Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CO-ORDINATED SCIENCES 0654/02

Paper 2

May/June 2003

2 hours

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 24.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
1	
2	
3	
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12	
Total	

This document consists of **22** printed pages and **2** blank pages.

1 Fig. 1.1 shows a white blood cell.

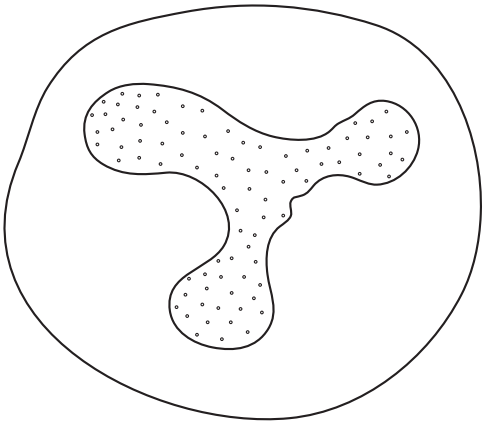

Fig. 1.1

(a) **(i)** Describe two ways in which the structure of a red blood cell differs from the structure of a white blood cell.

1. .....

2. ..... [2]

(ii) Describe two ways in which the structure of a plant cell from a leaf differs from the structure of the white blood cell shown in Fig. 1.1.

1. .....

2. ..... [2]

(b) State the function of white blood cells.

..... [1]

(c) In the disease AIDS, white blood cells are infected by a virus.

(i) Give the name of the virus which causes AIDS.

..... [1]

(ii) State two ways in which this virus can be transmitted.

1. .....

2. ..... [2]

2 Explain the following in terms of particles and their movement.

(a) A puddle of water evaporates more quickly on a warm day than on a cool day.

.....

.....

.....

.....

..... [3]

(b) When a solid is heated it expands.

.....

.....

.....

.....

..... [3]

(c) A metal bar conducts heat.

.....

.....

.....

..... [2]

3 **(a)** Fig. 3.1 shows the structure of four substances, **A**, **B**, **C** and **D**, which contain atoms.

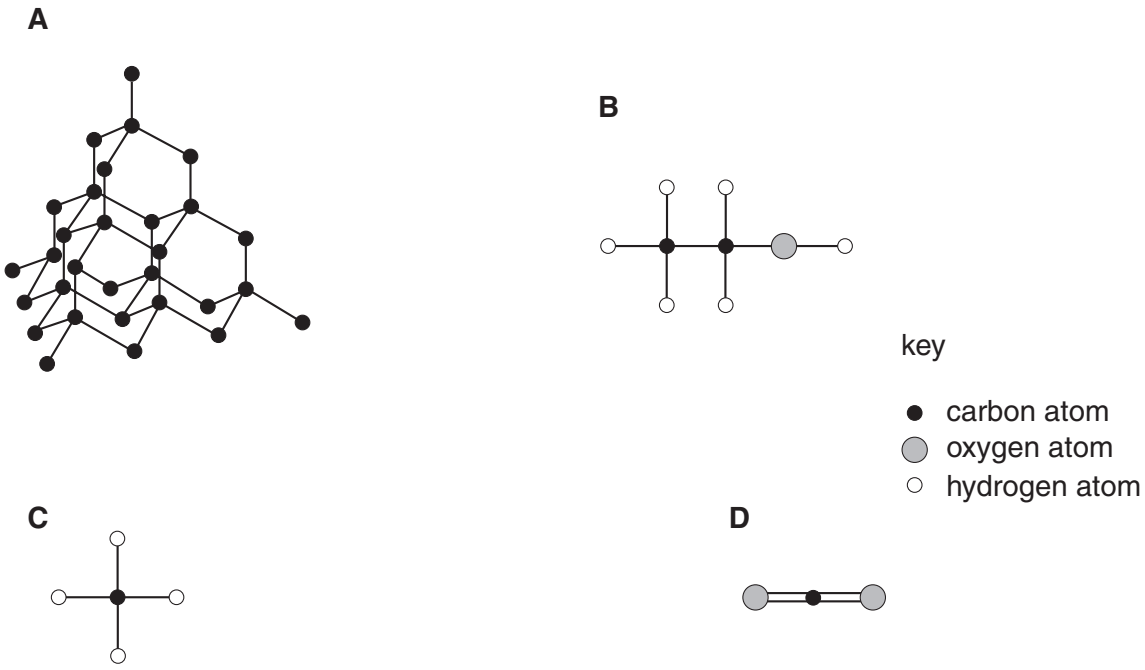

Fig. 3.1

State which of these substances is an element. Explain your answer.

