

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
June 2006



**SCIENCE: SINGLE AWARD B (CO-ORDINATED)**  
**Paper 3**  
**Higher Tier**

3463/3H

**H**

Friday 16 June 2006 9.00 am to 9.45 am

**For this paper you must have:**

- a ruler

You may use a calculator.

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.
- Answer the 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.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use			
Number	Mark	Number	Mark
1		4	
2		5	
3		6	
		7	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

**There are no questions printed on this page**

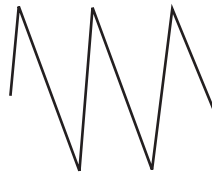
Answer **all** questions in the spaces provided.

- 1 Converting sound waves into electrical signals allows information to be sent over long distances.

The diagram shows three analogue signals and one digital signal.



U



V



W



X

- (a) Which signal, **U**, **V**, **W** or **X**, is the digital signal?

.....

Give a reason for your choice.

.....

.....

(2 marks)

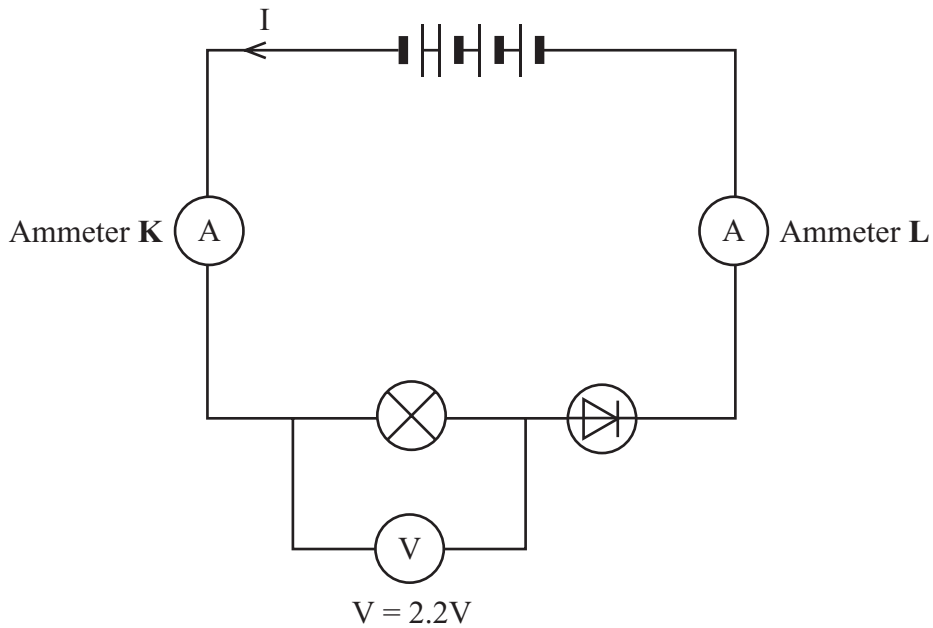
- (b) Give **one** advantage of sending information as a digital signal instead of as an analogue signal.

.....

.....

(1 mark)

- 2 The diagram shows how a student joined several components, including a 6-volt lamp and four identical 1.5 volt cells, in a circuit.



- (a) The reading on ammeter **K** is 0.05 A.

What is the reading on ammeter **L**?

.....  
(1 mark)

- (b) The student expected the lamp in the diagram to be much brighter and the reading on the voltmeter to be 6 volts.

- (i) Give **two** reasons why the reading on the voltmeter is much less than 6 volts.  
The voltmeter is working correctly.

1.....  
.....  
2.....  
.....

(2 marks)

- (ii) The student decides that the lamp is dim because the diode is connected the wrong way round. When the student reverses the connections to the diode the lamp goes out.

Explain why.

.....

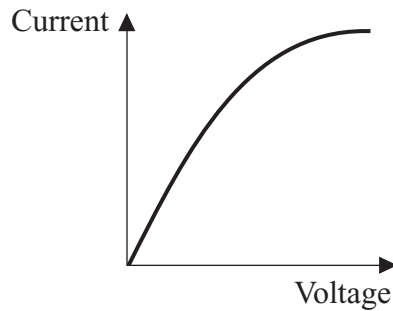
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.....

.....

(2 marks)

- (c) The graph shows how the current through a filament lamp changes as the voltage (potential difference) across it changes.



