

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Secondary Education
June 2005

**SCIENCE: DOUBLE AWARD A (MODULAR) 3468/1H
HIGHER TIER
Paper 1**

Monday 6 June 2005 1.30 pm to 3.00 pm

H

<p>In addition to this paper you will require:</p> <ul style="list-style-type: none"> the Data Sheet (enclosed); a ruler. <p>You may use a calculator.</p>

For Examiner's Use			
Number	Mark	Number	Mark
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
		17	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

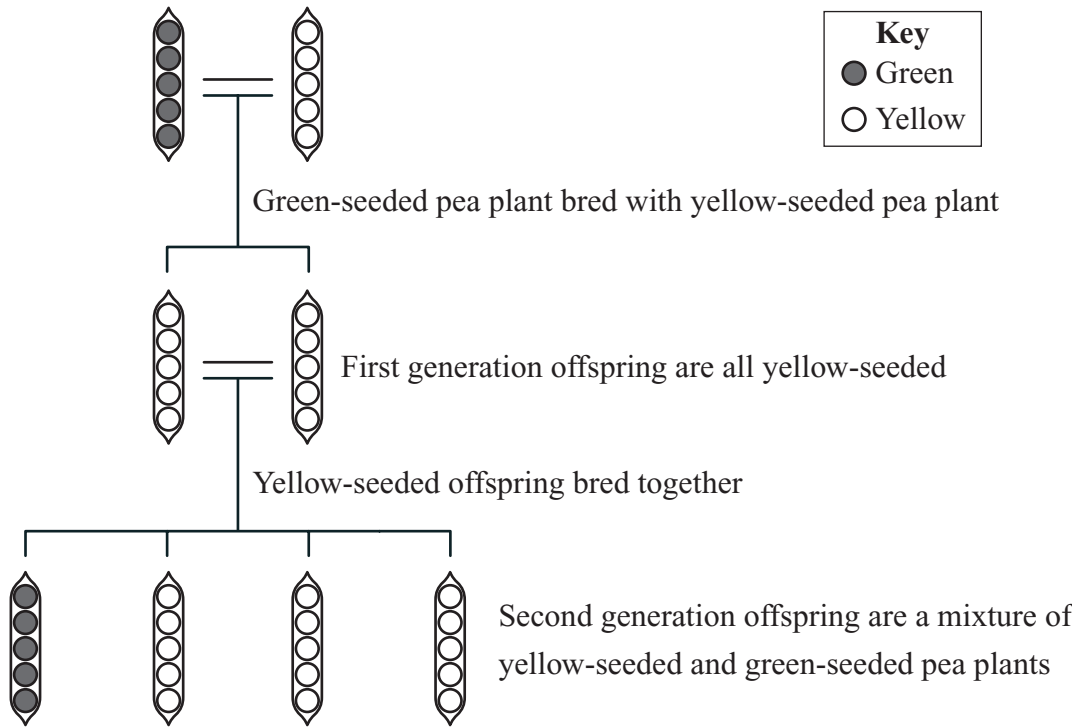
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

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 diagram shows one of the experiments performed by a scientist called Mendel in the 1850s. He bred pea plants which had different coloured pea seeds.



(a) Use words from the box to help you to explain the results of this experiment.

dominant factor recessive

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(3 marks)

(b) Mendel explained these results in terms of *inherited factors*.

(i) What do we now call *inherited factors*?

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(1 mark)

(ii) Where, in a cell, are these *inherited factors* found?

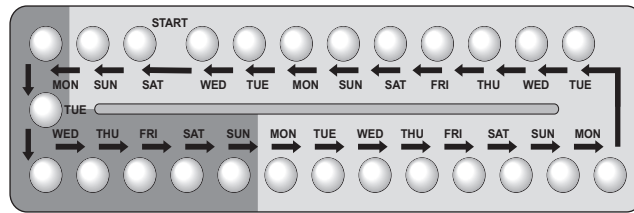
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(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

2 The picture shows some birth control (contraceptive) pills for women.



These are some facts about using birth control pills:

- birth control pills are 99 per cent effective in preventing pregnancy
- the hormones in the pills have some rare but serious side effects
- this method of birth control gives no protection against sexually transmitted diseases
- the hormones in the pills give protection against some women’s diseases
- the woman has to remember to take a pill every day
- the woman’s monthly periods become more regular.

