Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

Leave blank

General Certificate of Secondary Education
June 2005

ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Monday 6 June 2005 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

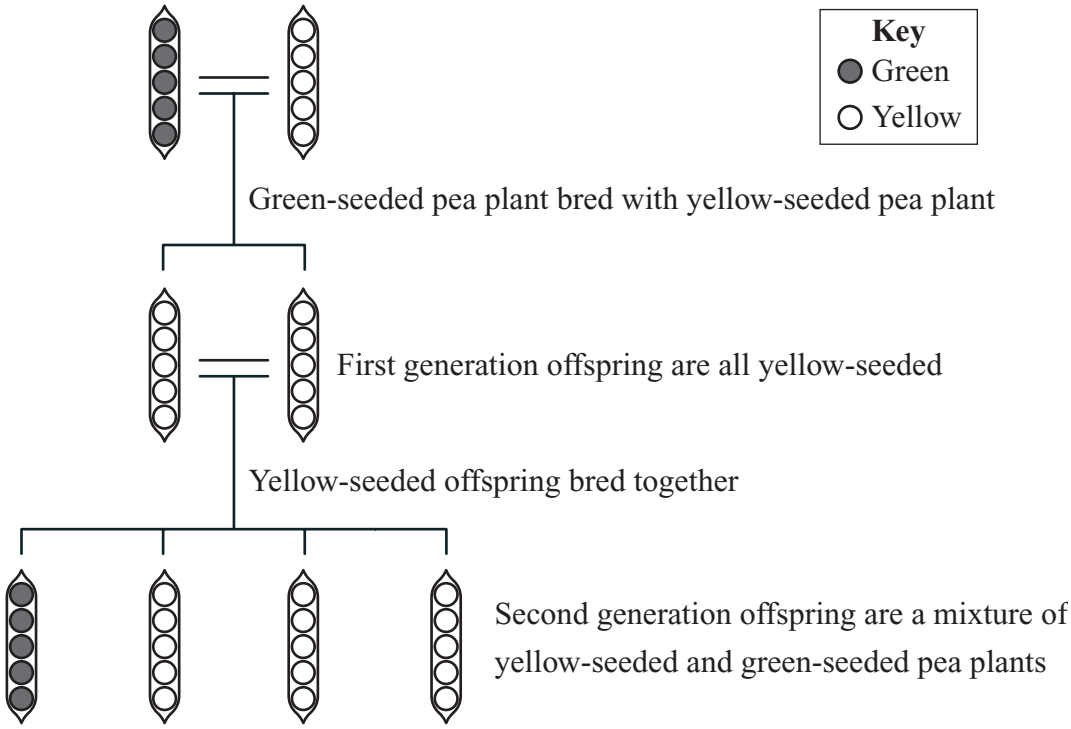
Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

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		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			

ENVIRONMENT, 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**

.....

.....

.....

.....

.....

.....

(3 marks)

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

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

.....

(1 mark)

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

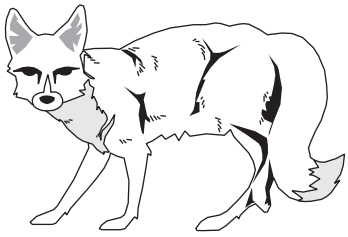
.....

(1 mark)

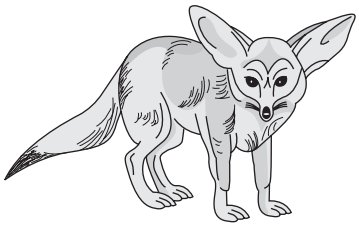
5

TURN OVER FOR THE NEXT QUESTION

2 The drawings show an arctic fox and a fennec fox.



Arctic fox



Fennec fox

(a) The arctic fox lives in cold, snowy conditions.

Explain how each of the following helps the arctic fox to survive in these conditions.

1 Long, thick fur

.....

.....

2 A white coat

.....

.....

(2 marks)

(b) The fennec fox lives in hot deserts.

Explain how each of the following helps it to survive in hot conditions.

1 Very large ear flaps

.....

.....

2 Hairs on the soles of its feet

.....

.....

