

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

Leave blank

General Certificate of Secondary Education
June 2003



**SCIENCE: DOUBLE AWARD (MODULAR)
HIGHER TIER
Paper 1**

3468/1H

H

Monday 2 June 2003 1.30 pm to 3.00 pm

In addition to this paper you will require:

- the Data Sheet (enclosed);
- a ruler.

You may use a calculator.

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		20	
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

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.

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

.....

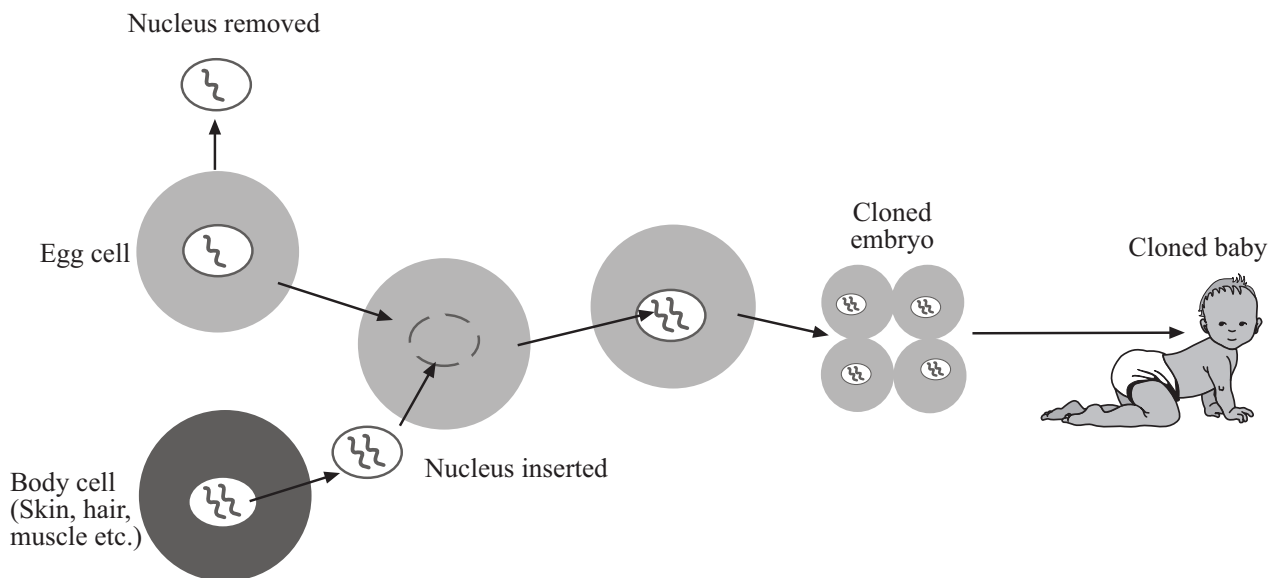
2

.....

(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.

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

(2 marks)

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

Suggest how this might be done.

.....
.....

(1 mark)

3 Read the passage about antibiotics.

People do not always agree about the use of antibiotics in food production.

If we put low doses of antibiotics in feed for animals such as cattle and sheep, it helps to produce high-quality, low-cost food. Antibiotics help to keep animals disease-free. They also help animals to grow. Animals get fatter quicker because they do not waste energy trying to overcome illness.

The use of antibiotics in livestock feed means that there is a higher risk of antibiotic-resistant bacteria developing. The rapid reproduction of bacteria means there is always a chance that a population of bacteria will develop which is antibiotic-resistant. These could be dangerous to human health.

- (a) *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.*

Explain how a population of antibiotic-resistant bacteria might develop from non-resistant bacteria.

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

(3 marks)

- (b) Do you think that farmers should be allowed to put low doses of antibiotics in animal feed?

Explain the reasons for your answer.