.....

.....

..... [2]

(b) Potassium reacts with bromine to form compound **X**.

(i) Name compound **X**.

..... [1]

Compound **X** may be decomposed into potassium and bromine using electrolysis, as shown in Fig. 3.2.

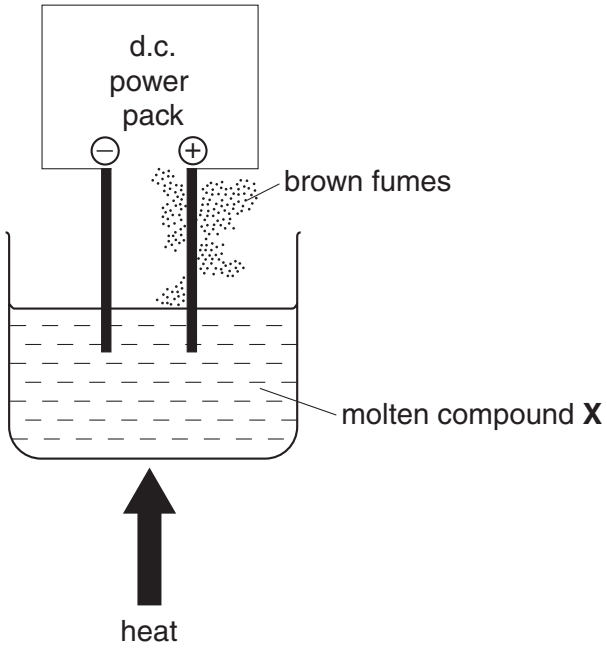

Fig. 3.2

(ii) Explain why compound **X** must be heated strongly in this process.

.....

.....

..... [2]

(iii) Explain why it is possible to predict at which electrode potassium will be formed.

.....

..... [1]

(iv) A word equation for the reaction between potassium and bromine is shown below.

potassium + bromine $\longrightarrow$ compound **X**

…… …… ……

On the line below each substance write the term, chosen from the following list, which best describes its structure.

giant ionic **giant metallic** **giant molecular** **simple molecular**

[3]

4 Fig. 4.1 shows a lizard, which is a reptile.

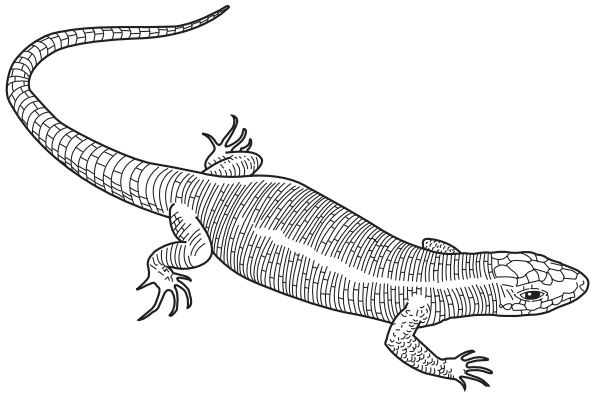

Fig. 4.1

(a) Describe two ways in which reptiles differ from amphibians.

1. .....

.....

2. .....

..... [2]

(b) The skin colour of this reptile is controlled by a gene with two alleles. Allele **G** gives green skin, and allele **g** gives brown skin.

(i) State the genotype of a brown lizard.

..... [1]

(ii) State the genotype of a homozygous green lizard.

..... [1]

(iii) Complete the genetic diagram to show the offspring that could be produced by two parents with the genotypes **Gg** and **Gg**. (You may use the space below for your working.)

phenotypes of parents		
genotypes of parents	**Gg**	**Gg**
gametes produced		
genotypes of offspring		

[3]

(iv) State the ratio of green to brown offspring that would be expected from this cross.

