Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2006

SCIENCE: SINGLE AWARD A (MODULAR) **3469/H**
Higher Tier

H

Wednesday 7 June 2006 1.30 pm to 3.00 pm

For this paper you must have:
- the Data Sheet (enclosed)
- a ruler

You may use a calculator.

Time allowed: 1 hour 30 minutes

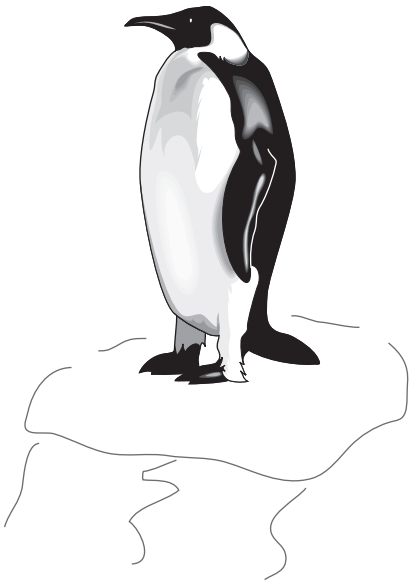
Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for this paper is 90.
- 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		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

ENVIRONMENT, INHERITANCE AND SELECTION

1 The drawing shows a penguin. Penguins live in the Antarctic. They swim underwater to catch fish.



These are some facts about penguins. They have:

- a thick layer of fat underneath the skin
- heavy, solid bones that act like a diver's weight belt
- wings shaped like flippers
- stiff, tightly packed feathers
- feathers coated with oil from a gland near the tail
- a streamlined body
- feet that resemble paddles.

(a) Give **two** adaptations of penguins for surviving in cold conditions.

1 .....

.....

2 .....

.....

(2 marks)

(b) Give **two** adaptations of penguins for catching fish.

1 .....

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2 .....

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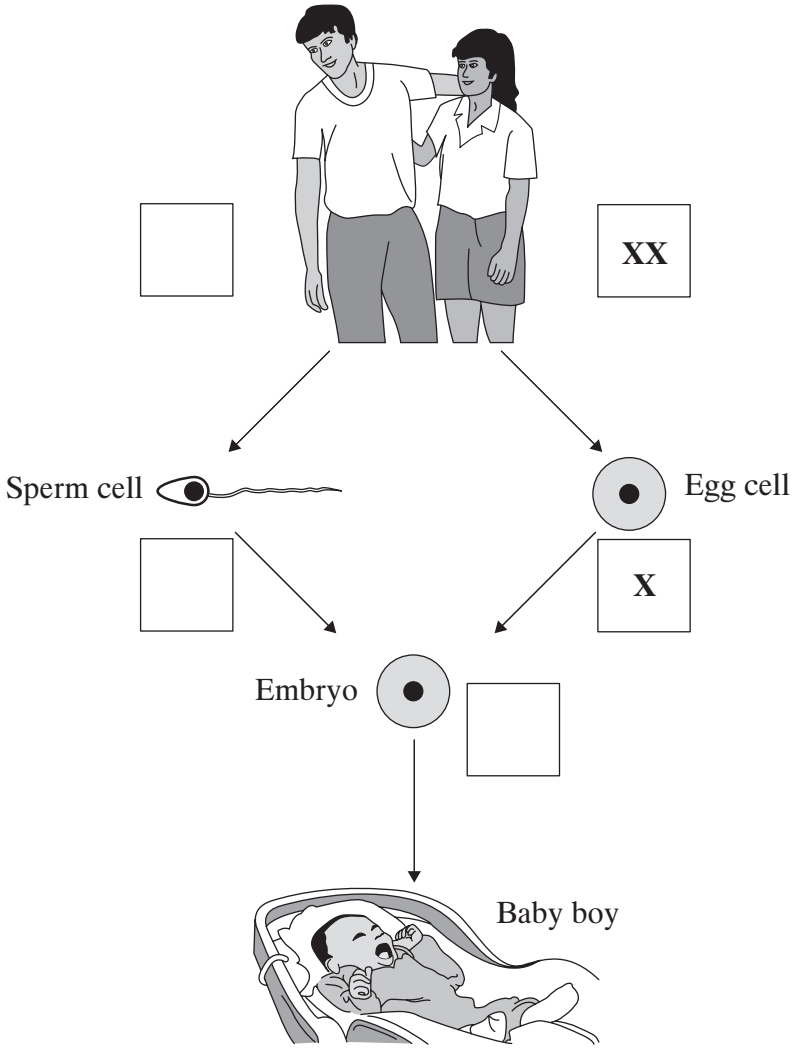
(2 marks)

4

Turn over for the next question

2 The diagram shows some stages in sexual reproduction in humans.



(a) The box for the woman shows her chromosomes.

