Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/02**

Paper 2

May/June 2005

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.
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	
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Total	

This document consists of **24** printed pages.

1 Fig. 1.1 shows some experiments carried out by a student investigating the reactions of three metals, **Q**, **R** and **S**.

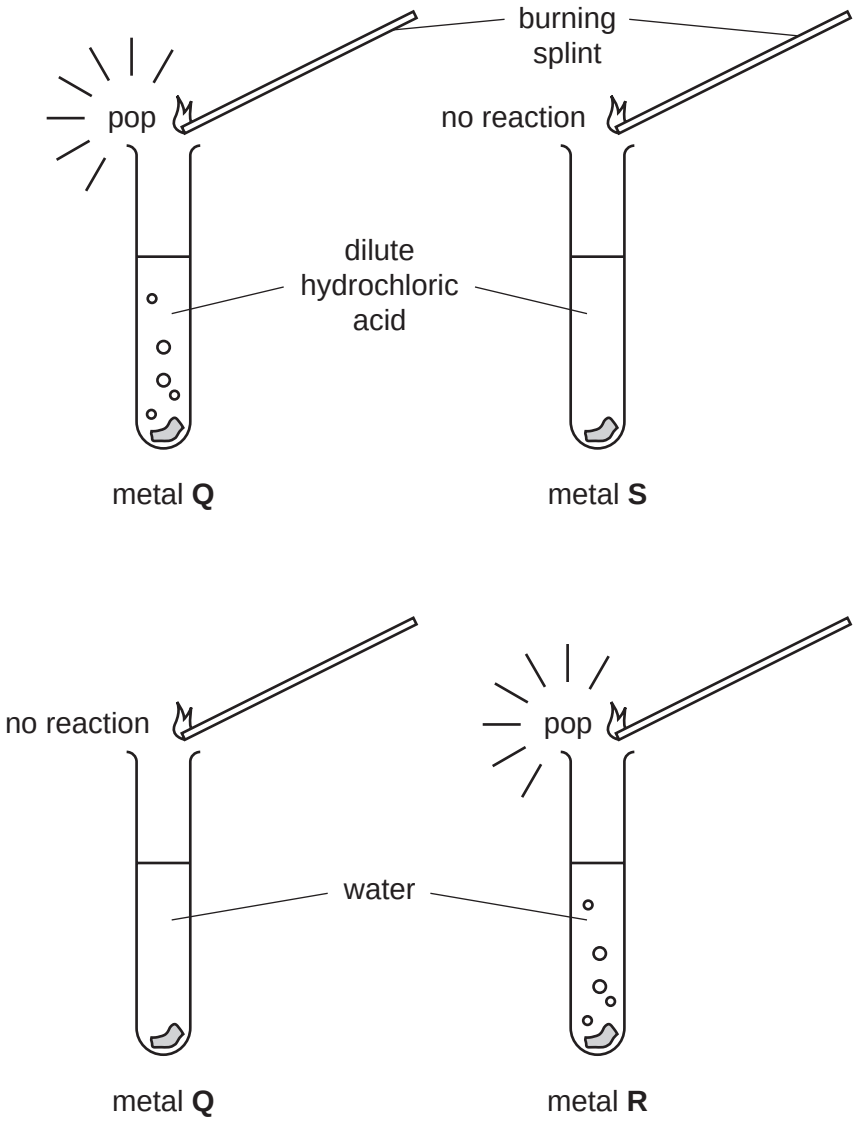


Fig. 1.1

(a) (i) Name the gas given off in these experiments.

..... [1]

(ii) Place the metals in the order of reactivity suggested by the results of the experiments.

..... most reactive

.....

..... least reactive [1]

(iii) State **one** observation which would show that the reaction between metal **R** and water is exothermic.

.....

..... [1]

(b) Fig. 1.2 shows the apparatus and some of the substances needed to make an electrical cell.