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

(2 marks)



STRUCTURES AND BONDING

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)

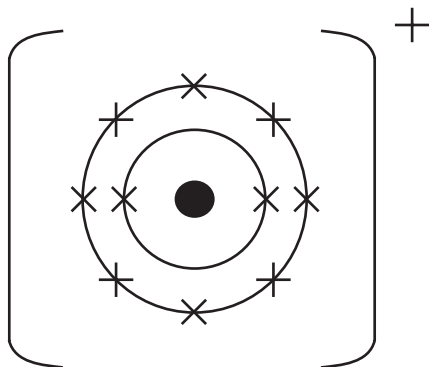
4

TURN OVER FOR THE NEXT QUESTION

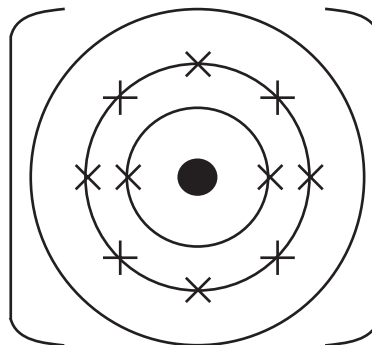
Turn over ►

- 5 (a) Sodium chloride is an ionic compound.

This is a diagram of a sodium ion.



Complete this diagram of a chloride ion.

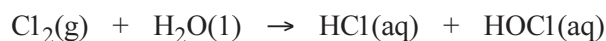


(2 marks)

- (b) The electrolysis of sodium chloride produces chlorine.

Chlorine is used to produce bleach (HOCl).

This equation represents the reaction.



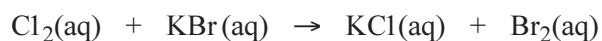
Give the meaning of the state symbols (l) and (aq).

(l)

(aq).....

(2 marks)

- (c) The equation below represents the reaction between chlorine and potassium bromide.



- (i) Balance this equation. (1 mark)

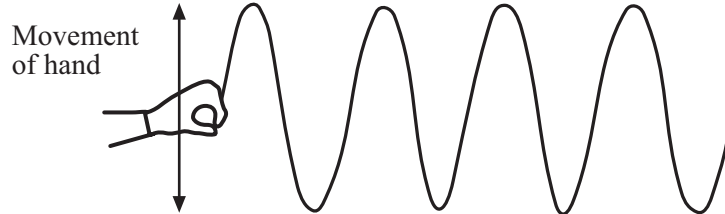
- (ii) Why does chlorine displace bromine from potassium bromide solution?

.....
.....

(1 mark)

WAVES AND RADIATION

- 6 The diagram shows a wave travelling along a rope.



- (a) On the diagram:
- show the wavelength and label it **W**;
 - show the amplitude and label it **A**.

(2 marks)

- (b) The wavelength of the wave is 0.1 m. Its frequency is 2 Hz.

Calculate the speed of the wave. Show clearly how you work out your answer and give the unit.

.....

.....

.....

Speed of wave

(3 marks)

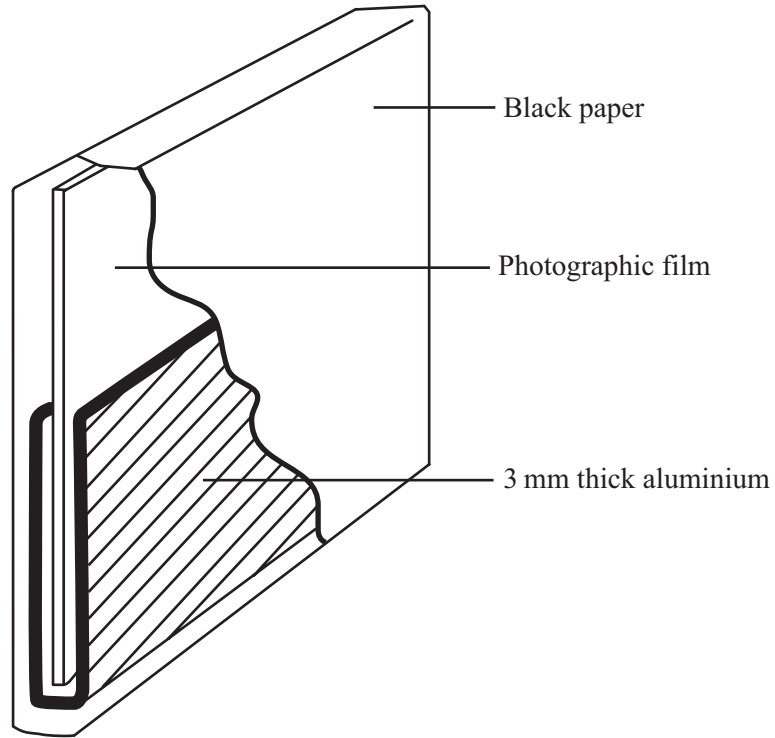
5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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.

.....

.....