..... green : ..... brown [1]

5 Fig. 5.1 shows a hovercraft.

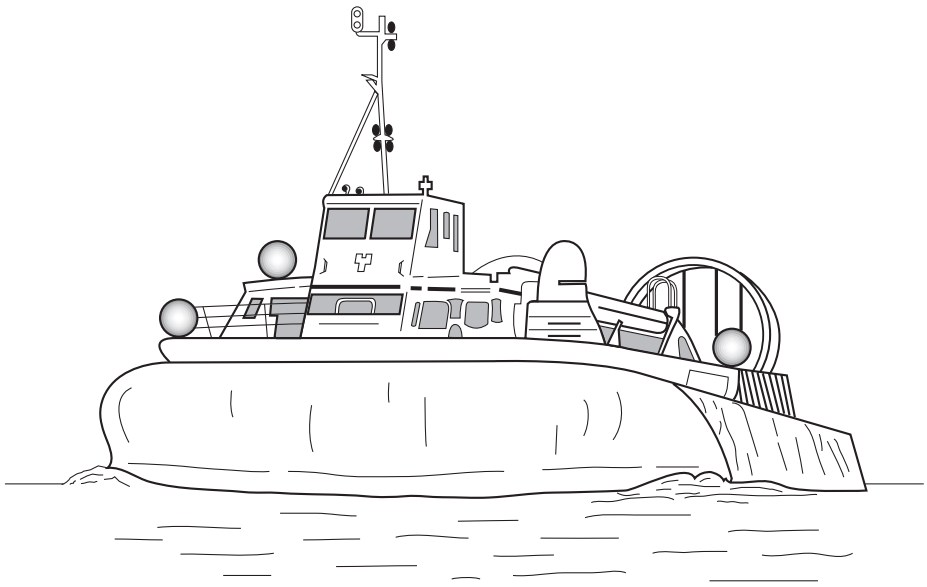

Fig. 5.1

(a) When a hovercraft is moving, the friction between it and the surface it is travelling over is very low.

Explain the advantage of having this low friction.

.....

.....

..... [2]

(b) A small hovercraft has a mass of 2000 kg. It hovers a few centimetres above the water. It is supported by a cushion of air, which covers an area of 8 m^2. The air pressure is kept at a pressure greater than atmospheric pressure.

(i) If the Earth's gravitational field strength is 10 N / kg, state the weight of the hovercraft.

..... N [1]

(ii) State the upward force that the air cushion must provide to keep the hovercraft hovering above the water.

..... N [1]

(c) Fig. 5.2 shows a speed-time graph for a hovercraft making a very short journey.

