Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3309311037

COMBINED SCIENCE **0653/23**

Paper 2 (Core) **October/November 2014**

1 hour 15 minutes

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.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 24.

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.

This document consists of **23** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

1 A student performs some experiments to find out what makes iron rust.

(a) Fig. 1.1 shows his first experiment.

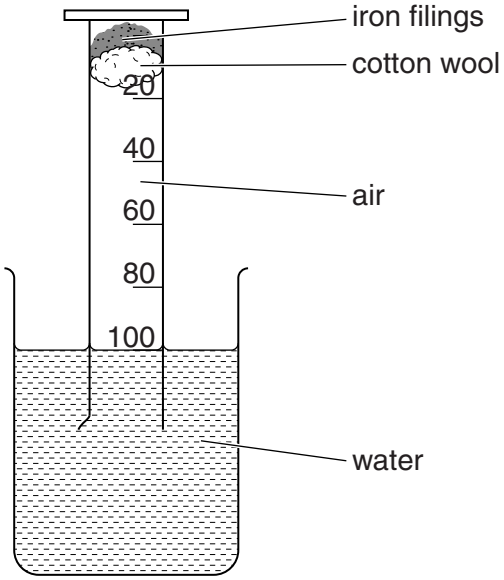


Fig. 1.1

The student makes sure that the water levels inside and outside the measuring cylinder are in line with the 100 cm^3 mark.

Fig. 1.2 shows the apparatus after a few days.

The iron has rusted and the water has started to rise up the cylinder.

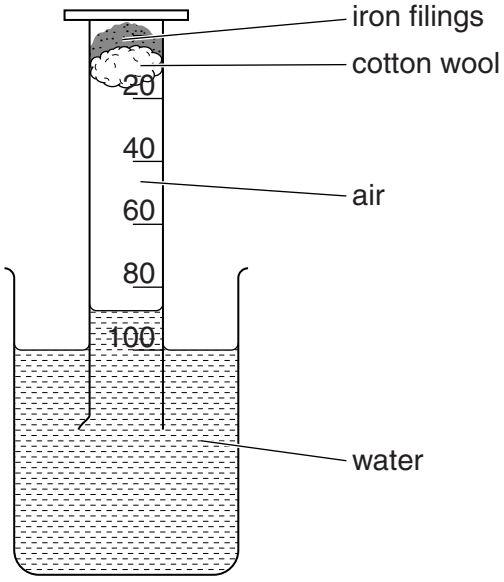


Fig. 1.2

(i) One of the compounds present in rust is iron oxide.

In this compound there are two iron atoms for every three oxygen atoms.

State the chemical formula of iron oxide.

..... [1]

(ii) Explain why the water has risen up the cylinder.

.....

.....[1]

(iii) After a week, the water stops rising although some of the iron has not rusted.

Predict the mark the water finally reaches.

..... [1]

(iv) Name the main element in the gas remaining in the measuring cylinder after one week.

.....[1]

(b) Fig. 1.3 shows the first experiment repeated with the beaker containing oil instead of water.

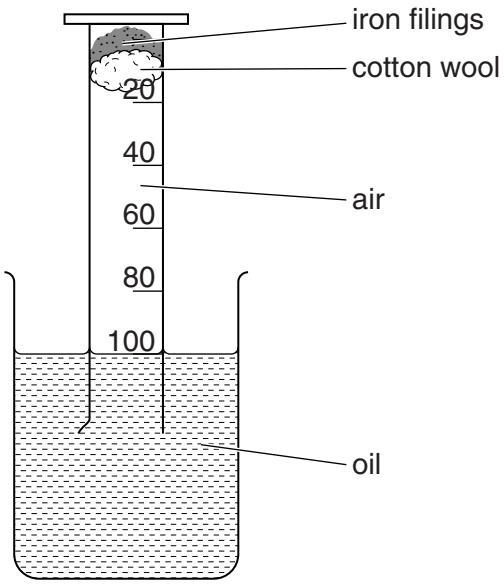


Fig. 1.3

State what happens in this version of the experiment.

.....

Explain your answer.

.....

.....[2]

(c) Describe and explain **one** method that is used to prevent an iron object from rusting.

.....

.....

.....[2]

2 **(a)** Fig. 2.1 shows a man paddling a canoe up a river.