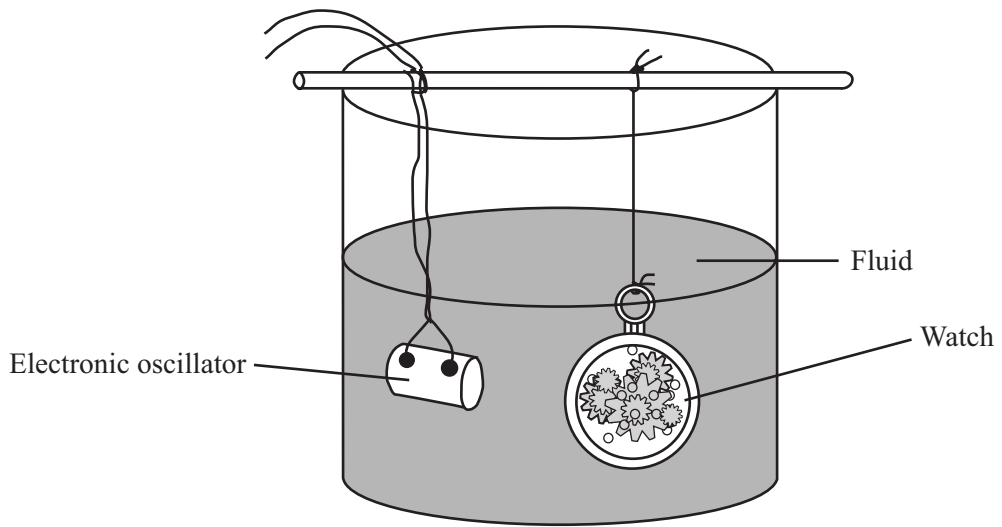
.....

.....

(2 marks)

2

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



Suggest how this method cleans the watch.

.....

.....

.....

.....

(2 marks)

2

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

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.

.....

.....

.....

.....

.....

.....

(3 marks)

(b) Which part of the blood:

(i) transports most carbon dioxide;

(ii) transports most oxygen?

(2 marks)

10 Use the Formulae of Some Common Ions table on the Data Sheet to help you to answer this question.

Acids react with alkalis to form salts and water.

Complete the table below by writing in the name and formula of the salt formed in each reaction.

The first one has been done for you.

Acid	Alkali	Salt	Formula of salt
Hydrochloric acid	Sodium hydroxide	Sodium chloride	NaCl
Nitric acid	Sodium hydroxide		
Sulphuric acid	Potassium hydroxide		

(4 marks)

4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

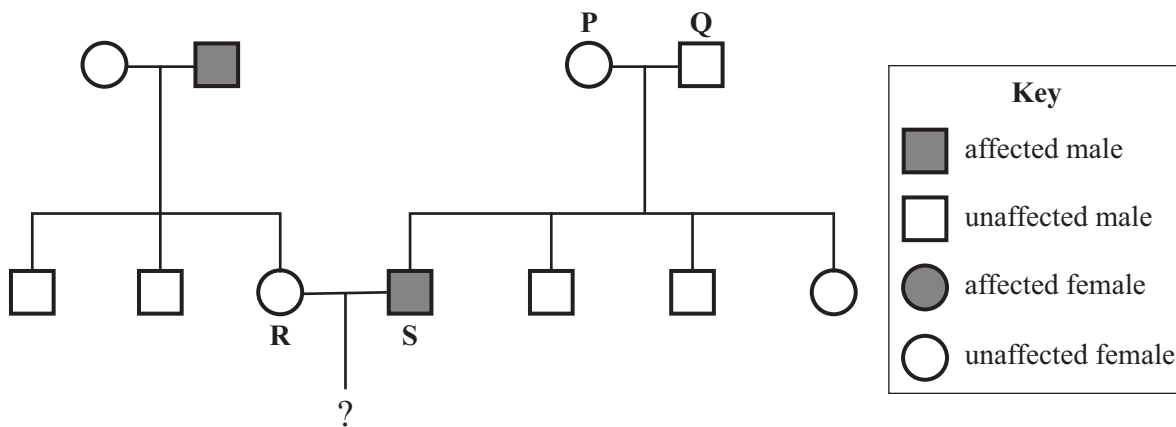
INHERITANCE AND SELECTION

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)