Use the information above to answer these questions.

(a) Give **two** advantages of using birth control pills.

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(2 marks)

(b) Give **two** disadvantages of using birth control pills.

1

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2

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(2 marks)

STRUCTURES AND BONDING

3 The table shows some properties of four Group 7 elements.

Element	Boiling point in °C	Melting point in °C	State at room temperature	Reaction with hydrogen	
				Description	Product
Fluorine	- 218	- 188	gas	Explosive reaction in dim light	Hydrogen fluoride
Chlorine	- 34	- 101	gas	Explosive reaction in sunlight	Hydrogen chloride
Bromine	+ 59	- 7		Reacts if heated	
Iodine	+ 185	+ 114		Reacts if heated strongly	Hydrogen iodide

(a) What is the state at room temperature of:

(i) bromine;

(ii) iodine?

(2 marks)

(b) Which **one** of the four elements is most reactive?

.....
(1 mark)

(c) Name the compound formed when hydrogen reacts with bromine.

.....
(1 mark)

TURN OVER FOR THE NEXT QUESTION

4

Turn over ►

- 4 (a) A piece of lithium is placed on the surface of some water in a beaker.
Hydrogen is given off.
Lithium hydroxide is also formed.

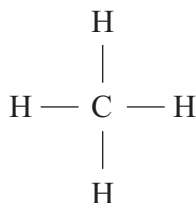
(i) Write a word equation for this reaction.

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(2 marks)

(ii) Describe the test for hydrogen.

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(2 marks)

- (b) The diagram shows the structure of a molecule of methane.



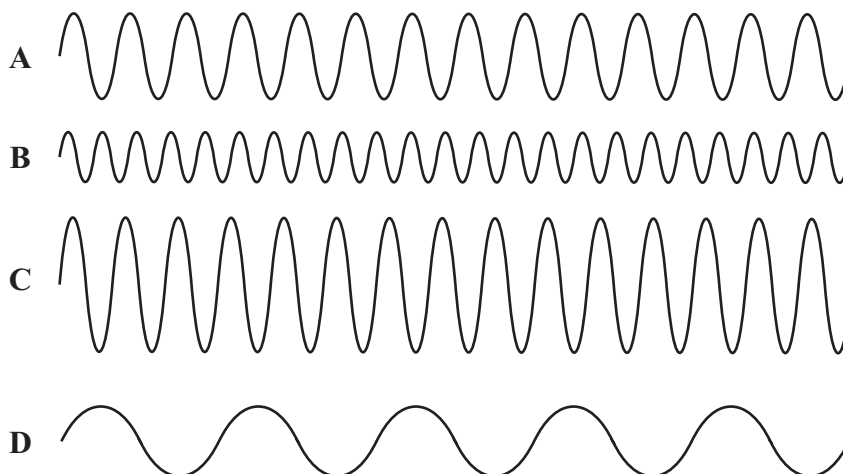
Write down everything that this diagram tells you about a methane molecule.

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)

WAVES AND RADIATION

- 5 The diagram shows oscilloscope traces of four waves, **A**, **B**, **C** and **D**. All four waves are drawn to the same scale.



Which wave has:

- (a) the longest wavelength;
- (b) the greatest amplitude;
- (c) the highest frequency?

(3 marks)

3

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 6 (a) Complete the sentences about atoms.