(2 marks)

4

PATTERNS AND REACTIONS

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)

4

4 (a) Living cells are used in the manufacture of food materials.

(i) Name **one** food material which is made using yeast.

.....

(1 mark)

(ii) Name **one** food material which is made using bacteria.

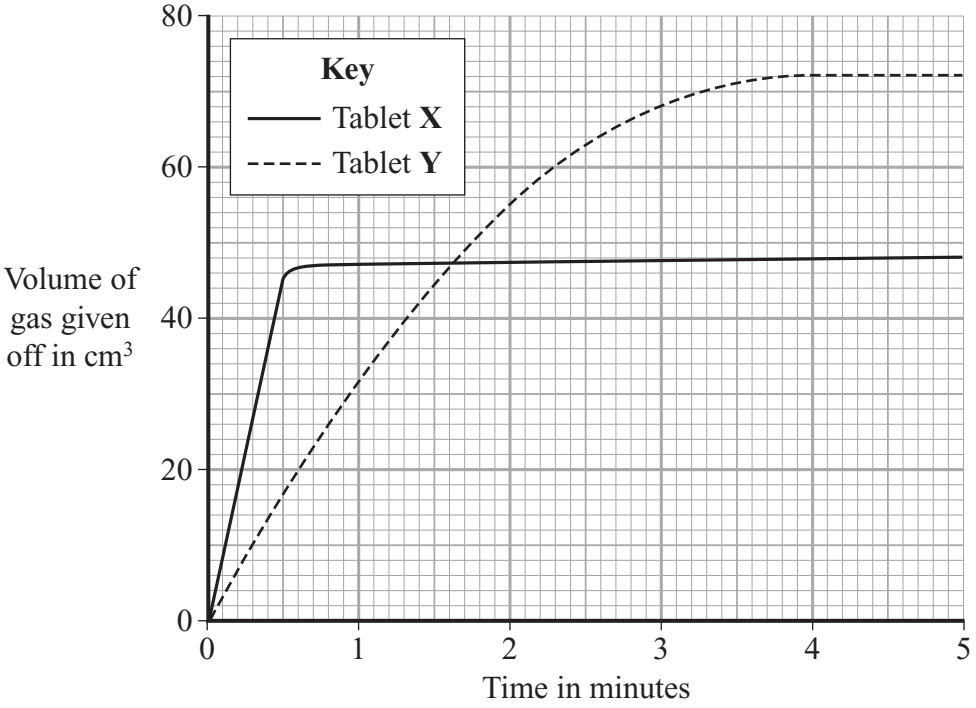
.....

(1 mark)

(b) Many indigestion tablets contain calcium carbonate as their only active ingredient. Calcium carbonate neutralises some of the hydrochloric acid in the stomach.

Two different indigestion tablets, **X** and **Y**, were separately reacted with excess hydrochloric acid. The volume of gas given off in each reaction was measured every minute.

The results are shown in the graph.



(i) Which tablet, **X** or **Y**, contained most calcium carbonate? .....

Explain the reason for your answer.

.....

.....

(1 mark)

(ii) Which tablet, **X** or **Y**, reacted faster with hydrochloric acid? .....

Explain the reason for your answer.

.....

.....

(1 mark)

(iii) Explain the shape of the graph for tablet **X** between 3 and 5 minutes.

.....

.....

.....

.....

(1 mark)

(iv) The gas given off during the reaction is carbon dioxide.

Describe the test for carbon dioxide.

.....

.....

.....

.....

(2 marks)

7

FORCES, WAVES AND RADIATION

5 (a) Complete the sentences about atoms.