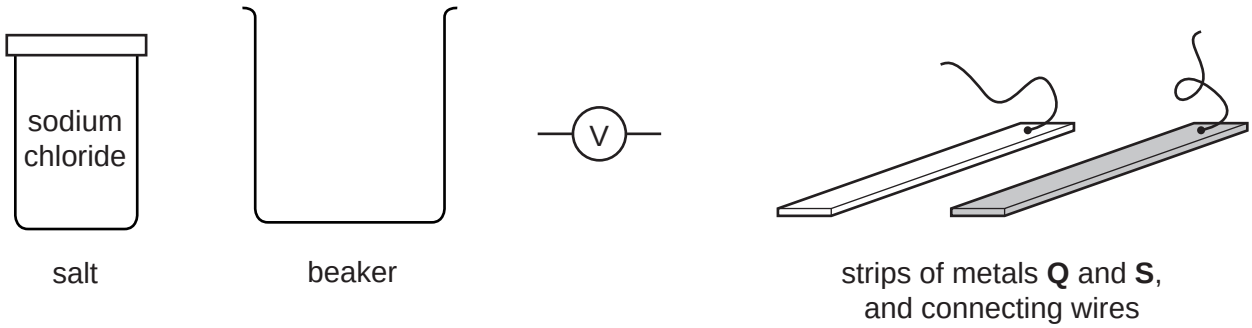


Fig. 1.2

(i) State the other substance needed to make the cell.

..... [1]

(ii) In the space below, draw a diagram showing how the apparatus and substances should be used to make an electrical cell whose voltage is being measured.

..... [2]

(iii) Explain why metal **R**, shown in Fig. 1.1, would be unsuitable for use as an electrode in this electrical cell.

..... [1]

2 Sheep, like most mammals, have skin covered by hair. The covering of hair on a sheep is called a fleece. The fibres which make up the fleece are called wool. Wool fibres are elastic, which means that they can stretch and then return to their original length.

(a) Fig. 2.1 shows how the length of wool fibres changes as different forces are applied to them.

