

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
June 2005



**SCIENCE: SINGLE AWARD (CO-ORDINATED) 3463/3H  
HIGHER TIER  
Paper 3**

**H**

Wednesday 22 June 2005 9.00 am to 9.45 am

**In addition to this paper you will require:**  
a ruler.  
You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		4	
2		5	
3		6	
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 45 minutes

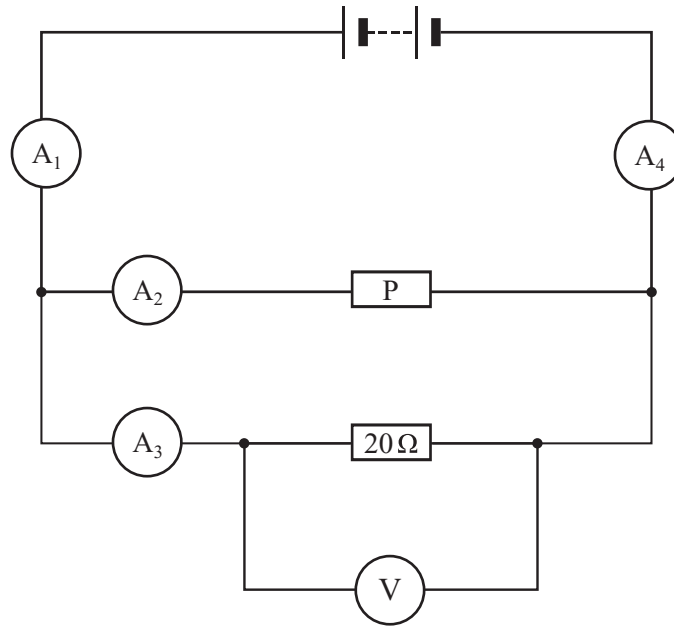
**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

- The maximum mark for this paper is 45.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

1 The circuit shown has four identical ammeters.



(a) The table gives the current through two of the ammeters.

(i) Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A <sub>1</sub>	
A <sub>2</sub>	0.2
A <sub>3</sub>	0.3
A <sub>4</sub>	

(2 marks)

(ii) Which **one** of the following statements is correct. Tick (✓) the box next to your choice.

The resistance of **P** is more than 20 Ω.

The resistance of **P** is equal to 20 Ω.

The resistance of **P** is less than 20 Ω.

Give a reason for your choice.

.....

.....

.....

(2 marks)

- (b) (i) Write down the equation that links current, potential difference and resistance.

.....  
(1 mark)

- (ii) Calculate the reading on the voltmeter. Show clearly how you work out your answer.

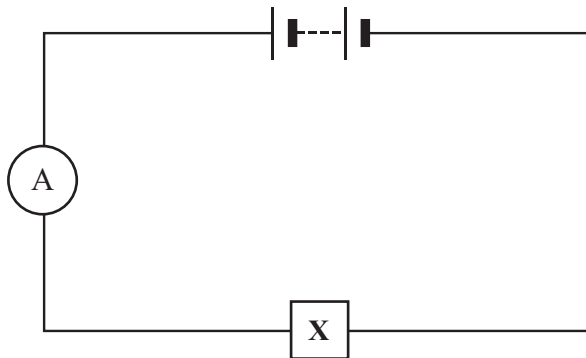
.....  
.....

Voltmeter reading = ..... volts.  
(2 marks)

- (iii) State the potential difference of the power supply.

.....  
(1 mark)

- (c) A second circuit contains an unknown component labelled X.



As component X is heated, the reading on the ammeter goes up.

What is component X?

.....

Give a reason for your answer.

