UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

COMBINED SCIENCE

Paper 2

5129/02

October/November 2006

2 hours 15 minutes

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

Candidate Name

Centre Number

Candidate Number

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, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
A copy of the Periodic Table is printed on page 20.
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.

For Examiner's Use

This document consists of **20** printed pages.

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[Turn over

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1 Fig. 1.1 shows a ray of light entering and passing through a parallel-sided plastic block.

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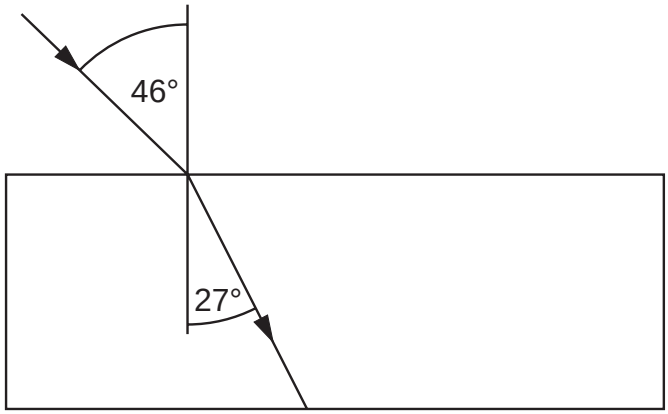

Fig. 1.1

(a) On Fig. 1.1 draw an arrow to show the path of the ray after it has left the plastic block. [2]

(b) Calculate the refractive index of the plastic.

[2]

2 **(a)** What type of substance are all enzymes?

.....[1]

(b) State the effect of the enzyme amylase on the conversion of starch to maltose.

.....

.....[1]

(c) Explain two ways in which chewing a piece of bread helps the process of digestion.

1. .....

.....

2. .....

.....[2]

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3 Air is a mixture of gases.
This mixture includes the noble gases helium and argon.

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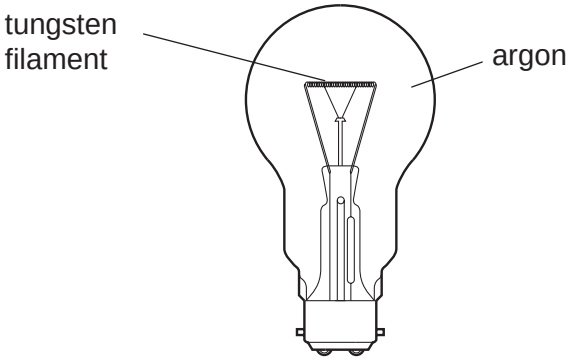
(a) Helium is used to fill airships and balloons.

State two reasons why helium is a good choice for this use.

1. .....

2. .....[2]

(b) Argon is used to fill light bulbs.



(i) Why are light bulbs **not** filled with air?

.....

.....

.....[2]

(ii) Use your knowledge of the electronic structure of argon to explain why it is a good choice to fill light bulbs.

.....

.....

.....[2]

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4 Fig. 4.1 represents a hydroelectric power station. Water flows from an upper lake to a lower lake to generate electrical energy.

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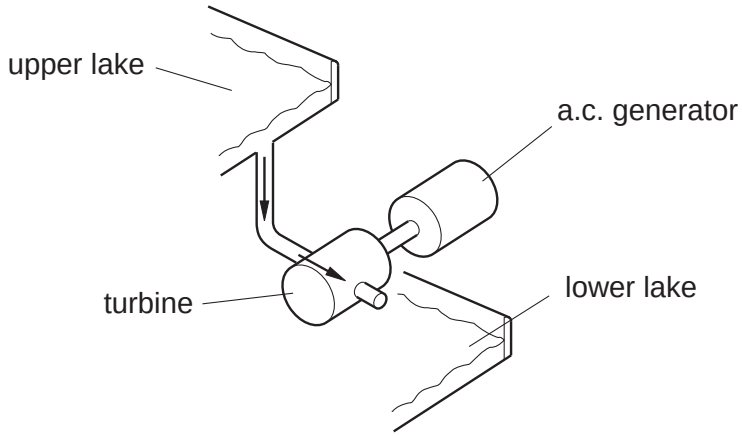