In an atom, the number of electrons is equal to the number of

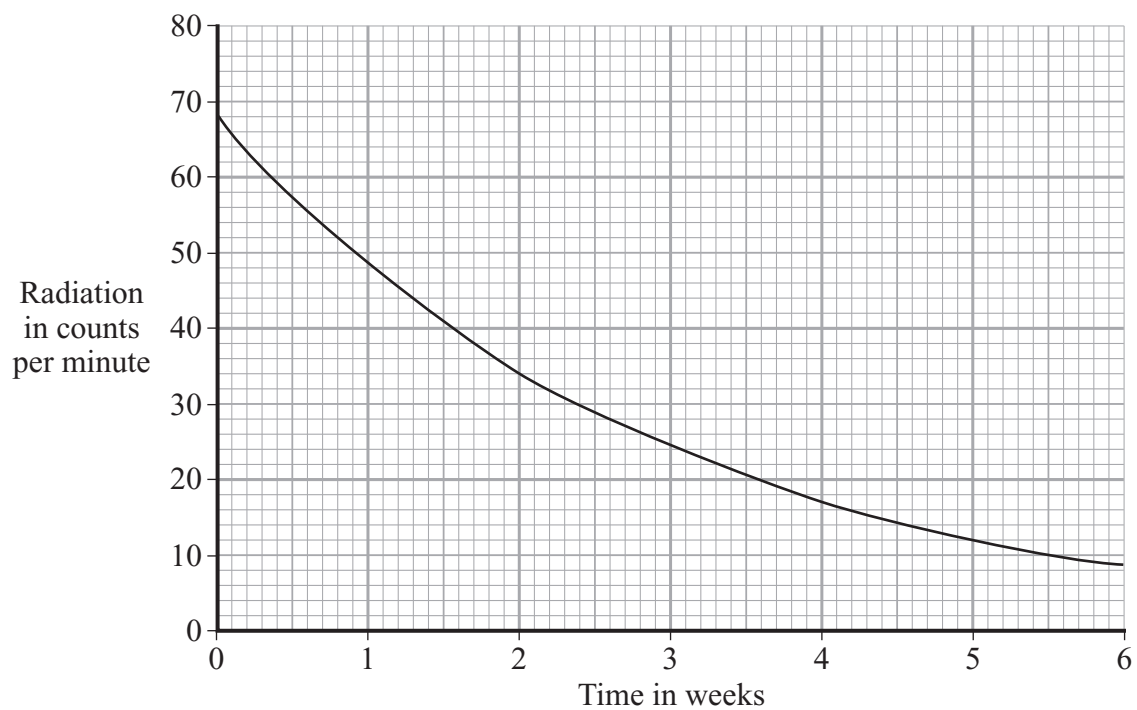
All atoms of an element have the same number of

Isotopes of the same element have different numbers of

(3 marks)

- (b) A teacher measured the amount of radiation from a radioactive source, during the same lesson each week, over a period of six weeks.

The results are shown on the graph.



- (i) How long does it take for the radiation to fall from 68 counts per minute to half that value?

Show clearly how you work out your answer.

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Time taken for radiation to halve
(3 marks)

- (ii) Complete the sentence.

When an atom of a radioactive element emits alpha radiation, an atom of a different element is formed. A different element is formed because the radioactive element has lost

(1 mark)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 7 (a) 'Life expectancy' is the age to which a person can expect to live.

The table shows the life expectancy, in years, of smokers and of people who have never smoked.

Life expectancy at age	Females who have never smoked	Female smokers	Males who have never smoked	Male smokers
25–29	87.6	80.7	79.7	72.2
30–34	87.7	80.9	80.1	72.7
35–39	87.9	81.1	80.3	73.3
40–44	88.1	81.3	80.7	73.8
45–49	88.3	81.6	81.1	74.5
50–54	88.6	82.0	81.4	75.2
55–59	89.0	83.0	82.0	76.4
60–64	89.5	84.2	83.0	78.1
65–69	90.4	85.4	84.3	79.9
70–74	91.5	87.3	85.7	82.4

- (i) A woman is 43. She has never smoked.

To what age can she expect to live?

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(1 mark)

- (ii) What happens to our life expectancy as we get older?

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(1 mark)

(iii) Describe, in as much detail as you can, the effect of smoking on the life expectancy of male smokers.