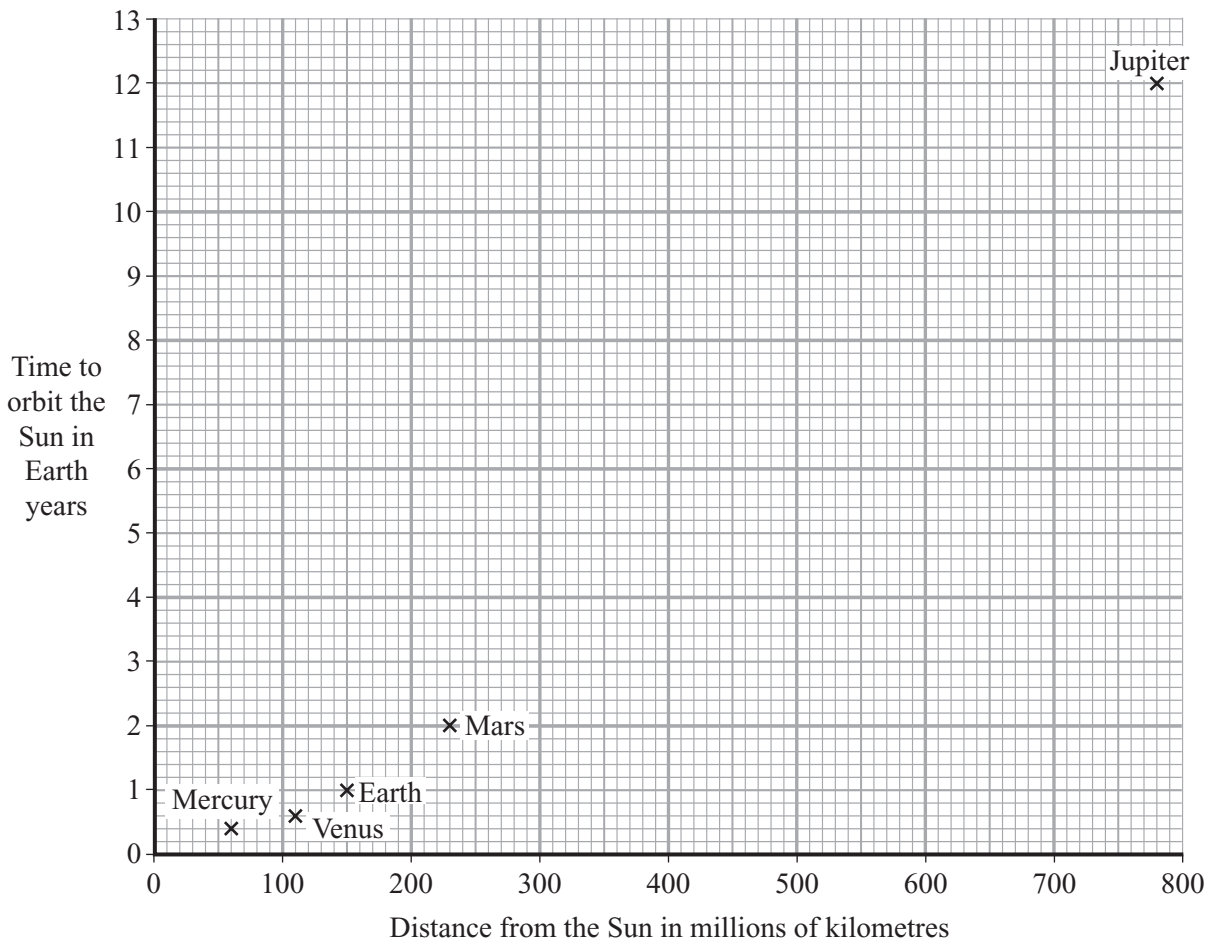
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(2 marks)

10

Turn over ►

- 2 (a) The chart shows that the time taken by a planet to orbit the Sun depends on its distance from the Sun.



- (i) How does the time taken by a planet to orbit the Sun depend on the distance the planet is from the Sun?

.....  
 .....

(1 mark)

- (ii) Asteroids orbit the Sun. One asteroid is 550 million kilometres from the Sun.

Estimate how long this asteroid takes to orbit the Sun.

