Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

Leave blank

General Certificate of Secondary Education
June 2003

SCIENCE: SINGLE AWARD (MODULAR) 3469/H
HIGHER TIER

ASSESSMENT and QUALIFICATIONS ALLIANCE

Monday 2 June 2003 1.30 pm to 3.00 pm

H

In addition to this paper you will require:
- 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 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.
- Mark allocations 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		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

LEAVE MARGIN BLANK

ENVIRONMENT, INHERITANCE AND SELECTION

1 The monthly cycle of women is controlled by hormones.

(a) Name the **two** glands that secrete these hormones.

1 .....

2 .....

(2 marks)

(b) Describe **two** ways in which fertility in women can be controlled by giving hormones.

1 .....

.....

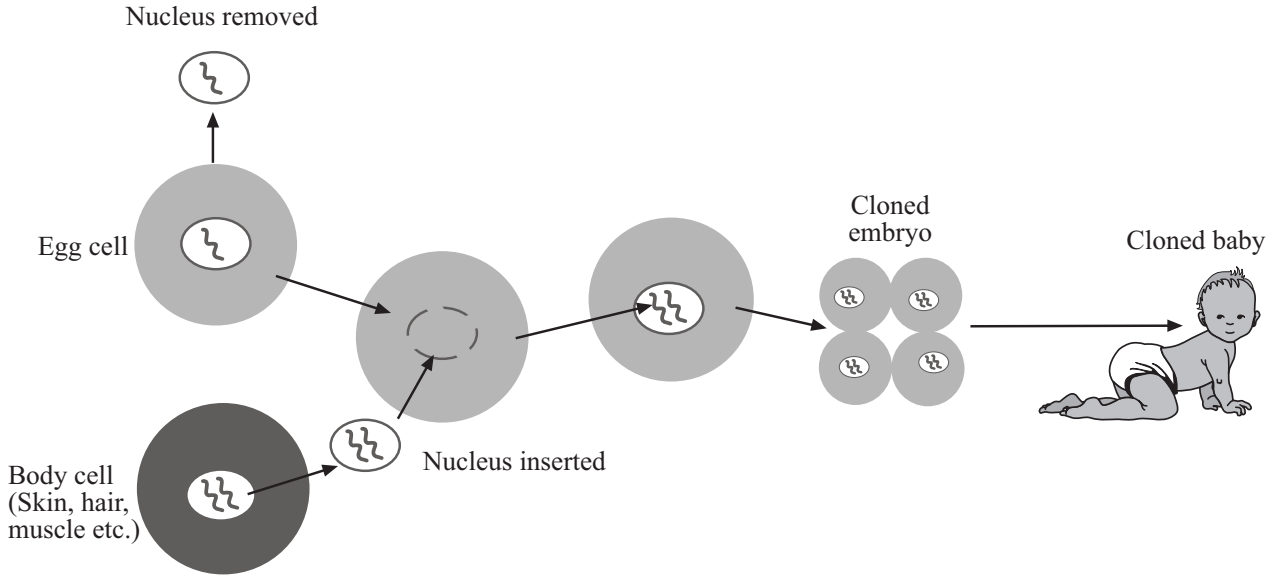
2 .....

.....

(2 marks)

4

2 It is now possible to clone humans. The diagram shows one way in which this can be done.



(a) What type of reproduction is this?

.....

(1 mark)

(b) Will the baby have the characteristics of the egg cell or the body cell?

.....

Explain the reason for your answer.

.....

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.....

.....

(2 marks)

(c) The procedure in the diagram could be used to produce several cloned embryos.

Suggest how this might be done.

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(1 mark)

4

3 The concentration of carbon dioxide in the Earth's atmosphere is rising.

(a) Explain, as fully as you can, why this is happening.