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

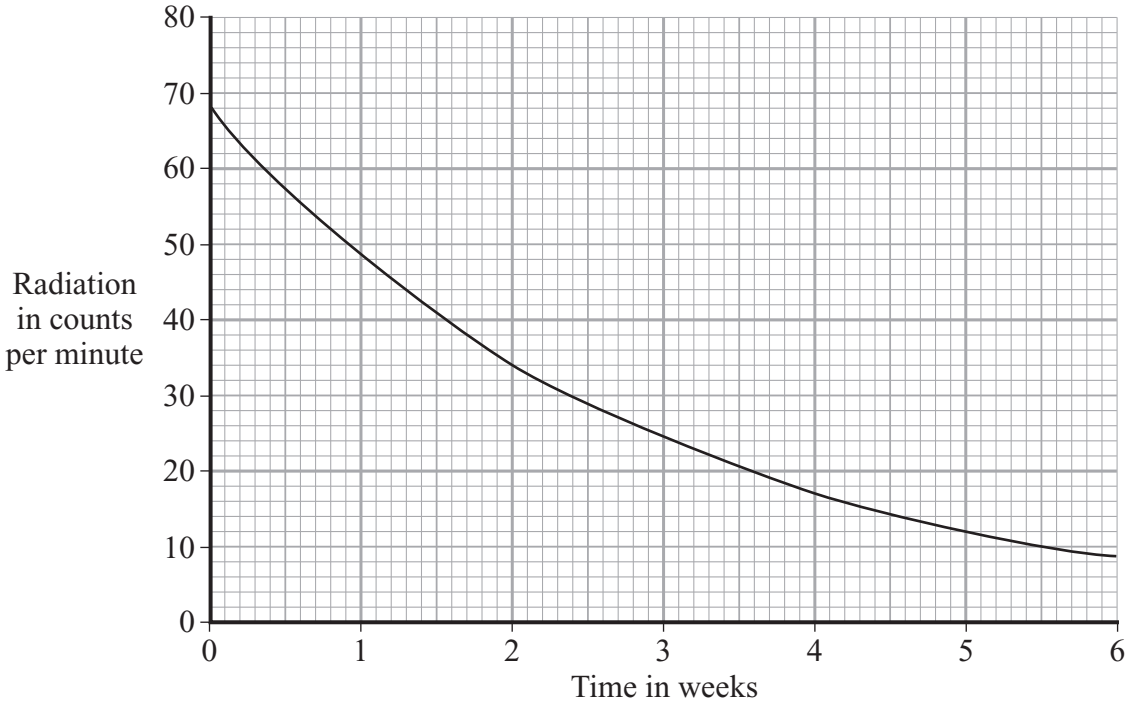
All atoms of an element have the same number of ..... .

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.

.....

.....

.....

Time taken for radiation to halve .....

(3 marks)

(ii) Complete the sentence.

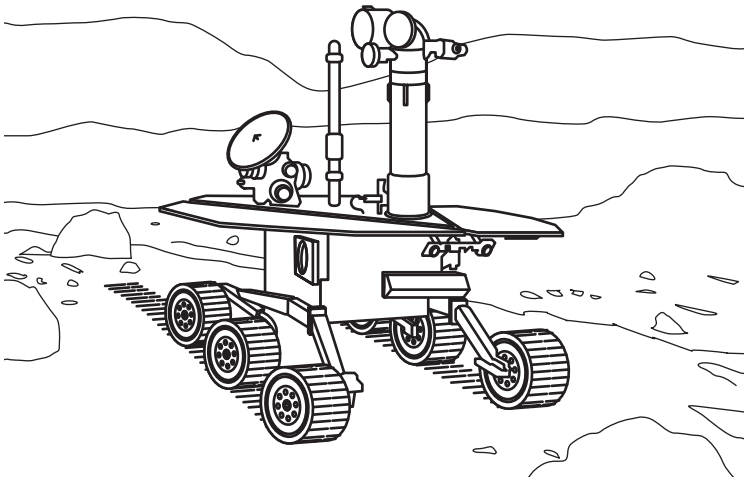
When an atom of a radioactive element emits alpha radiation, an atom of a different element is formed. A different element is formed because the radioactive element has lost ..... .

(1 mark)

7

TURN OVER FOR THE NEXT QUESTION

6 The picture shows a robot exploring Mars.



Describe what the robot might investigate on Mars.

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.

.....

.....

.....

.....

.....

.....