Fig. 4.1

(a) Name the type of energy lost by the water

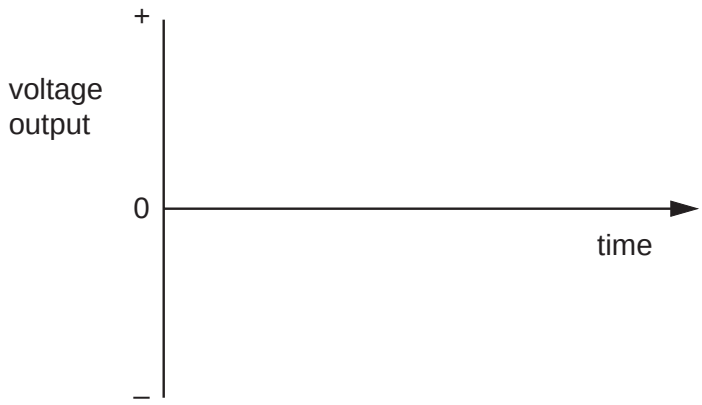
(i) as it falls from the upper lake,

..... energy [1]

(ii) as it slows down in the turbine.

..... energy [1]

(b) Complete Fig. 4.2 to show how the voltage output of a simple a.c. generator varies with time.



[2]

Fig. 4.2

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(c) A small generator has an output of 20 W.
Calculate how much electrical energy is produced in 3 minutes.

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[3]

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5 Hydrochloric acid is a strong acid which turns Universal Indicator red.

(a) (i) Name the ion present in hydrochloric acid which causes acidity.

.....[1]

(ii) Suggest the pH of hydrochloric acid.

.....[1]

(b) A student adds hydrochloric acid to calcium carbonate. The colourless gas produced passes through limewater as shown in Fig. 5.1.

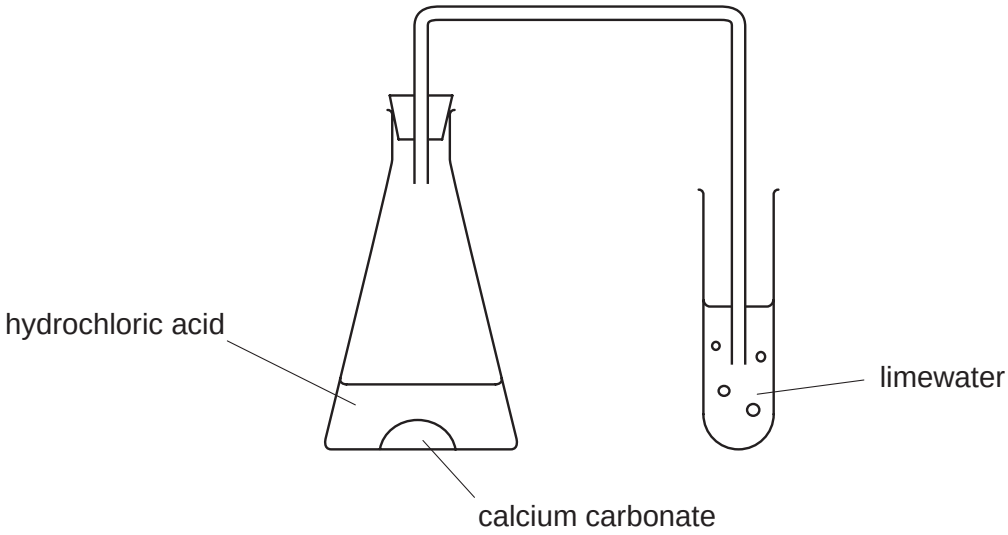

Fig. 5.1

(i) Describe the change in appearance of the limewater as the colourless gas passes through it.

.....[1]

(ii) Name this gas that is produced during the reaction of hydrochloric acid and calcium carbonate.

.....[1]

(iii) Suggest the name of the salt produced by the reaction between hydrochloric acid and calcium carbonate.

.....[1]

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6 Fig. 6.1 shows an external view of the heart.