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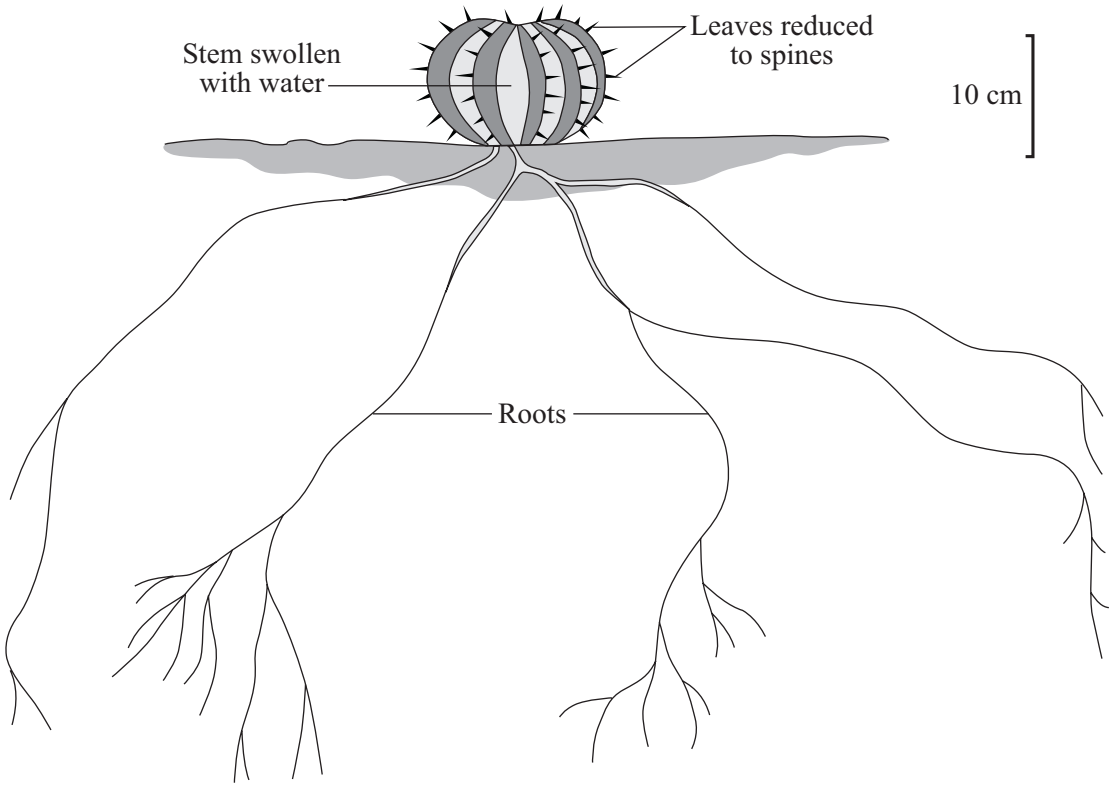
(3 marks)

(b) The rise in carbon dioxide concentration may cause more of the Earth's surface to become desert.

The drawing shows a plant that is adapted to life in a hot, dry desert.



Suggest **two** ways in which the structure of the plant helps it to survive in a hot, dry desert.

1 .....

.....

2 .....

.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

PATTERNS AND REACTIONS

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

The table below gives the electronic structures of four elements, **W**, **X**, **Y** and **Z**.

Element	Electronic structure
W	2,5
X	2,7
Y	2,8,8
Z	2,8,8,1

(a) Which element **W**, **X**, **Y** or **Z**:

(i) is a Group 0 gas? .....

(ii) is nitrogen? .....

(iii) is a Group 7 gas? .....

(iv) reacts violently with water? .....

(3 marks)

(b) Which **two** groups of the periodic table do **not** contain any non-metals?

.....

(1 mark)

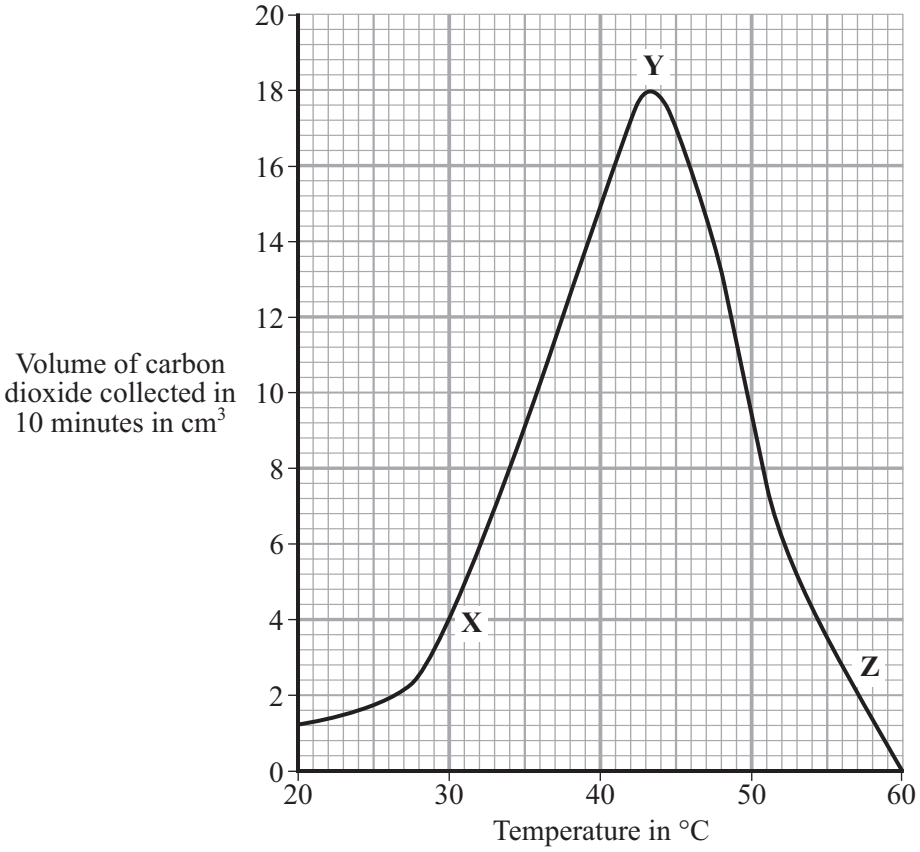
4

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

5 Fermentation of sugar by yeast produces carbon dioxide.

The graph shows the effect of temperature on the production of carbon dioxide by fermentation.



(a) By how much did the volume of carbon dioxide collected change when the temperature was raised from 30 ºC to 40 ºC?

.....cm^3

(1 mark)

(b) Complete the sentences to explain the shape of the curve between **X** and **Y**.

Raising the temperature ..... the speed of the reacting particles.

These particles collide more ..... and more ..... .

(3 marks)

(c) The rate of the reaction decreases between **Y** and **Z**.

Suggest **one** reason for this.

.....

.....

(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

FORCES, WAVES AND RADIATION

6 (a) Complete the sentence about the orbits of planets.

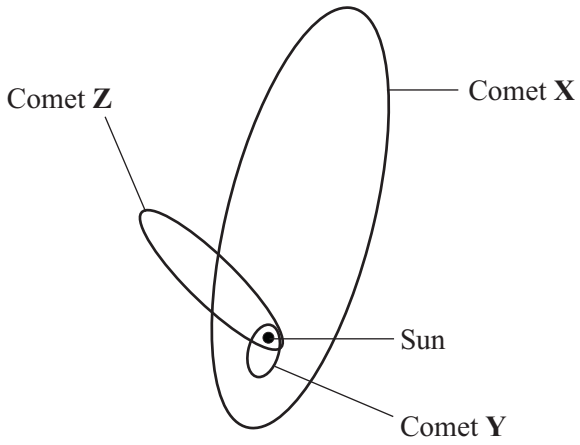
The orbits of planets are ..... shaped, with the ..... at the centre.

(2 marks)

(b) The table gives the time taken for three different comets to orbit the Sun.

Comet	**Time taken to orbit the Sun in years**
Encke	3.5
Nenjmin	18
Tempel-tuttle	30

The diagram shows the orbits of the three comets.



Use information from the table to identify the three comets.

X .....

Y .....

Z .....

(2 marks)

(c) Some scientists are searching for extra-terrestrial intelligence (SETI).

Describe how they are doing this.

.....

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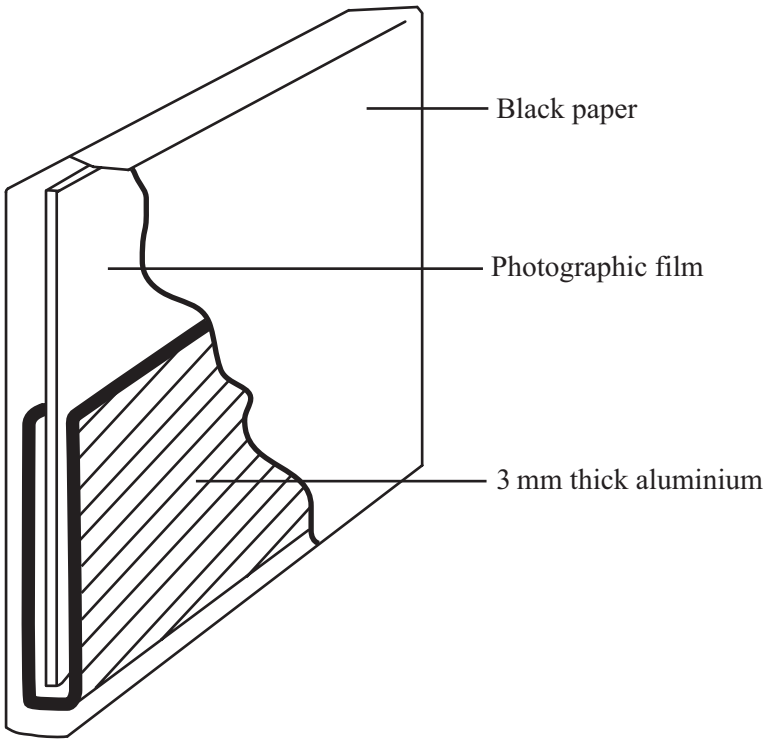
(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

7 The diagram shows a badge worn by a worker at a nuclear power station.

Part of the outer black paper has been removed so that you can see the inside of the badge.