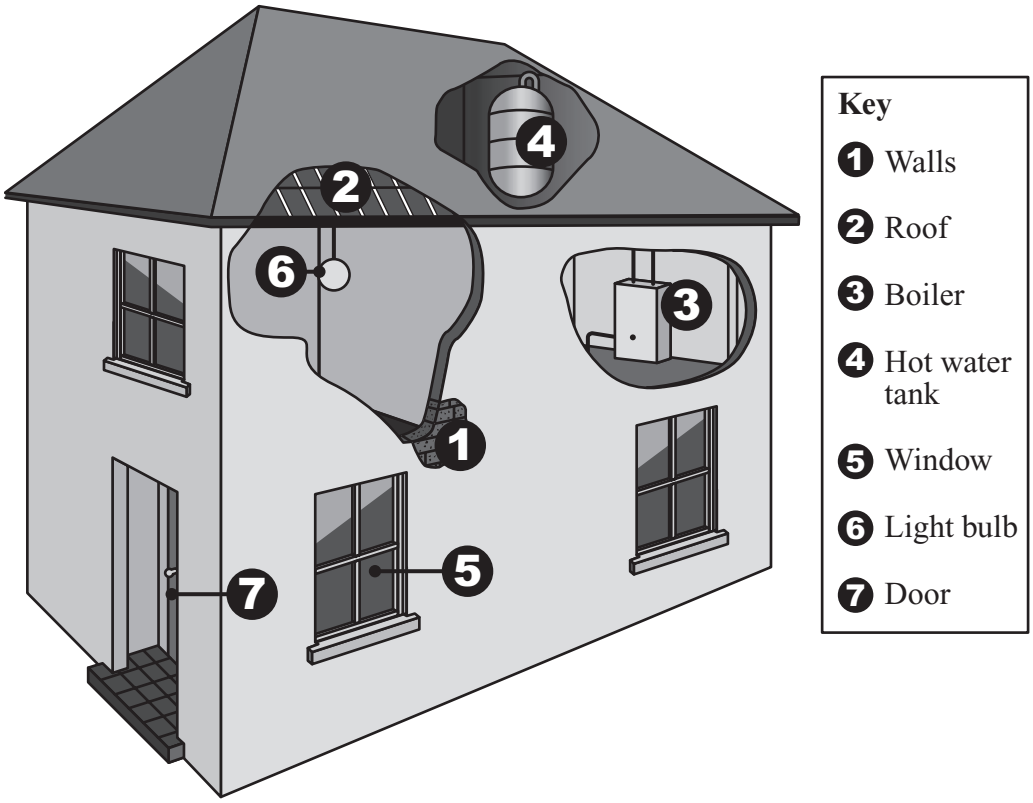
(4 marks)

4

LEAVE MARGIN BLANK

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

7 The drawing shows parts of a house where it is possible to reduce the amount of energy lost.



(a) Give **one** way in which the amount of energy lost can be reduced from each of the following parts of the house.

1, **2** and **4** .....

5 .....

7 .....

(3 marks)

(b) Energy consumption can be reduced by using a more efficient boiler or more efficient light bulbs.

What is meant by a *more efficient* light bulb?

.....

.....

(1 mark)

4

Turn over ▶

8 (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?

.....

(1 mark)

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

.....

.....

(1 mark)

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

.....

.....

.....

.....

.....

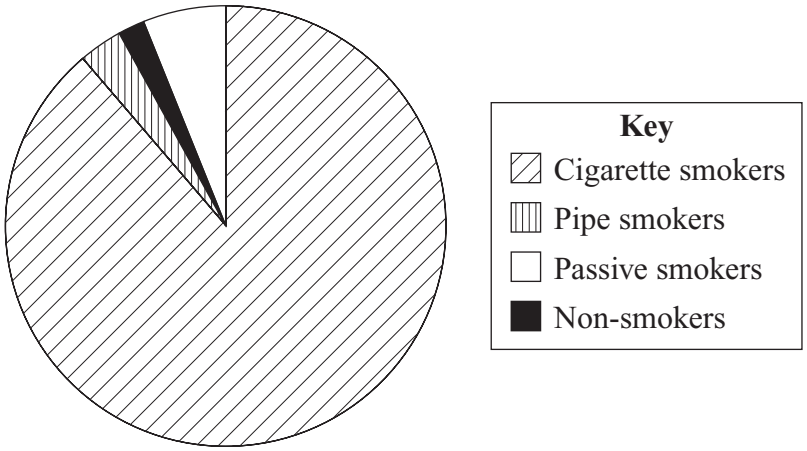
.....