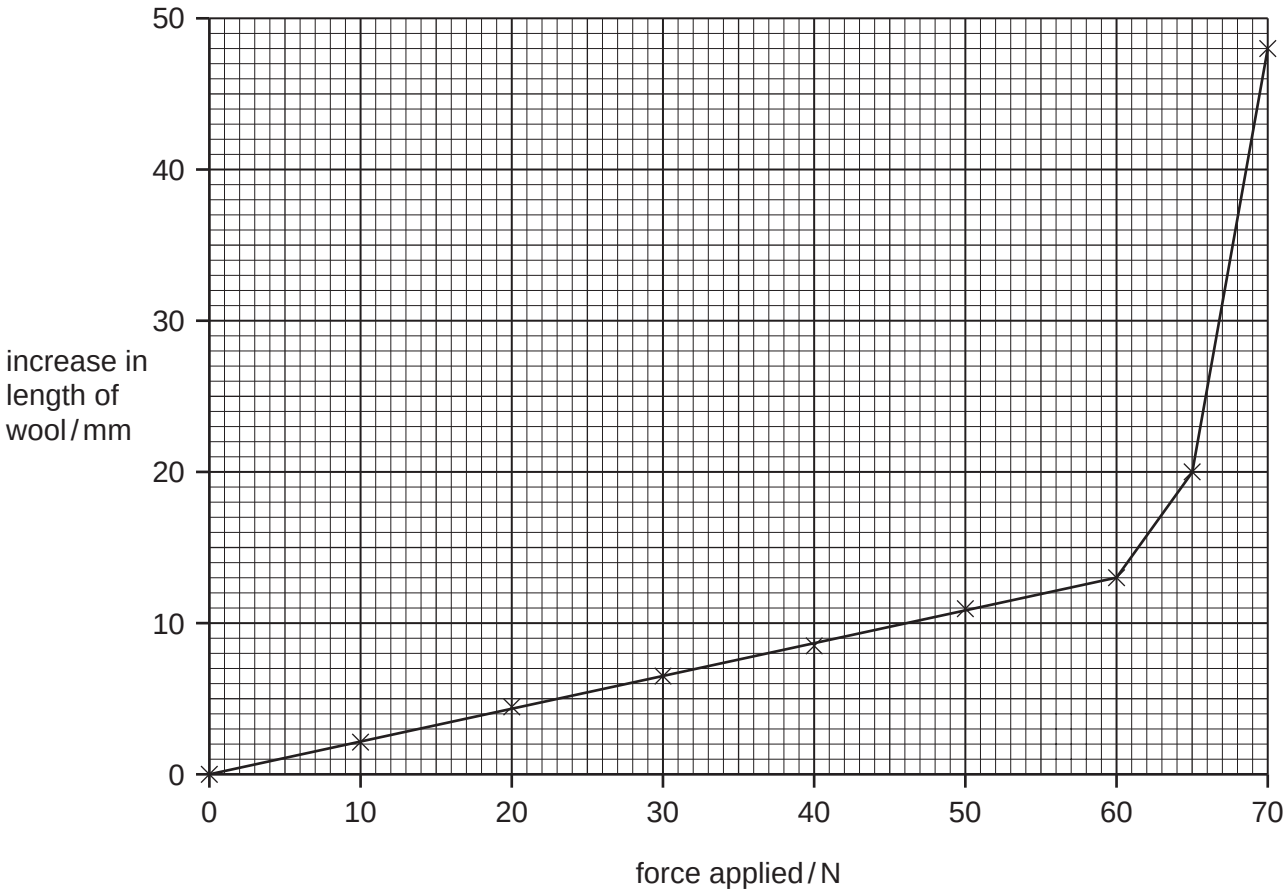


Fig. 2.1

(i) Describe the relationship between the force applied and the increase in the length of the wool fibres up to a force of 60 N.

.....

..... [2]

(ii) Suggest what happens when a force greater than 70 N is applied to the wool fibres.

.....

..... [1]

(b) Wool helps sheep to maintain their body temperature in cold conditions. With reference to methods of heat transfer, suggest how wool reduces heat loss from a sheep's body to the air.

.....

.....

..... [2]

(c) Merino sheep are kept for their excellent wool. The finer the wool, the better the price that a farmer can get for it.

One farmer kept a flock of sheep on a farm in a part of Australia where the climate is hot and dry. A second farmer kept sheep in a wetter, cooler area. The fleeces of the sheep belonging to the first farmer had fewer, thicker fibres than the fleeces of the sheep belonging to the second farmer.

Suggest **two** different factors which might account for this variation between the two flocks of sheep.

.....

.....

..... [2]

(d) Having hair on the skin is a characteristic of mammals. What type of skin covering would you find on an animal from each of the following groups?

(i) reptiles ..... [1]

(ii) amphibians ..... [1]

3 Fig. 3.1 shows an astronaut.

Fig. 3.1

(a) Four astronauts are standing on four different planets. One of these planets is Earth, which has a gravitational field strength of 10N / kg.

Table 3.1 shows the mass and weight of each astronaut as they stand on the four planets.

Table 3.1

astronaut	mass / kg	weight / N
A	70	140
B	60	600
C	50	1000
D	80	160

(i) Which astronaut is on Earth? Explain your answer.

.....

..... [1]

(ii) Which two astronauts are standing on planets with the same gravitational field strength?

.....

..... [1]

(iii) Which astronaut would weigh the least on Earth? Explain your answer.

.....

..... [1]

(b) Astronauts on the Moon are unable to talk directly to each other, but must use radio signals as the Moon has no atmosphere.

Explain why sound waves need a medium such as air to travel through.

.....

.....

..... [2]

(c) A radio signal sent from Earth to an astronaut on the Moon travels 400 000 kilometres. The speed of radio waves is 300 000 km / s.

Calculate how long it will take the radio signal to travel from the Earth to the astronaut on the Moon.
Show your working and state the formula that you use.

formula used

working

..... s [2]

4 Mixtures of raw materials used to make three types of coloured glass are shown below.

blue glass	violet glass	green glass
white sand	white sand	white sand
potassium carbonate	sodium carbonate	sodium carbonate
borax	potassium nitrate	potassium nitrate
lead oxide	calcium carbonate	calcium carbonate
cobalt oxide	manganese dioxide	iron oxide
	iron oxide	copper oxide

(a) For which colours of glass shown above is limestone a raw material?

.....

[1]

(b) Suggest how the mixture of raw materials required for **colourless** glass would differ from that shown above for violet glass.

Explain your answer.

.....

.....

.....

.....

[3]

(c) The diagrams in Fig. 4.1 show the arrangement of particles in different types of substances.