Time to orbit the Sun = ..... Earth years  
 (1 mark)

- (b) The atmosphere on Venus contains a large percentage of a greenhouse gas.

	<b>Mercury</b>	<b>Venus</b>	<b>Earth</b>
Average surface temperature	230 °C	470 °C	20 °C

- (i) Which **one** of these gases increases the greenhouse effect? Draw a ring around your answer.

**argon**

**carbon dioxide**

**nitrogen**

**oxygen**

(1 mark)

- (ii) Explain how the information in the table and the chart shows that the atmosphere of Venus produces a greenhouse effect.

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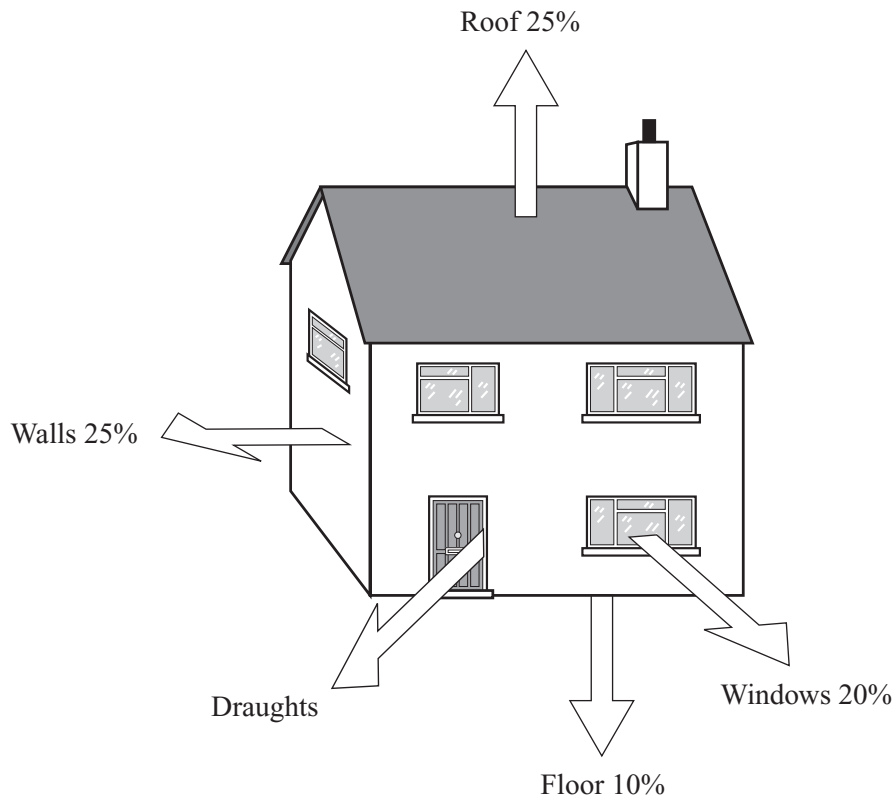
(2 marks)

5

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

- 3 (a) The diagram shows the ways in which heat energy can be transferred from an old house.



- (i) Calculate the percentage of energy transferred by draughts.

.....

% energy transferred by draughts = .....  
(1 mark)

- (ii) Complete the following sentence using **one** of the words from the box.

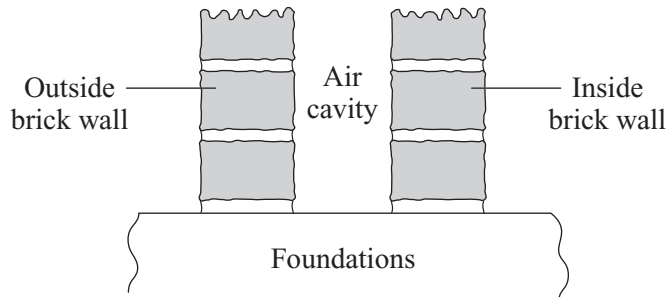
<b>conduction</b>	<b>convection</b>	<b>radiation</b>
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Draughts transfer heat energy by .....  
(1 mark)

- (iii) State **one** way of reducing the heat transfer by draughts.