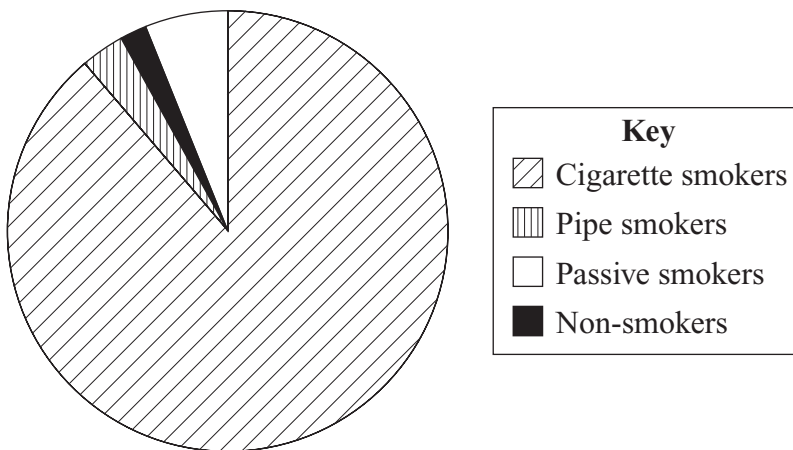
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(3 marks)

(b) The pie chart shows the smoking habits of people who get lung cancer.

‘Passive smokers’ are people who do not smoke, but who live or work with people who do smoke.

People Who Get Lung Cancer



Some people say that this data proves that smoking causes lung cancer.

Others say that it provides evidence for a link between smoking and lung cancer.

Which group is right? Explain the reasons for your answer.

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(2 marks)

Turn over ►

8 A chemist reacted samples of four different metals:

- first with cold water for a few minutes;
- then with steam.

The table shows the results.

Metal	Reaction with cold water	Reaction with steam
A	Does not react	Does not react
B	Reacts violently	Too dangerous to try
C	Does not react	Reacts slowly
D	Reacts slowly	Reacts quickly

Use the Reactivity Series of Metals on the Data Sheet to answer this question.

Which metal, **A**, **B**, **C** or **D**, was

gold?

iron?

magnesium?

potassium?

(4 marks)

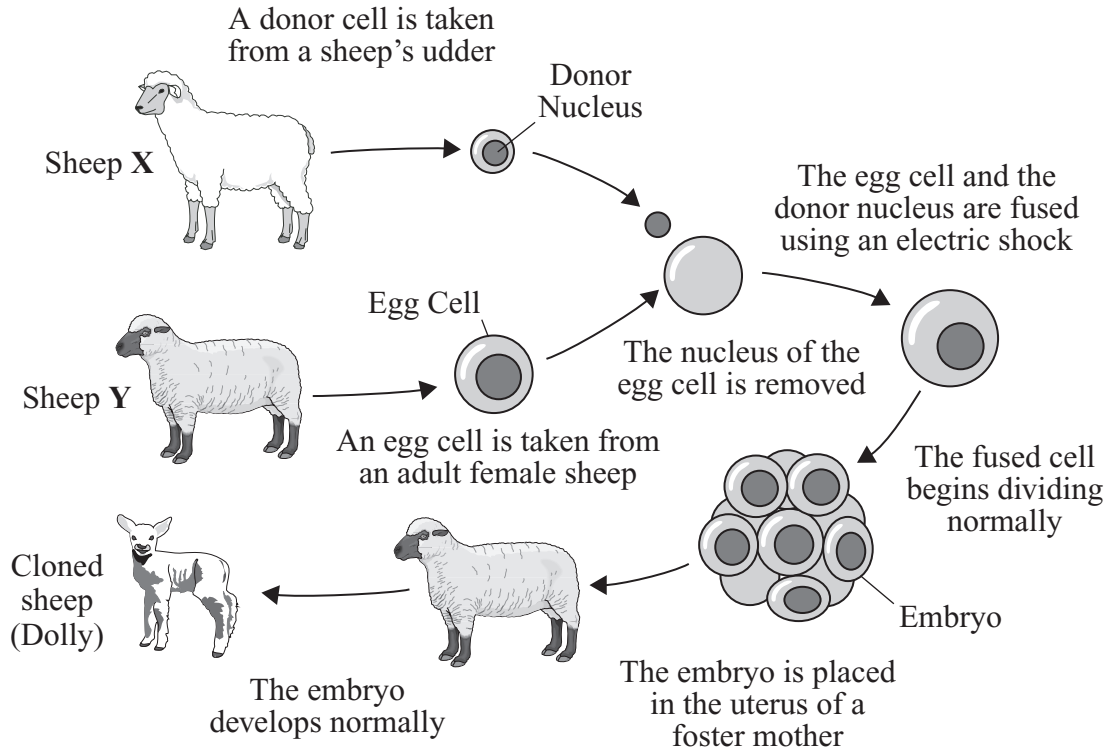
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TURN OVER FOR THE NEXT QUESTION

Turn over ►

INHERITANCE AND SELECTION

9 The diagram shows how Dolly the sheep was cloned.



(a) Name the type of cell division that occurs:

(i) as the egg cell is produced;

(ii) as the fused cell begins to divide normally.