The man is paddling gently, but the canoe remains stationary alongside the river bank.

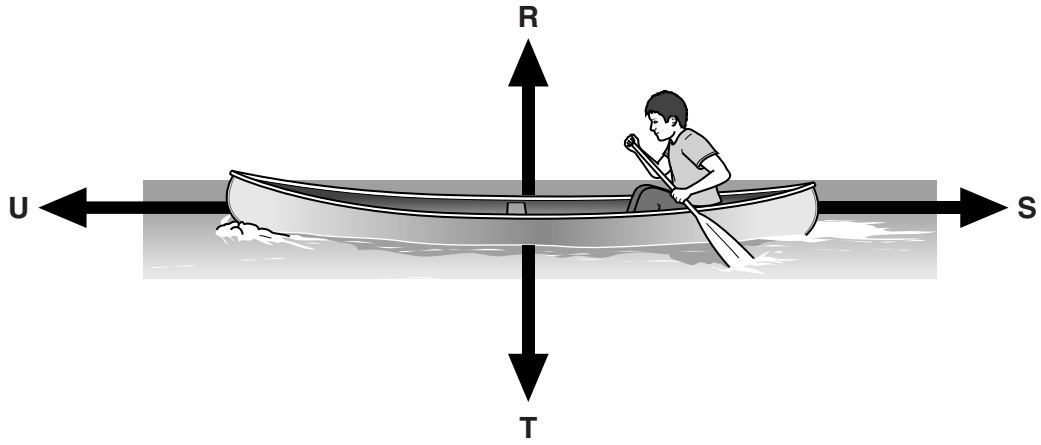


Fig. 2.1

(i) State which force from **R**, **S**, **T** and **U** is

the weight of the canoe and the man, ...

the force propelling the canoe forward, ...

the force due to the water current. .....

[2]

(ii) Explain, in terms of balanced forces, why the canoe remains stationary alongside the river bank.

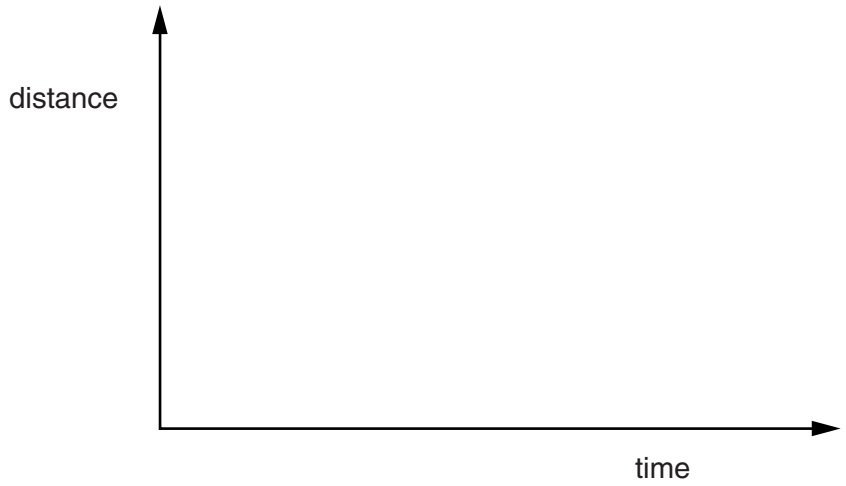
.....

.....

.....[2]

(b) The man now paddles the canoe steadily so that it moves along the river at a constant speed.

On the axes below, sketch a distance/time graph for the canoe as it moves along the river.



[1]

(c) **(i)** State the form of stored energy in the man that is transferred from him as he paddles the canoe.

.....[1]

(ii) State the useful form of energy gained by the canoe as a result of this transfer.

.....[1]

(iii) Identify **one** form of energy that is **not** useful that is transferred from the man paddling the canoe.

.....[1]

(d) The man now paddles the canoe at a steady speed of 2 m/s.

Calculate the time in seconds taken by the canoe to travel 2400 m.

State the formula you use and show your working.

formula

working

time = ... s [2]

3 **(a)** Fig. 3.1 shows one undecayed human tooth and one with decay.