Scientists examined the worker's badge at the end of a day's work.

They found that the top part of the badge had been affected by radiation, but the bottom half had not.

What type of radiation had the worker been exposed to? Explain the reasons for your answer.

.....

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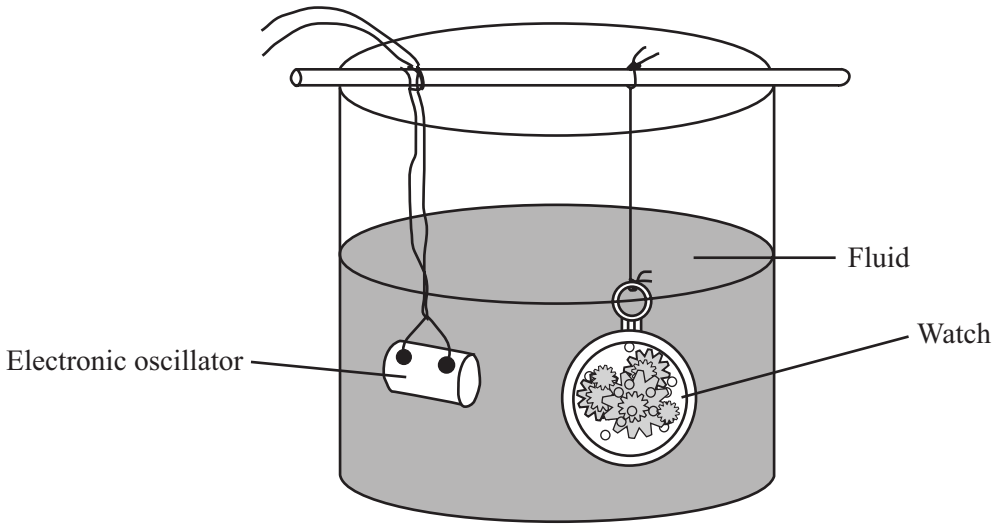
(2 marks)

2

8 The diagram shows how ultrasonic waves can be used to clean a watch.



Suggest how this method cleans the watch.

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(2 marks)

2

TURN OVER FOR THE NEXT QUESTION

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

9 The table shows the composition of blood entering and leaving the lungs.

Gas	Concentration in arbitrary units	
	Blood entering lungs	**Blood leaving lungs**
Oxygen	40	100
Carbon dioxide	46	40

(a) Describe, in as much detail as you can, the changes that take place in the composition of blood as it passes through the lungs.

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.....

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.....

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.....

(3 marks)

(b) Which part of the blood:

(i) transports most carbon dioxide; .....

(ii) transports most oxygen? .....

(2 marks)