(2 marks)

(b) Is Dolly a clone of sheep X or sheep Y? Explain the reason for your answer.

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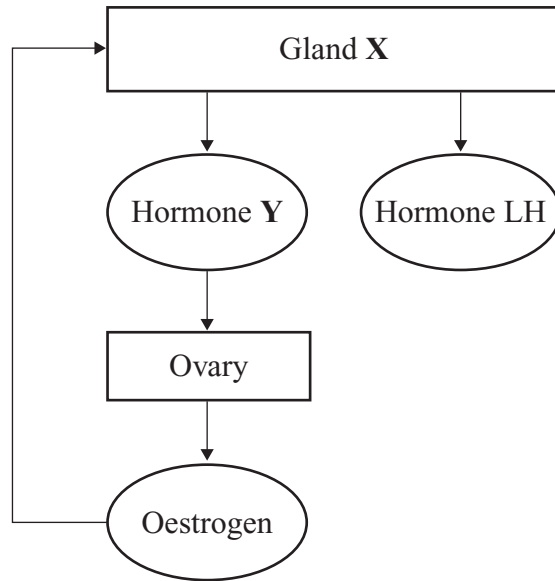
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(2 marks)

(c) The diagram below shows the relationships between the glands and hormones that control the menstrual cycle of a woman.



(i) Name:

gland **X**;

hormone **Y**.

(2 marks)

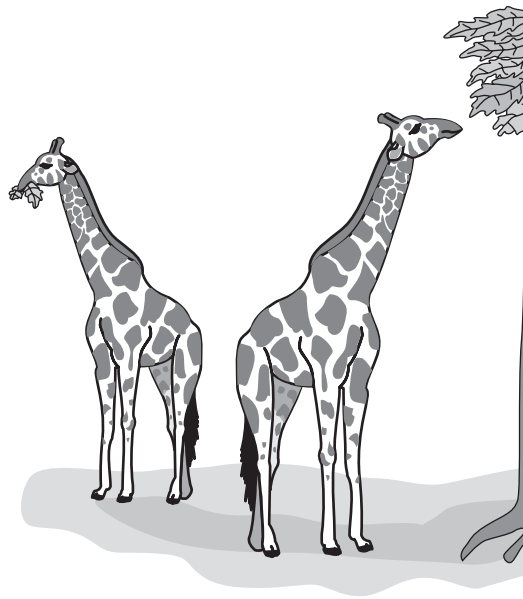
(ii) Give **two** effects of the hormone oestrogen on gland **X**.

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(2 marks)

10 Giraffes feed on the leaves of trees and other plants in areas of Africa.



Lamarck explained the evolution of the long neck of the giraffe in terms of the animals stretching their necks to eat leaves from tall trees.

Darwin also explained the evolution of the long neck in terms of getting leaves from tall trees.

Neither scientist used any evidence to support their explanation.

Recently, scientists have tried to explain how the long neck of the giraffe might have evolved.

These are some of their observations.

- Giraffes spend almost all of the dry season, when food is scarce, feeding from low bushes.
- Only in the wet season do they feed from tall trees when new leaves are plentiful.
- Females spend over 50% of their time feeding with their necks horizontal. Both sexes feed faster and most often with their necks bent.
- Long giraffe necks are very important in male-to-male combat. Males fight each other with their long, powerful necks!
- Female giraffes prefer male giraffes with longer necks.

- (a) Do the observations support or reject the explanation that the long neck of the giraffe evolved to get leaves from tall trees? Explain the reasons for your answer.

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(2 marks)

- (b) Use the recent observations to give another explanation for the evolution of the long neck of the male giraffe.

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(2 marks)

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4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

STRUCTURES AND BONDING

- 11** (a) The table shows how Group 7 elements react with hydrogen.