On the diagram, write the sex chromosomes which should be in the empty boxes.

(3 marks)

(b) The child has inherited cystic fibrosis from its parents.

Neither parent has cystic fibrosis.

Explain, as fully as you can, how the child has inherited cystic fibrosis.

To gain full marks for 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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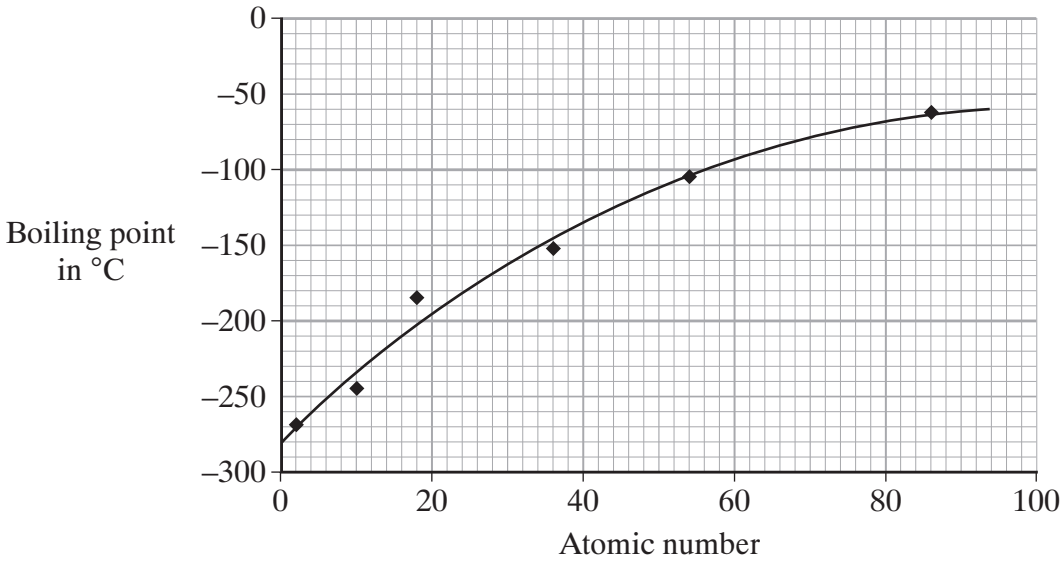
(4 marks)

7

Turn over for the next question

PATTERNS AND REACTIONS

3 The graph shows how the boiling points of the Group 0 elements are related to their atomic numbers.



Use the periodic table on the Data Sheet to help you to answer these questions.

(a) What is the state of radon at room temperature? ..... *(1 mark)*

(b) What is the boiling point of krypton? ..... °C *(1 mark)*

(c) Describe the trend in the boiling points of the Group 0 elements.

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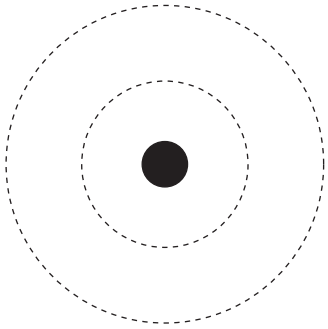
(2 marks)

(d) Use dots or crosses to complete the diagram of the electronic structure of a neon atom.