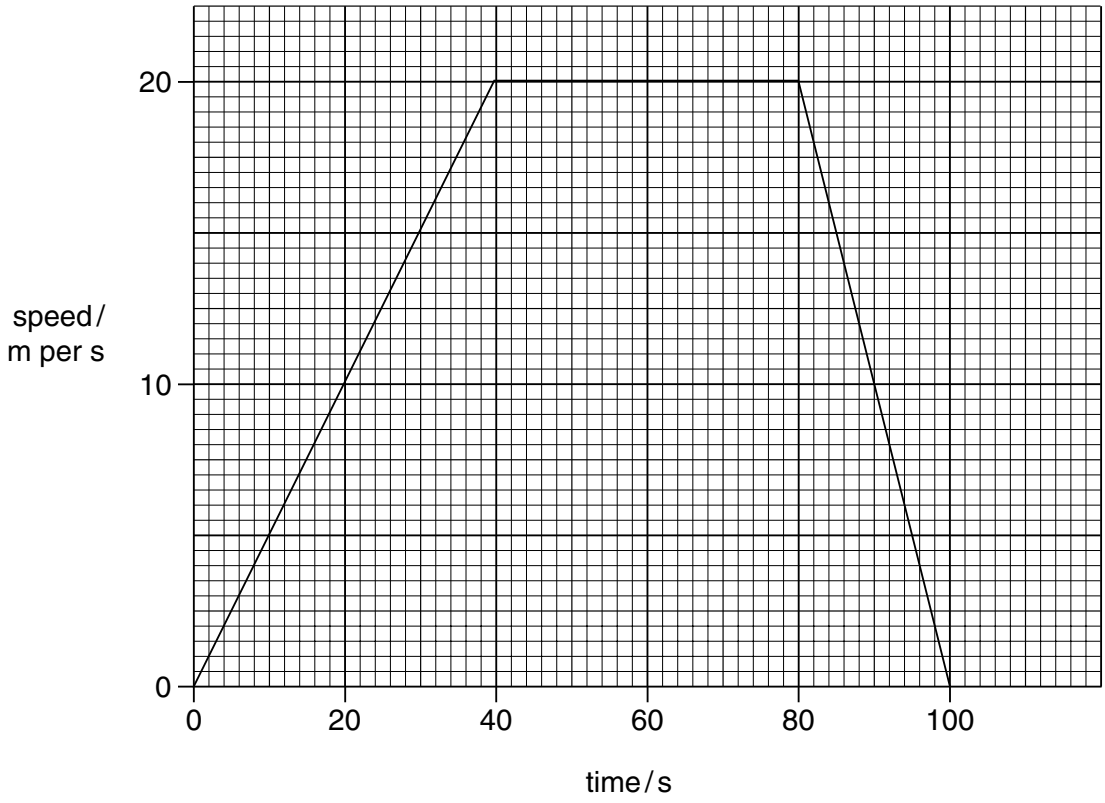

Fig. 5.2

(i) State the maximum speed of the hovercraft.

..... m / s [1]

(ii) For how many seconds does the hovercraft stay at its maximum speed?

..... seconds [1]

(iii) For how many seconds does the hovercraft move?

..... seconds [1]

(iv) Calculate the acceleration of the hovercraft during the first 40 seconds.

Show your working.

..... m / s^2 [2]

6 Petroleum (crude oil) is a fossil fuel. It consists of a mixture of compounds, most of which are hydrocarbons.

(a) Explain the meaning of the term *fossil fuel*.

.....

.....

..... [2]

(b) **(i)** The chemical formulae of three hydrocarbons, **X**, **Y** and **Z**, are shown below.

X – $C_{10}H_{22}$

Y – $C_{20}H_{42}$

Z – C_5H_{12}

Complete Fig. 6.1 below by writing in the letters, **X**, **Y** or **Z**.

hydrocarbon	boiling point / °C
	344
	174
	36

Fig. 6.1 [1]

(ii) Explain briefly your answer to **(i)**.

.....

..... [1]

Fig. 6.2 shows industrial apparatus used to separate petroleum into simpler mixt

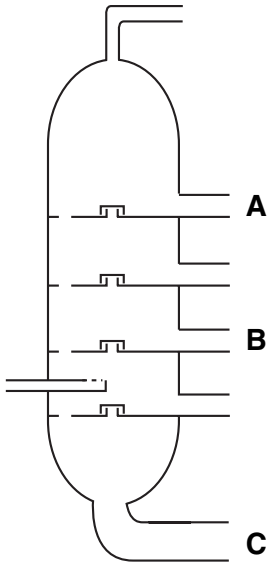

Fig. 6.2

(iii) Name the process which is carried out in this apparatus.

..... [1]

(iv) At which point, **A**, **B** or **C**, in Fig. 6.2 is C_5H_{12} most likely to be produced?

..... [1]

(c) In catalytic cracking, large saturated hydrocarbon molecules are broken down into simpler ones. Some of these simpler molecules are unsaturated.

Describe the difference between a saturated and an unsaturated hydrocarbon.

.....

.....

..... [2]

7 A plant growing in a pot was covered with a transparent polythene bag. The pla… placed in a sunny window and left there for 24 hours.

Samples of air were taken from the bag at hourly intervals. The concentration of oxygen and carbon dioxide in the air inside the bag was then measured. The results for oxygen are shown in Fig. 7.1.