(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.

.....

.....

.....

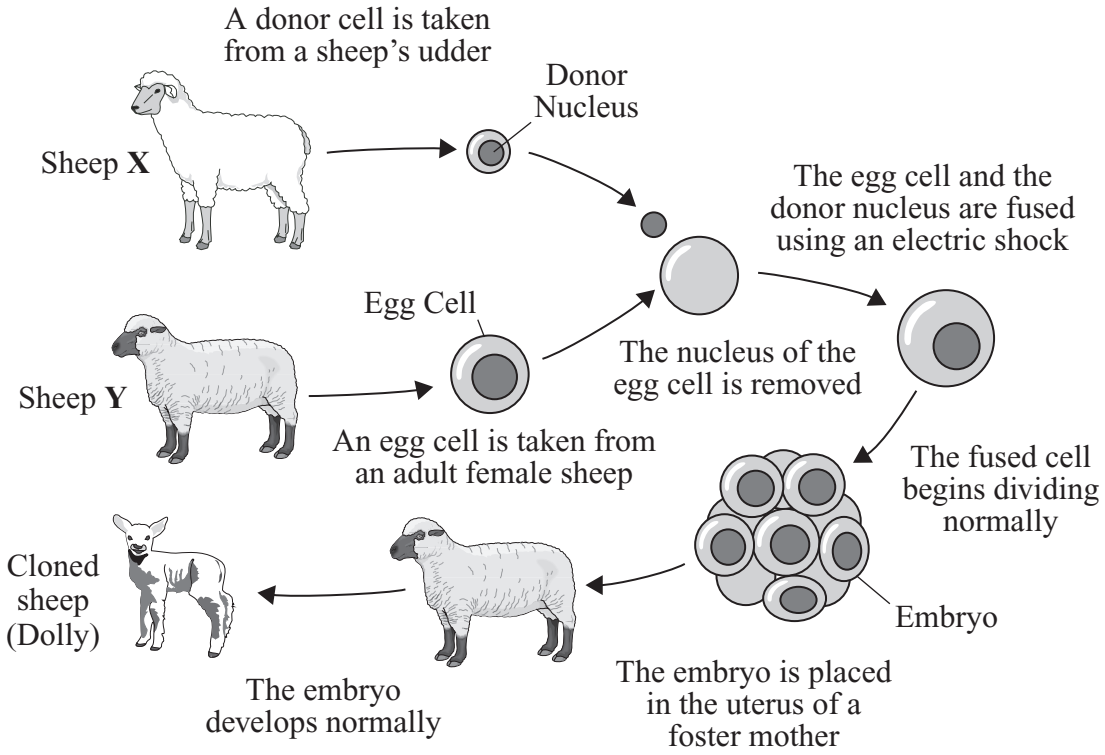
.....

(2 marks)

7

ENVIRONMENT, 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.

.....

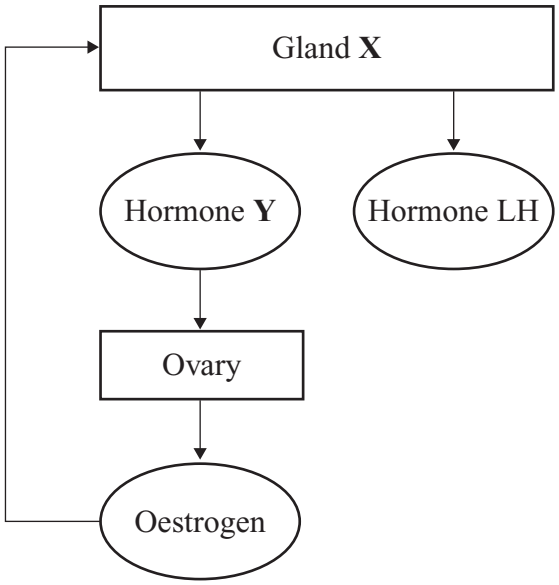
.....