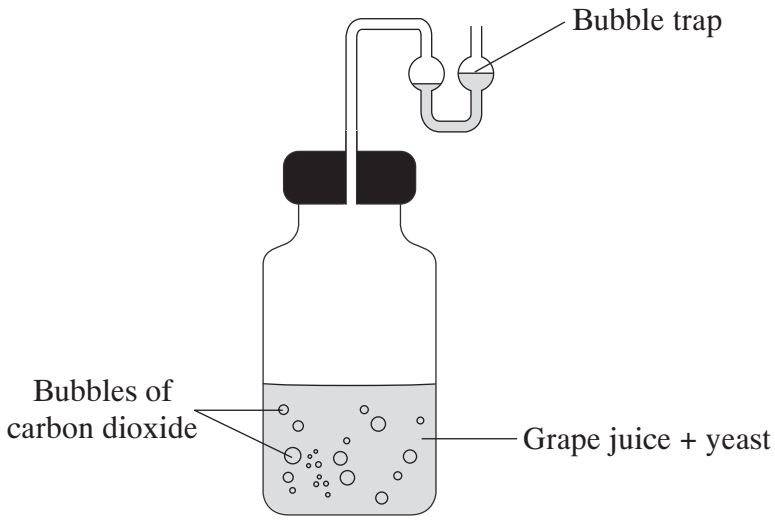
(2 marks)

6

Turn over for the next question

4 (a) The diagram shows how wine can be made at home by fermenting grape juice.

Grape juice contains sugar.



Write a word equation for fermentation

..... → ..... + ...

(2 marks)

(b) Name the type of enzyme used in industry to 'pre-digest' proteins in some baby foods.

.....

(1 mark)

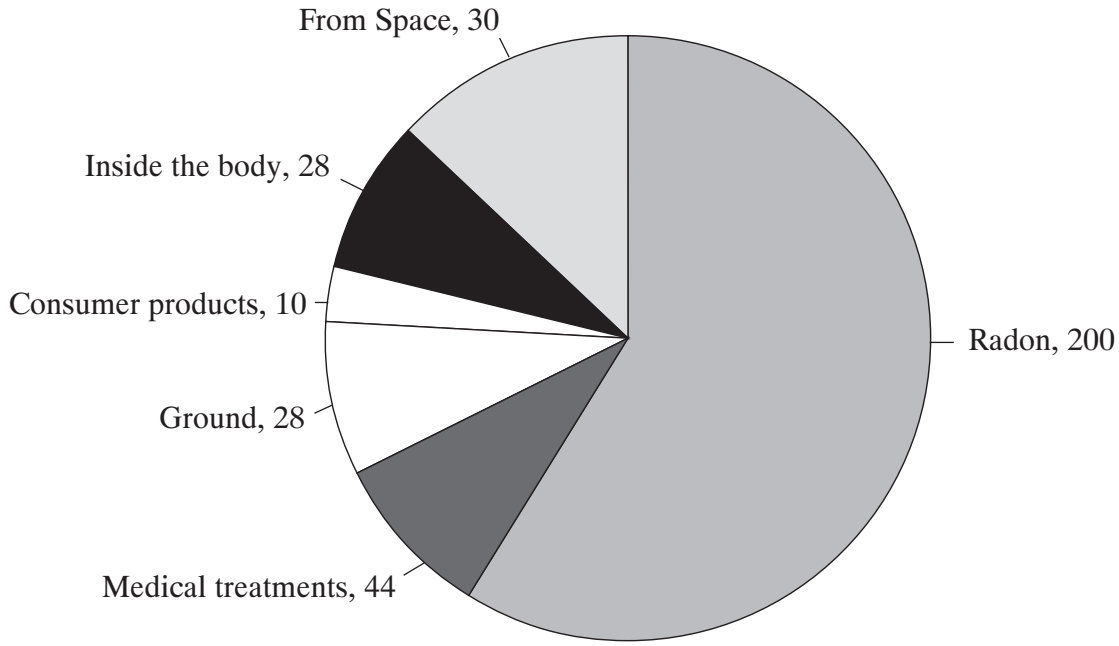
3

Turn over for the next question

FORCES, WAVES AND RADIATION

5 The pie chart shows the average amount of background radiation that a person receives each year.

Amount of background radiation in mrem per year



(a) Calculate the proportion of background radiation which comes from radon.

Show your working.

.....

.....

Proportion of radon ..... *(2 marks)*

(b) Name **three** types of radiation which may be emitted by radioactive sources.

..... and ..... and ..... *(1 mark)*

(c) Which type of radiation is the most dangerous when the radioactive source is **outside** the body?

.....