.....  
(1 mark)

(b) The diagram shows a section through the walls of a house built in 1930.



Explain how the air cavity between the two walls reduces the heat transfer from the house.

.....

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.....

(2 marks)

(c) The table shows the installation costs and yearly savings on energy bills for different methods of insulating a house.

Method of insulation	Installation cost in £	Yearly saving on energy bills in £
Double glazing	4000	65
Loft insulation	240	60
Cavity wall insulation	600	80

(i) Give **one** reason why loft insulation is often fitted to an old house before double glazing or cavity wall insulation.

.....

.....

(1 mark)

(ii) The time it takes for the saving on energy bills to equal the cost of installing the insulation is called the pay-back time.

Calculate the pay-back time for loft insulation.

.....

Pay-back time = ..... years  
(1 mark)



Turn over ►

4 Stars do not stay the same forever.

- (a) Over billions of years the amount of hydrogen in a star decreases. Why?

.....  
.....

(1 mark)

- (b) Describe how a massive star (at least five times bigger than the Sun) will change at the end of the main stable period.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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(4 marks)

- (c) The inner planets of the solar system contain atoms of the heaviest elements.

- (i) Where did these atoms come from?

.....  
.....

(1 mark)

- (ii) What does this tell us about the age of the solar system compared with many of the stars in the Universe?

.....

(1 mark)





5 (a) Information transmitted through an optical fibre communications system is sent as a digital signal.

(i) Name **one** type of electromagnetic wave, other than visible light, used to carry information through an optical fibre.

.....  
(1 mark)

(ii) What is a digital signal?

.....  
.....  
(1 mark)

(b) Information can be sent as an analogue signal. The signals weaken with distance and need to be amplified.

Explain why this causes the quality of the signal to deteriorate.

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(3 marks)

(c) Microwaves are used to send information within mobile phone networks.

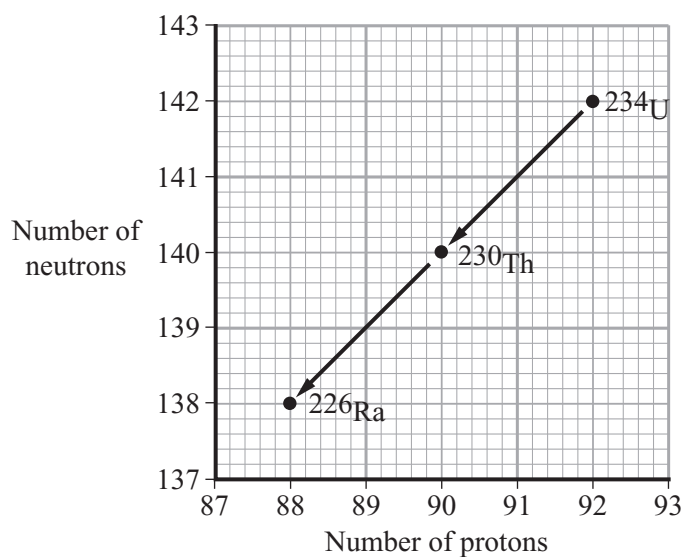
Explain how microwaves could be harmful to living cells.

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(2 marks)

7

Turn over ►

- 6 (a) Uranium-234 ( $^{234}\text{U}$ ) is a radioactive element. The graph shows the number of protons and neutrons in the nuclei of the elements formed when uranium-234 decays.



- (i) How does the graph show that uranium-234 ( $^{234}\text{U}$ ) and thorium-230 ( $^{230}\text{Th}$ ) emit alpha particles?

.....  
(1 mark)

- (ii) What makes uranium and thorium different elements?