Element	Reaction with hydrogen	
	Description	Product
Fluorine	Explosive reaction in dim light	Hydrogen fluoride
Chlorine	Explosive reaction in sunlight	Hydrogen chloride
Bromine	Reacts if heated	Hydrogen bromide
Iodine	Reacts if heated strongly	Hydrogen iodide

Explain the difference in the rates of the reaction of fluorine with hydrogen and, of iodine with hydrogen.

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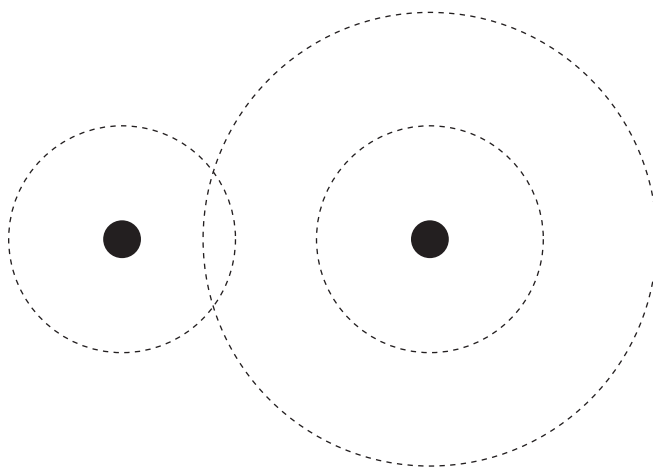
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(2 marks)

- (b) (i) Complete the drawing to show the electron structure of a hydrogen fluoride molecule.

Draw electrons as dots or crosses.



(1 mark)

- (ii) Explain why hydrogen fluoride is a gas at room temperature.

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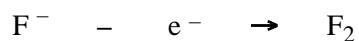
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(2 marks)

- (c) Fluorine can be manufactured by electrolysis of a liquid containing hydrogen fluoride.

Complete the half equation for the reaction which occurs at the positive electrode.



(1 mark)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 12 John Newlands produced a periodic table in 1866. The first 21 elements in his table are shown in the diagram.

Column						
1	2	3	4	5	6	7
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe

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

- (a) In which **two** columns of Newland's periodic table do all the elements have similar properties?

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(1 mark)

- (b) The modern periodic table is arranged in a different order to Newland's table.

- (i) What order is used in the modern periodic table?

.....
(1 mark)

- (ii) Argon has a higher relative atomic mass than potassium. Explain why.

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(1 mark)

- (iii) Describe the changes in the number of electrons in the atoms of elements in the period which begins with potassium and ends with krypton.

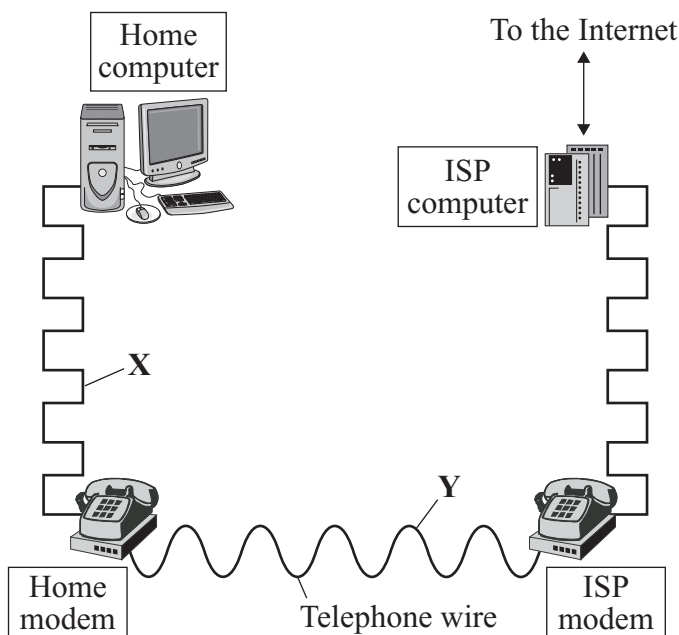
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(2 marks)

WAVES AND RADIATION

13 (a) The diagram shows how home computers can be connected to the internet.

A modem converts one type of signal into a different kind of signal.

The telephone wire connects the home modem to the internet service provider (ISP).