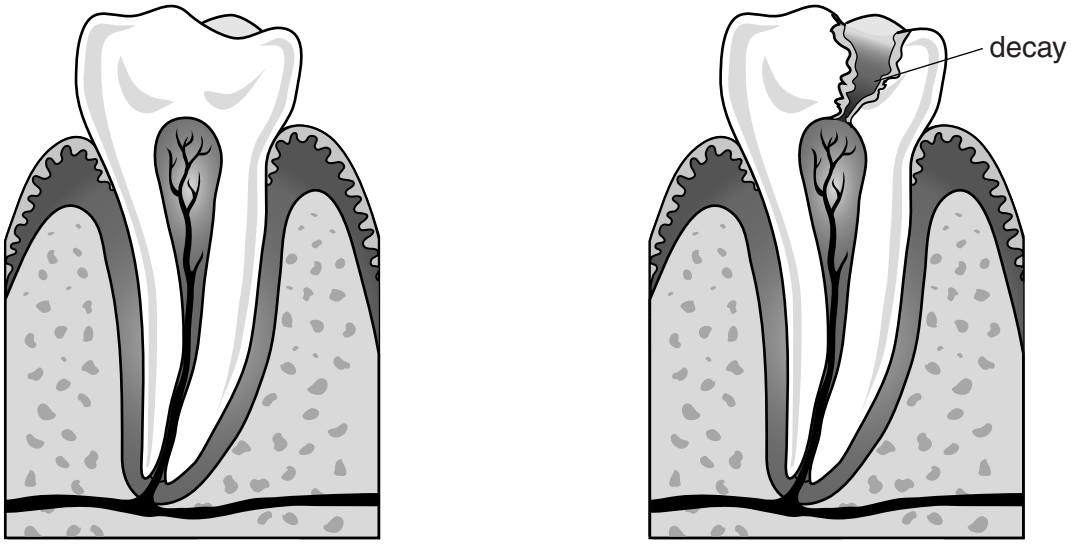


Fig. 3.1

State which type of tooth is shown in both diagrams in Fig. 3.1.

..... [1]

(b) Tooth **B** shows tooth decay.

(i) Suggest why the person had toothache.

.....

.....[1]

(ii) Explain fully how eating sugary foods can cause tooth decay.

.....

.....

.....

.....

.....[3]

(c) When babies start to eat solid food they do not have enough teeth to chew their food.

Explain why it is important that the food should be broken down for them into very small pieces.

.....

.....

.....

.....[2]

(d) In the mouth, the process of chemical digestion starts.

Explain what is meant by the term *chemical digestion*.

.....

.....

.....

.....[3]

(e) Protease (protein-digesting enzyme) digests protein in the acidic environment of the stomach.

Predict whether this protease will continue to digest proteins in the alkaline environment of the small intestine.

Explain your answer.

.....

.....

.....[2]

4 Fig. 4.1 shows an electric hairdryer that uses mains electricity.

Fig. 4.1

A heater inside the hairdryer warms the air. A fan blows the warm air out of the hairdryer.

(a) The hairdryer contains a switch, a heater to warm the air and an electric motor to drive the fan. The heater and the motor are connected in parallel.

Fig. 4.2 shows the circuit symbols for a switch, a heater and an electric motor.

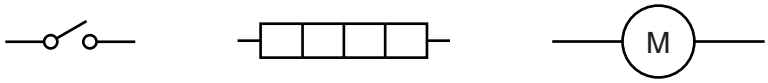


Fig. 4.2

On Fig. 4.3 use the symbols in Fig. 4.2 to complete the circuit diagram for the hairdryer connected to the mains electricity supply. The mains electricity supply has been drawn for you.

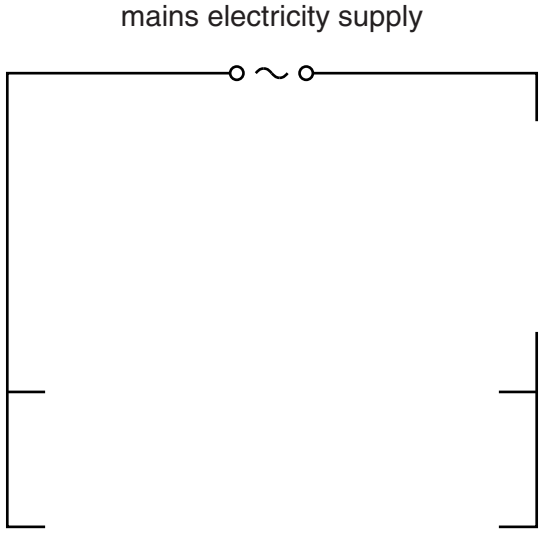


Fig. 4.3

[2]

(b) The flow of warm air dries the wet hair by evaporation.