$\frac{\quad}{6}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

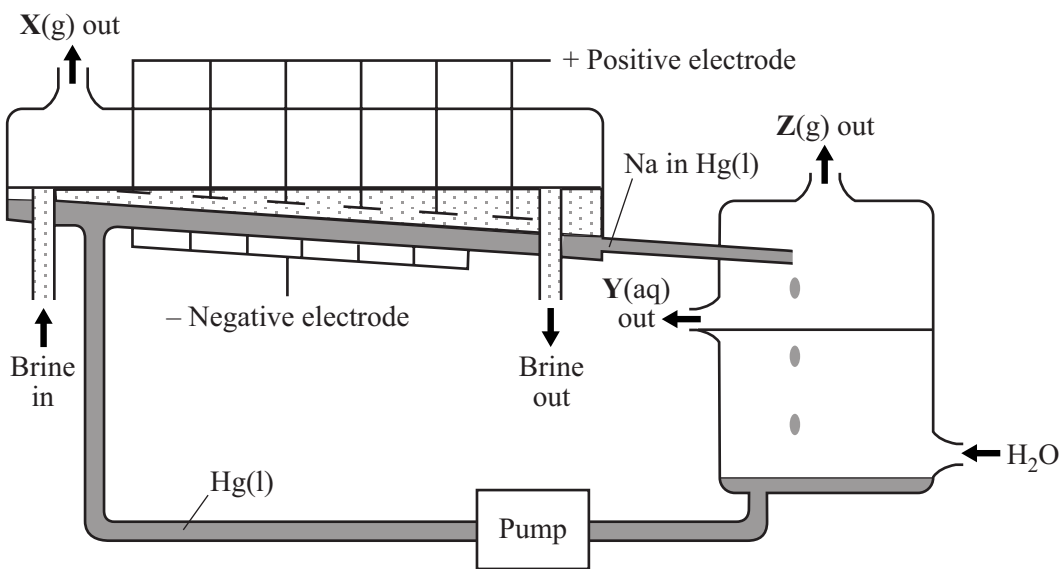
(4 marks)



STRUCTURES AND BONDING

- 13 The diagram shows the equipment used in one industrial method of electrolyising brine.

At the negative electrode sodium ions become sodium atoms. The sodium dissolves in mercury (Hg) forming sodium/mercury amalgam. This amalgam is mixed with distilled water. The sodium then reacts with water.



- (a) Three products X, Y and Z, are shown in the diagram.

Name these products.

X

Y

Z

(3 marks)

- (b) Write a balanced symbol equation for the reaction between sodium and water.

State symbols are **not** required.

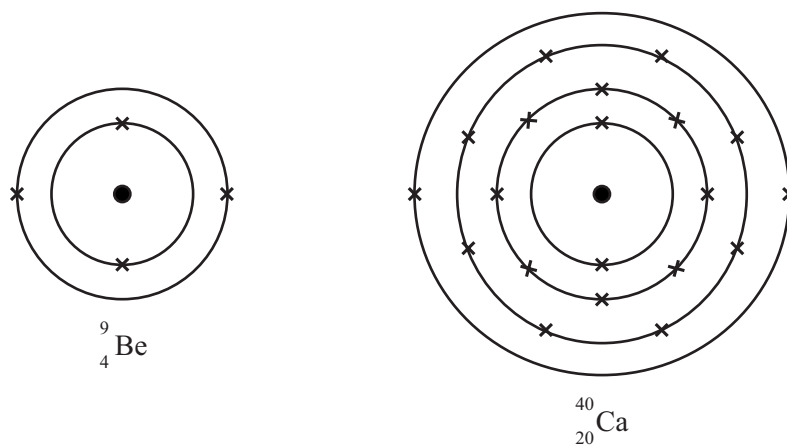
.....
(3 marks)

6

Turn over ►

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

The diagrams show their electronic structures.



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

.....

.....

.....

.....

(1 mark)

(b) Calcium is more reactive than beryllium.

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

.....