5

NO QUESTIONS APPEAR ON THIS PAGE

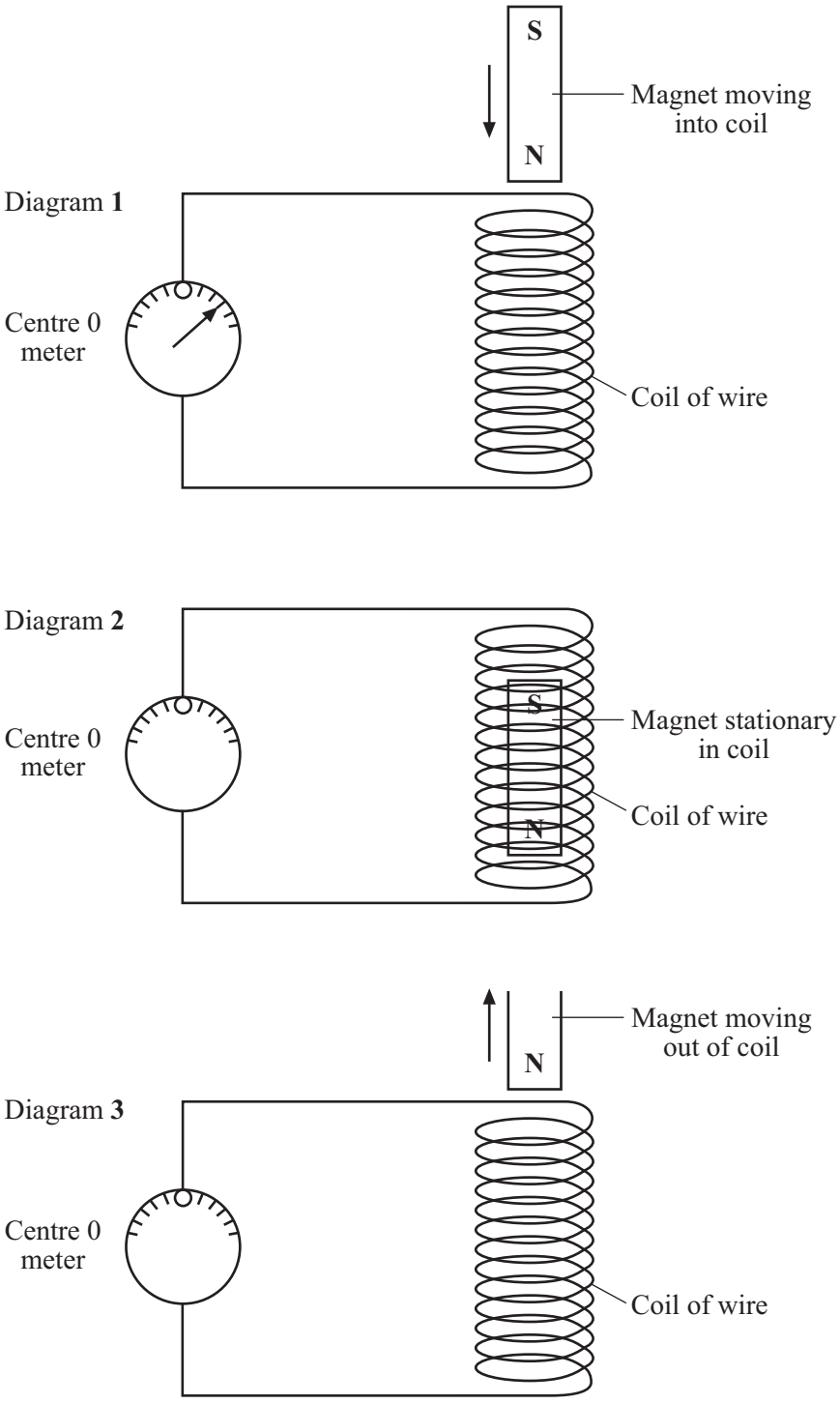
TURN OVER FOR THE NEXT QUESTION

10

- Diagram **1** shows a magnet being moved into a coil.
- Diagram **2** shows a magnet stationary in a coil.
- Diagram **3** shows a magnet being moved out of a coil.

The meter looks like this when no current is flowing.

(a) The position of the meter pointer has been drawn on diagram **1**.
Draw the positions of the meter pointer on diagrams **2** and **3**.



(2 marks)

(b) Bicycle dynamos generate electricity by rotating a magnet inside a coil of wire.

Give **two** ways of increasing the voltage produced by this kind of generator.

1 .....

2 .....

(2 marks)

4

TURN OVER FOR THE NEXT QUESTION

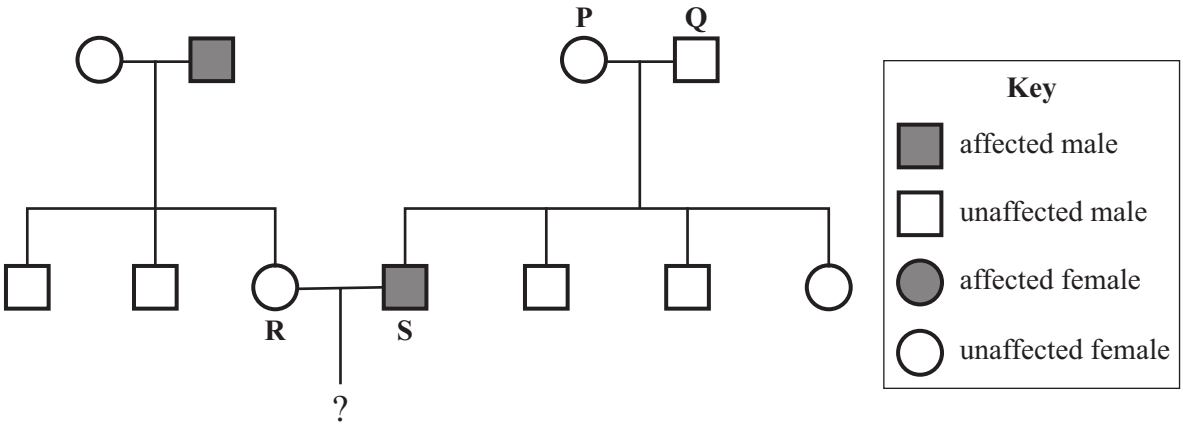
ENVIRONMENT, INHERITANCE AND SELECTION

11 The black pigment in human skin and eyes is called melanin.

A single gene controls the production of melanin.