Explain, in terms of molecules, why using warm air helps to dry wet hair.

.....

.....

.....[2]

(c) When air is heated, it rises.

State the name of the process by which heated air rises.

.....[1]

(d) Fig. 4.4 shows information on a label fixed to the hairdryer.

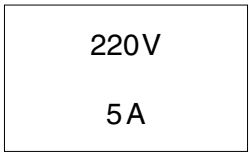


Fig. 4.4

(i) State the name of the unit whose symbol is V.

.....[1]

(ii) Use the formula

$$R = \frac{V}{I}$$

to find the combined resistance of the circuit components in the hairdryer when in use.

Show your working and state the unit of your answer.

resistance = ... unit = ... [2]

(e) The plug on the mains lead of the hairdryer is fitted with a fuse. One day, the fuse blows while the hairdryer is being used.

(i) Give **one** possible cause for the fuse blowing.

.....

.....[1]

(ii) The fuse has to be replaced.

The current through the hairdryer when in use is 5 A. Several new fuses with different current ratings are available, as shown in this list:

2 A 5 A 10 A 15 A

Explain which of these four fuses should be used.

Fuse ..... should be used because .....

.....

.....

.....[2]

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5 **(a)** A student investigates the effect of gravity on the growth of a seedling.

The student germinates a seed. When the radicle is clearly visible, he pins the seedling to a board, as shown in Fig. 5.1 (a). He positions the board so that the radical is horizontal.

The radicle continues to grow and curves downwards, as shown in Fig. 5.1 (b).

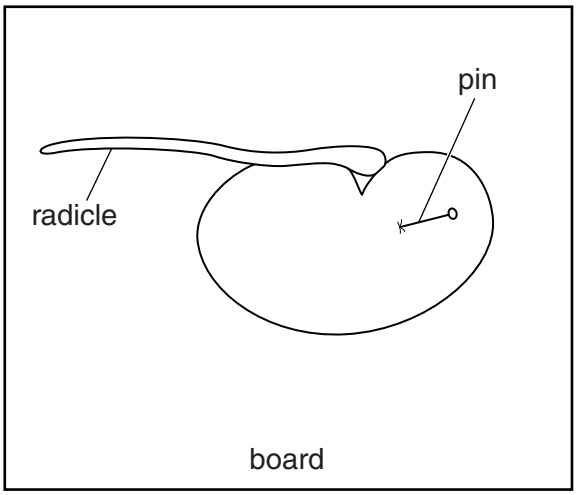

Fig. 5.1 (a)

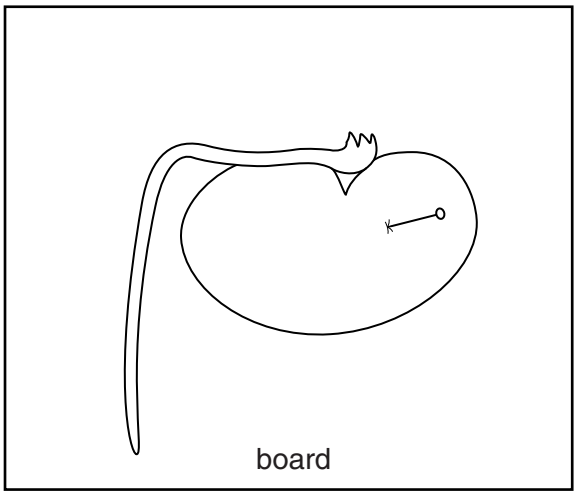

Fig. 5.1 (b)

(i) Name the growth response shown by the seedling.

..... [1]

(ii) Explain how this growth response is an advantage to the seedling.

.....

.....

.....[2]

(iii) In a second experiment the seedling is pinned on the board in a different position, as shown in Fig. 5.2 (a).