Why is this type of radiation the most dangerous?

.....

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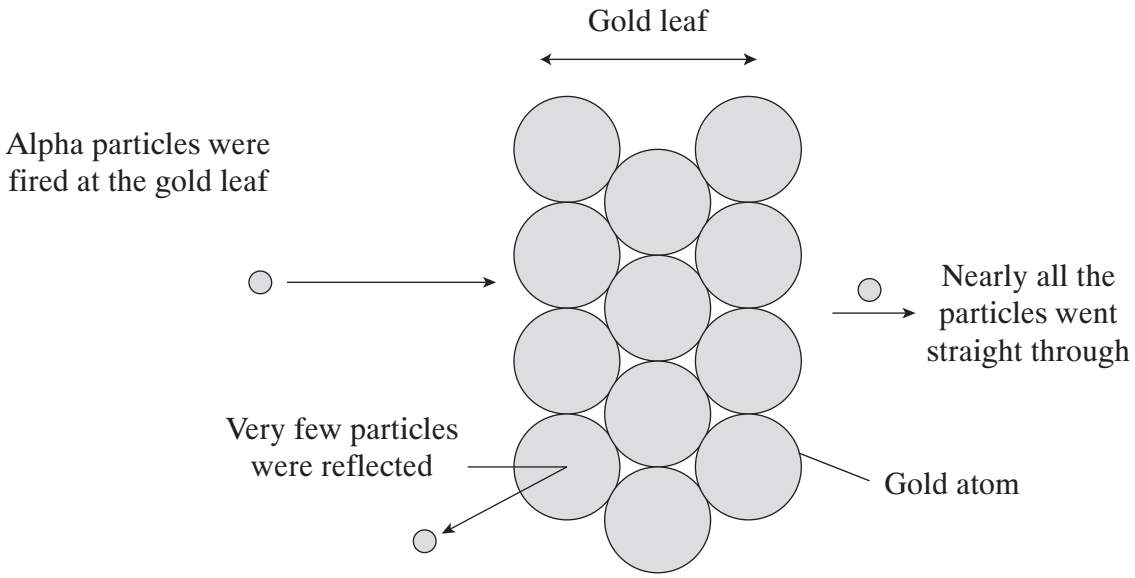
(2 marks)

5

Turn over for the next question

6 The diagram shows the results of an experiment carried out by a team of scientists led by Ernest Rutherford. They fired alpha particles at very thin pieces of gold leaf.



(a) Most of the alpha particles went straight through the atoms in the gold leaf.

What did this tell Rutherford about gold atoms?

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(1 mark)

(b) Alpha particles are positively charged. A few alpha particles were reflected by the atoms in the gold leaf.

Explain why.

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(1 mark)

(c) Many experiments since Rutherford's have given us more evidence about the structure of the atom.

Describe the structure of an atom.

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(3 marks)

5

Turn over for the next question

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

7 The table shows the mass of carbohydrate, fat and protein in five different foods, **A** to **E**.

	Mass in 100 g of food in g		
Food	**Carbohydrate**	**Fat**	**Protein**
A	0	1	20
B	50	12	8
C	0	42	0
D	12	1	0
E	20	0	2

(a) Calculate the mass of carbohydrate in a 40 g portion of food **E**.

Show your working.

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.....

Mass = ... g

(2 marks)

(b) Carbohydrates and proteins release about the same amount of energy in the body.

Fats release about twice as much energy as carbohydrates and proteins.

Which food, **B** or **C**, releases most energy in the body?

Food .....

Show your working.

.....

.....

(2 marks)

(c) Describe what happens to food in the small intestine.

You are **not** required to give the names of any enzymes.

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(3 marks)

7

Turn over for the next question

8 Useful products are obtained from crude oil.

(a) Describe how crude oil is separated into different fractions by fractional distillation.