A person who is homozygous for the recessive allele of the gene has no melanin and is said to be albino.

The diagram shows the inheritance of albinism in a family.



(a) Use a genetic diagram to explain the inheritance of the albino allele by children of parents **P** and **Q**.

(3 marks)

(b) **R** and **S** decide to have a child.

What is the chance that this child will be an albino? .....

Use a genetic diagram to explain your answer.

(3 marks)

6

TURN OVER FOR THE NEXT QUESTION

12 A scientist called Lamarck proposed a theory of evolution. The passage gives Lamarck's explanation of the evolution of the long legs of wading birds.

Change occurs because an animal passes on to its offspring changes it acquires during its lifetime. The long legs of wading birds arose when those animals' ancestors responded to a need to feed on fish. In their attempt to get into deeper water, but still keep their bodies dry, they would stretch their legs to the full extent, making them slightly longer in the process. This trait would be passed on to the next generation, who would in turn stretch their legs. Over many generations, the wading birds' legs became much longer.

Darwin's theory of natural selection would give a different explanation for the evolution of the long legs of wading birds.

Describe the differences between Lamarck's and Darwin's explanations of the evolution of the long legs of wading birds.

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(4 marks)

4

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

PATTERNS AND REACTIONS

13 Isomerase is an enzyme that converts glucose into fructose.

In industry the reaction is carried out using immobilised isomerase.

(a) Give **one** way in which isomerase could be immobilised.

.....

.....

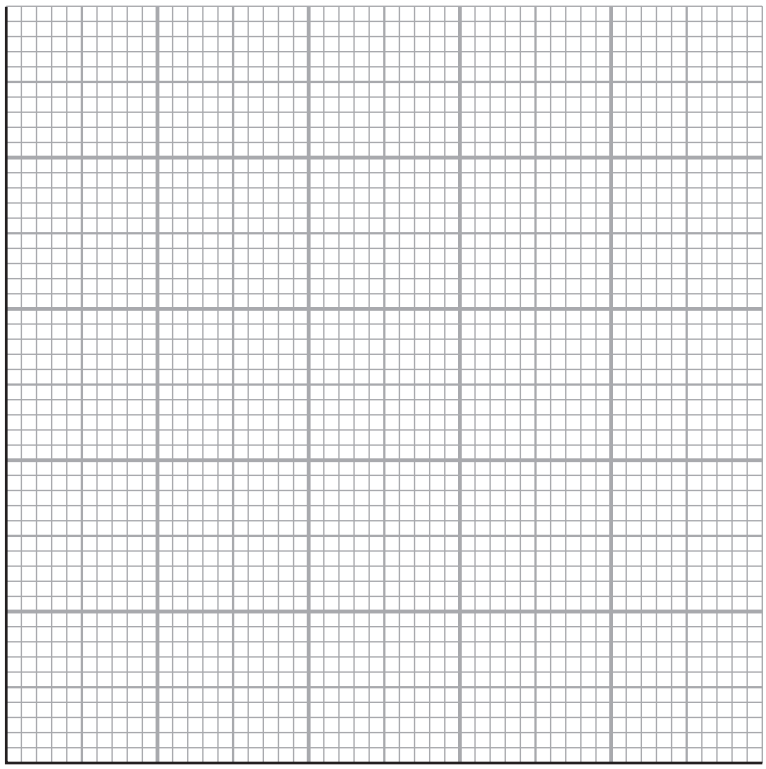
(1 mark)

The table shows the effect of temperature on immobilised isomerase and isomerase in solution.

Temperature in ºC	**Rate of reaction in arbitrary units**	
	Isomerase in solution	**Immobilised isomerase**
30	100	100
40	100	100
50	90	100
60	78	90
70	35	78
80	10	50

(b) Plot the data on the grid below.

Rate of reaction in arbitrary units



Temperature in ºC

(4 marks)

(c) (i) Compare the effect of temperature on the rates of reaction of immobilised isomerase and isomerase in solution.

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(3 marks)

(ii) Give **one** other advantage of using immobilised enzymes in industry.

.....