(i) Name the **two** types of signal, **X** and **Y**:

X;

Y.

(1 mark)

(ii) In some areas, telephone wires are being replaced by cables containing optical fibres.

Give **two** advantages of replacing telephone wires with optical fibres.

1

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2

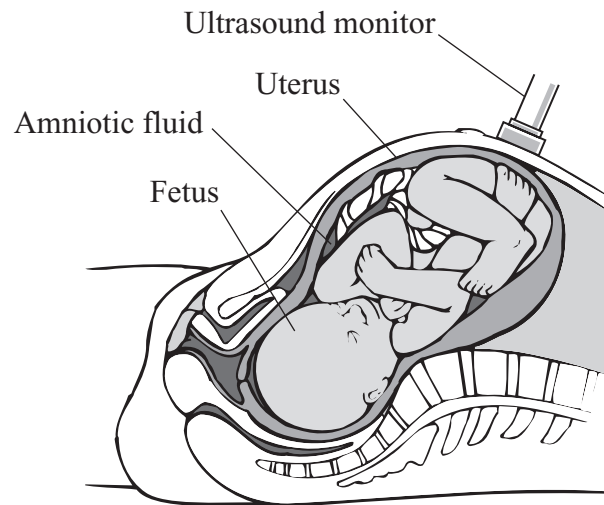
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(2 marks)

QUESTION 13 CONTINUES ON THE NEXT PAGE

Turn over ►

- (b) The diagram shows an ultrasound monitor being used to scan a fetus.



The table shows the velocity of ultrasound waves in different tissues of the fetus.

Tissue	Velocity of ultrasound in m/s
Amniotic fluid (liquid surrounding fetus)	1540
Bone	3080
Kidney	1561
Liver	1549
Muscle	1585

- (i) Explain why we are able to see the different parts of the fetus in an ultrasound scan. You may use information from the table in your answer.

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)

(ii) The ultrasound waves used to produce the scan for this fetus have a frequency of 2 000 000 Hz.

Calculate their wavelength in the muscle of the fetus.

Show clearly how you work out your answer.

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Wavelength..... m
(2 marks)

$\frac{\quad}{9}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 14 (a) The table gives the properties of some radionuclides (radioactive isotopes).

Radionuclide	Half life	Main type of radiation emitted
Radon-220	54.5 seconds	Alpha
Americium-241	433 years	Alpha
Phosphorus-32	14 days	Beta
Strontium-90	28 years	Beta
Technetium-99	6 hours	Gamma
Cobalt-60	5 years	Gamma

- (i) Which radionuclide would be best for monitoring the thickness of aluminium foil?

.....

Explain the reason for your answer.

.....

(2 marks)

- (ii) Which radionuclide would be best for acting as a tracer inside the human body?

.....

Explain the reason for your answer.

.....

(2 marks)

- (b) ${}_{43}^{99}\text{Tc}$ (technetium) is produced by the radioactive decay of ${}_{42}^{99}\text{Mo}$ (molybdenum).

What change occurs in the nucleus of a molybdenum atom when this happens?

.....

(1 mark)

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

15 The table gives some properties of the element silicon.

Melting point	1410°C
Relative atomic mass	28
Conductivity	Conducts electricity
Compounds	Forms compounds with covalent bonds
Position in periodic table	Group 4
Reaction with water	Unreactive
Density	Relatively low

(a) Give **two** ways in which silicon is similar to the alkali metals.

1

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2

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(2 marks)

(b) Give **two** ways in which the properties of silicon are different from those of the alkali metals.

1

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2

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(2 marks)