Explain why the graph is not a straight line.

*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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.....

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(4 marks)

9

Turn over ►

- 3 (a) The diagram shows water waves made by a wave machine in a swimming pool.



In 10 seconds 5 complete waves go past a person standing in the pool.

Calculate the frequency of the water waves and give the unit.

Show how you work out your answer.

.....

Frequency = .....  
(2 marks)

- (b) Water waves are transverse waves.

Give **one** other example of a transverse wave.

.....

(1 mark)

- (c) How is a transverse wave different from a longitudinal wave? You may draw a diagram to help you with your answer.

.....

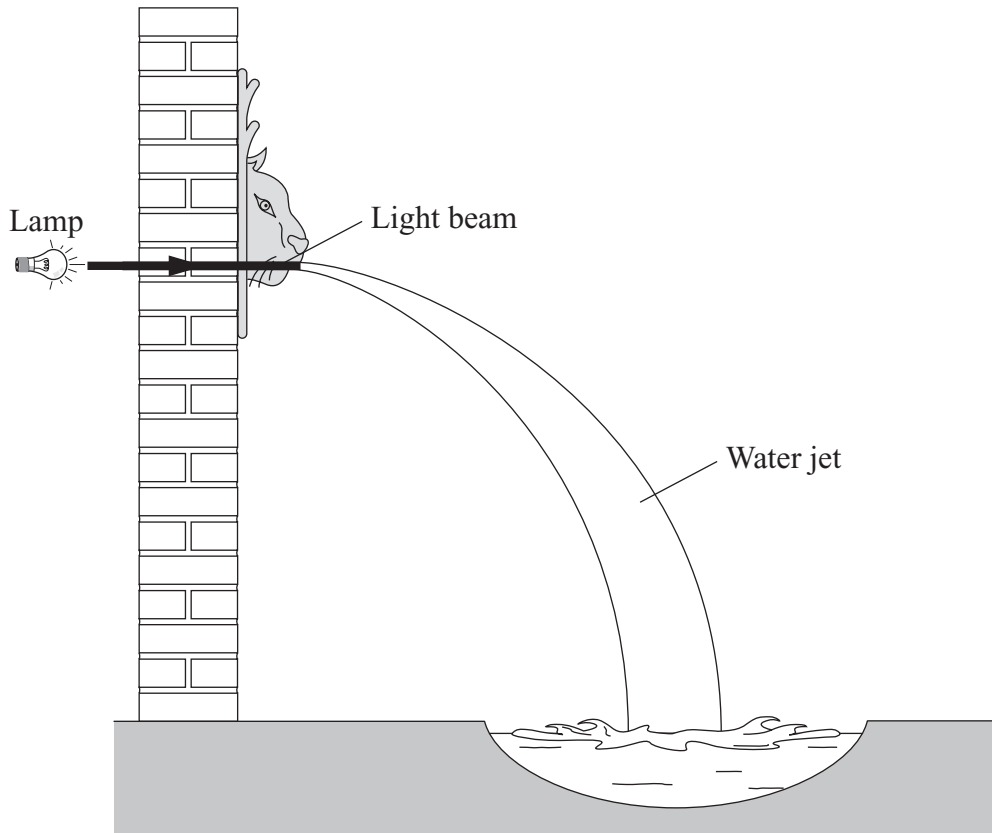
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(2 marks)

- (d) The diagram shows a garden fountain. The fountain features a light beam that is totally internally reflected by the water jet.



- (i) Draw the path of the light beam through the water jet. (1 mark)
- (ii) Complete the following sentence by crossing out the **two** lines in the box that are wrong.

For light to be totally internally reflected the angle between the light ray and the

normal must be 

smaller than
equal to
bigger than

 the critical angle.

(1 mark)

<b>7</b>

Turn over ►

4 (a) The Sun’s energy comes from nuclear reactions that convert hydrogen into helium.

What is this type of nuclear reaction called?

.....  
(1 mark)

(b) The Sun has reached the main stable period of its life.

Explain, in terms of the forces acting inside the Sun, what this means.

.....  
.....  
.....  
.....  
(2 marks)

(c) Light from other galaxies shows a *red-shift*. This is used as evidence that the Universe began with a huge explosion.

(i) What causes *red-shift*?