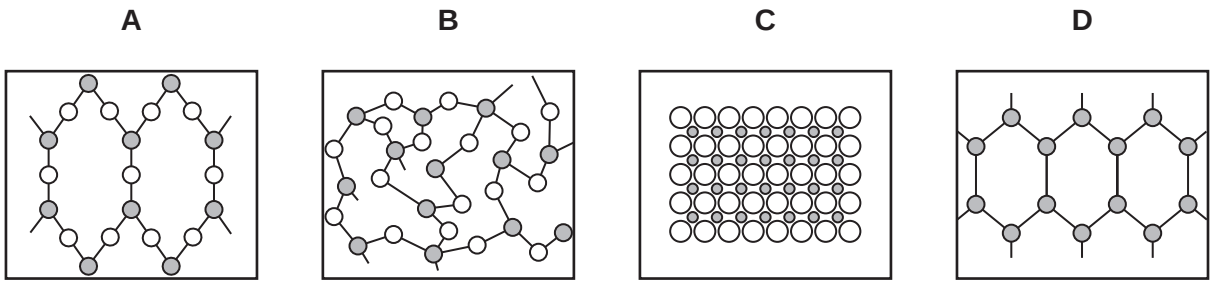


Fig. 4.1

State, with reasons, which diagram, **A**, **B**, **C** or **D**, shows the way atoms are arranged in a typical glass.

diagram .....

reasons .....

.....

.....

[3]

(d) Craftsmen who make glass ornaments use a special gas burner to melt glass. Fig. 4.2 shows this type of burner which gives a much higher flame temperature than an ordinary gas burner such as a Bunsen burner.

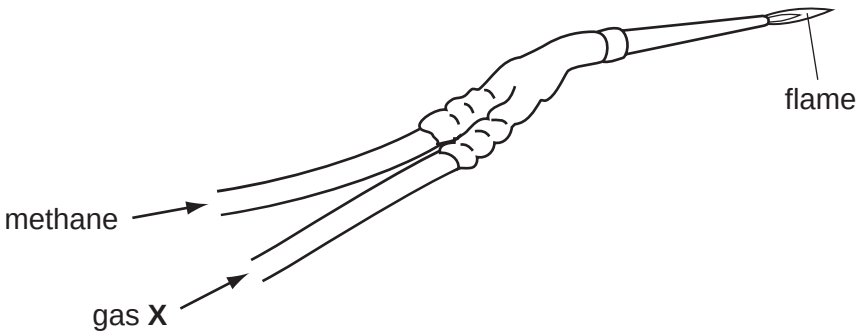


Fig. 4.2

(i) Suggest the name of gas **X**.

..... [1]

(ii) The gas suppliers add a sulphur compound to the methane. This gives an odour to the methane so that leaks may be detected. The sulphur compound burns when the methane burns.

Explain why the amount of the sulphur compound added to the methane should be kept at a very low level.

.....

.....

..... [2]

5 Fig. 5.1 shows the structure of an insect-pollinated flower. The flower produces nectar on which bees can feed.

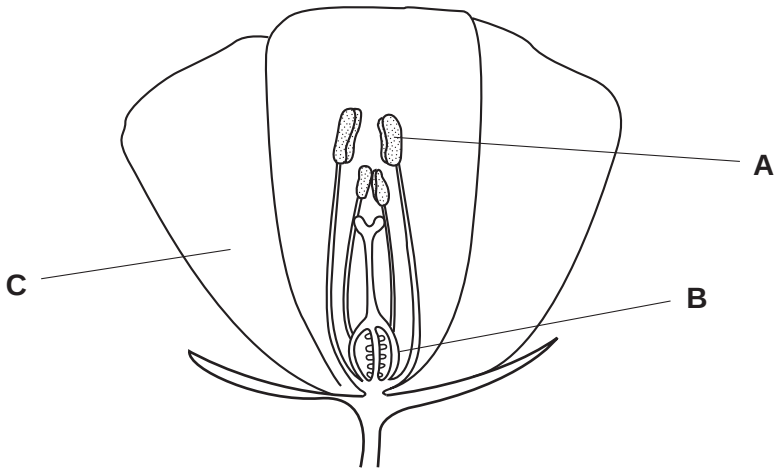


Fig. 5.1

(a) Name the parts labelled **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(b) Describe how pollination takes place in this flower.

.....

.....

.....

..... [3]

(c) Nectar contains sugar, which provides the bees with energy.

(i) Name the process by which a plant produces sugar, such as glucose.

..... [1]

(ii) Describe the role of chlorophyll in this process.

.....

.....

..... [2]

(d) Bees may be eaten by birds called bee-eaters.