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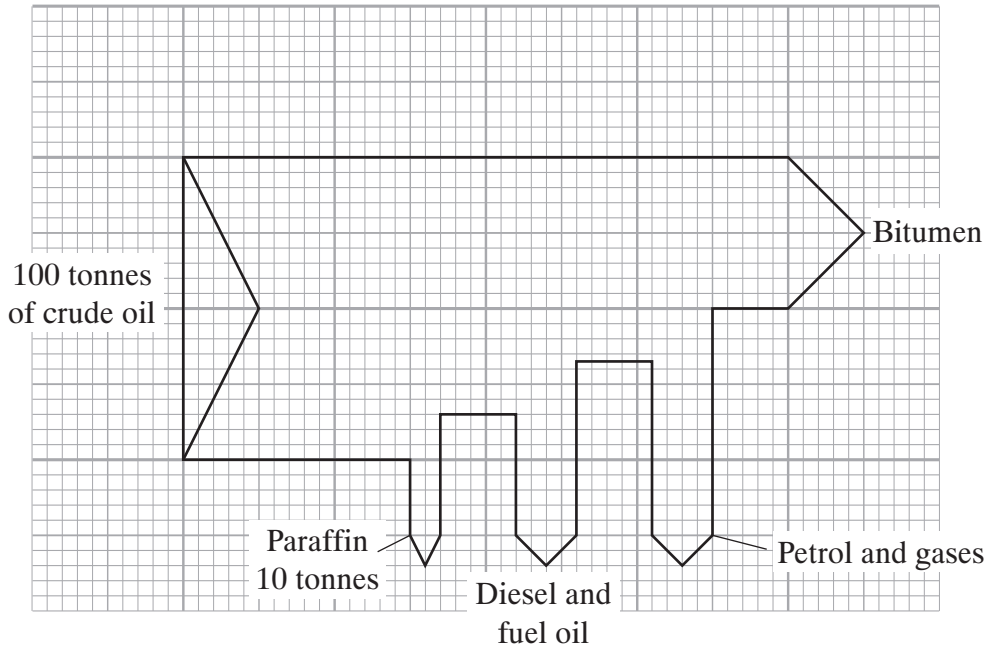
(3 marks)

(b) The diagram shows the percentages of different fractions produced from crude oil.



How many tonnes of **each** of the following would be obtained from 100 tonnes of crude oil?

(i) Diesel and fuel oil

..... tonnes

(ii) Bitumen

..... tonnes

(2 marks)

5

LEAVE MARGIN BLANK

ENVIRONMENT, INHERITANCE AND SELECTION

9 In many parts of the world, forests are being cut down and burned.

Explain, as fully as you can, why this may be contributing to the greenhouse effect.

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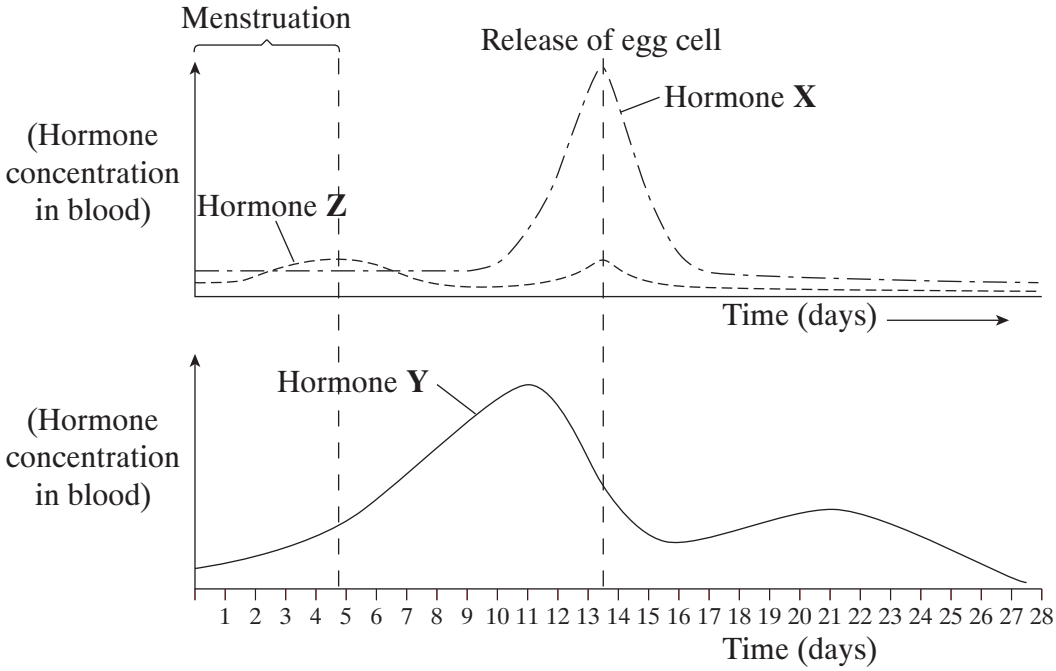
(4 marks)

4

Turn over for the next question

10 The human menstrual cycle is controlled by hormones.

(a) The graph shows how different hormone levels vary in the menstrual cycle.