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

(ii) The further away a galaxy is, the bigger the red-shift. Why?

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



(d) Planets, other than the Earth, may be capable of supporting life. Space probes are used to analyse the atmosphere of other planets.

(i) How could this analysis give evidence that organisms may once have lived on the planet?

.....  
.....  
.....  
.....

*(2 marks)*

(ii) How are the scientists on the SETI project trying to find evidence for the existence of extra-terrestrial intelligence?

.....  
.....  
.....  
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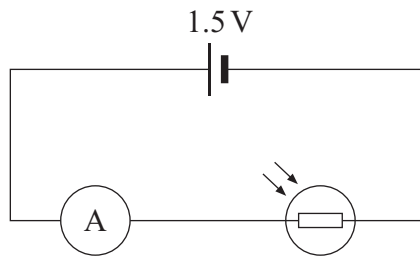
*(2 marks)*

<b>9</b>

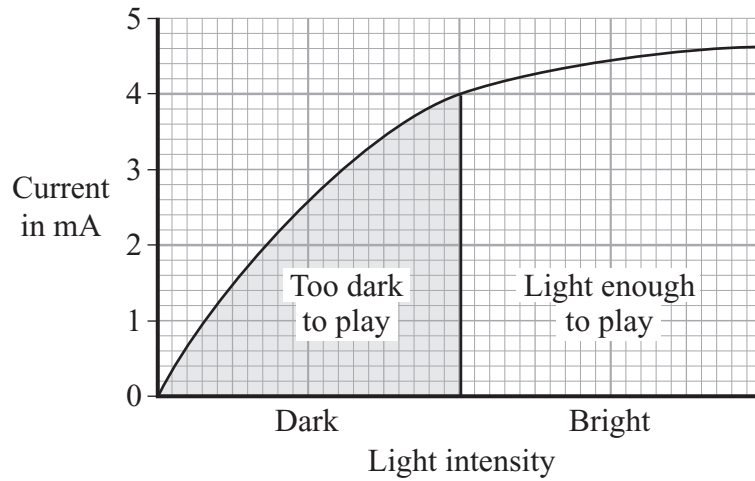
**Turn over for the next question**

**Turn over ►**

5 The diagram shows the circuit for a simple light meter.



(a) The graph shows how a tennis umpire uses the light meter to decide when it is too dark for play to continue.



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

.....  
(1 mark)

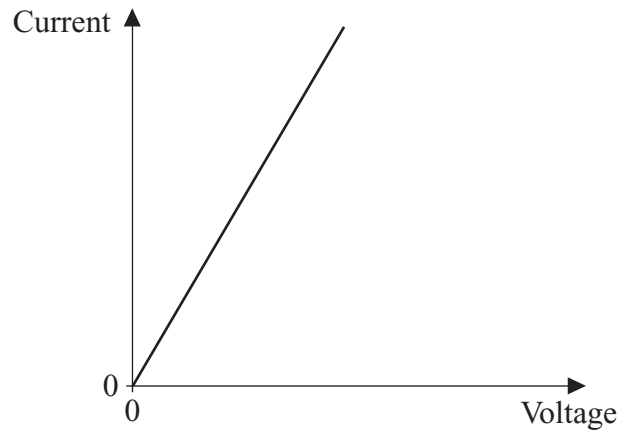
(ii) Calculate the resistance of the light dependent resistor (LDR) at the point when it becomes too dark for play to continue.

Show clearly how you work out your answer.  
(1000 mA = 1 A)

.....  
.....  
.....

Resistance = .....  $\Omega$   
(3 marks)

(b) The current-voltage (potential difference) graph for an LDR in daylight is drawn below.



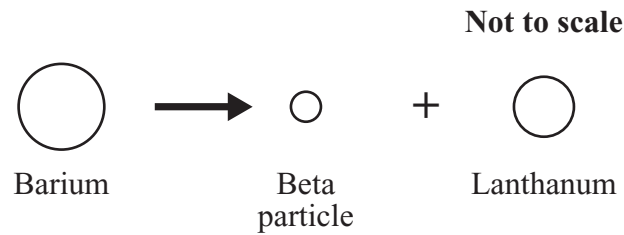
Draw a second line on the graph to show how the current may change with the voltage when the LDR is in the dark. (1 mark)

5
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**Turn over for the next question**

**Turn over ►**

- 6 (a) When an unstable barium nucleus changes into a lanthanum nucleus, a beta particle is emitted.