.....

.....

(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**.

1.....

.....

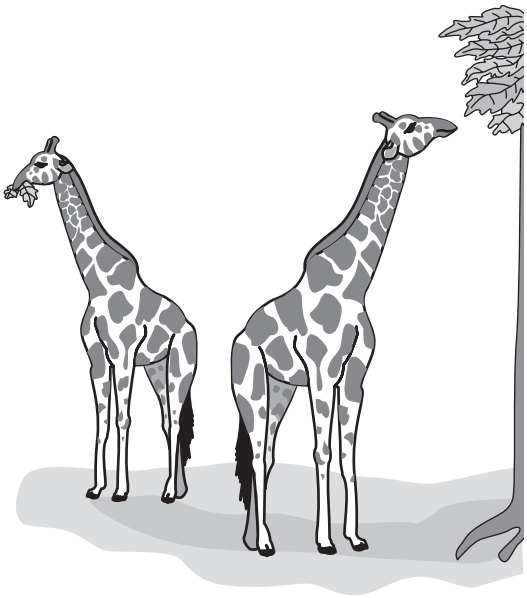
2.....

.....

(2 marks)

8

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.

.....

.....

.....

.....

.....

.....

(2 marks)

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

.....

.....

.....

.....

.....

.....

(2 marks)

4

TURN OVER FOR THE NEXT QUESTION

PATTERNS AND REACTIONS

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

(i) Explain why all the Group 7 elements react in a similar way with hydrogen.

.....

.....

.....

.....

(2 marks)

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

.....

.....

.....

.....

(2 marks)

(b) Explain why Group 0 elements are monatomic.

.....

.....

.....

.....

(2 marks)

6

12 John Newland 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?

.....

(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.

.....

.....

(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.

.....

.....

.....

(2 marks)

5

FORCES, WAVES AND RADIATION

13 Astronomers use red shift in two ways.
They calculate the distance to each galaxy from Earth.
They also calculate the speed at which galaxies are moving away from Earth.

The table shows some results. Distance is given in zettametres, Zm. One zettametre is 10^{21} metres.

Galaxy	Distance from Earth to galaxy in Zm	Speed at which galaxy is moving away from us in Zm per billion years	Time the galaxy has been moving away from us in billions of years (Calculated by distance ÷ speed)
Abell 963	25 000	1950	12.8
Abell 1302	14 000	1100	
Abell 1314	4 100	320	12.8
Abell 1978	18 000	1400	12.9
Abell 2255	10 000	770	13.0

(a) Complete the data for Abell 1302. *(1 mark)*

(b) Describe the relationship between the distance to a galaxy and the speed at which the galaxy is moving away from us.

.....

.....

(1 mark)

(c) Explain how the data for time provides evidence for the theory that the origin of the Universe was a huge explosion (‘big bang’).

.....

.....

.....

.....

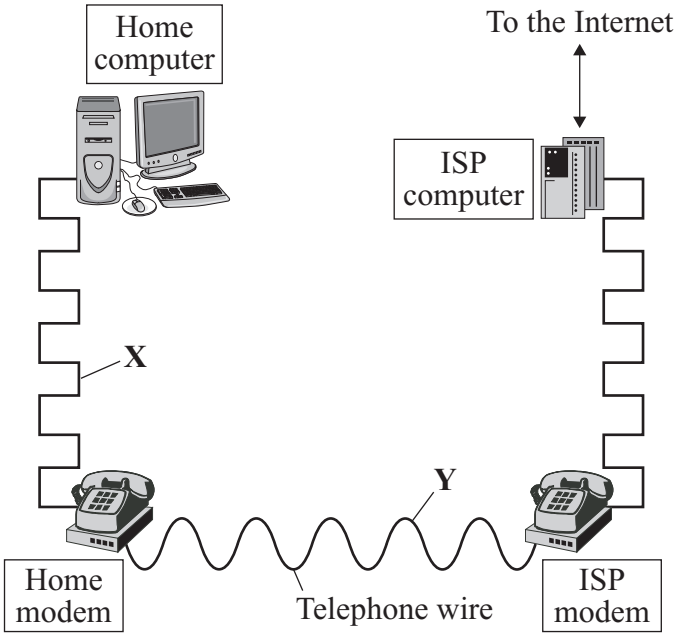
(2 marks)

4

14 (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.....

.....

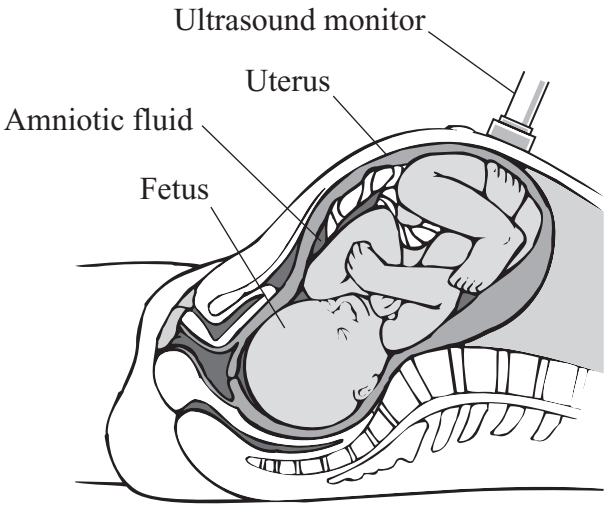
2.....

.....

(2 marks)

QUESTION 14 CONTINUES ON THE NEXT PAGE

(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.

.....

.....

.....

.....

.....

(4 marks)

(ii) Describe **one** use of ultrasound in industry.

.....

.....

.....

.....

(2 marks)

9

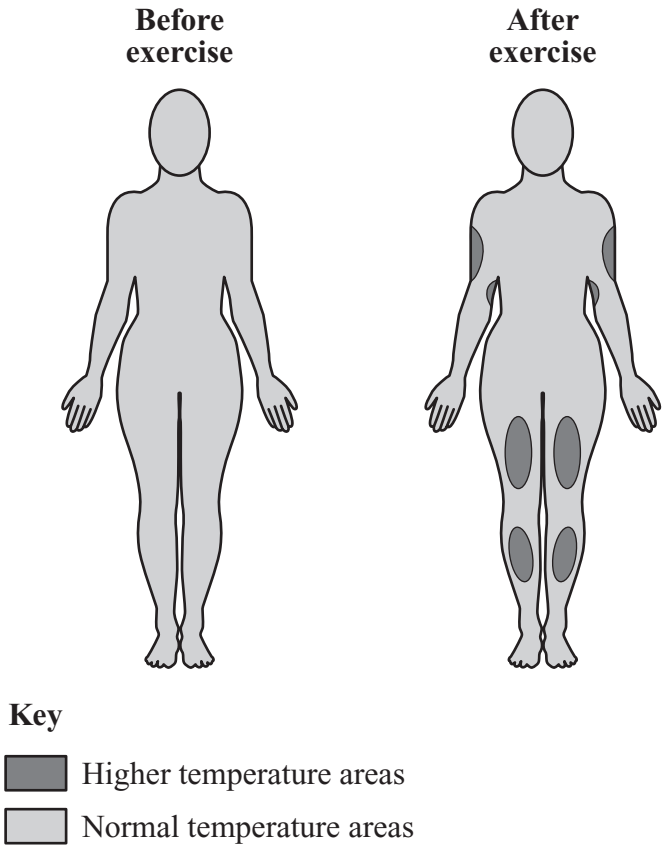
TURN OVER FOR THE NEXT QUESTION

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

15 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.



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

.....

.....

.....

.....

.....

.....

.....

.....

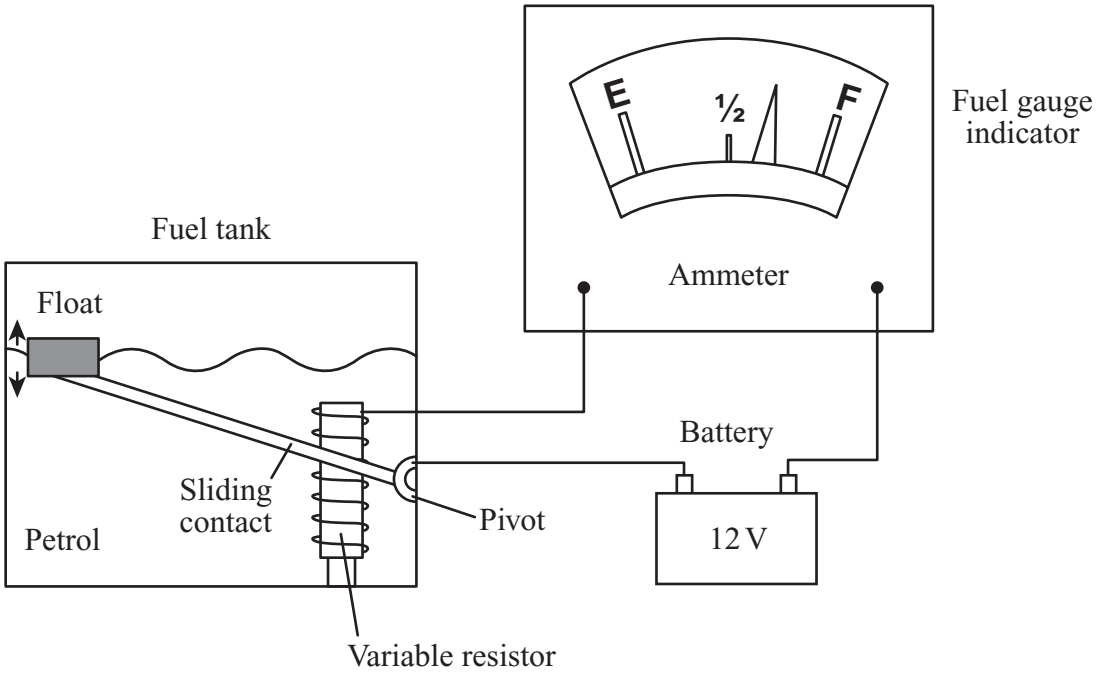
(3 marks)

3

TURN OVER FOR THE NEXT QUESTION

16 The diagram shows the fuel gauge assembly in a car.

- The sliding contact touches a coil of wire and moves over it.
- The sliding contact and the coil form a variable resistor.
- The sliding contact is connected to a float via a pivot.
- The fuel gauge indicator is an ammeter.
- When the petrol level changes, the resistance of the circuit changes.
- This causes the pointer in the fuel gauge indicator to move.



(a) Use standard symbols to draw a circuit diagram for the fuel gauge assembly.

(3 marks)

(b) How will the current in the circuit change as the level of petrol in the tank falls?

.....

Explain the reason for your answer.

.....

.....

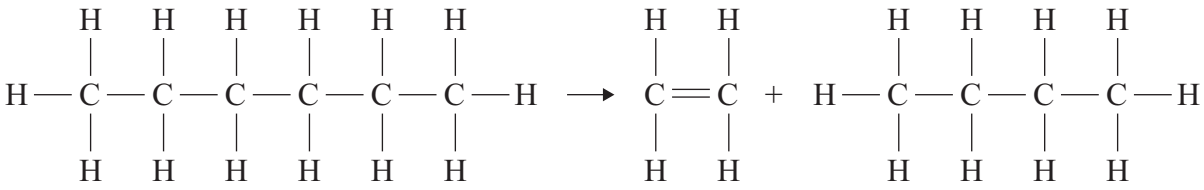
.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

17 The diagram shows a reaction which takes place in an oil refinery.



Compound **X** Compound **Y** Compound **Z**

(a) **X**, **Y** and **Z** are all examples of which type of compound?

.....

(1 mark)

(b) What type of chemical reaction takes place when compound **X** is converted into compounds **Y** and **Z**?

.....

(1 mark)

(c) Compounds **Y** and **Z** are both useful substances.

Compound **Y** is unsaturated. Compound **Z** is saturated.

(i) Suggest **one** use for compound **Y**.

.....

(1 mark)

(ii) Suggest **one** use for compound **Z**.

.....

(1 mark)

4

END OF QUESTIONS