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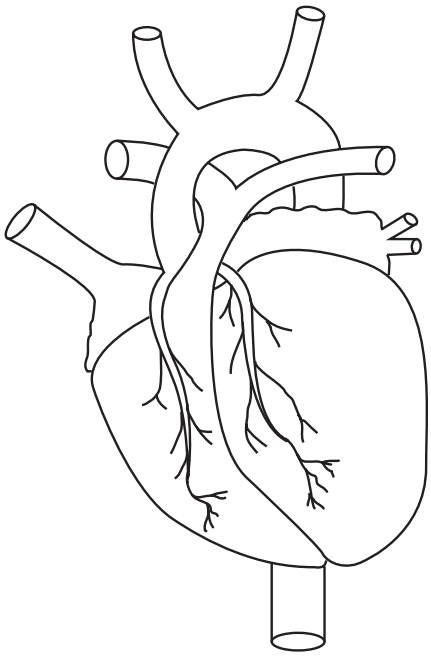

Fig. 6.1

(a) (i) Name the tissue that is supplied with blood by the coronary arteries.

.....[1]

(ii) Suggest three substances that the blood supplies to this tissue.

1. .....

2. .....

3. .....[3]

(b) A person's diet may cause them to suffer from coronary heart disease.

(i) Name a substance in a diet that may cause coronary heart disease.

.....[1]

(ii) State the change in the coronary arteries that leads to coronary heart disease.

.....

.....[1]

(iii) State **one** other cause of coronary heart disease.

.....

.....[1]

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7 The car in Fig. 7.1 has a mass of 840 kg.

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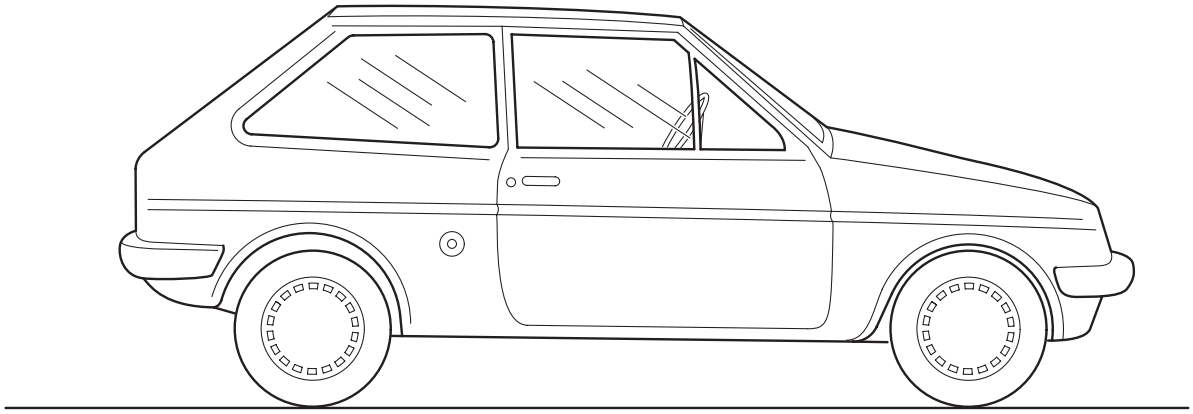

Fig. 7.1

(a) The gravitational field strength g on Earth is 10 N / kg.
Calculate the weight of the car.

[2]

(b) The force produced by the engine that accelerates the car is 2100 N.
Calculate the acceleration of the car.

[3]

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8 Atoms are made up of three types of particle.

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(a) **(i)** Complete the table to show the relative mass and the relative charge of each of these three types of particle.

particle	relative mass	relative charge
proton		+1
electron	$\frac{1}{1840}$	
neutron	1	

[3]

(ii) Define the term *nucleon number* (mass number).

.....

.....[1]

(b) Bromine is element 35 in the periodic table.
An atom of an isotope of bromine contains 35 protons, 35 electrons and 44 neutrons.
The atom is represented by

$$^{A}_{Z}Br$$

Deduce the values of **A** and **Z**.

A .....

Z ..... [2]

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9 Fig. 9.1 is a circuit diagram for the headlamps of a car. **P** and **Q** are identical lamps.