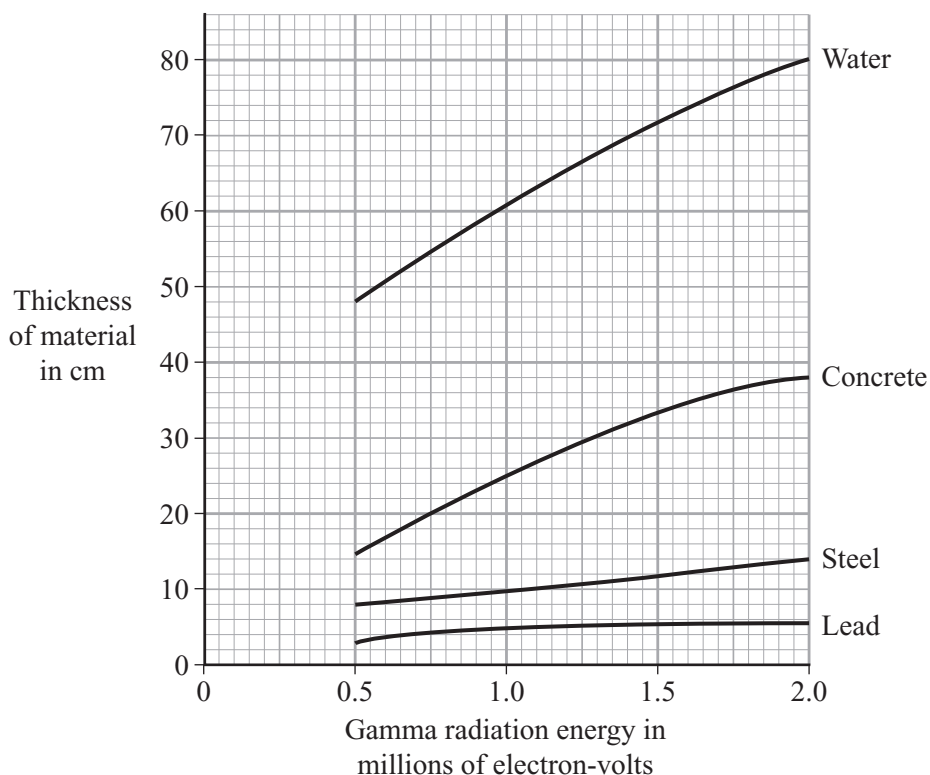
.....  
(1 mark)

- (iii) Radioactive decay may also produce gamma radiation.

Why does the emission of gamma radiation **not** cause a new element to be formed?

.....  
.....  
(1 mark)

- (b) The graph shows how the thickness of different materials needed to absorb 90% of the gamma radiation emitted by a source depends on the energy of the radiation. The energy of the gamma radiation is given in units called electron-volts.



- (i) Which of the materials shown is least effective at absorbing gamma radiation? Use the information in the graph to give a reason for your answer.

.....  
 .....

(1 mark)

- (ii) For gamma radiation of energy 1.5 million electron-volts, how many times more effective is steel than water at absorbing the radiation? Show clearly how you obtain your answer.

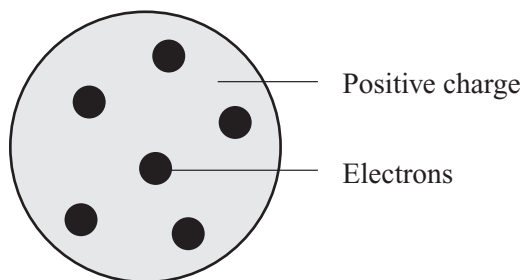
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(2 marks)

**QUESTION 6 CONTINUES ON THE NEXT PAGE**

**Turn over** ►

- (c) Scientists in the early twentieth century thought that atoms were made up of electrons scattered inside a ball of positive charge. This was called the 'plum-pudding' model of the atom.



### Plum pudding model

Rutherford and Marsden did an experiment, in which a beam of alpha particles was aimed at a thin sheet of gold.

Explain how the results of this experiment led to a new model of the atom. You may include one or more diagrams in your answer.

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(3 marks)

**END OF QUESTIONS**