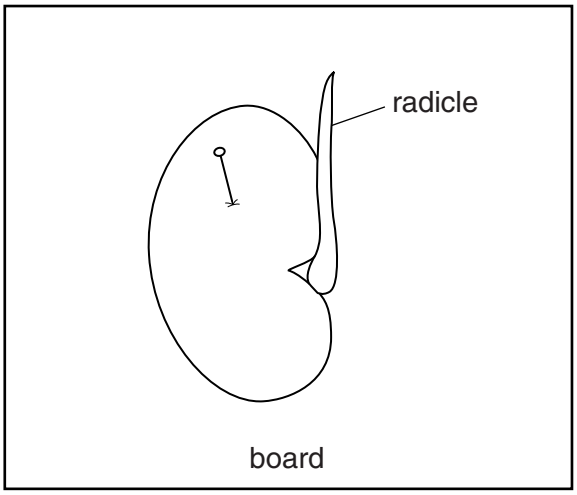

Fig. 5.2 (a)

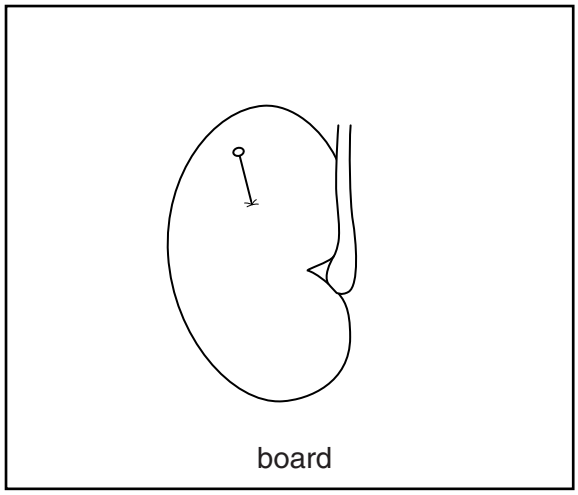

Fig. 5.2 (b)

Complete Fig. 5.2 (b) to show the appearance of the radicle after a few days. [1]

(b) Fig. 5.3 shows a strawberry plant. The strawberry plant can reproduce both asexually and sexually.

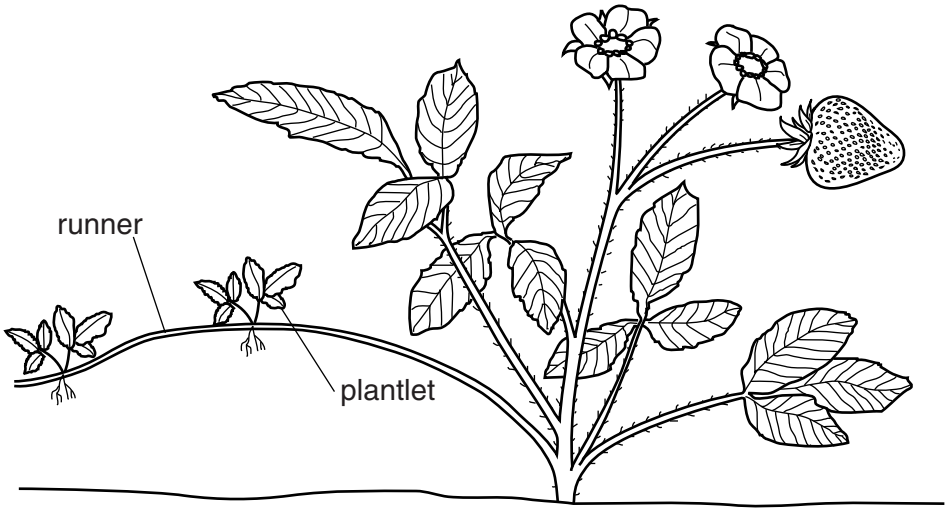

Fig. 5.3

The strawberry plant produces runners with plantlets. The runners are stems produced by the parent plant. If the roots of a plantlet come into contact with damp soil, the plantlet can grow into a new independent plant.

(i) Use the information provided to explain why reproduction with runners is asexual.

.....