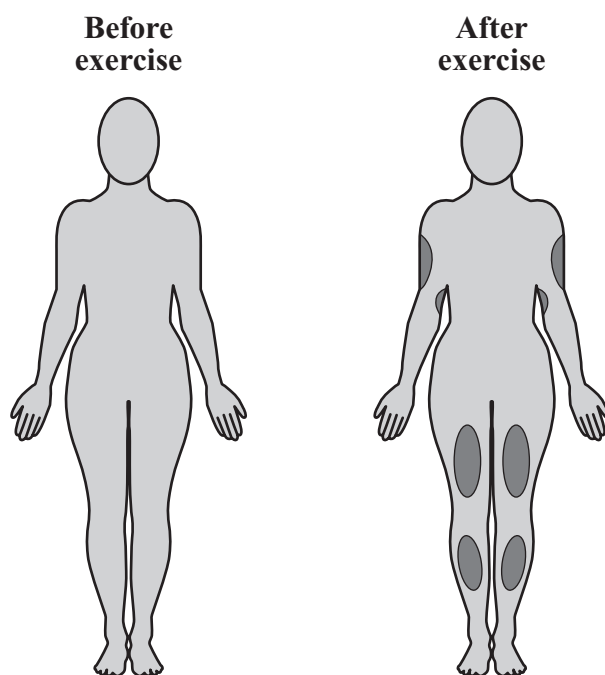
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Turn over ►



16 The temperature at the surface of the skin can be measured by using a technique called thermography.

In this technique, areas with higher temperature appear as a different colour on the thermographs.

The drawings below show the results of an investigation in which thermographs were taken from a person before and after exercise.



Key

-  Higher temperature areas
-  Normal temperature areas

Describe and explain, as fully as you can, the effects of exercise on skin temperature.

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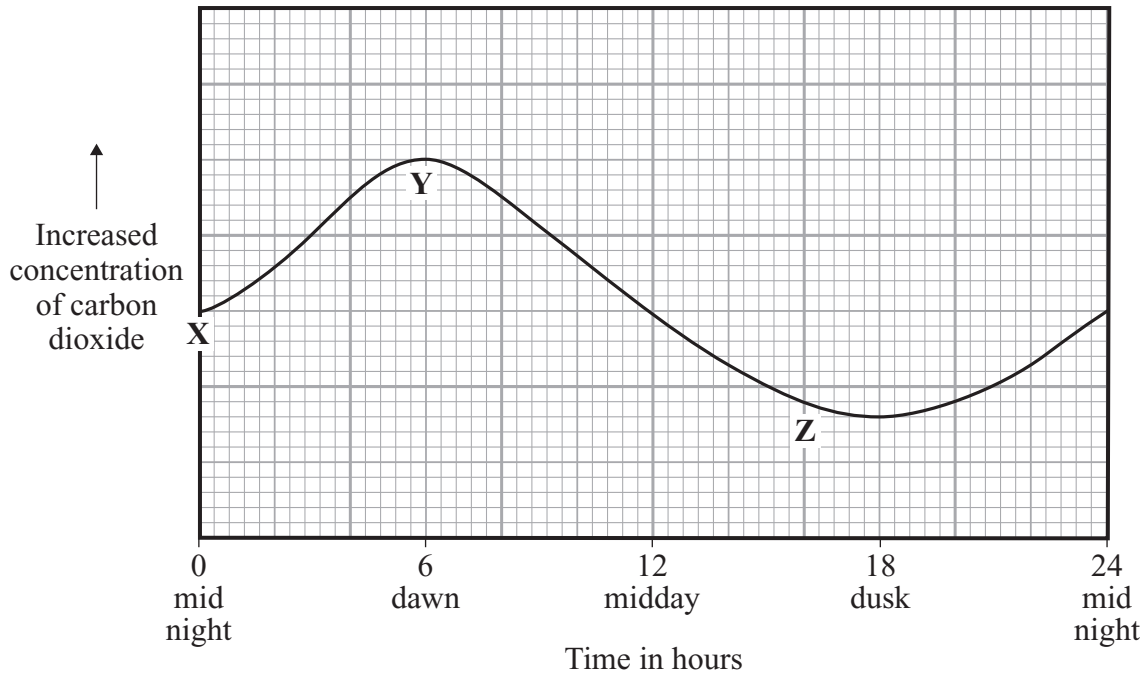
(3 marks)

$\frac{\quad}{3}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 17 The graph shows the concentration of carbon dioxide in the air in a greenhouse full of tomato plants, measured over a period of 24 hours.



- (a) Explain why the concentration of carbon dioxide in the air in the greenhouse increased between **X** and **Y**.

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(2 marks)

- (b) Explain why the concentration of carbon dioxide in the air in the greenhouse decreased between **Y** and **Z**.

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(2 marks)

END OF QUESTIONS

4