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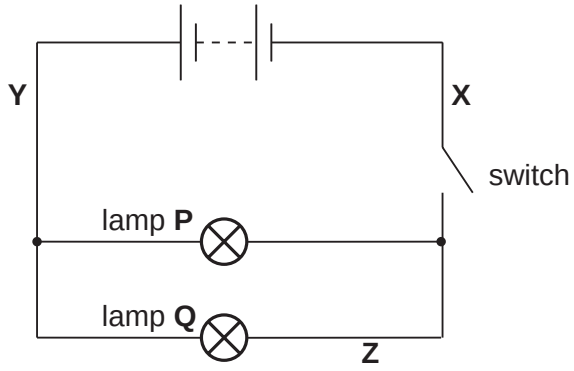

Fig. 9.1

(a) On Fig. 9.1, draw the symbol for a voltmeter that is connected into the circuit so that the voltage across lamp **Q** may be measured. [2]

(b) The switch is closed. The current in lamp **Q** is 3.0 A and the potential difference across it is 12 V.

(i) Calculate the resistance of the lamp.

[3]

(ii) Determine the current at

X, ... A

Y, ... A

Z. ..... A [3]

(c) Suggest why the lamps are connected in parallel rather than in series.

.....

..... [1]

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10 Fig. 10.1 shows the structures of four organic compounds, **A**, **B**, **C** and **D**.

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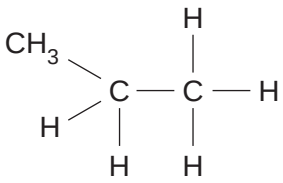
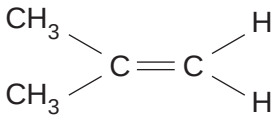
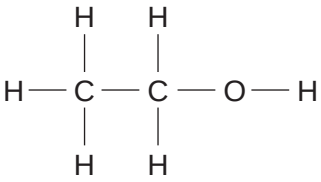


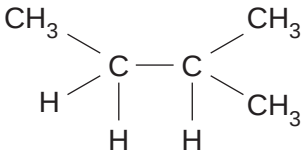
A



B



C



D

Fig. 10.1

(a) Which compound is

(i) an alkene, ...

(ii) an alcohol, ...

(iii) oxidised to a carboxylic acid? ..... [3]

(b) Two of the compounds are alkanes.
Which of these two alkanes has the higher boiling point? ..... [1]

(c) All four compounds burn in excess oxygen to give the same two products.
State the names of these two products.

..... and ..... [2]

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11 Fig. 11.1 shows a plant in a pot of damp soil on a balance.
The pot and the soil are covered by a plastic bag.

For Examiner's Use

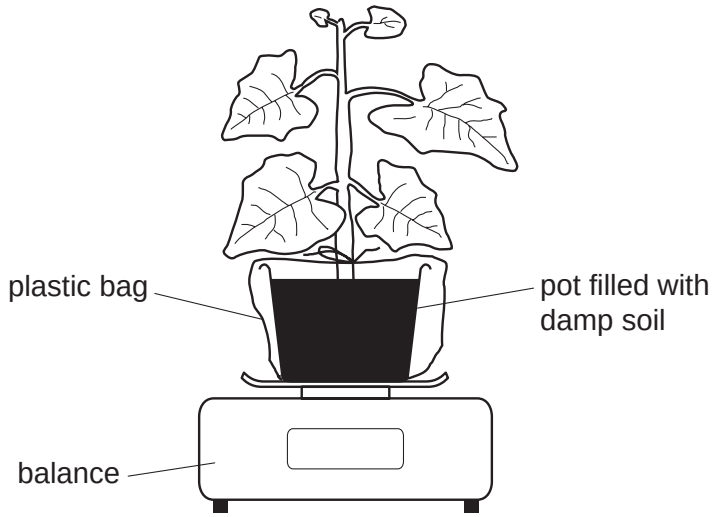

Fig. 11.1

(a) During the next hour, the reading on the balance decreases.

(i) Name the substance that is being lost from the plant.

.....[1]

(ii) Name the structures in the leaves of the plant through which the substance is lost.

.....[1]

(iii) Name the process that causes the decrease in mass.

.....[1]

(b) (i) Describe how the appearance of the plant will alter if the apparatus in Fig. 11.1 is left on the balance for a week.

.....

.....[1]

(ii) Explain your answer.

.....

.....

.....

.....[2]

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12 The radioactive isotope strontium-90 emits beta-particles.

For Examiner's Use

(a) State the nature of a beta-particle. ..... [1]

(b) State from which part of the atom the beta-particle is emitted. ..... [1]

(c) Fig. 12.1 shows how the activity of a sample of strontium-90 varies with time.

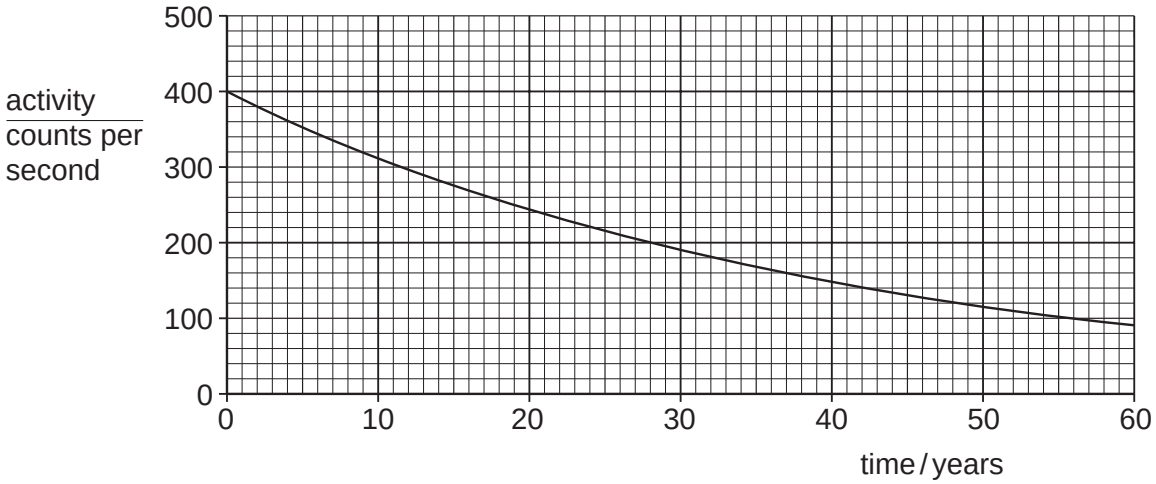

Fig. 12.1

Use Fig. 12.1 to determine the half-life of strontium-90.

half-life = ... years [1]

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13 Magnesium is in Group II of the Periodic Table.
The electronic structure of magnesium is 2, 8, 2.

(a) **(i)** Draw a diagram showing the arrangement of the electrons in a magnesium **ion**.

[1]

(ii) Write the formula of the magnesium ion. .....[1]

(b) Fig. 13.1 shows magnesium burning in carbon dioxide.
The reaction produces a black solid (carbon) and a white solid (magnesium oxide).

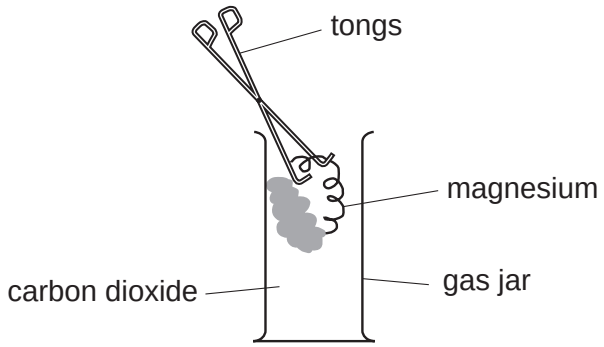

Fig. 13.1

(i) Complete the equation for the reaction by adding the state symbols.

$$2Mg(\ ) + CO_2(\ ) \longrightarrow 2MgO(\ ) + C(\ )$$ [1]

(ii) Calculate the relative molecular mass of carbon dioxide.
[A_r: C,12; O,16.]

.....[1]

(iii) Calculate the mass of magnesium that is required to react completely with 2.2 g of carbon dioxide.
[A_r: Mg,24.]

.....

.....[2]

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14 **(a)** **(i)** Name the two types of cell that form a zygote during sexual reproduction.

1. .....

2. .....[2]

(ii) When these two cells meet, their nuclei fuse.

Name this process.

.....[1]

(b) Fig. 14.1 shows part of the female reproductive and urinary systems.

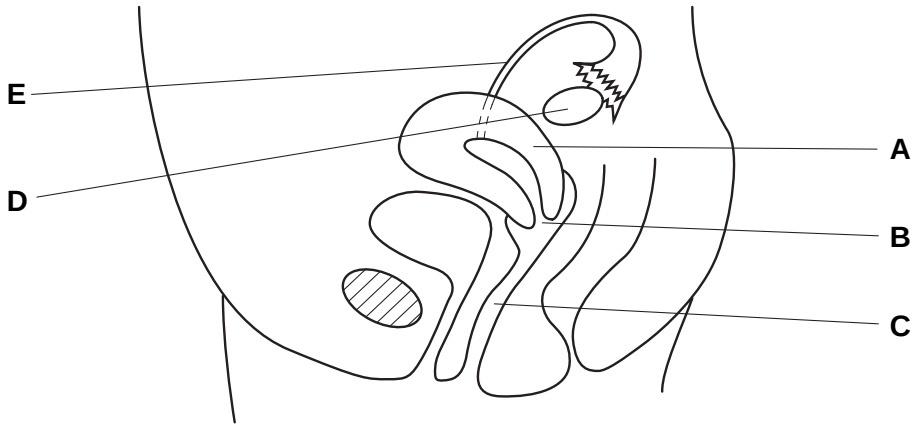

Fig. 14.1

(i) Name the parts labelled

A, ...

B, ...

C. .....[3]

(ii) State the function of the parts labelled

D, ...

.....

E. .....

.....[2]

(c) On Fig. 14.1 mark an **X** where a zygote will develop. [1]

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15 A road is made by laying slabs of concrete with gaps between them.
Fig. 15.1 shows this road at low temperature.

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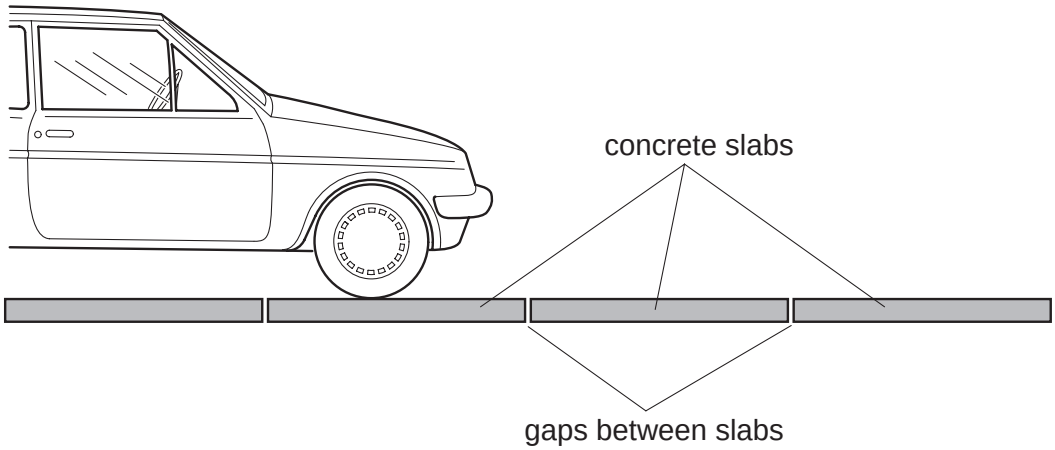

Fig. 15.1

(a) The temperature increases.
Suggest what happens to

(i) the concrete slabs, ...[1]

(ii) the gaps between the slabs. .....[1]

(b) Another road is laid on a cold day with no gaps between the concrete slabs.

Suggest what may happen to this road on a very hot day.

.....

.....[1]

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16 A small piece of each of four metals is placed in a separate test-tube containing dilute hydrochloric acid.
Results of this experiment are shown in Fig. 16.1.

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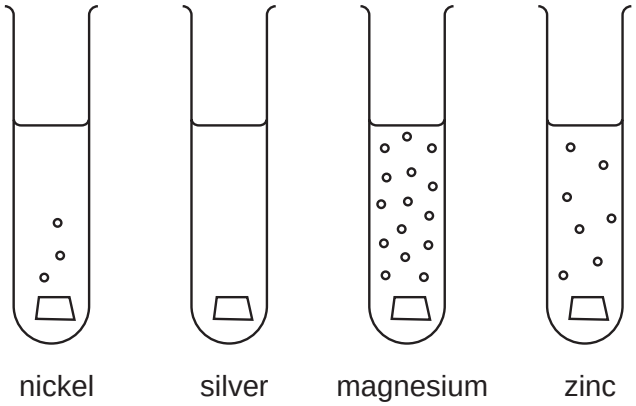

Fig. 16.1

(a) Use Fig. 16.1 to deduce the reactivity series of these metals.

most reactive .....

.....

.....

least reactive ..... [1]

(b) The reaction between a metal and an acid produces a salt and hydrogen.

(i) Draw a dot and cross diagram to show the bonding in a molecule of hydrogen.

[1]

(ii) Name the salt produced when magnesium reacts with hydrochloric acid.

.....[1]

(iii) State the type of bonding present in this salt. .....[1]

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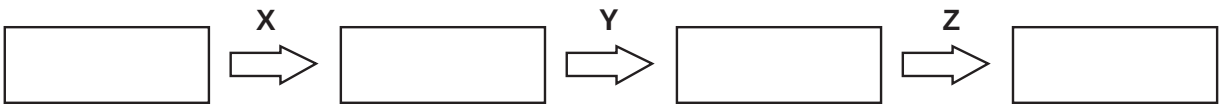
17 **(a)** The following words describe organisms found in a food chain.

carnivore **decomposer** **herbivore** **producer**

Write these words in the boxes in the order in which they occur in a food chain.



[2]

(b) **(i)** State the original source of the energy in a food chain.

.....[1]

(ii) Name the process that makes this energy available to the food chain.

.....[1]

(iii) Referring to the diagram in **(a)**, at which stage, **X**, **Y** or **Z** does most energy pass?

.....[1]

(c) Carbon passes along a food chain in carbon compounds.

(i) Suggest a carbon compound in which carbon might pass from one organism to another.

.....[1]

(ii) Name the compound in which carbon leaves the food chain.

.....[1]

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18 **(a)** Fig. 18.1 shows two magnets that are repelling each other. One of the magnets has poles marked on it.
On Fig. 18.1, label the poles on the unmarked magnet.

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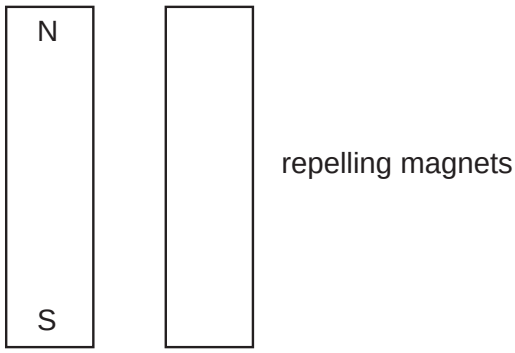

[1]

Fig. 18.1

(b) Fig. 18.2 shows an electromagnet. The electromagnet has an iron core.

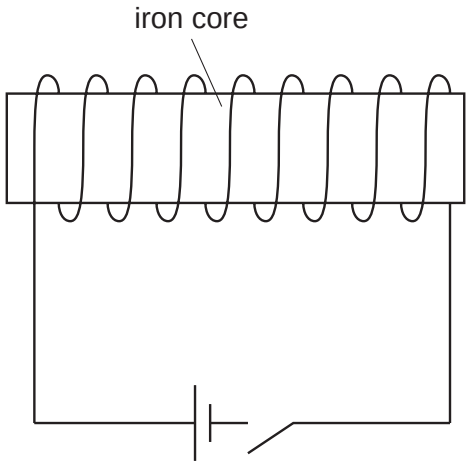

Fig. 18.2

Explain why brass and steel are **not** used for the core.

brass .....

.....

steel .....

.....[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 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 Radius 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 = 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.).

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