- (i) What is a beta particle?

.....  
(1 mark)

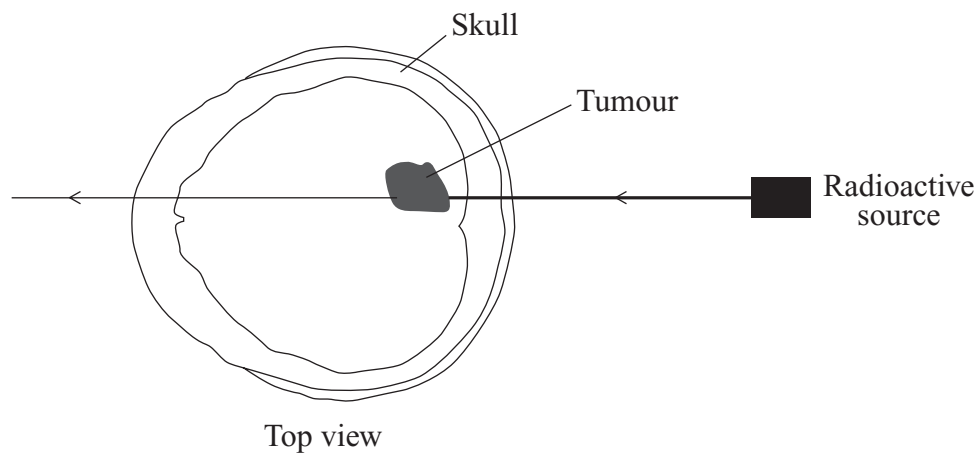
- (ii) How is the nucleus of a lanthanum atom different from the nucleus of a barium atom?

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

- (iii) Describe how a neutral atom may be changed by a collision with a beta particle.

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

- (b) The diagram shows how radiation can be used to kill the cells of a brain tumour.



Why is a beta emitting radioactive source unsuitable for this purpose?

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

- (c) The table gives the average radiation dose which someone in the UK receives in one year from background radiation.

Source of radiation	Dose in millisieverts
the ground	0.30
radon gas	0.80
food	0.40
space	0.25
man-made sources	0.25

- (i) What percentage of the background radiation comes from space?

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

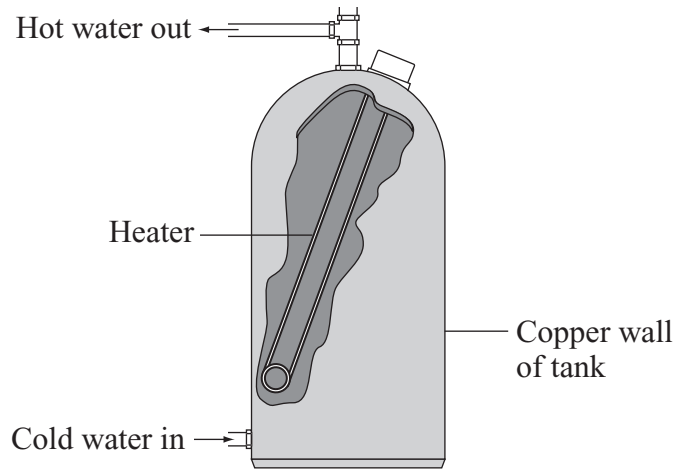
- (ii) It is estimated that flying across the Atlantic exposes passengers to an additional radiation dose equivalent to one chest X-ray.

Suggest why flying increases radiation dose and give a possible effect this may have on the health of someone who flies a lot.

.....  
 .....  
 .....  
 .....  
 (2 marks)

7
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7 (a) The diagram shows a copper hot water tank.



Explain, in terms of the particles in the copper, how heat energy is transferred through the wall of the hot water tank.

.....

.....

.....

.....

(2 marks)

(b) The table gives information about some ways of reducing the energy used in a house.

Method of reducing energy used	Installation cost in £	Money saved each year on energy bills in £
Hot water tank jacket	30	20
Draught proofing	50	15
Under floor insulation	75	20
Upgraded central heating controls	350	80

Which of the methods in the table would be most cost-effective over 5 years?

To gain full marks you must support your answer with calculations.

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(3 marks)

5
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**END OF QUESTIONS**

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