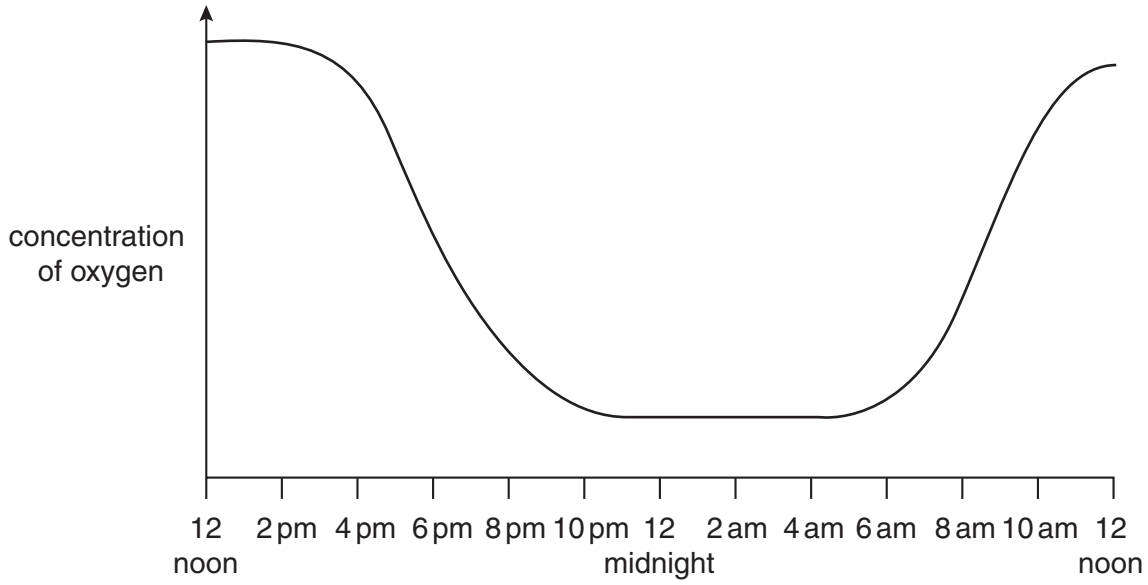

Fig. 7.1

(a) Explain why the bag covering the plant needed to be transparent.

.....

..... [2]

(b) With reference to photosynthesis and respiration, explain the shape of the curve in Fig. 7.1.

.....

.....

.....

..... [2]

(c) On Fig. 7.1, sketch a curve to show how the concentration of carbon dioxide ins bag would vary during this 24 hour period.

(d) Plants are the producers in a food chain.

(i) Explain what is meant by the term *producer*.

.....

..... [1]

(ii) Describe how energy is transferred from a plant to an animal in a food chain.

.....

.....

..... [2]

8 Read the passage and then answer the questions that follow.

Sounds can be recorded using a tape cassette recorder. This relies on electromagnetism.

A new recording tape has a coating of tiny magnetic particles that are arranged randomly. During recording, the electrical signal carrying the sound pattern is passed to a coil in the tape recorder. This produces a varying magnetic field which lines up the magnetic particles on the tape in patterns.

During playback, the magnetic pattern passes back over the coil inducing a varying electric current. This is then fed to an amplifier and on to a loudspeaker.

(a) **(i)** Suggest a suitable magnetic material for coating the tape.

..... [1]

(ii) Why should strong magnets be kept away from the recording tape?

.....

..... [1]

(iii) What useful energy change takes place in the loudspeaker?

..... energy to ..... energy [2]

(iv) State the meaning of the term *magnetic field*.

.....

..... [1]

(b) A sound wave is represented by Fig. 8.1.

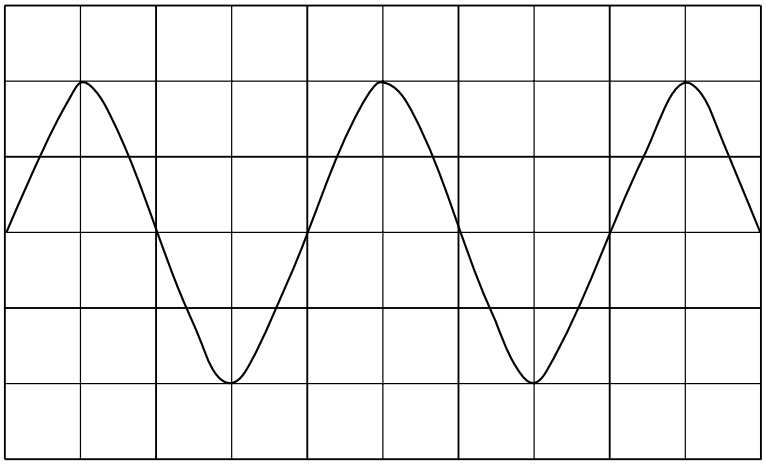

Fig. 8.1

(i) On Fig. 8.1, show clearly the wavelength of the wave. [1]

(ii) On Fig. 8.1, draw a second wave which has half the amplitude of the original wave, but the same frequency. [2]

(iii) Does the wave that you have drawn represent a louder sound or a quieter sound than the original wave? Explain your answer.

.....

..... [1]

9 Fig. 9.1 shows information about two drugs.

name	chemical formula	use
cis-platin	$N_2H_6Cl_2Pt$	cancer treatment
aspirin	$C_9H_8O_4$	pain relief

Fig. 9.1

(a) **(i)** What name is used for the treatment of diseases like cancer with chemicals such as cis-platin?