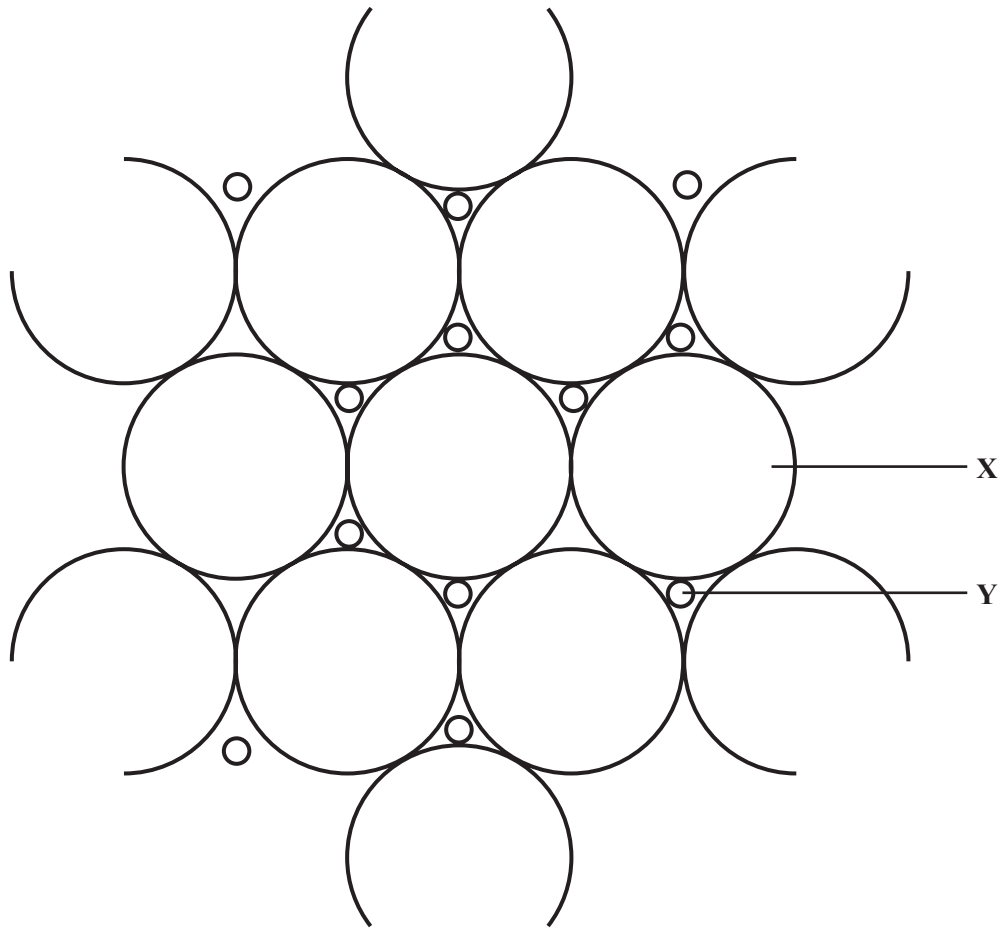
.....

.....

.....

(2 marks)

15 The diagram shows a model of part of the giant lattice of a metal.



(a) Name particles X and Y.

X

Y

(2 marks)

(b) Explain, in terms of the giant structure above, why it is possible to bend a piece of metal.

.....

.....

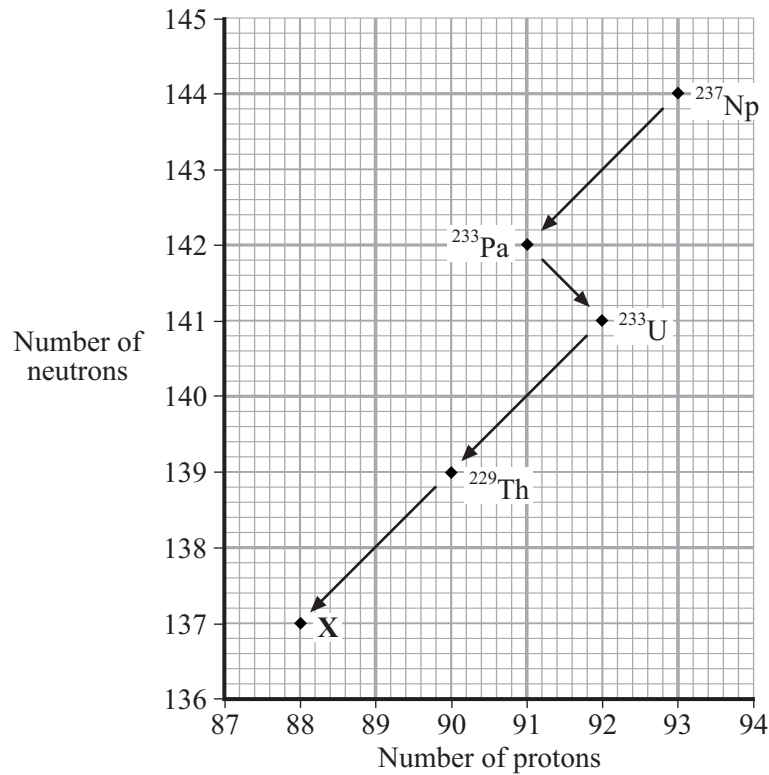
.....