.....[1]

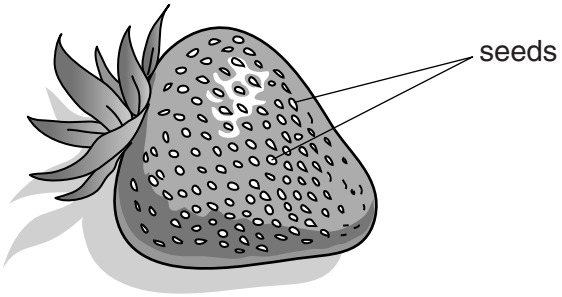

Fig. 5.4

Fig. 5.4 shows a strawberry produced by the plant after one of the flowers is pollinated. The seeds on the strawberry will produce new plants when they are germinated.

(ii) Explain why this method of reproduction is sexual.

.....

.....[1]

(iii) Describe and explain how a group of plants grown from runners will be different from a group of plants produced when seeds germinate.

.....

.....

.....

.....[2]

6 **(a)** Dilute hydrochloric acid reacts with zinc to produce a colourless gas.

Describe a test to show that the gas is hydrogen.

test .....

result ..... [2]

(b) Fig. 6.1 shows the apparatus a student uses to investigate the effect of changing the temperature of acid on the rate of reaction with zinc.

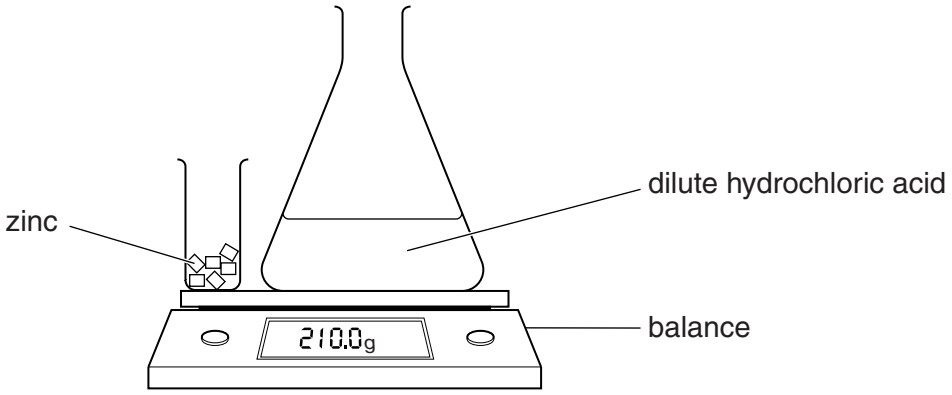

Fig. 6.1

At the start of the experiment, the student adds the zinc to acid at a temperature of 20 °C.

(i) The student expects the balance reading to decrease while zinc reacts with the acid.

Suggest the measurements the student makes to find the rate of reaction.

.....

.....

.....[2]

(ii) Suggest what he should do to find the effect of temperature on the rate of reaction.

.....

.....[1]

(iii) Describe the expected effect of temperature on the rate of reaction.

.....

.....[1]

(c) The student investigates what happens if he uses copper in place of zinc in the apparatus in Fig. 6.1.

(i) Name the part of the Periodic Table in which copper is found.

.....[1]

(ii) Describe and explain what he observes.

.....

.....

.....[2]

7 Astronomers use telescopes to study the electromagnetic radiation that reaches the Earth from the stars.

(a) (i) Complete the sentences below using words from the list. You may use each term once, more than once or not at all.

radio waves **sound waves** **ultra-violet** **visible light** **water waves**

People can see stars with their eyes because the stars emit ..... .

Astronomers need special telescopes to see other types of electromagnetic radiation from stars. Examples of such types of radiation are ..... and ..... . [2]

(ii) We are able to see the Moon, even though the Moon itself does not emit electromagnetic radiation.

State a characteristic behaviour of electromagnetic radiation that enables us to see the Moon.

.....[1]

(b) Some stars emit electromagnetic radiation with a very high frequency, such as X-rays.

(i) State the meaning of the term *frequency*.

.....

.....[1]

(ii) Fig. 7.1 shows an incomplete diagram of the electromagnetic spectrum.

gamma radiation					microwaves	

Fig. 7.1

Mark with an **X** on Fig. 7.1 the part of the spectrum where X-rays are situated. [1]

(c) Increasing the amplitude of sound waves makes sound louder.

Suggest what effect will be seen when the amplitude of light waves is increased.

.....

.....[1]

Question 8 begins on page 20

8 (a) *Diffusion* is the net movement of molecules from a region of higher concentration to a region of lower concentration. It is how some substances enter and leave cells.