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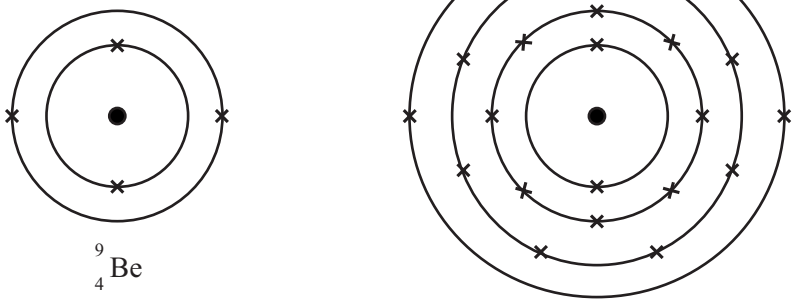
(1 mark)

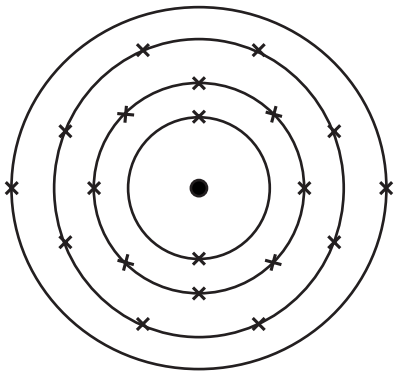
9

14 Beryllium and calcium are metals in Group 2 of the periodic table.

The diagrams show their electronic structures.



$^{9}_{4}Be$



$^{40}_{20}Ca$

(a) Why do beryllium and calcium have similar chemical properties?

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(1 mark)

(b) Calcium is more reactive then beryllium.

Suggest an explanation for this in terms of the electronic structure of the two elements.

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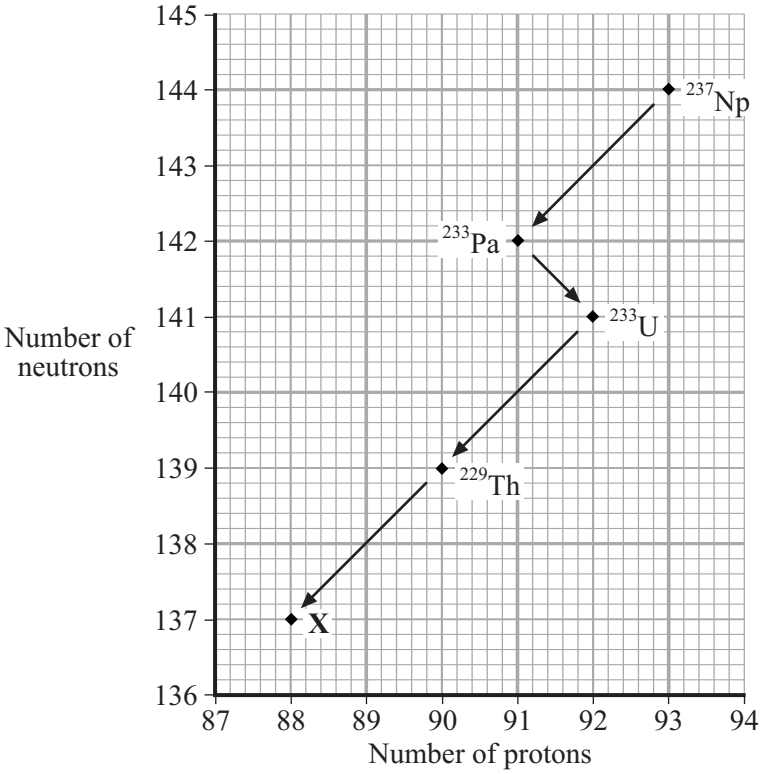
(2 marks)

3

FORCES, WAVES AND RADIATION

15 Neptunium-237 (^{237}Np) is a radioactive element. The graph shows the numbers of neutrons and protons in the nuclei of the elements formed when ^{237}Np decays.



(a) Use the periodic table on the Data Sheet to identify element **X**.

.....

(1 mark)

(b) Why are ^{233}Pa and ^{233}U considered to be different elements?

.....

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(1 mark)

(c) What type of radiation is released when ^{237}Np decays to form ^{233}Pa?

.....

(1 mark)

(d) What change takes place in the nucleus when ^{233}Pa changes into ^{233}U?

.....

(1 mark)

4

Turn over ▶

16 If you were to look inside a mobile phone you would find it contains only a few individual parts: a circuit board (the brains of the phone), antenna, keyboard, battery, microphone, speaker and an LCD (liquid crystal display). The circuit board is made up of individual chips. The most important of these is an analogue-to-digital and digital-to-analogue chip. This translates the outgoing signal into digital form, and the incoming digital signal back into analogue form.

