Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

ADDITIONAL COMBINED SCIENCE **5130/02**

Paper 2

October/November 2005

2 hours 15 minutes

Additional Materials: Answer Paper

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.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **one** part of each of the three questions.
Write your answers on the separate answer paper provided.

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 16.

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	
Section A	
10	
11	
12	
Total	

This document consists of **16** printed pages.

Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

1 Fig. 1.1 shows a root hair cell in the soil.

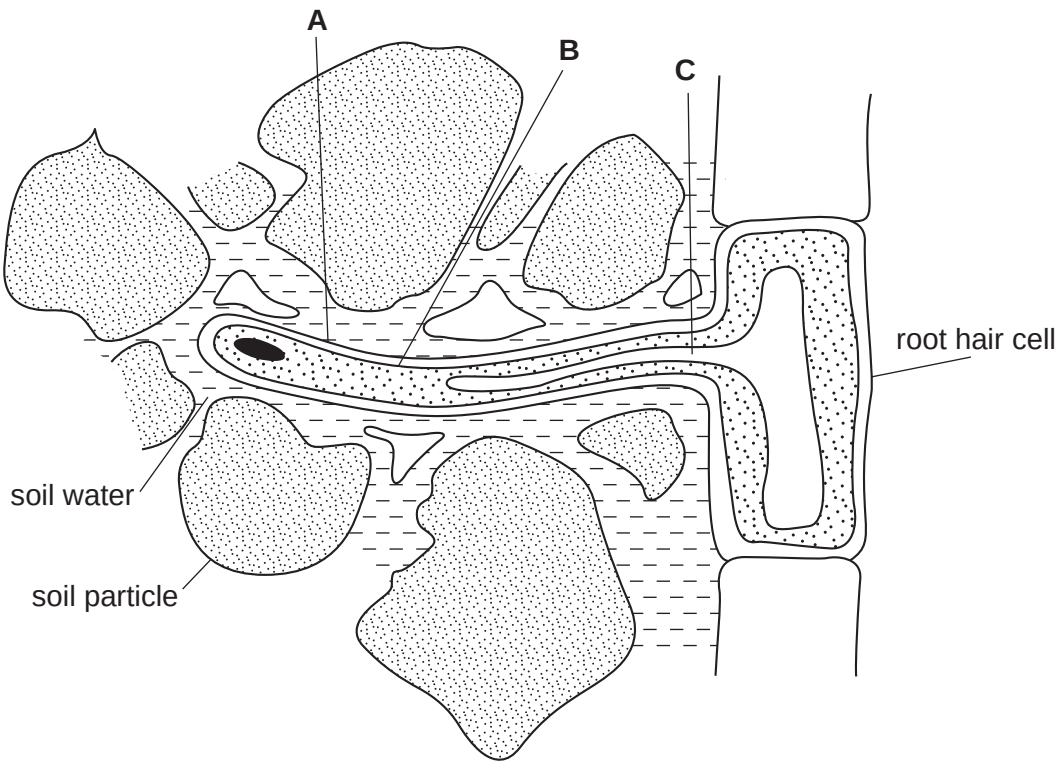


Fig. 1.1

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

A .....

B .....

C ..... [3]

(b) **(i)** Name the process by which water enters the root hair cell from the soil.

.....[1]

(ii) Describe and explain this process.

.....

.....

.....

.....[3]

(iii) What other essential substances are absorbed into root hair cells from soil?

.....[1]

(c) How is a root hair cell adapted to its function?

.....

.....[2]

2 Fig. 2.1 shows the arrangement of particles in metal **M**.

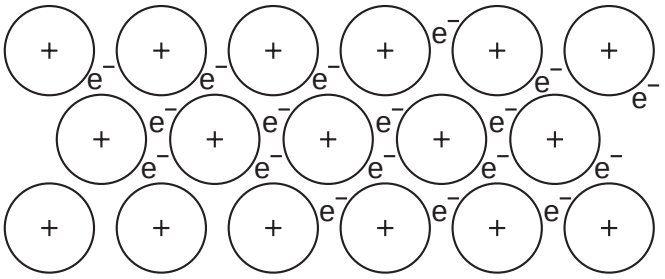


Fig. 2.1

(a) Use information from Fig. 2.1 to help explain the following facts about this metal.