A student carries out an experiment to study diffusion. He uses gelatine cubes of different sizes which represent differently-sized cells. See Fig. 8.1.

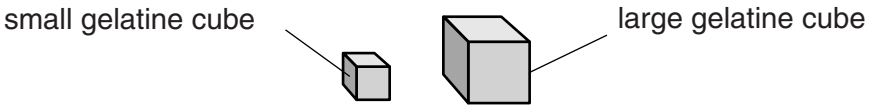

Fig. 8.1

The student immerses the cubes in acid. The gelatine contains a purple indicator that turns colourless when the acid reaches it. See Fig. 8.2.

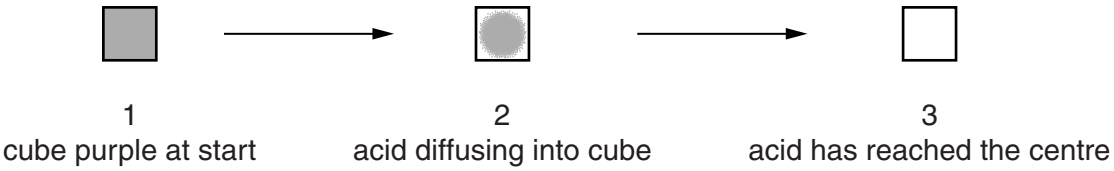

Fig. 8.2

The student measures the time taken for the acid to reach the centre of the cubes.

The results are shown by the graph in Fig. 8.3.

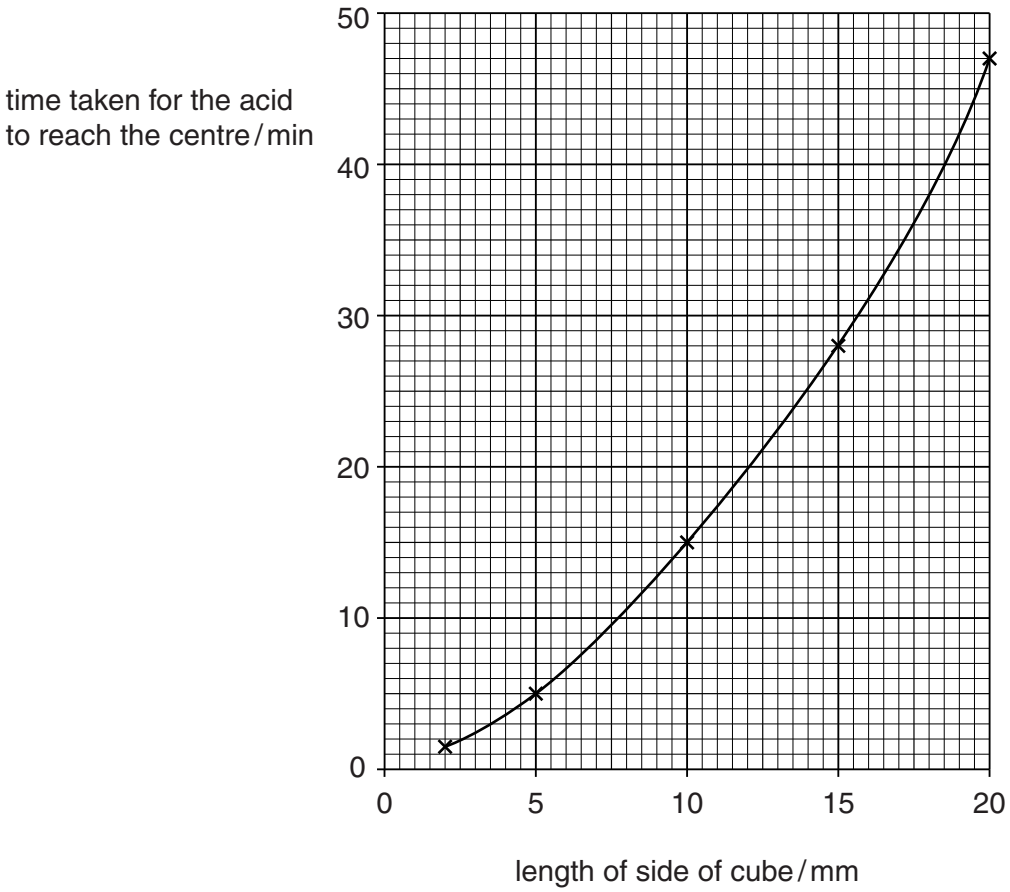

Fig. 8.3

(i) Describe how the time taken for the acid to reach the centre varies as the size of the cube increases.