(i) Use the information in this question to construct a food chain including bee-eaters.

..... [2]

(ii) Which organisms in your food chain are consumers?

..... [1]

[Turn over

6 Electricity is a useful form of energy.

(a) Use the information given to answer the questions below.

Wind power
Wind can be used as an energy source to produce electrical energy. One wind turbine is able to generate 2 megawatts (MW) of power.

Nuclear power
A nuclear power station uses enriched uranium as a fuel. Radioactive waste materials are produced. A typical nuclear power station can generate 1500 MW.

Electricity demand
Typical demand for electric power in an industrial country is about 50 000 MW.

(i) State one advantage and one disadvantage (apart from cost) of using each energy source to generate electricity in an industrial country.

	using wind power	using nuclear power
advantage		
disadvantage		

[4]

(ii) Why are scientists trying to find alternatives to fossil fuels for generating electricity?

.....

..... [1]

(b) **(i)** Name the device which increases the voltage of the electricity generated at power stations before transmission.

..... [1]

(ii) Explain why it is advantageous to increase the voltage of the electricity before transmission.

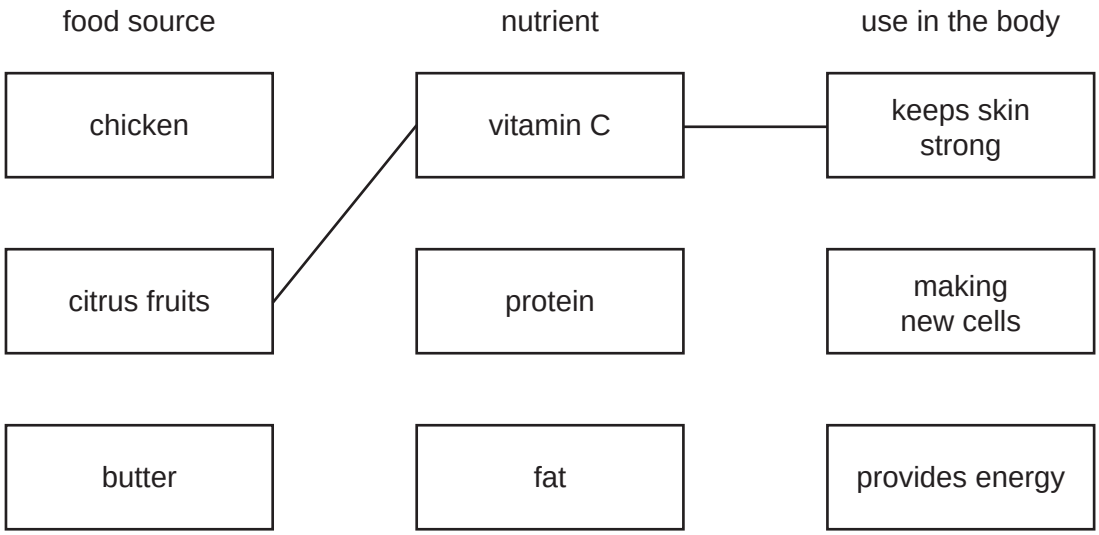
.....

..... [1]

7 **(a)** The boxes below list foods each containing a particular type of nutrient, and the use of that nutrient in the body.

Draw a line from each nutrient to a good food source and to a use of it in the body.

The first one has been done for you.



[2]

(b) If the diet contains more protein than is needed, the excess is changed into urea and excreted from the body.

(i) Name the organ in which excess protein is converted to urea.

.....[1]

(ii) How is the urea excreted from the body?

.....

.....

.....[2]

8 Water, H_2O, and hydrogen peroxide, H_2O_2, are colourless, transparent liquids.

(a) What is meant by the term *transparent*?

.....

..... [1]

(b) State **one** similarity and **one** difference between a molecule of water and a molecule of hydrogen peroxide.

similarity .....

.....

difference .....

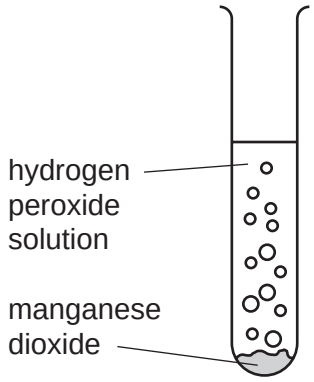
..... [2]

(c) Hydrogen peroxide slowly decomposes according to the equation

hydrogen peroxide ⟶ water + oxygen

Manganese dioxide is an insoluble compound which catalyses this reaction.

