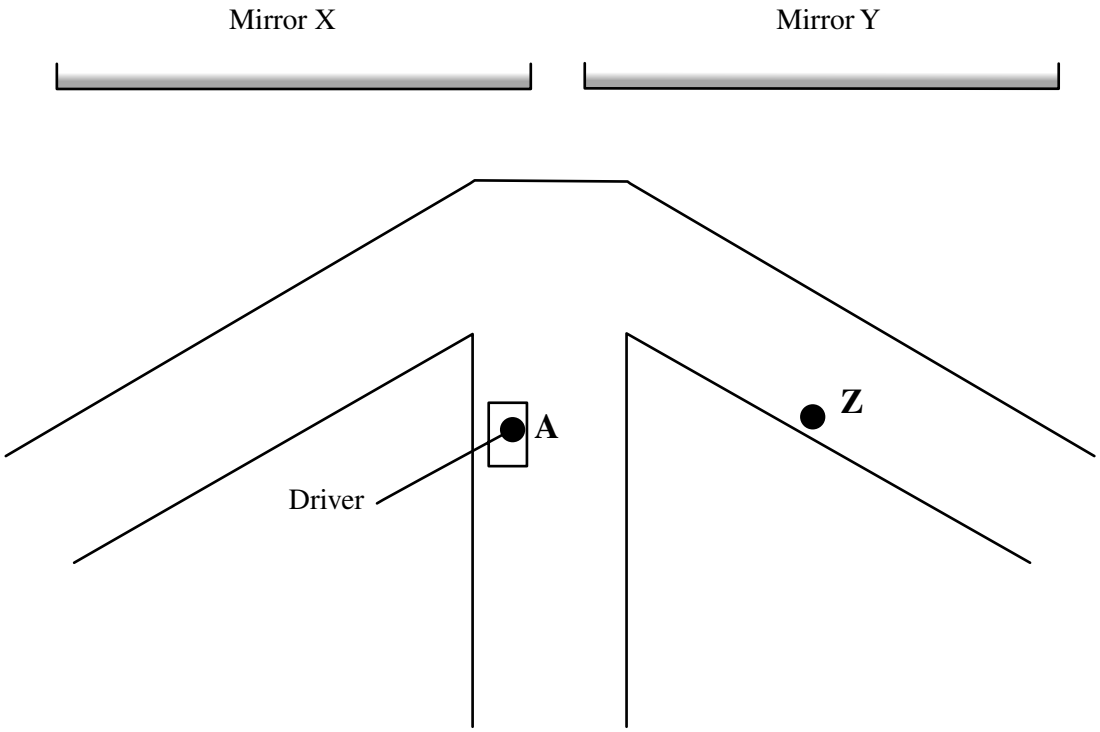
(Questions continue overleaf)

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.



Examiner Only	
Marks	Remark

(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]

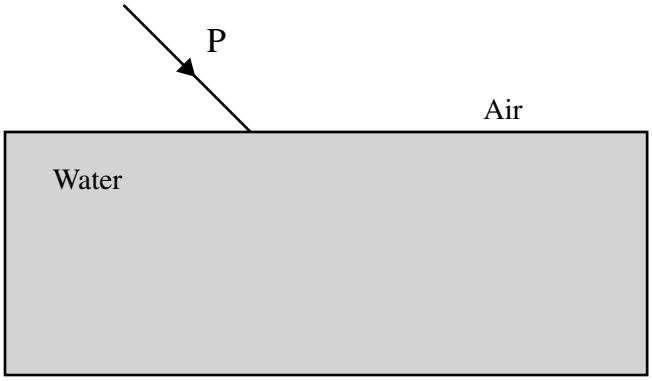
(v) What is the purpose of the mirror **X**?

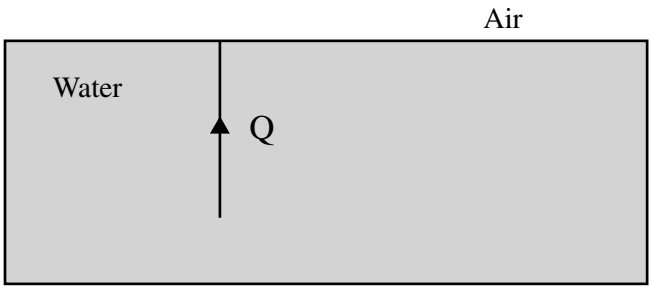
_____ [1]

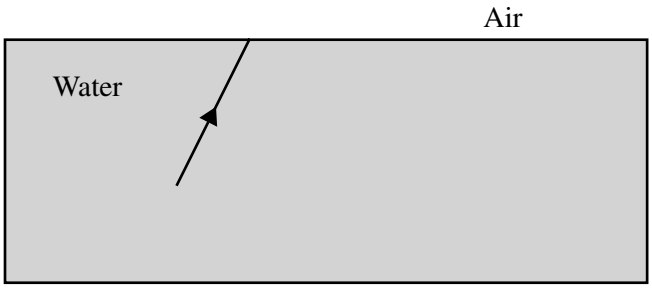
Examiner Only	
Marks	Remark

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]

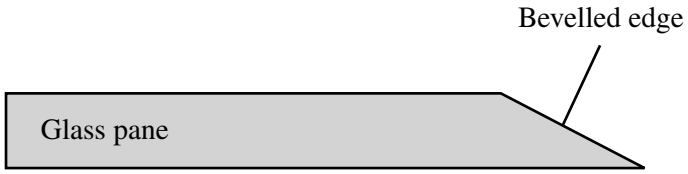
(ii) How does the speed of light change for the rays P and Q as each moves into a new medium? Circle the correct answer in each case.

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

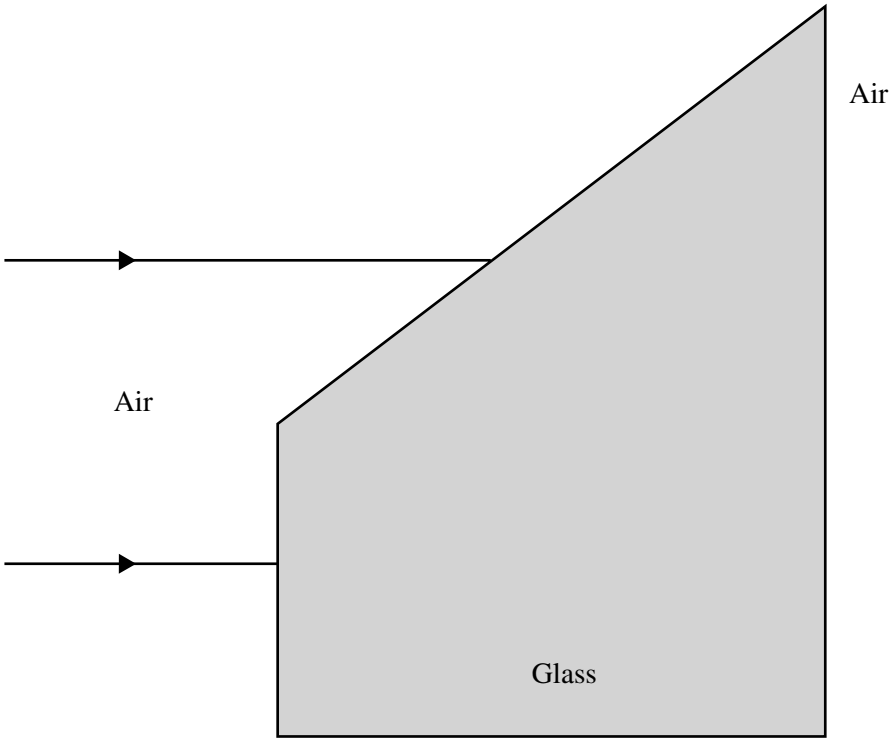
Ray Q increases in speed no change in speed decreases in speed

[1]

(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

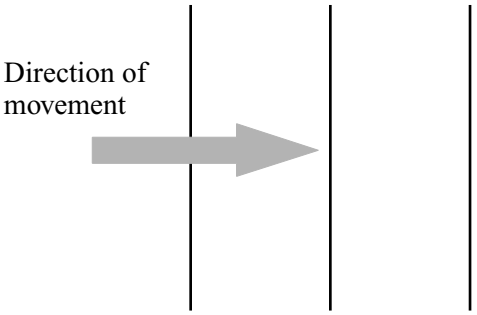
Marks	Remark

(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)