.....

.....

.....[2]

(ii) From Fig. 8.3 find the time taken for cubes with a length of

6 mm, ...

12 mm. ..... [2]

(iii) In living cells, oxygen and food substances must diffuse across the cell membrane and reach the centre of the cell.

Use this information to suggest why cells cannot grow to a large size.

.....

.....[1]

(b) Fig. 8.4 shows a red blood cell.

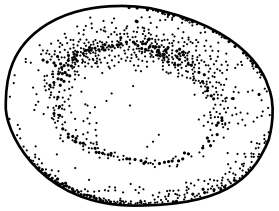

Fig. 8.4

Describe **one** feature of the red blood cell that enables oxygen to get to all parts of the cell quickly.

.....

.....[1]

9 **(a)** Fig. 9.1 shows the apparatus used to demonstrate the electrolysis of copper chloride solution.

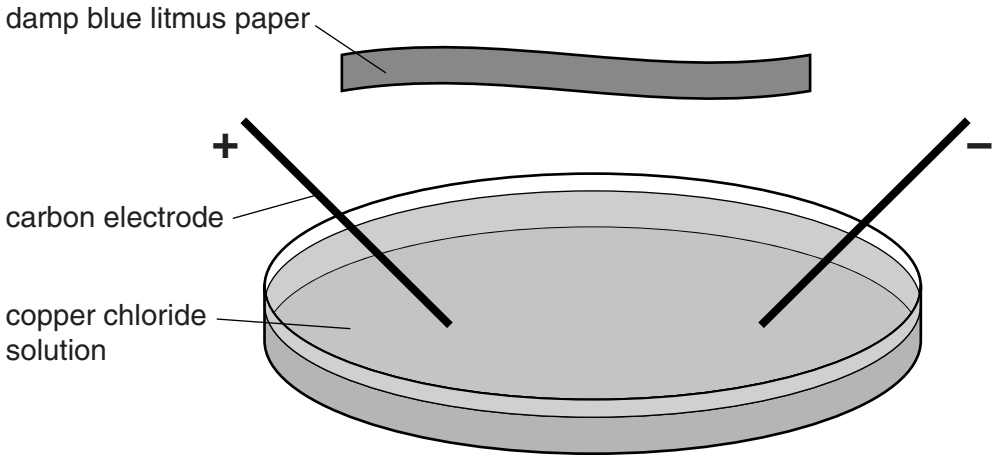

Fig. 9.1

(i) State the names given to the electrodes.

The **positive** electrode is called the ..... .

The **negative** electrode is called the ..... . [2]

(ii) A substance **X** is formed on the negative electrode.

Name and describe the appearance of substance **X**.

name of **X** .....

description .....

.....[2]

(iii) A substance **Y** is formed at the positive electrode.

Name **Y** and describe its effect on the damp blue litmus paper.

name of **Y** .....

description .....

.....[2]

(b) State whether each of the substances involved in the experiment is

an element **or** a compound **or** a mixture.

Write your answers in Table 9.1.

Table 9.1

substance	element **or** compound **or** mixture
copper chloride	
copper chloride solution	
substance **X**	
substance **Y**	
water	

[2]

(c) (i) Explain **one** difference between an element and a compound.

.....

.....

.....[1]

(ii) Explain **one** difference between a compound and a mixture.

.....

.....

.....[1]

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** Sulfur 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	209 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	147 **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	231 **Pa** Protactinium 91	238 **U** Uranium 92	237 **Np** Neptunium 93	244 **Pu** Plutonium 94	243 **Am** Americium 95	247 **Cm** Curium 96	247 **Bk** Berkelium 97	251 **Cf** Californium 98	252 **Es** Einsteinium 99	257 **Fm** Fermium 100	258 **Md** Mendelevium 101	259 **No** Nobelium 102	260 **Lr** Lawrencium 103

* 58–71 Lanthanoid series
† 90–103 Actinoid series

Key

a **X** b	a = relative atomic mass **X** = atomic symbol b = atomic (proton) number

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