(a) Explain why the mobile phone needs the analogue-to-digital and digital-to-analogue chip.

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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(3 marks)

(b) Over long distances, the quality of a digital signal is maintained much better than that of an analogue signal. Explain why.

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(2 marks)

5

17 Studying stars gives scientists evidence about the evolution of the Universe.

(a) (i) In astronomy, what is meant by a black hole?

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(2 marks)

(ii) How is it possible to detect a black hole?

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(2 marks)

(b) The changes which happen in stars result in new elements being formed.

Nuclei of the heaviest elements are found in the Sun.

Describe how these nuclei are formed.

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(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

18 (a) Explain how sweating helps to keep our body temperature relatively constant.

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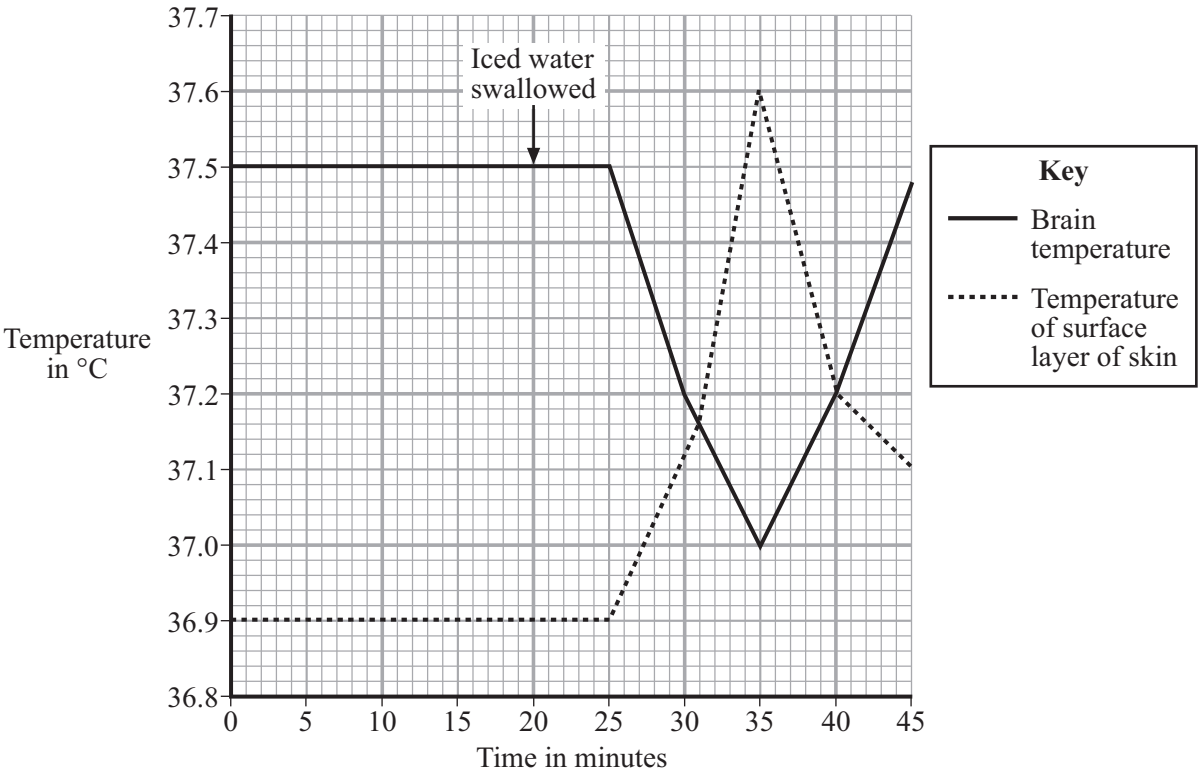
(2 marks)

(b) In an experiment, a student swallowed some iced water. The graph shows how this affected the student's skin temperature and brain temperature.



(i) Explain why the temperature of the brain changed after the student swallowed the iced water.

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(2 marks)

(ii) This change in brain temperature led to a change in the temperature of the surface layer of the skin.

Explain how this happened.

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(3 marks)

7

TURN OVER FOR THE NEXT QUESTION

19 The table gives information about some methods of conserving energy in a house.

Conservation method	Installation cost in £	Annual saving on energy bills in £
Cavity wall insulation	500	60
Hot water tank jacket	10	15
Loft insulation	110	60
Thermostatic radiator valves	75	20

(a) Explain which of the methods in the table is the most cost effective way of saving energy over a 10 year period. To obtain full marks you must support your answer with calculations.

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(3 marks)

(b) Describe what happens to the energy which is 'wasted' in a house.

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(2 marks)

5

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE