Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

9497045297

CO-ORDINATED SCIENCES **0654/23**

Paper 2 (Core) **May/June 2014**

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.
You may use an HB 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 32.

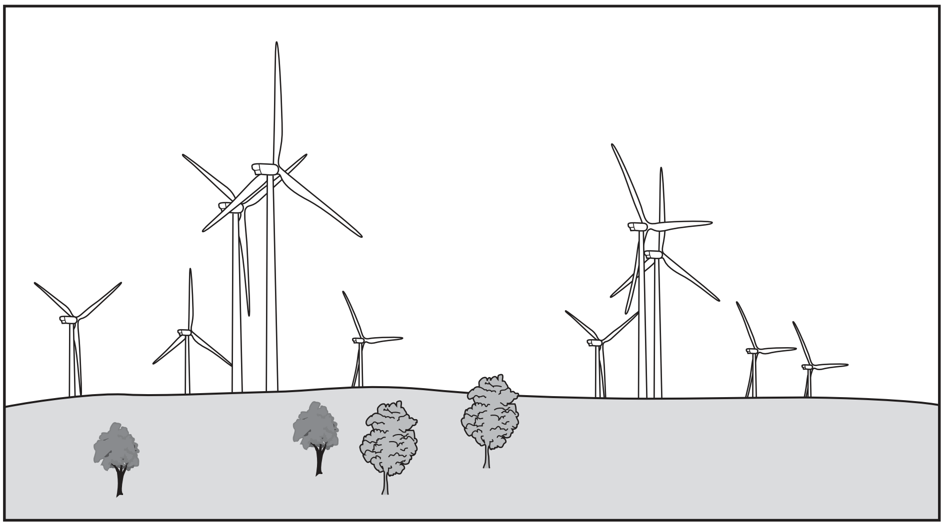
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **32** printed pages.

IB14 06_0654_23/4RP

[Turn over

1 **(a)** Wind farms are areas of land containing many wind turbines. Four thousand wind turbines can produce the same power as one coal-fired power station.



(i) State **one advantage** of using wind, rather than coal, to generate electrical power.

.... [1]

(ii) State **one disadvantage** of using wind, rather than coal, to generate electrical power.

.... [1]

(iii) Complete the sentence to show the energy transfer taking place when a wind turbine generates electricity.

.... energy is transferred to electrical energy. [1]

(b) Nuclear power stations generate electricity using energy released by nuclear fission.

Describe the process that transforms this energy into electrical energy.

....

....

.... [2]

(c) Fig. 1.1 shows how the electricity cables carrying electricity from a wind farm are attached to pylons.

The cables hang loosely in hot weather.

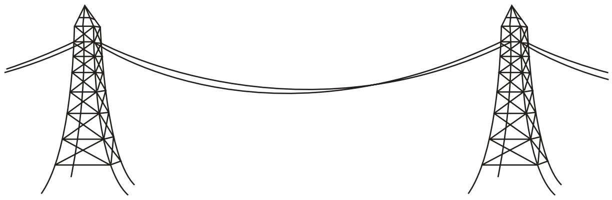


Fig. 1.1

Explain why the cables must hang loosely in hot weather.

....

....

.... [2]

(d) A scientist investigates three different wires used in making these cables. He wants to determine the resistance of each piece of wire.

wire	metal composition	length / m	cross-sectional area / cm^2
A	copper	10	0.1
B	copper	20	0.1
C	copper	10	0.2

(i) Which wire, **A** or **B**, will have the smaller resistance?

Explain your answer.

....

.... [1]

(ii) Which wire, **A** or **C**, will have the smaller resistance?

Explain your answer.

....

.... [1]

(iii) A current of 80 A passed through wire **B** when a voltage of 12 V was applied across it.

Calculate the resistance of the wire.

State the formula that you use, show your working and state the unit of your answer.

formula

working

resistance = ... unit = ... [3]

Please turn over for Question 2.

2 Fig. 2.1 is a photomicrograph of part of a leaf in cross-section.

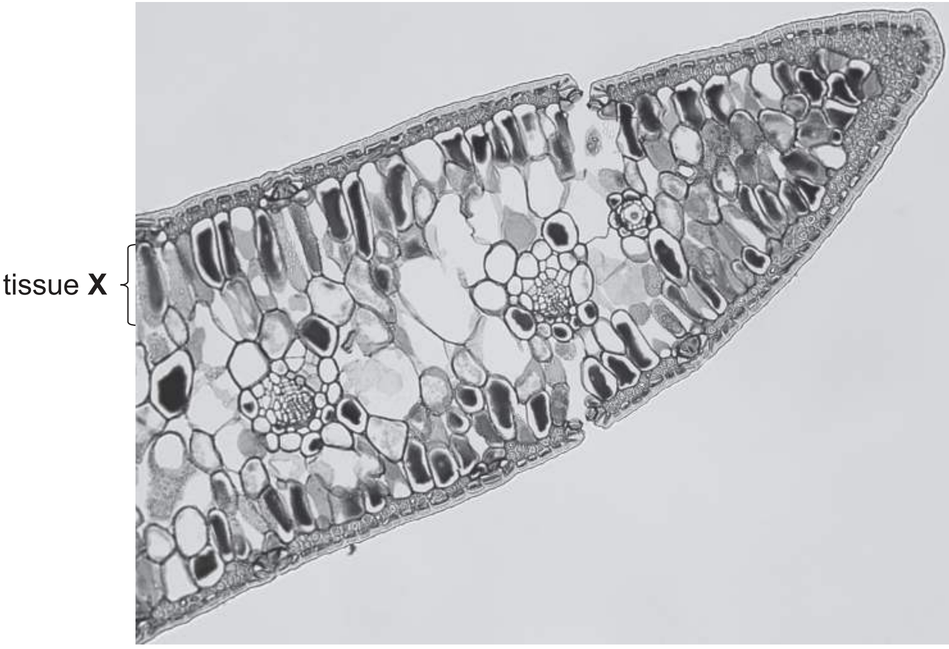


Fig. 2.1

(a) State the main function of a leaf.

.... [1]

(b) Name tissue **X**.

.... [1]

(c) In the space below, draw a large diagram of one cell of the type found in tissue **X**.

Label **four** structures present in this cell.

[5]

(d) The leaf contains vascular bundles.

(i) On Fig. 2.1, use a label line and the letter **V** to label a vascular bundle. [1]

(ii) Name a type of cell present in a vascular bundle.

.... [1]

(iii) State **two** functions of the vascular bundles.

1 ....

2 .... [2]

[Turn over

3 **(a)** Dutch metal is an alloy of copper and zinc that has been formed into very thin sheets.

When a small piece of Dutch metal is dropped into a container filled with chlorine it bursts into flame and two compounds are produced as shown in Fig. 3.1.

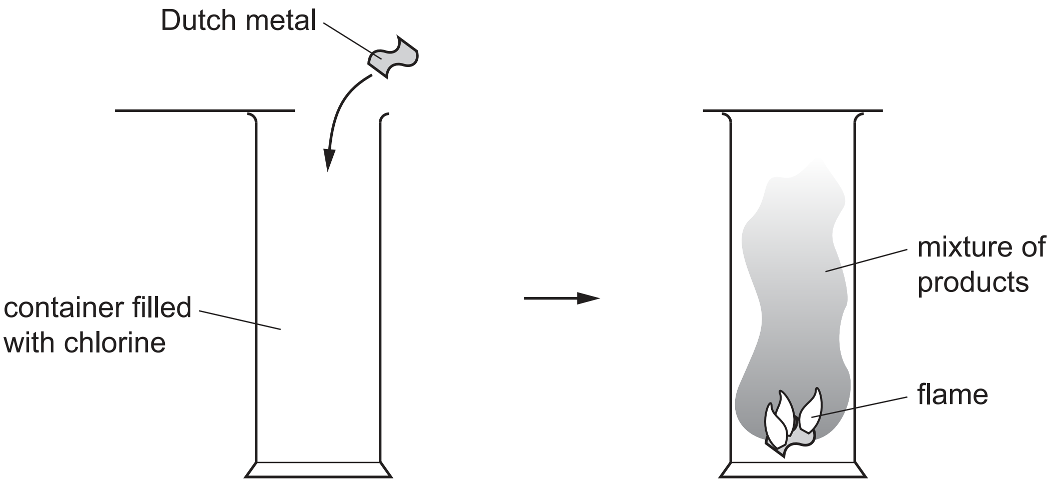


Fig. 3.1

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

....

.... [1]

(ii) State the physical property of metals that allows them to be formed into very thin sheets.

.... [1]

(iii) Suggest the names of the **two** compounds formed when Dutch metal reacts with chlorine.

1 ....

2 .... [2]

(b) Sodium reacts with chlorine to produce the ionic compound, sodium chloride.

Fig. 3.2 shows a sodium atom and a chlorine atom.

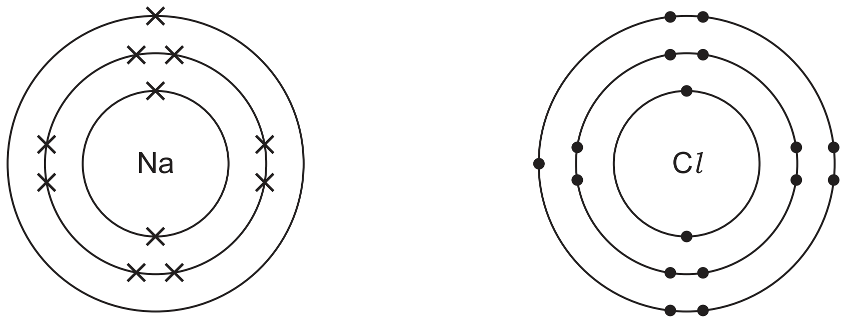


Fig. 3.2

Describe the changes to these atoms when they become ions.

....

....

....

.... [2]

(c) Phosphorus (proton number 15) is a non-metallic element that combines with oxygen to form an oxide.

(i) A molecule of phosphorus oxide contains four phosphorus atoms and ten oxygen atoms bonded together.

Predict the chemical formula of phosphorus oxide.

.... [2]

(ii) Predict and explain the change in colour when some phosphorus oxide is dissolved in water that contains full-range indicator solution (Universal Indicator).

colour change from .... to ....

explanation ....

.... [2]

4 **(a)** Selection is important in agriculture.

Choose words to complete the sentences. You may use each word once, more than once or not at all.

artificial **breeding** **decrease** **generations** **genotypes**
harvesting **increase** **natural**

In .... selection, animals or plants are chosen by humans

for .... so as to improve the variety.

This has to be done over many .... ,

and can .... their economic importance. [4]

(b) As well as being raised for meat, sheep may also be raised for wool and milk production. Table 4.1 shows some characteristics of five different sheep breeds.

Table 4.1

	wool yield	wool quality	meat yield	milk yield
Arapawa	average	good	poor	average
Awassi	average	poor	average	very good
Blackbelly	low	poor	very good	average
Merino	good	very good	good	poor
Tsurcana	average	good	average	average

(i) Use the information in Table 4.1 to explain which **two** breeds should be crossed to produce sheep with a high milk yield and also a high wool yield.

breed .... and breed ....

explanation ....

.... [2]

(ii) Suggest **two** other characteristics of sheep, **not** shown in Table 4.1, which would be important to a sheep farmer.

....

....

.... [2]

(c) Sheep with high meat yields usually give a low yield of wool. Suggest why this is.

....

....

.... [1]

(d) Lambs that are slaughtered for meat are more often males than females. Suggest a reason for this.

....

.... [1]

5 **(a)** Two bar magnets **A** and **B** are shown in Fig. 5.1. Magnet **A** is moved towards magnet **B**.

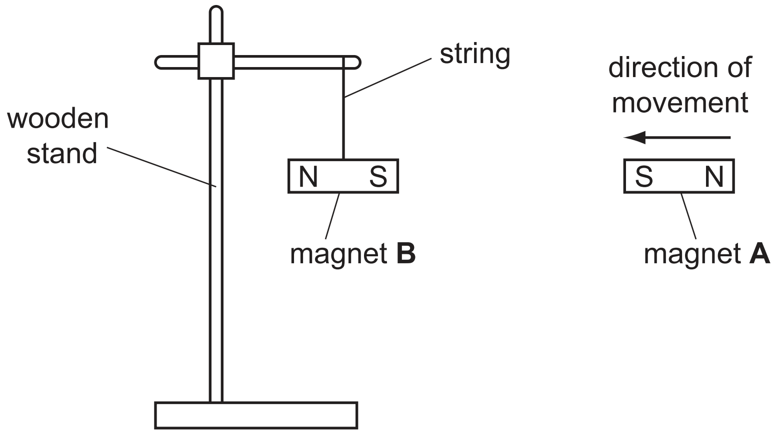


Fig. 5.1

(i) Describe and explain what happens to magnet **B** as magnet **A** is moved towards it.

....

....

.... [2]

(ii) Magnet **A** is removed. When magnet **B** is allowed to hang on its own, it is acted on by a number of forces.

Name **two** forces still affecting magnet **B**.

1 ....

2 .... [2]

(b) Fig. 5.2 shows two plastic balls hanging from threads. Both balls are electrically charged.

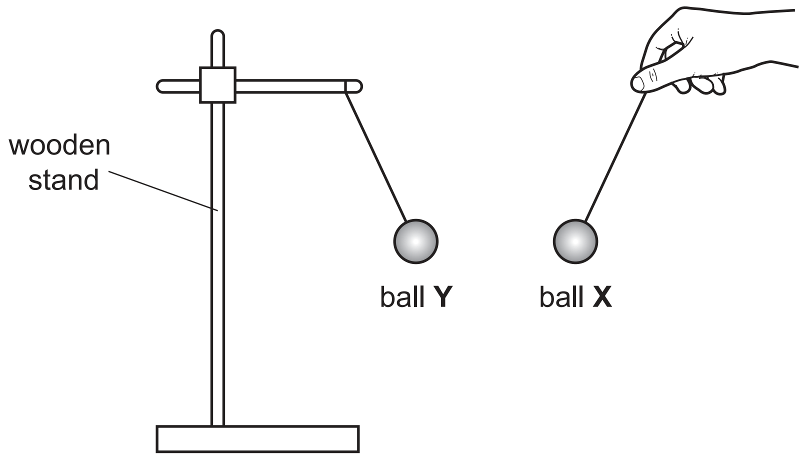


Fig. 5.2

Ball **Y** is negatively charged.

(i) State the charge on ball **X**. Give a reason for your answer.

....

.... [1]

(ii) Describe and explain how ball **Y** has been given a negative charge.

....

....

.... [2]

(c) The mass of ball **X** is 4.0 g. The volume of ball **X** is 4.2 cm^3.

Calculate the density of the plastic used to make ball **X**.

State the formula that you use and show your working.

formula

working

.... g/cm^3 [2]

6 **(a)** Fig. 6.1 shows diagrams **P**, **Q** and **R**, of three molecules containing carbon atoms.

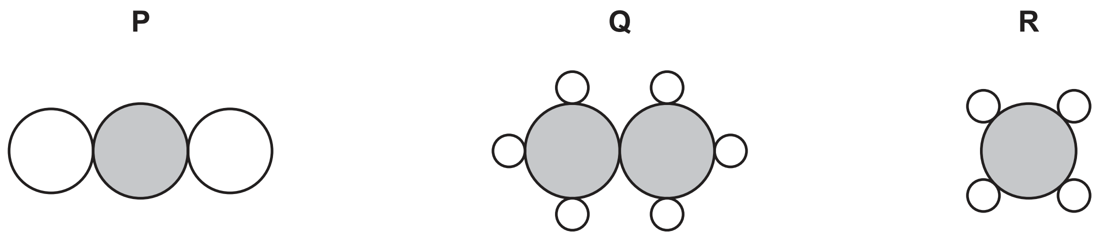


Fig. 6.1

(i) Using the Periodic Table on page 32, state the number of electrons in one atom of carbon.

Explain how you obtained your answer.

number of electrons ....

explanation ....

.... [2]

(ii) Name the type of chemical bonding found in all of the compounds show in Fig. 6.1.

Give a reason for your answer.

type of bonding ....

reason ....

.... [2]

(iii) State and explain briefly which diagram, **P**, **Q** or **R**, in Fig. 6.1, represents one molecule of carbon dioxide.

diagram ....

explanation ....

.... [1]

(iv) Release of carbon dioxide into the atmosphere by human activities is thought to contribute to global warming.

State **two** ways in which human activities cause relatively large amounts of carbon dioxide to be released into the atmosphere.

1 ....

....

2 ....

.... [2]

(b) Fig. 6.2 shows apparatus a student used to show that a chemical reaction produced carbon dioxide.

Test-tube **C** contained copper carbonate and dilute sulfuric acid. Test-tube **D** contained a colourless aqueous solution.

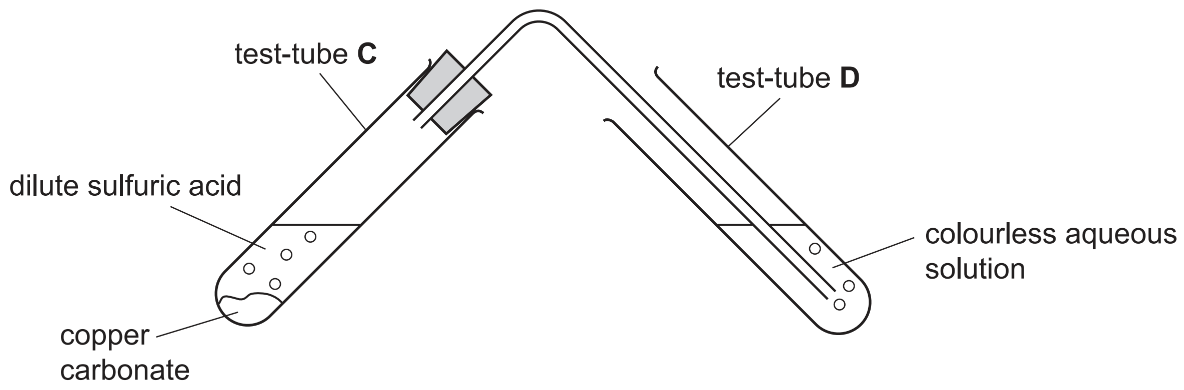


Fig. 6.2

(i) State the name of the aqueous solution in test-tube **D**.

Describe how the appearance of this solution changes when carbon dioxide passes through it.

name ....

observation ....

.... [2]

(ii) Predict and explain how the mass of the contents of test-tube **C** changes, if at all, during the experiment.

prediction ....

explanation ....

.... [2]

7 **(a)** A student set up the apparatus shown in Fig. 7.1.

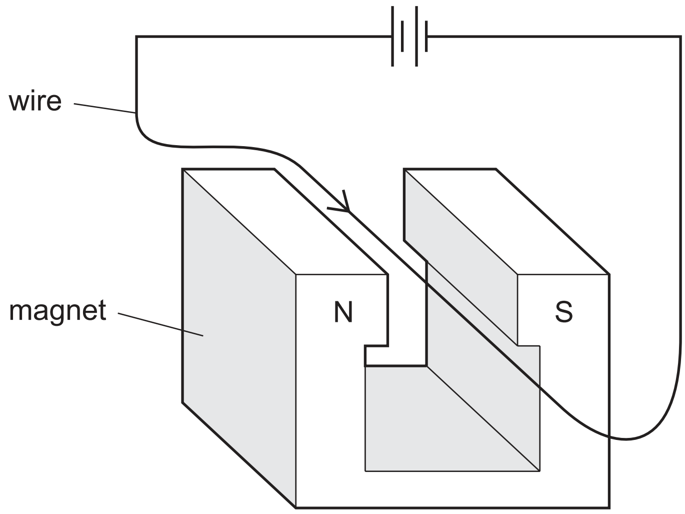


Fig. 7.1

He hangs a wire between the two poles of the magnet. He passes an electric current through the wire. The wire moves upwards out of the gap between the poles of the magnet.

(i) The student now reverses the direction of the electric current, as shown in Fig. 7.2.

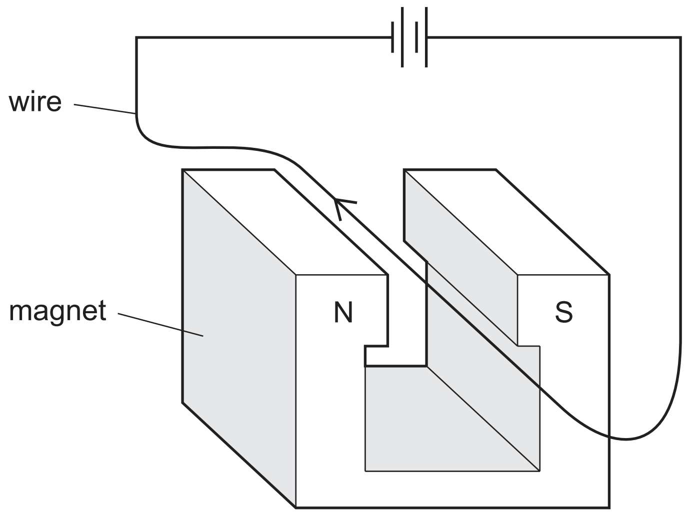


Fig. 7.2

State what the student now observes.

.... [1]

(ii) The student now reverses the poles of the magnet as shown in Fig. 7.3.

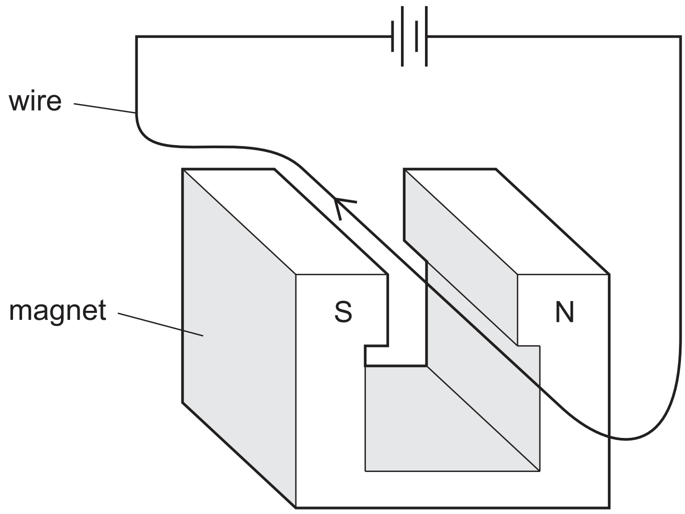


Fig. 7.3

State what the student now observes when the same current as in **(i)** passes through.

.... [1]

(b) The ideas demonstrated in the experiments in part **(a)** are used to make an electric motor. When an electric motor is used it produces a quiet sound with a high pitch.

(i) Do the sound waves produced have a high or low frequency?

Explain your answer.

The frequency is .... because ....

....

.... [1]

(ii) Do the sound waves produced have a large or small amplitude?

Explain your answer.

The amplitude is .... because ....

....

.... [1]

(c) An electric motor inflates a car tyre by pumping air into it.

Explain in terms of particles, how the air causes the tyre to inflate.

....

....

....

....

....

.... [3]

(d) Fig. 7.4 shows a student measuring the speed of sound in air.

He stands a distance ***d*** from a distant wall.

He claps his hands and times how long it takes for the echo to return from the distant wall.

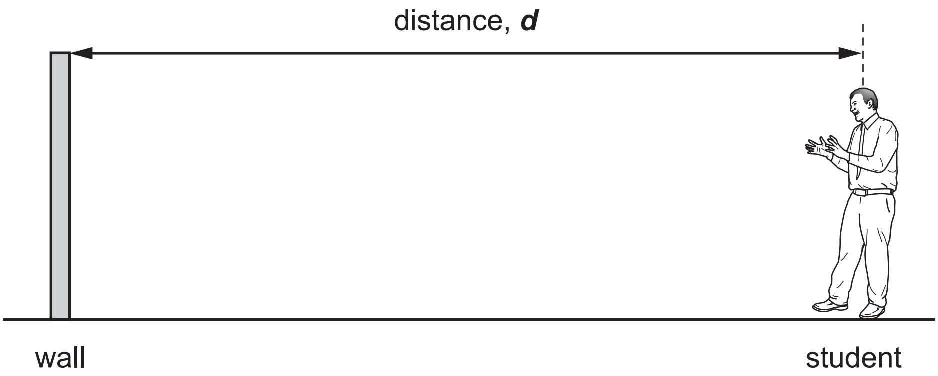


Fig. 7.4

The time taken for the echo to return is 0.6 s. The speed of sound is 330 m / s.

Calculate the distance ***d***.

State the formula that you use and show your working.

formula

working

.... m [3]

8 **(a)** A green-seeded pea plant was crossed with a yellow-seeded pea plant. The results are shown below.

parents

phenotype	green seed		yellow seed
genotype	**Gg**		**gg**
gametes	**G** **g**		**g** **g**

F1 generation

genotype	**Gg**		**gg**
phenotype	green seed		yellow seed
ratio	1	:	1

(i) Explain what is meant by

genotype,

....

gamete.

....

[2]

(ii) State which allele in the genetic diagram is dominant.

.... [1]

(b) Yellow-seeded plants are always pure-breeding.

Explain why this is so.

....

.... [1]

(c) Complete the genetic diagram below to show what would happen if two of the green-seeded plants from the F1 generation were crossed.

F1 parents

phenotype	green seed	green seed
genotype	....	....
gametes	◯ and ◯	◯ and ◯

offspring

		male gametes ◯	male gametes ◯
female gametes	◯		**Gg** green
	◯		

ratio ....

[5]

(d) Suggest what substance gives the green seeds their colour.

.... [1]

9 **(a)** Fig. 9.1 shows air passing into the engine of a car, and a mixture of exhaust (waste) gases being released.

composition of air taken into the car's engine

oxygen	21%
....	....

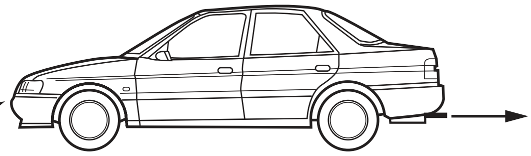


Fig. 9.1

(i) Complete the table in Fig. 9.1 to show the name and percentage of the main gas in air. [2]

(ii) Name **one** gas, other than carbon dioxide, in the mixture of exhaust gases which causes air pollution.

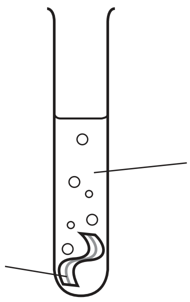
State **one** harmful effect that this gas has in the environment.

gas ....

harmful effect ....

.... [2]

(b) Hydrogen gas is released when magnesium reacts with dilute hydrochloric acid.



(i) Describe the test for hydrogen gas.

test ....

result .... [2]

(ii) Complete the **word** chemical equation for the reaction between magnesium and dilute hydrochloric acid.

magnesium	+	hydrochloric acid	→		+	hydrogen

[1]

(c) Fig. 9.2 shows the apparatus a student used to measure the temperature change when magnesium powder reacted in dilute hydrochloric acid.

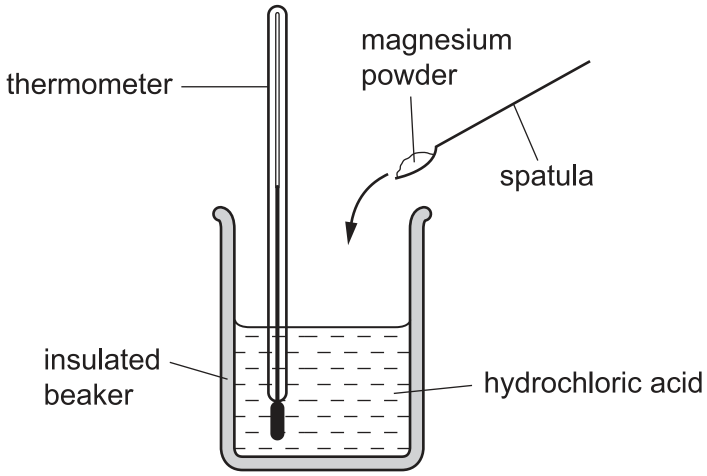


Fig. 9.2

The student stirred the magnesium powder into the acid and took temperature measurements every ten seconds for one minute.

The student drew a graph of his results and this is shown in Fig. 9.3.

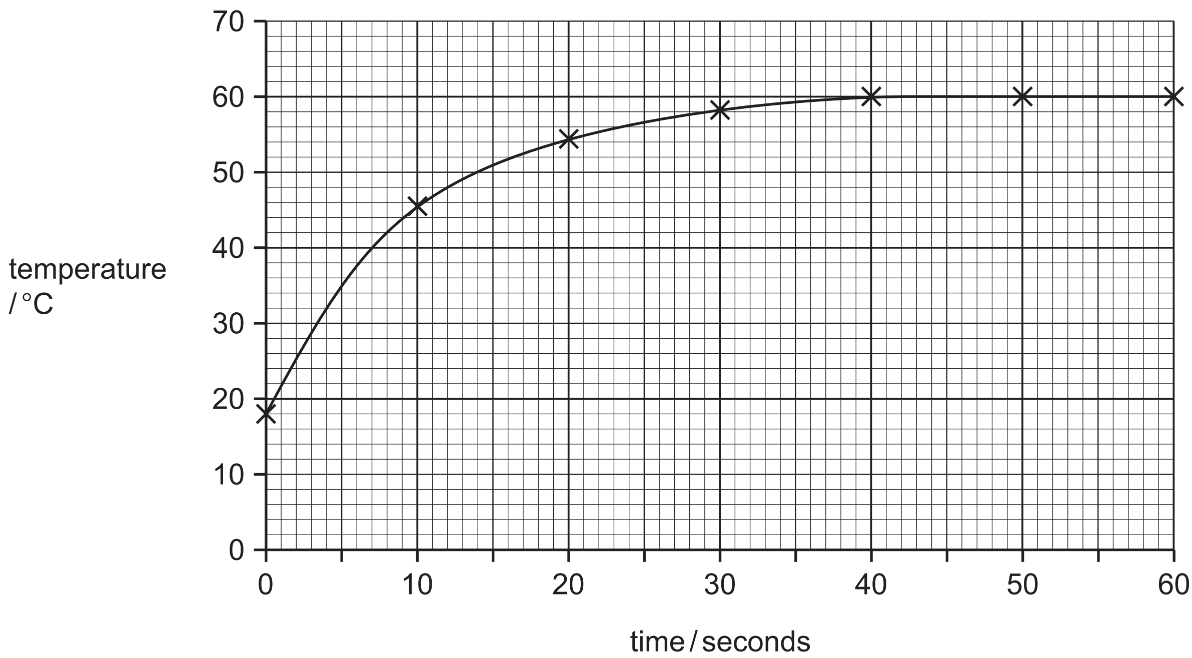


Fig. 9.3

(i) Use the results shown in Fig. 9.3 to explain whether the reaction was exothermic or endothermic.

The reaction is .... because ....

.... [1]

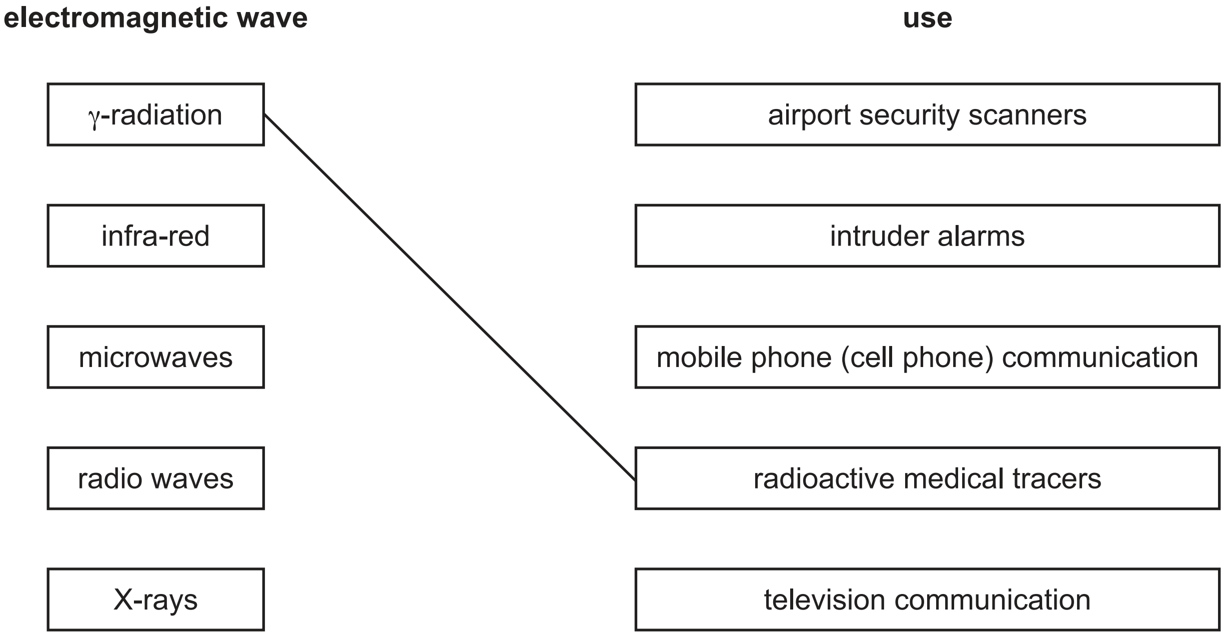
(ii) Suggest why the last three temperature readings were the same.

....

.... [1]

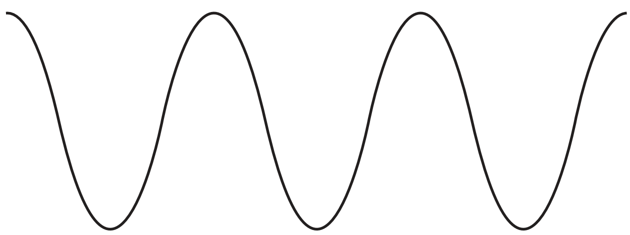
Please turn over for Question 10.

10 **(a)** Draw lines to link the waves in the electromagnetic spectrum to their uses. One line has been drawn for you.



[3]

(b) The different waves in the electromagnetic spectrum have different wavelengths. On Fig. 10.1, mark and label a wavelength.



[1]

Fig. 10.1

(c) α-radiation, β-radiation and γ-radiation are three radioactive emissions.

(i) Name a piece of apparatus used to detect these three radiations.

.... [1]

(ii) Place the three radiations in order of their ionising ability, placing the most ionising first.

most ionising ....

....

least ionising .... [1]

(iii) Place the three radiations in order of their penetrating ability, placing the most penetrating first.

most penetrating ....

....

least penetrating .... [1]

(iv) State what is meant by the term *radioactive decay.*

....

....

.... [2]

11 Fig. 11.1 shows part of one of the alveoli of the lungs and an associated capillary.

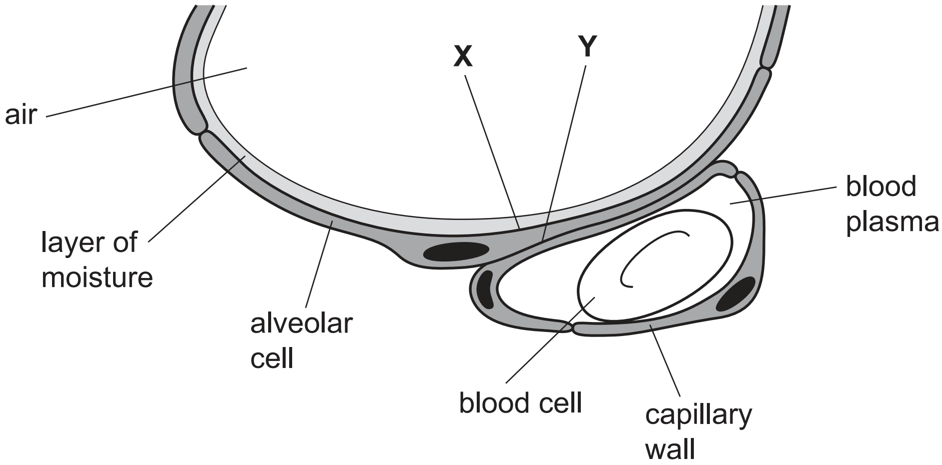


Fig. 11.1

(a) **(i)** State which gases show net movement in and out of the alveolar cell at the point labelled **X**.

gas that moves into the cell ....

gas that moves out of the cell .... [2]

(ii) Name the gas that is **entering** the alveolar cell at point **Y**.

.... [1]

(b) Name the process by which these gases move in and out of the cell.

.... [1]

(c) **(i)** Name the type of blood cell shown in Fig. 11.1.

.... [1]

(ii) Name the substance in this cell that carries oxygen.

.... [1]

(iii) Name **one** structure, normally found in animal cells, which is not found in this blood cell.

.... [1]

(d) With reference to Fig. 11.1, state where the oxygen concentration is lowest.

Explain the importance of this.

....

....

.... [2]

12 (a) Fig. 12.1 shows some of the particles present in a mixture of different gases.

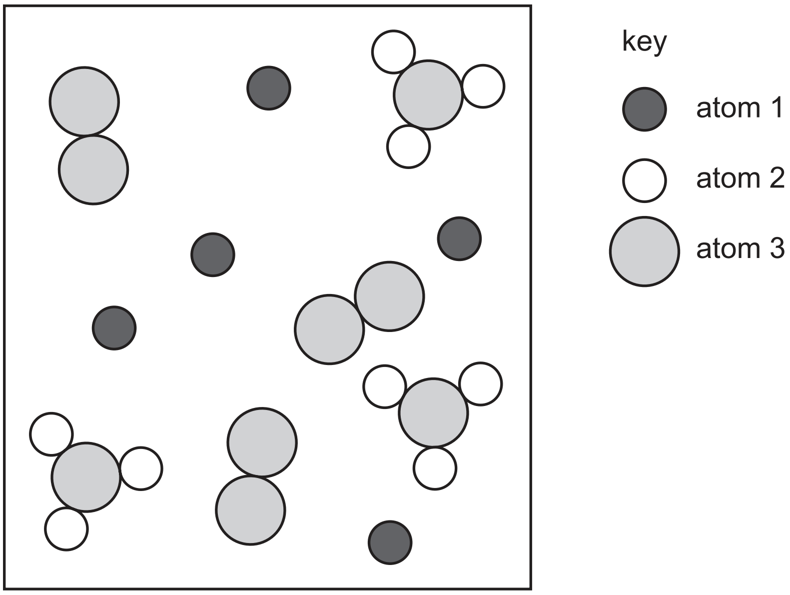


Fig. 12.1

(i) State the number of different gases that are contained in the mixture shown in Fig. 12.1.

.... [1]

(ii) On Fig. 12.1 draw a label line to a molecule of a compound. Label this molecule **C**. [1]

(iii) Explain your answer to **(ii)**.

....

.... [1]

(b) (i) Name the family of metals that includes iron and copper.

.... [1]

(ii) Aluminium is a metal in Group III of the Periodic Table.

State **two** ways in which a metal such as copper is different from aluminium.

1 ....

....

2 ....

.... [2]

(iii) State **one** large-scale use of aluminium, and explain why aluminium is a suitable metal for this use.

use ....

explanation ....

.... [2]

(c) Fig. 12.2 shows a simplified diagram of the industrial process used to produce aluminium.

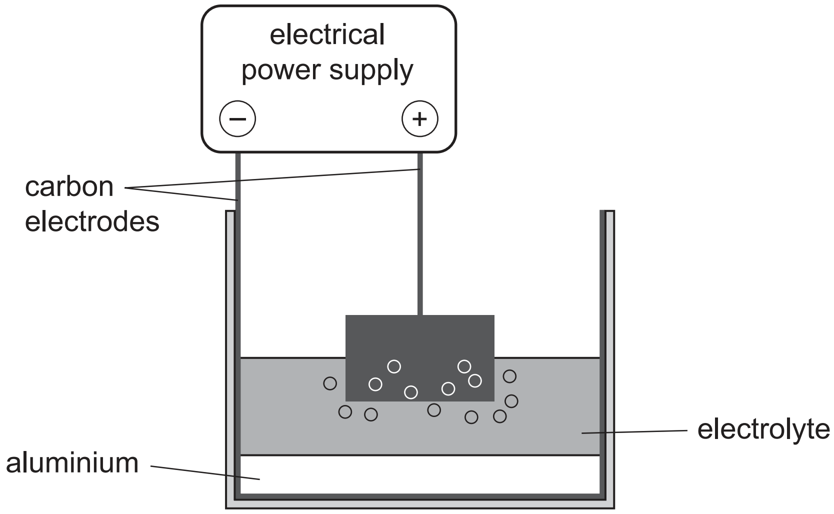


Fig. 12.2

(i) Name the type of process shown in Fig. 12.2.

.... [1]

(ii) The electrolyte contains aluminium oxide.

Suggest the name of a gas which bubbles from the surface of the anode.

.... [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	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

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

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

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.).