Which of the hormones, **X**, **Y** or **Z**, is:

(i) FSH; .....

(ii) LH; .....

(iii) oestrogen? .....

(2 marks)

(b) Explain how hormones can be used to help women who find it difficult to become pregnant.

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(2 marks)

(c) Contraceptive pills work in different ways. 'Morning-after pills' are designed to prevent pregnancy in women who have had unprotected sex. One type of 'morning-after pill' stops fertilised eggs from embedding in the lining of the womb and developing into an embryo.

(i) Explain how the action of a contraceptive pill differs from the action of this type of 'morning-after pill'.

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(2 marks)

(ii) Many groups of people are opposed to the use of this type of 'morning-after pill'.

Explain why some people might hold this view.

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(2 marks)

8

Turn over for the next question

PATTERNS AND REACTIONS

11 Fluorine and chlorine are both in Group 7 of the periodic table.

Use the periodic table on the Data Sheet to help you to answer these questions.

(a) Explain, as fully as you can, why fluorine is more reactive than chlorine.

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(2 marks)

(b) Fluorine does not react with helium, neon or argon.

(i) Explain why fluorine does not react with helium.

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(2 marks)

(ii) Fluorine reacts with xenon.

Do you think that fluorine will react with radon?

Explain the reason for your answer.

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(2 marks)

6

12 Increasing the temperature speeds up the rate of chemical reactions.

(a) Give **three other** ways of increasing the rate of chemical reactions.

1 .....

2 .....

3 .....

(3 marks)

(b) Explain, in terms of particles, why increasing the temperature increases the rate of a chemical reaction.

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(2 marks)

(c) Explain what is meant by *activation energy*.

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(1 mark)

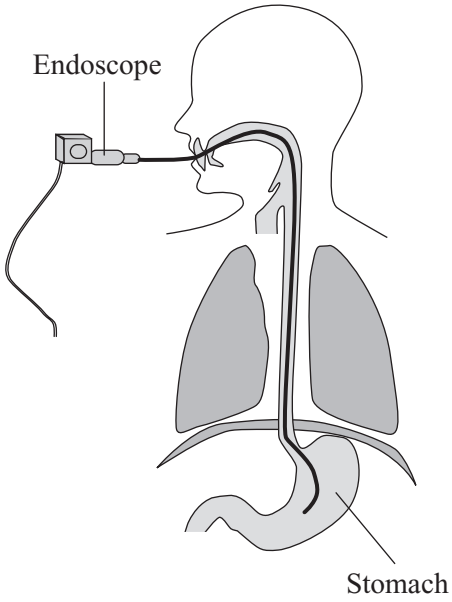
6

Turn over for the next question

There are no questions printed on this page

FORCES, WAVES AND RADIATION

13 The diagram shows an endoscope being used to observe the inside of a patient's stomach.



Light passes from the endoscope to the stomach along optical fibres.

Explain, as fully as you can, why light passes along optical fibres.