A student added 1.0 g of manganese dioxide to an aqueous solution of hydrogen peroxide.



(i) Describe how the student can show that the gas given off is oxygen.

.....

..... [2]

(ii) Predict the mass of manganese dioxide that is left in the test-tube when all the hydrogen peroxide has decomposed.

Explain your answer.

.....

.....

..... [2]

(d) Pure water is not suitable for removing oil from cloth, because oil does not dissolve in water.

Suggest two ways of cleaning the cloth, other than using pure water, that would be more successful in removing oil.

1. .....

.....

2. .....

..... [2]

9 **(a)** A student sets up an electric circuit as shown in Fig. 9.1.

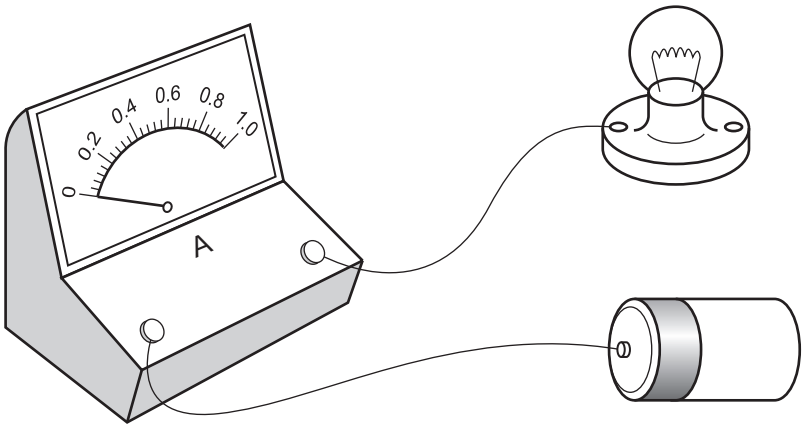


Fig. 9.1

(i) In the diagram the ammeter reading is zero. What is wrong with the circuit?

.....

..... [1]

(ii) What is the **name** of the unit in which current is measured?

..... [1]

(b) Another student investigates the relationship between the potential difference across a lamp and the current passing through it.

(i) Draw a circuit diagram showing the apparatus needed and how it should be connected. Use the correct symbols.

[3]

Fig. 9.2 shows the results of this investigation.