.....

(2 marks)

WAVES AND RADIATION

- 16 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?

.....
.....
(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)

17 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.

.....

.....

.....

.....

.....

.....

(3 marks)

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

.....

.....

.....

.....

(2 marks)

5

Turn over ►

18 Earthquakes produce different kinds of shockwaves. Two of these are **P** waves and **S** waves.

(a) Give **two** differences between **P** waves and **S** waves.

1

.....

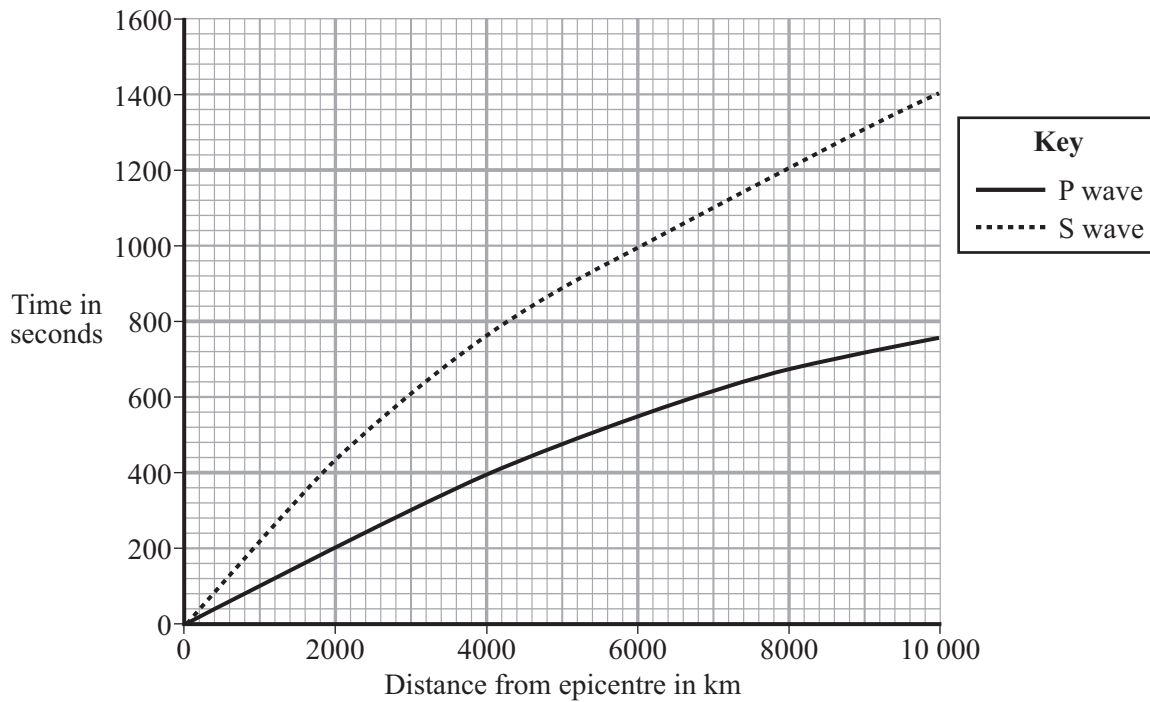
2

.....

(2 marks)

(b) Scientists have measured the speed of shock waves produced by many earthquakes.

From this data they have produced a distance-time graph. This graph shows how far the shock waves travel from the epicentre (origin) of an earthquake in a given time.



(i) As a result of a particular earthquake, a seismograph station records the first **S** waves arriving 360 seconds after the first **P** waves.

Use the graph to estimate the distance of the seismograph station from the epicentre of the earthquake.

.....

.....

Distance km
(1 mark)

(ii) The lines for the **P** wave and the **S** wave are not straight.

What does this tell you?

.....

.....

.....

.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

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

.....