To gain full marks for 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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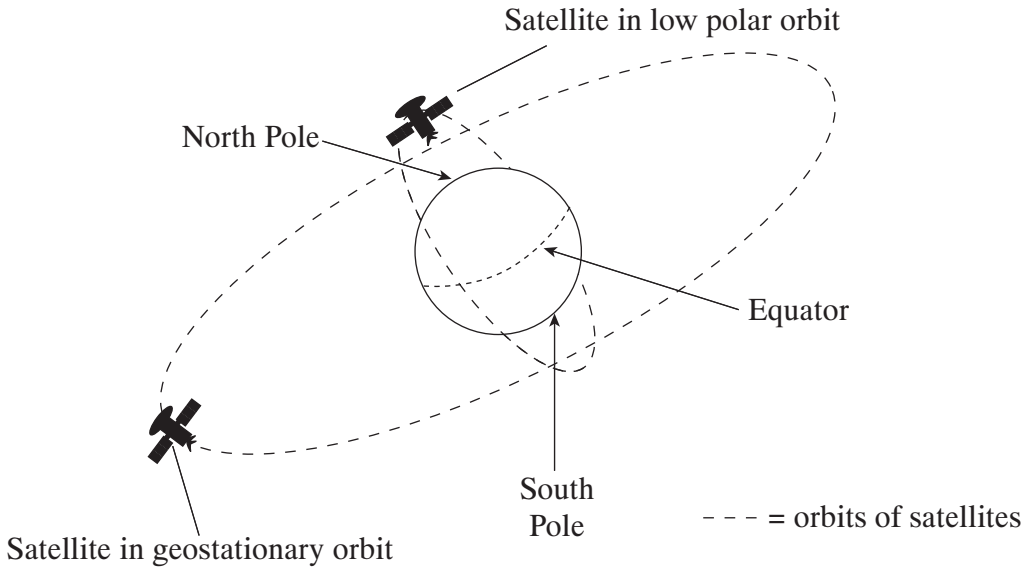
(4 marks)

4

14 (a) The diagram shows the orbits of two different artificial satellites.



(i) Explain why satellites stay in orbit.

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(2 marks)

(ii) To an observer on Earth, geostationary satellites appear to stay in one position.

Explain why this is so.

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(1 mark)

(iii) Explain why monitoring satellites are put into low polar orbits.

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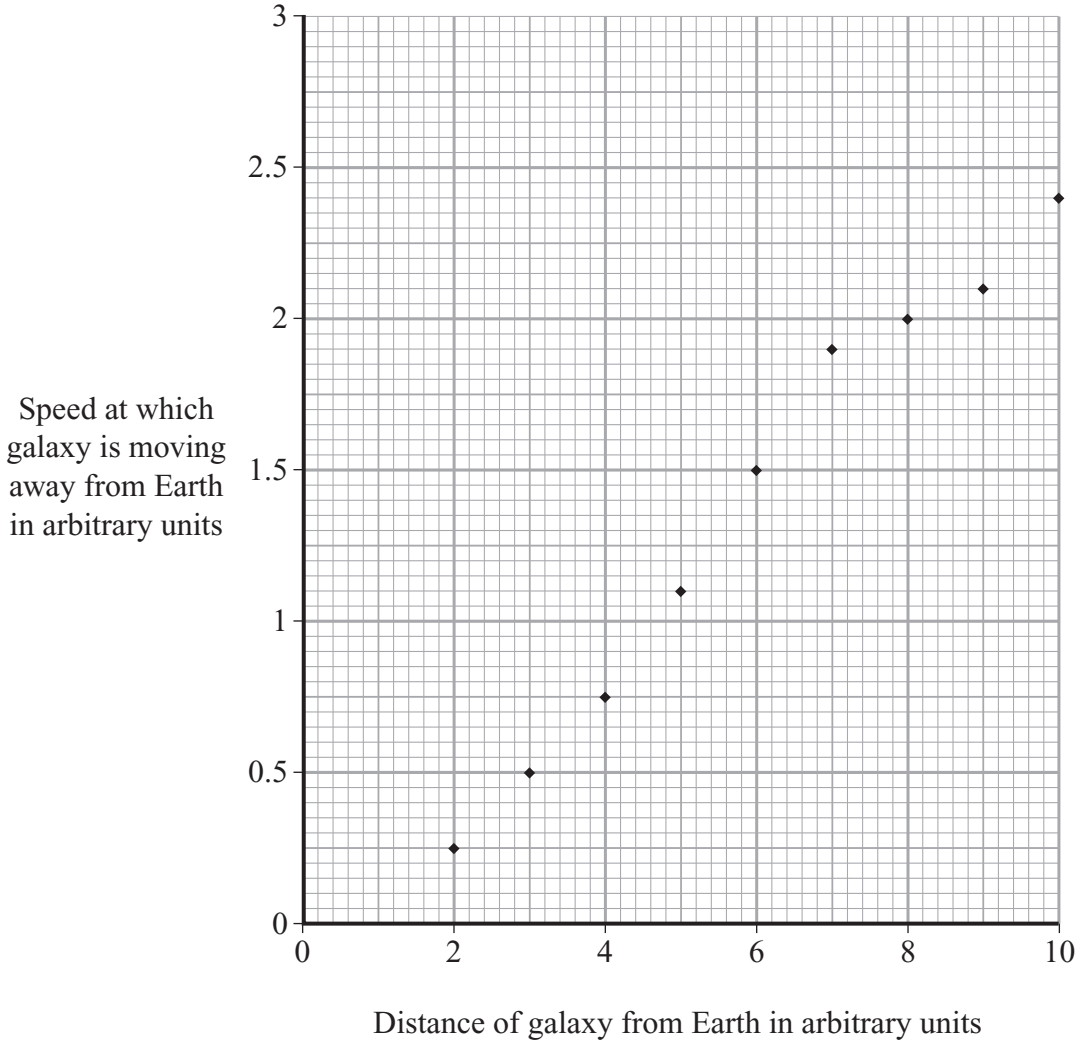
(2 marks)

(b) The graph shows the information about some galaxies. The data are in arbitrary units.



(i) Describe the relationship between the speed at which a galaxy is moving away from Earth and its distance from Earth.

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(1 mark)

(ii) What do the data from the graph suggest about the whole Universe?

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(2 marks)

8

Turn over ▶

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

15 The table shows data on the functioning of the kidney.

Substance	Percentage concentration of substance		
	In blood plasma	In liquid immediately after filtration	In urine
Protein	7.0	0	0
Ions	0.35	0.35	0.5
Glucose	0.1	0.1	0
Urea	0.03	0.03	2.0

Use information from the table to answer these questions.

(a) Describe, in as much detail as you can, what happens to each of the following as blood flows through the kidney.

(i) Glucose

.....

.....

.....

.....

(2 marks)

(ii) Ions

.....

.....

.....

.....

(2 marks)

(iii) Protein

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.....

(1 mark)

(b) Explain why the concentration of urea is higher in the urine than in blood plasma.

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(1 mark)

(c) Describe the effect of an increase in ADH secretion on the production of urine.

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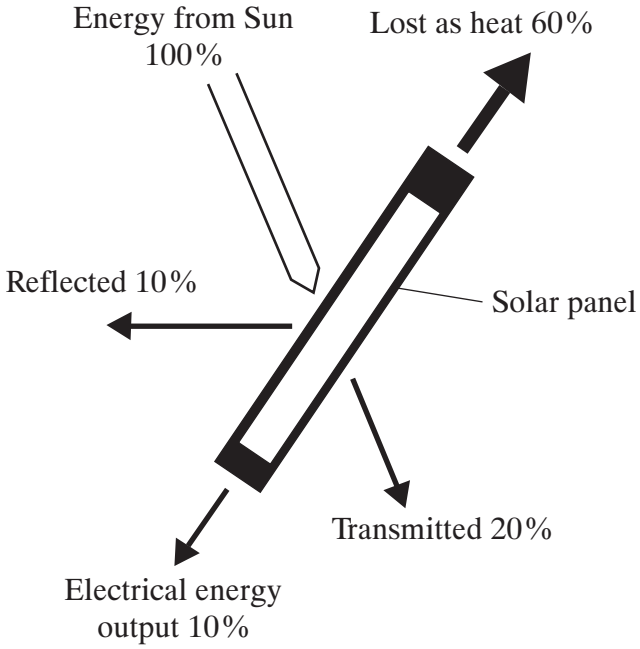
(2 marks)

8

Turn over for the next question

16 The solar panel in the diagram converts light energy from the Sun into electrical energy.

The diagram shows what happens to the energy falling on the solar panel.



(a) (i) What is the efficiency of the solar panel? ..... % *(1 mark)*

(ii) Calculate the electrical output of the panel when the input power is 3000 W.

.....

Output ..... W
(1 mark)

(b) What type of radiation will be emitted as heat by the solar panel?

.....
(1 mark)

(c) What happens to the energy which is lost from the solar panel as heat?

.....

.....
(1 mark)

4

END OF QUESTIONS