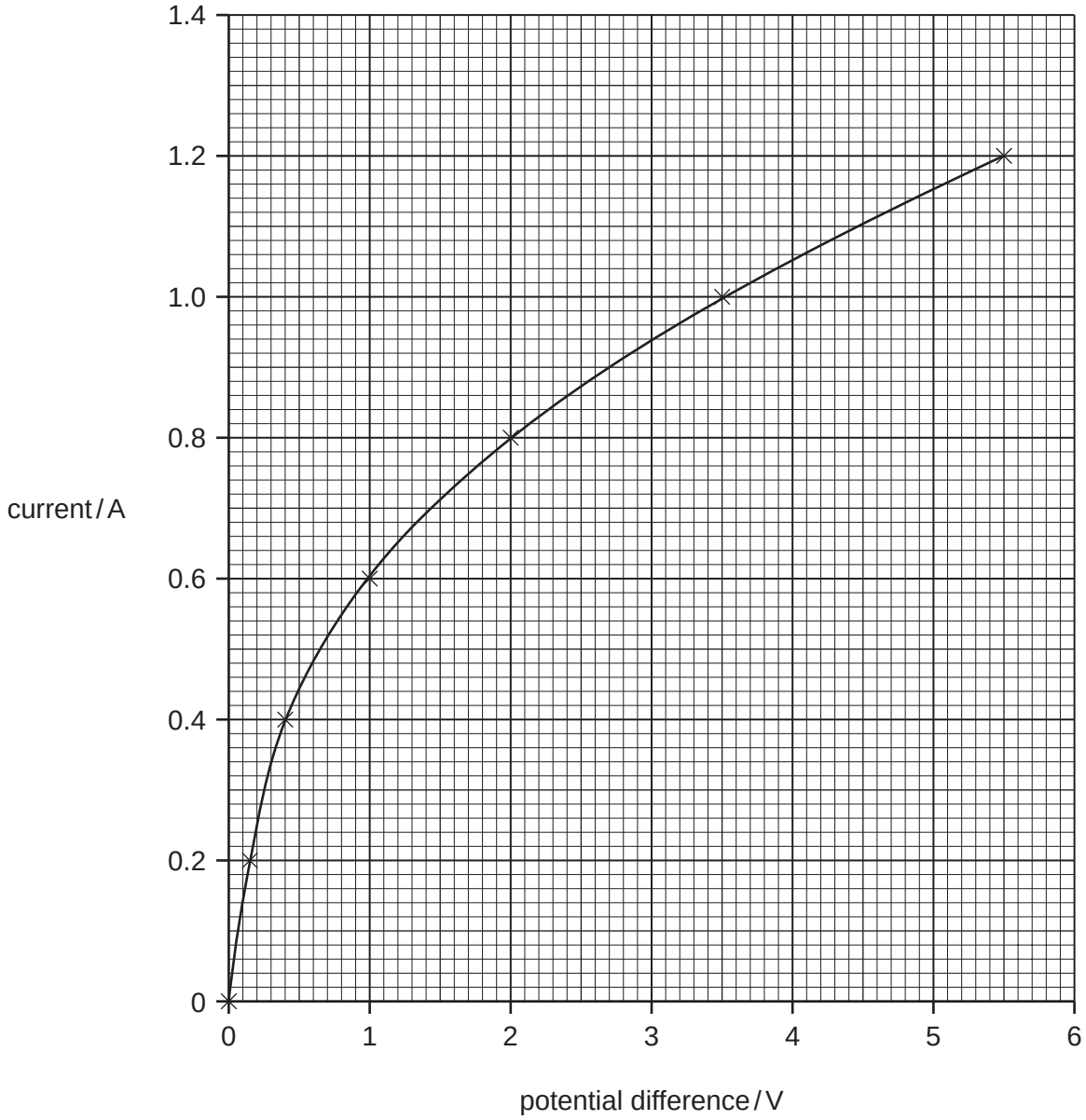


Fig. 9.2

(ii) Using data from Fig. 9.2 calculate the resistance of the lamp when the current passing through it is 0.4 A.

Show your working and state the formula that you use.

formula used

working

..... Ω [3]

(iii) Using the formula

power = voltage x current

calculate the power used by the lamp when the current is 0.4 A.

.....W [1]

(iv) State the number of joules of energy being transferred per second, when the current flowing through the lamp is 0.4 A.

..... J / s [1]

10 **(a)** When two cars collide, energy is said to be conserved. Explain what is meant by this.

.....

.....

..... [2]

(b) When water in a beaker is heated, its temperature rises until it begins to boil at 100°C. On further heating, it continues to boil but the temperature stays at 100°C.

Explain, in terms of particles, why this happens.

.....

.....

..... [2]

(c) Explain why you should never switch on a mains electrical appliance using wet hands.

.....

.....

..... [2]

(d) Fig. 10.1 shows a sample of gas held in a cylinder by a piston.

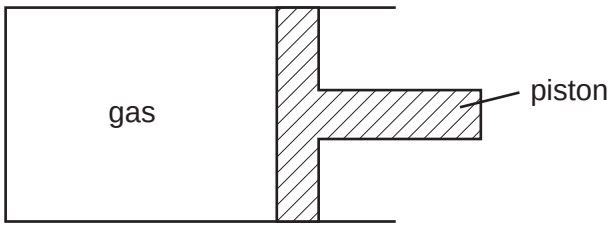


Fig. 10.1

Explain why, when the piston is pushed in, the pressure of the gas increases.

.....

.....

..... [2]

11 Fig. 11.1 shows apparatus which can be used to investigate what happens when sodium chloride solution is electrolysed.