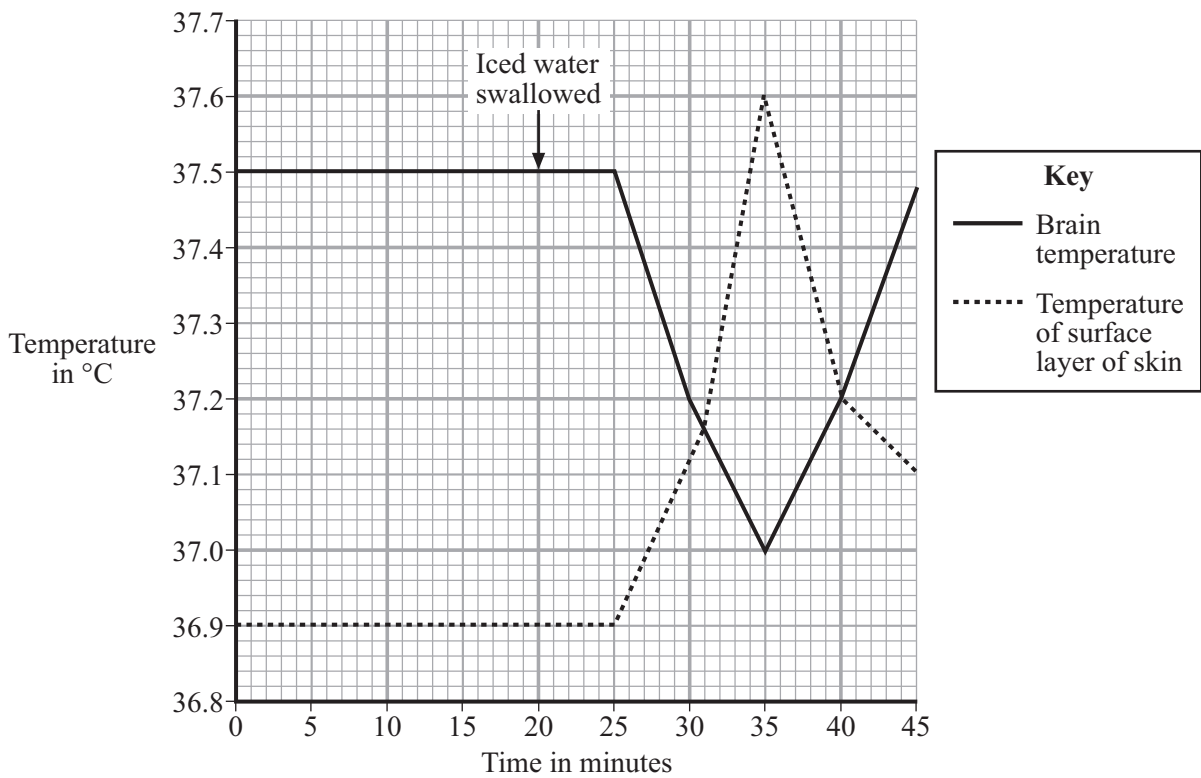
.....

.....

.....

(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.

.....

.....

.....

.....

(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.

.....

.....

.....

.....

.....

.....

(3 marks)

$\frac{\quad}{7}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

20 Low light intensity is one factor that limits the yield of a crop.

In Britain, many tomato growers use artificial lights to increase the yield of tomato crops.

The table shows the amount of natural daylight and artificial lamplight received by a tomato crop grown in a greenhouse.

Month	Natural daylight received by tomato plant		Artificial lamplight given to tomato plant		Total light energy received by plant per day in J/cm ²	Percentage increase in growth resulting from artificial light
	Day length in hours	Light energy received by plant per day in J/cm ²	Hours of light given per day	Light energy received by plant per day in J/cm ²		
January	8.1	239	18	492	731	206
February	9.9	492	18	492	984	100
March	11.9	848	12	328	1176	39
April	13.9	1401	2	55	1456	4
May	15.5	1786	0	0	1786	0
June	16.6	1960	0	0	1960	0
July	16.2	1849	0	0	1849	0
August	14.7	1561	0	0	1561	0
September	12.8	1064	2	55	1119	5
October	10.6	614	11	301	915	49
November	8.8	288	18	492	780	171
December	7.6	183	18	492	675	269

- (a) Describe the pattern for the amount of light energy received from natural daylight by a tomato plant during the year.

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

(3 marks)

- (b) A tomato plant needs 600 J of light energy per cm² each day to grow and produce tomatoes.

Use this information and data from the table to suggest an explanation for the pattern of the artificial light given to the tomato plants.

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

(2 marks)

END OF QUESTIONS

5

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE