Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
2011

Science: Physics

Paper 1
Foundation Tier

[G7602]

WEDNESDAY 25 MAY, MORNING

G7602

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.

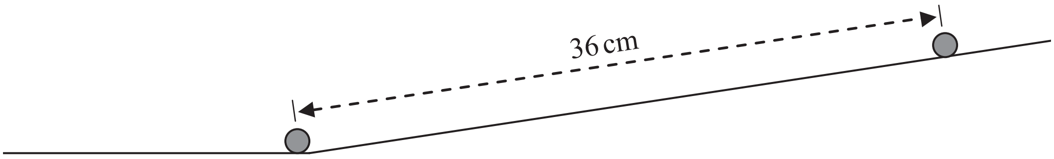
INFORMATION FOR CANDIDATES

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	

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]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(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.

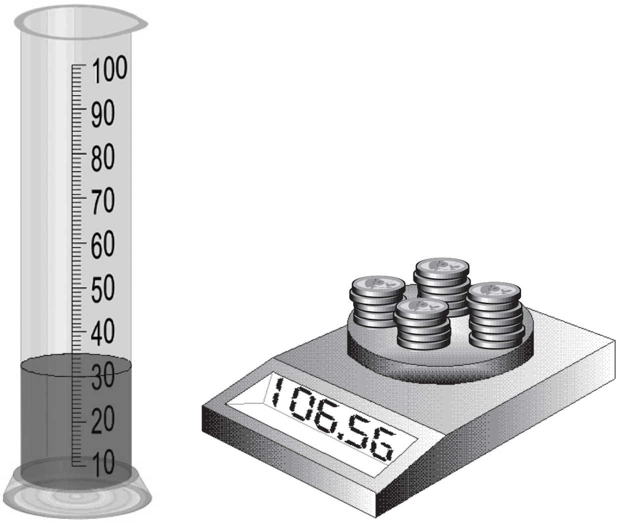
You are advised to show clearly how you get your answer.

Momentum of the marble = _______________ [4]

(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

Examiner Only	
Marks	Remark

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

____

____ [1]

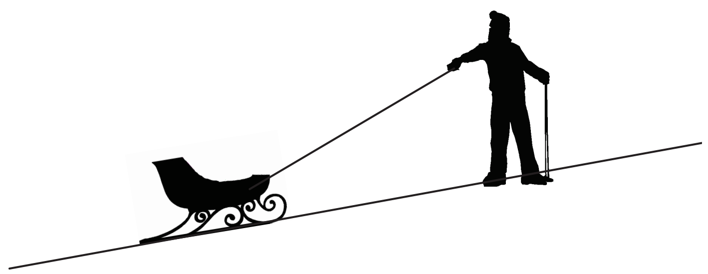
The table below gives a list of renewable and non-renewable energy sources.

(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.



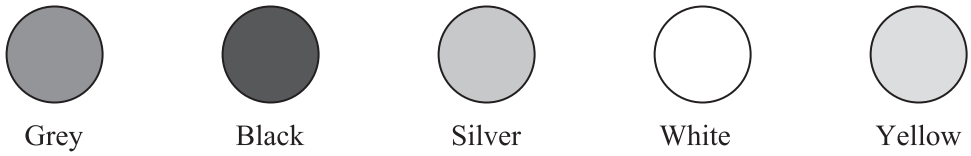
(i) Write down the gravitational potential energy of Desmond and his sleigh, at the top of the hill.

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]

(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.



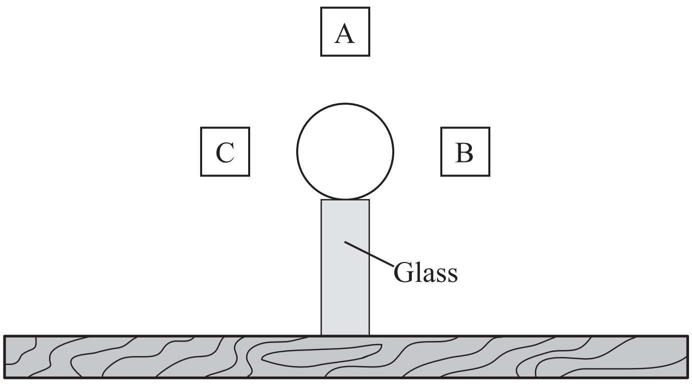
(i) Which ball gives out most heat radiation in one second?

______________________ [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

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**?

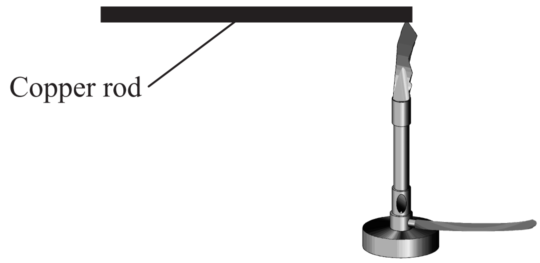
____________________ [1]

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

____________________ [1]

Examiner Only	
Marks	Remark

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.

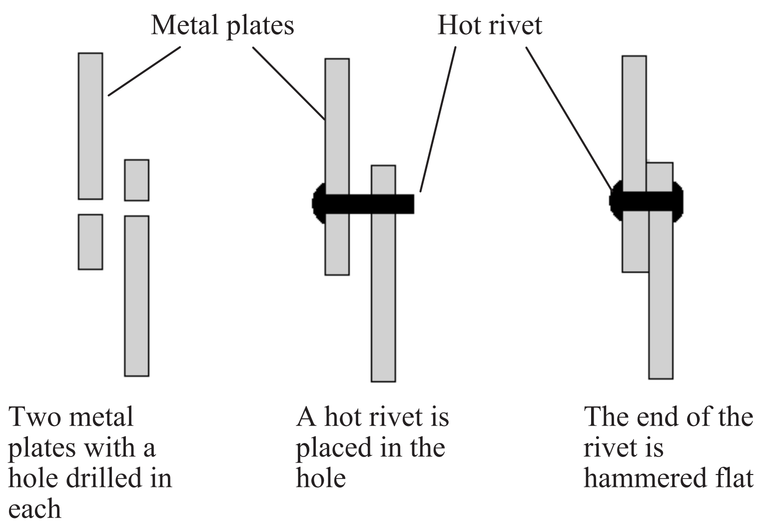
____

____

____

____ [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.



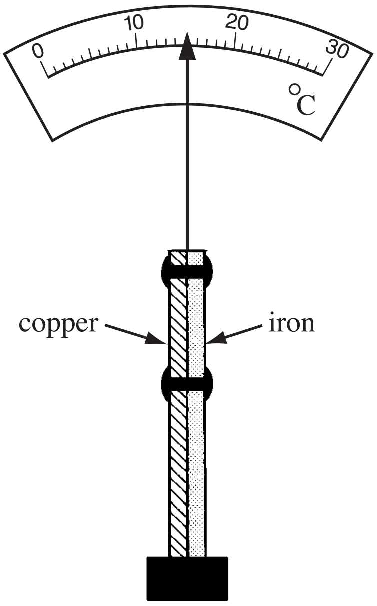
(i) Explain, briefly, why when the rivet cools, the two plates are held very tightly together.

____

____ [1]

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**.

____

____

____

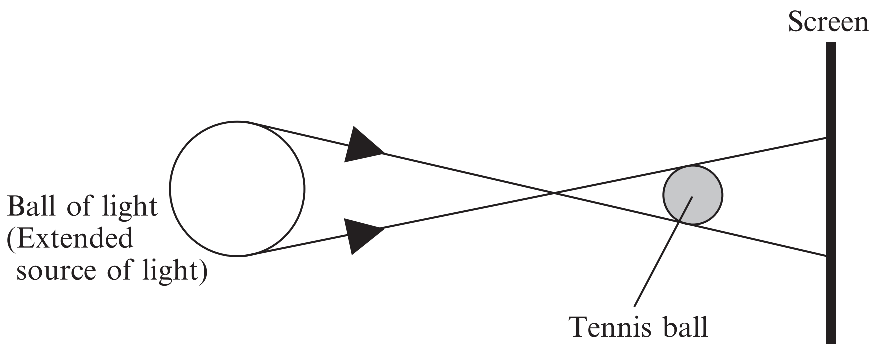
____

____ [2]

Examiner Only	
Marks	Remark

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?

____

____

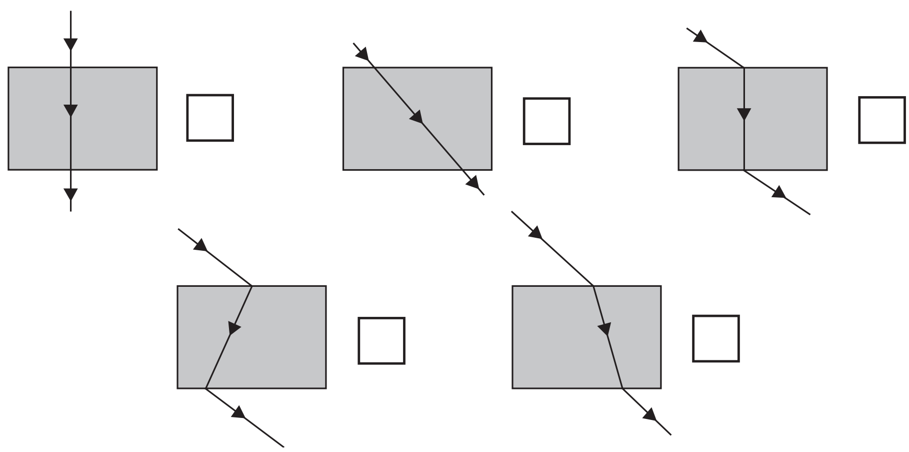
____ [1]

(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]

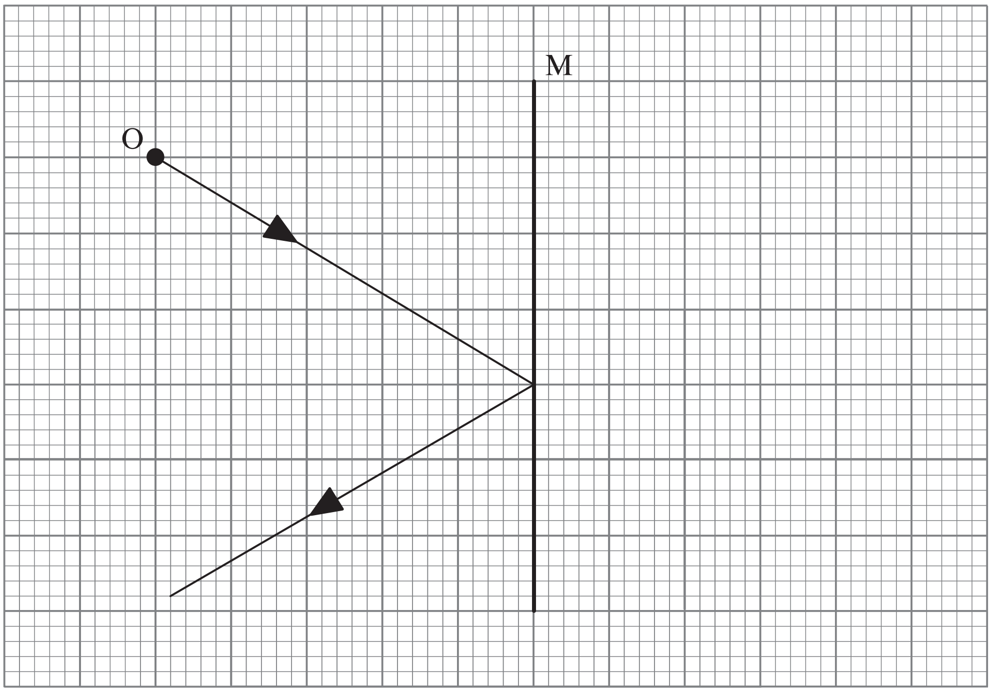
(b) Below are five diagrams showing the paths of light rays as they pass through rectangular blocks of glass. Some of the diagrams are incorrect.

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



[3]

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

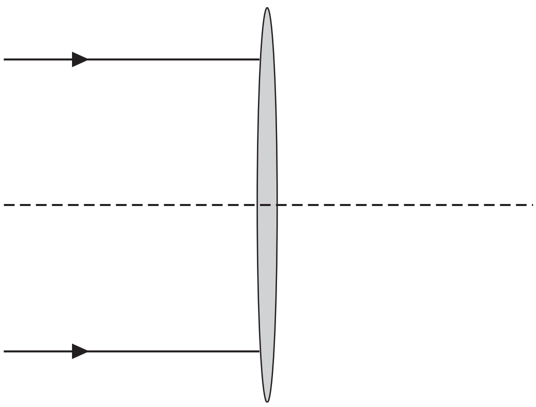


On the diagram:

(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.

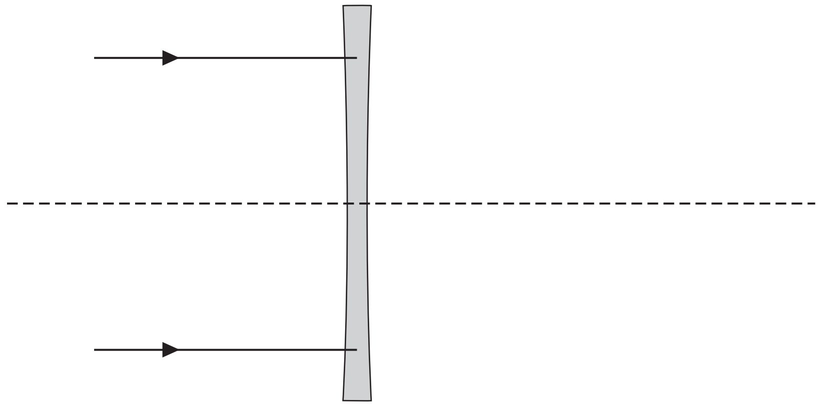


[2]

Examiner Only	
Marks	Remark

[Turn over

(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]

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

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

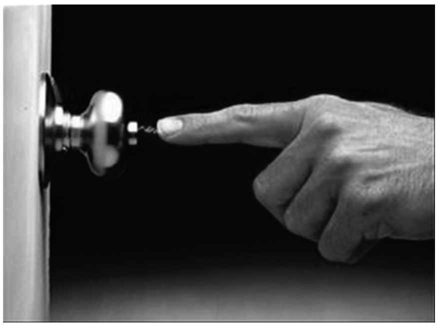
____ [1]

(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]

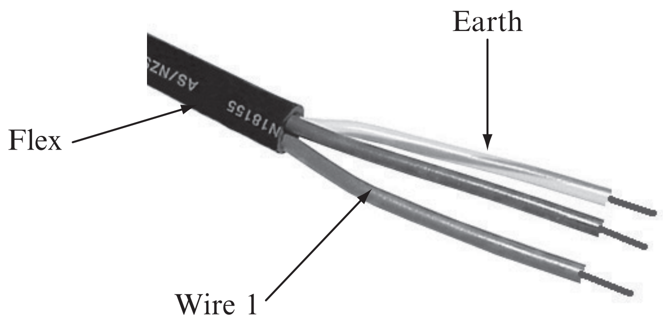
(iv) A comb is made of plastic which is an electrical insulator.
In terms of particles, explain the difference between an electrical insulator and an electrical conductor such as copper.

____

____ [1]

Examiner Only	
Marks	Remark

(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]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

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

(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.

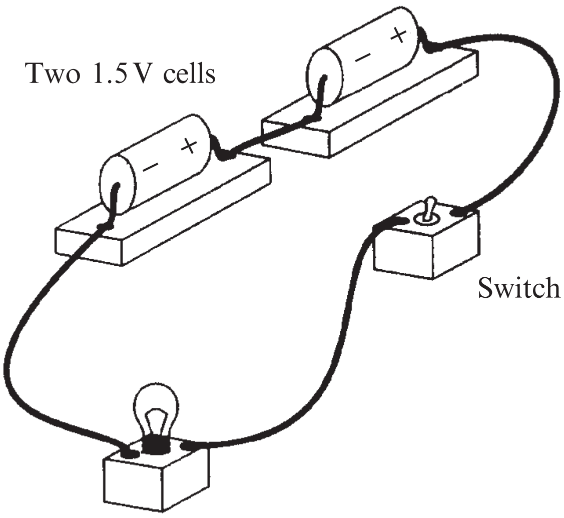
Resistance = _________ Ω [3]

(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]

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]

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.

____

____

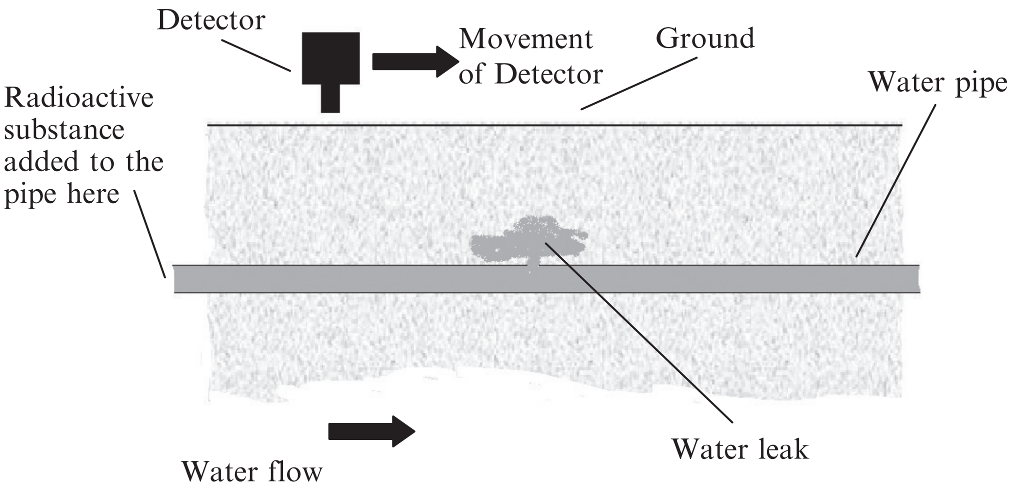
____

____

____ [2]

(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.

Examiner Only	
Marks	Remark



(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]

(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