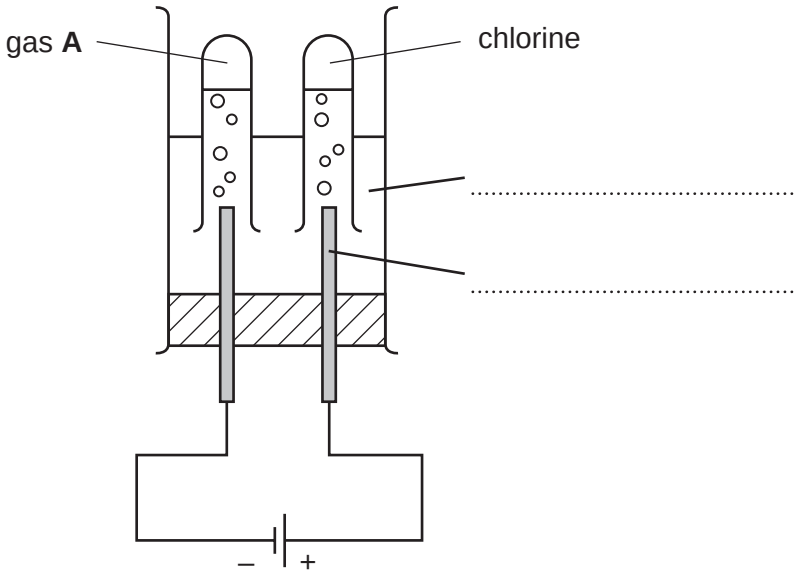


Fig. 11.1

(a) Complete the labelling of the diagram using words from the following list.

anode **cathode** **current** **electrolyte** **ion**

[2]

(b) Table 11.2 shows the results of pH measurements made on the solution during an experiment using the apparatus in Fig. 11.1.

Table 11.2

before the current is switched on	after the current has passed for several minutes
pH 7.0	pH 13.5

Explain these results.

.....

.....

..... [2]

(c) Fig. 11.3 shows a molecule of the compound halothane. Halothane is used as an anaesthetic.

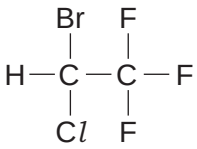


Fig. 11.3

(i) State the number of different elements present in one molecule of halothane.

..... [1]

(ii) State the total number of halogen atoms in one molecule of halothane.

..... [1]

(iii) An atom of chlorine has a proton number of 17. State the number of electrons in the outer energy level (shell) of a chlorine atom.

..... [1]

(iv) An atom of gas **A** in Fig. 11.1 has a nucleon number of 1.

State the type of particle **not** present in the nucleus of this atom, but which **is** present in the nucleus of atoms of all other elements.

..... [1]

12 Fig. 12.1 shows a human skull and the lower jaw.

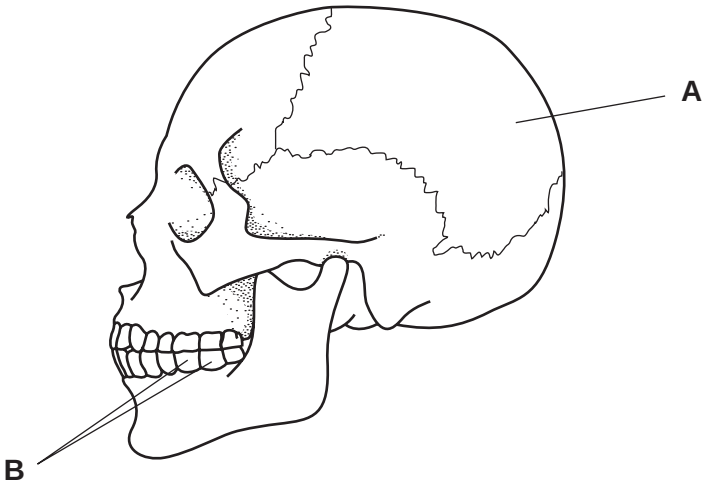


Fig. 12.1

(a) The part labelled **A** is made of bone.

(i) What is the role of this part of the skull?

.....

.....

[1]

(ii) Explain why cartilage would **not** be a suitable material for this part of the skull.

.....

.....

.....

[1]

(iii) State **one** part of the body where cartilage is found, and describe its role.

.....

.....

.....

.....

[2]

(b) **(i)** Describe the function of the teeth labelled **B** on Fig. 12.1.

.....

.....

.....

.....

[2]

(ii) On average, the teeth labelled **B** are more likely to decay than the teeth at the front of the mouth.
Suggest an explanation for this.

.....

.....

..... [2]

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 3	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 11	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 Potassium 19	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 37	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 55	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 87	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 Lawrencium 103

*58-71 Lanthanoid series
90-103 Actinoid series

Key: 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.).