..... [1]

(ii) What general name is used to describe a drug used for pain relief?

..... [1]

(b) State the number of different elements shown in the chemical formula of cis-platin.

..... [1]

(c) Cis-platin contains the metal platinum. An atom of platinum has the proton number 78 and a nucleon number 195.

(i) Calculate the number of neutrons in the nucleus of this platinum atom.

..... [1]

(ii) Name the element in Group I of the Periodic Table that is in the same period as platinum.

..... [1]

(iii) Platinum is a transition metal. Suggest **one** property of platinum which will be different from a metal in Group I.

..... [1]

(d) Suggest why scientists who develop new drugs study tropical rain forests, and are worried about the destruction of these forests.

.....

.....

..... [2]

10 **(a)** **(i)** Describe how you would test a food to see if it contains protein.

.....

..... [1]

(ii) State what you would see if the result was positive.

..... [1]

(b) Outline how protein is digested and absorbed in the alimentary canal.

how it is digested .....

.....

.....

where and how it is absorbed .....

.....

..... [3]

(c) If a person eats more proteins than they need, the excess amino acids are converted to urea.

(i) Name the organ in which excess amino acids are converted to urea.

..... [1]

(ii) Describe what happens to the urea that is produced.

.....

.....

..... [2]

11 A television picture is produced by firing electrons at a screen. Fig. 11.1 shows how this is done.

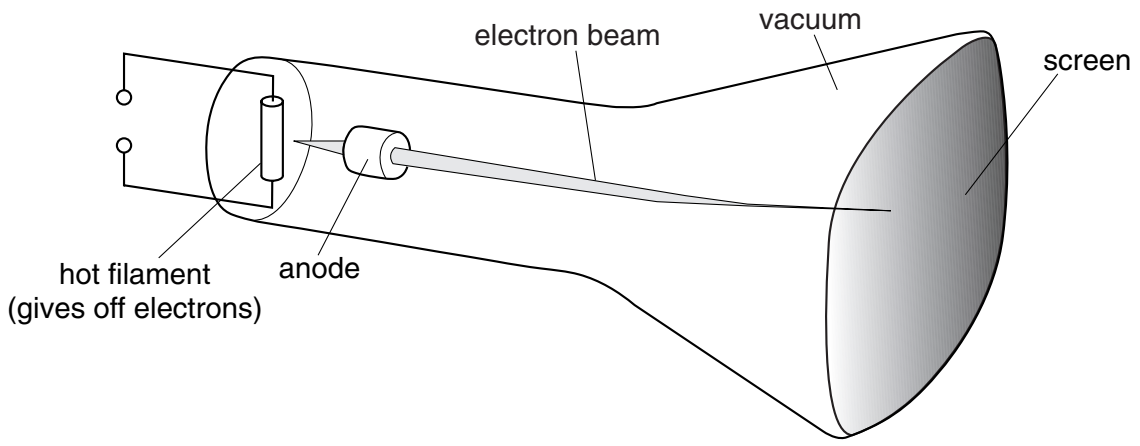

Fig. 11.1

(a) When a television set is in use, a static electric charge builds up on the screen. Suggest why this happens.

.....

.....

..... [2]

(b) To release electrons from the filament, electricity must flow through the filament. For this there must be a potential difference or voltage across the filament.

Using the correct symbol, draw on Fig. 11.1 where a voltmeter could be placed to measure the voltage across the filament. [2]

(c) The filament is a piece of wire.

State two factors that affect the resistance of a piece of wire.

1. .....

2. ..... [2]

(d) Two 100 Ω resistors are connected in series. Calculate their combined resistance.

..... Ω [1]

12 Fig. 12.1 shows three kinds of food.

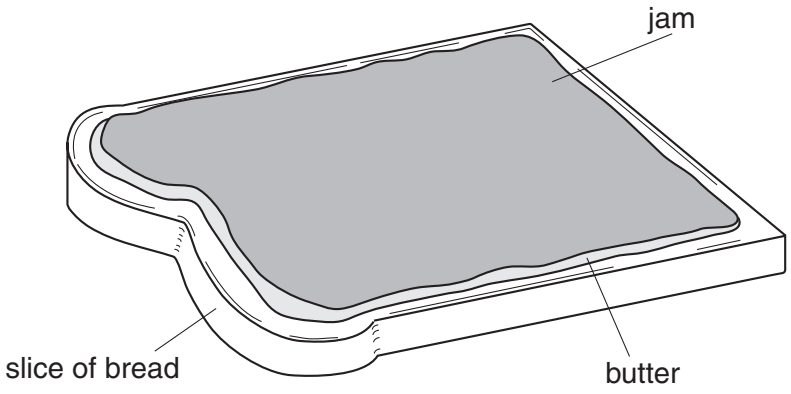

Fig. 12.1

(a) **(i)** Bread contains starch, and jam contains sugars. Molecules of starch and sugar contain the same three elements bonded together.

Name these elements.

.....

..... [2]

(ii) Starch is formed from glucose in plants.

Draw part of a starch molecule using the symbol —◯— to represent a glucose molecule.

[1]

(iii) Use your answer to **(ii)** to explain the meaning of the term *polymer*.

.....

.....

..... [2]

(b) When making bread, the first stage is to mix flour, water and yeast. Carbon dioxi forms in the mixture as a result of action by the yeast.

A student investigated this process using the apparatus shown in Fig. 12.2.

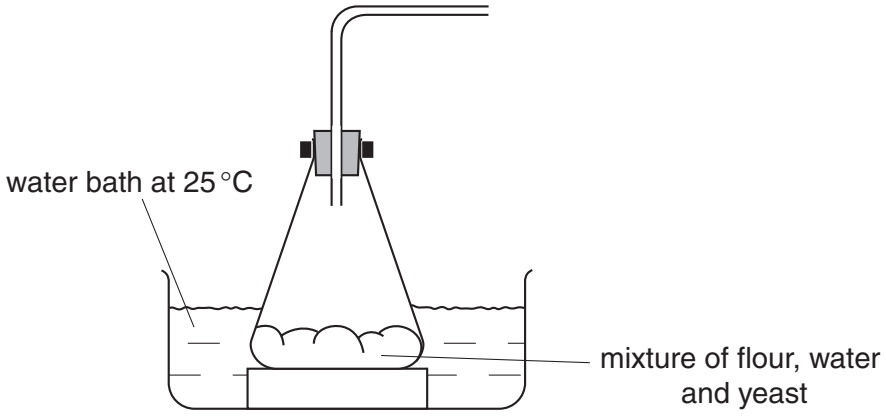

Fig. 12.2

Complete the diagram so that the apparatus could be used to prove that the gas given off is carbon dioxide. Label any additional apparatus and substances that are necessary. [2]

(c) Bread, butter and jam are all types of colloid.

Fig. 12.3 shows the structure of a typical colloid. In this diagram, substance **B** is dispersed in substance **A**.

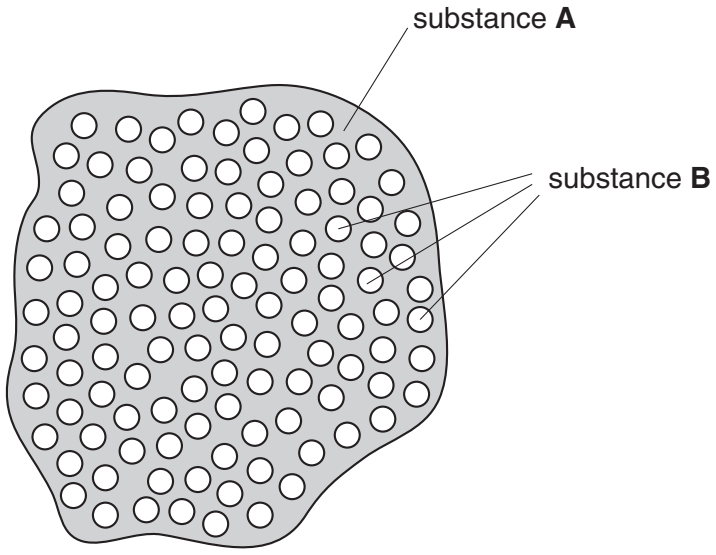

Fig. 12.3

Complete the table below using only the words **solid**, **liquid** or **gas**. The first row has been done for you.

food	type of colloid	substance **A**	substance **B**
bread	solid foam	solid	gas
butter	emulsion		
jam	gel		

[2]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K otassium	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawr 10

3-71 Lanthanoid series
0-103 Actinoid series

y | a X b | a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).