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]

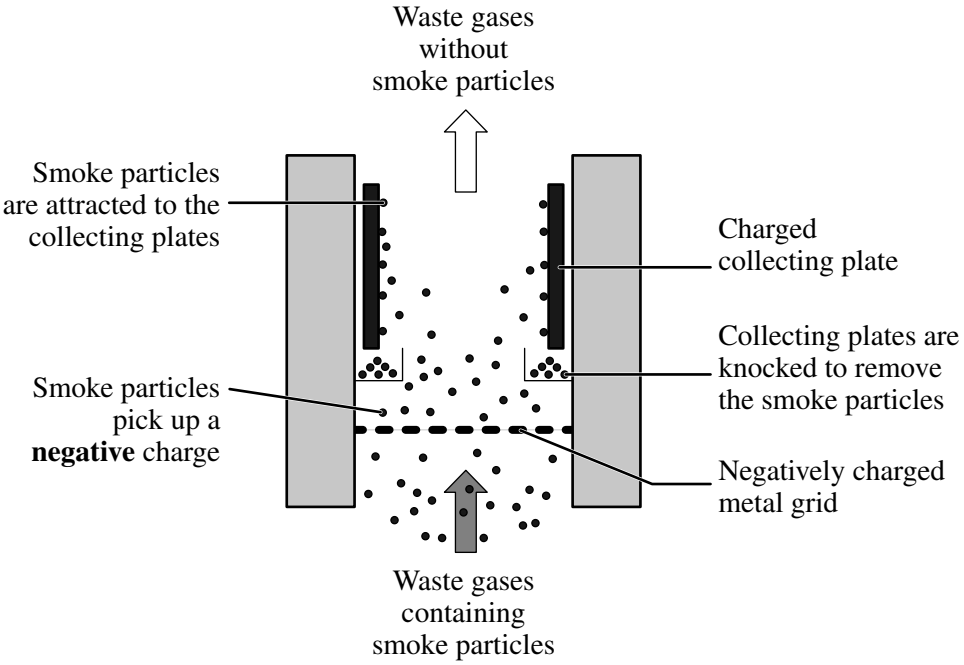
(ii) Which **one** of the following statements best explains the difference between electrical insulators and conductors?
Indicate your answer by placing a tick (✓) in the appropriate box.

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]

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?

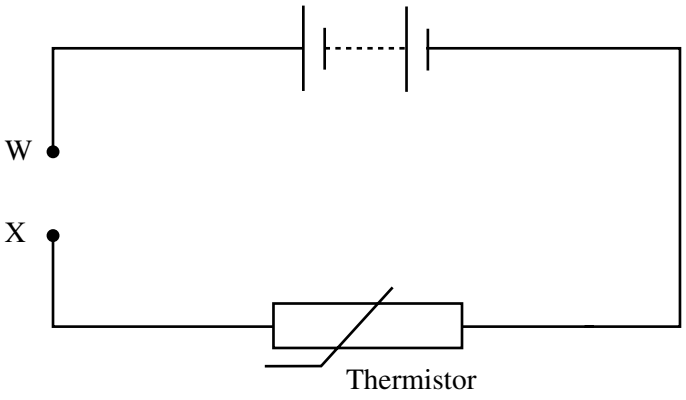
_____

_____ [1]

[Turn over

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]

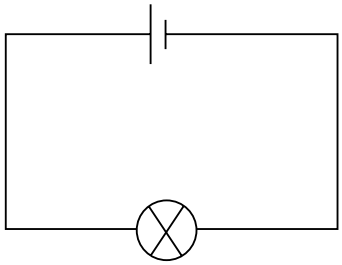
(v) Complete the circuit by drawing, in the correct place, and using the correct symbol, the piece of equipment needed to take this measurement. [2]

(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.

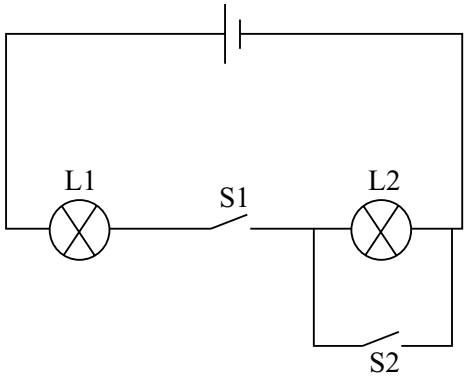
Resistance = _____ Ω [4]

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

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	

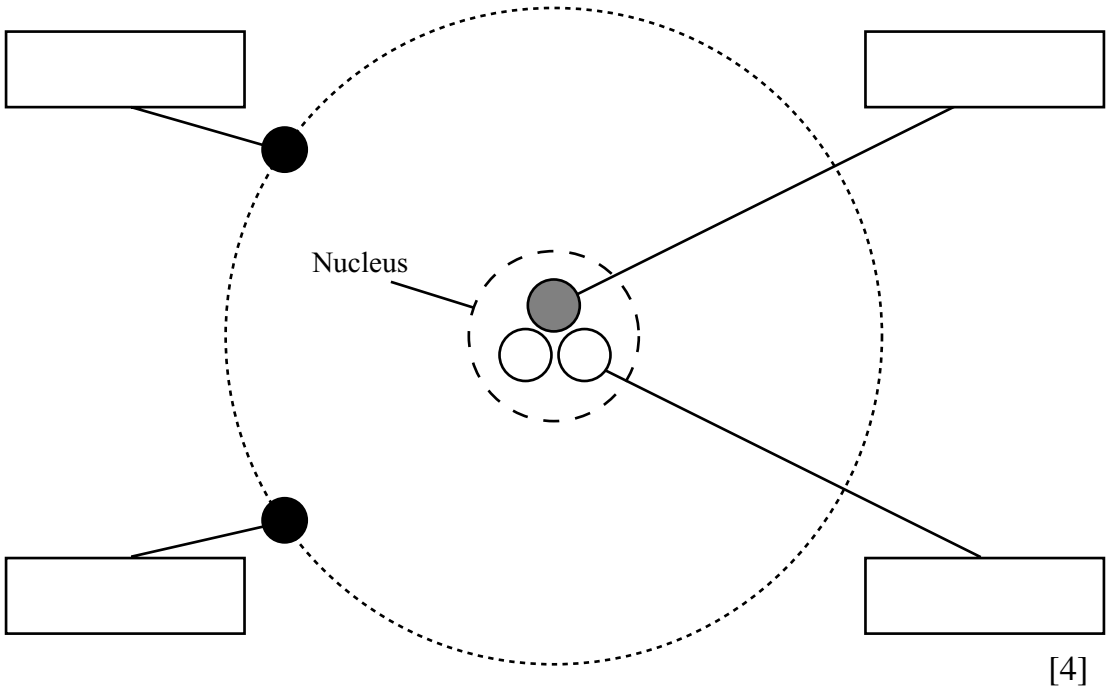
[3]

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]

(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.

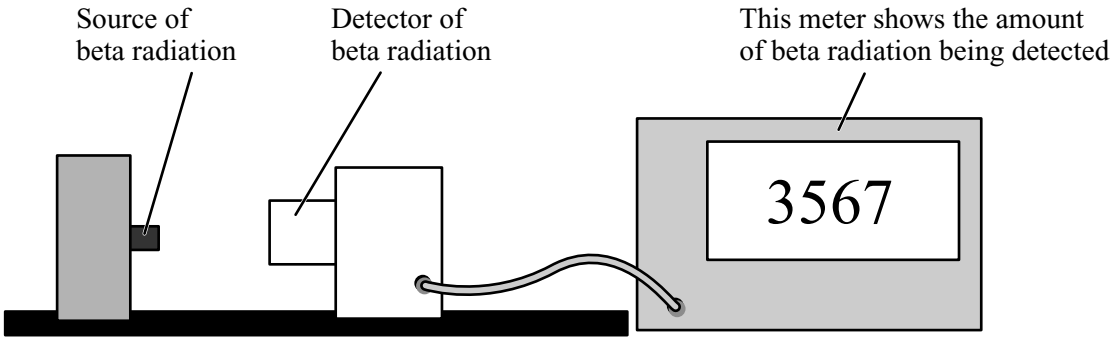
An electromagnetic wave of very short wavelength	
A light particle with a negative electric charge	
A particle with a positive charge, containing two protons and two neutrons.	

[3]

Examiner Only

Marks	Remark

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

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