(i) Metal **M** conducts electricity.

.....

.....

.....[2]

(ii) Metal **M** is malleable.

.....

.....

.....[2]

(b) Metal **M** is mixed with metal **X** to make an alloy.

(i) Suggest how the malleability of the alloy will compare with that of metal **M**.

.....[1]

(ii) Explain your suggestion.

.....

.....

.....[2]

3 Fig. 3.1 shows apparatus used to find the volume of an irregularly shaped solid.

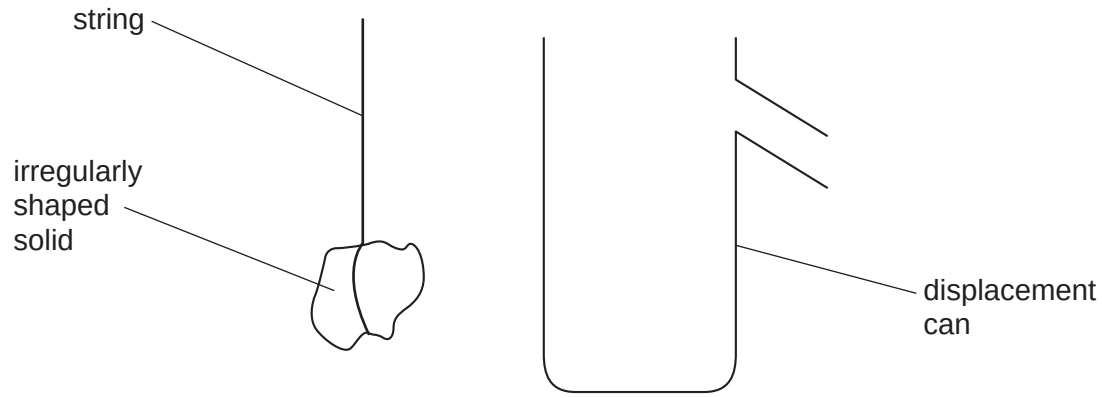


Fig. 3.1

(a) Describe how you would use this apparatus to find the volume of the solid.
Include the name of the other piece of apparatus that is required for this experiment.

.....

.....

.....

.....[3]

(b) What is the relationship between volume, mass and density?

.....[1]

(c) The volume of the solid is found to be 46.40 cm^3.
The mass of the solid is 125.28 g.
Calculate the density of the solid.

density of solid = ... g/cm^3 [2]

4 Fig. 4.1 shows the human alimentary canal.

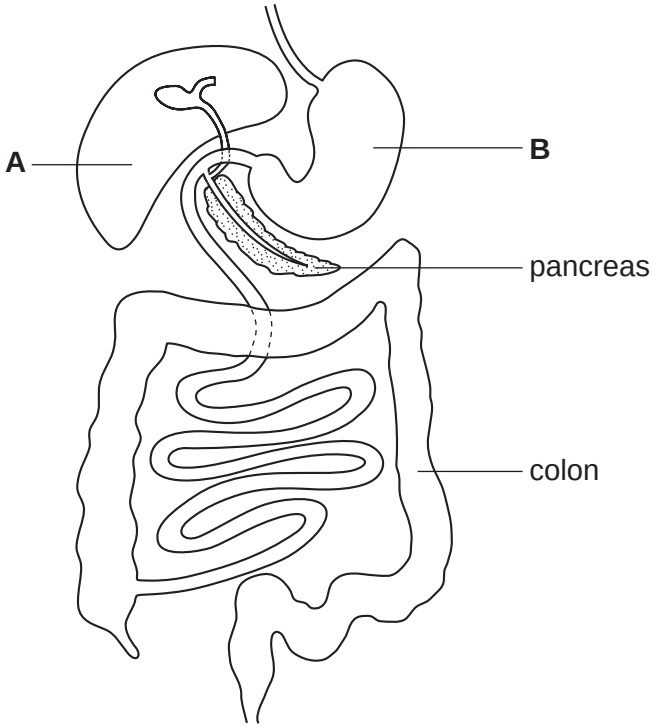


Fig. 4.1

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

A .....

B ..... [2]

(ii) Which part in Fig. 4.1 is responsible for the breakdown of alcohol?

.....[1]

(b) (i) Describe how the substances produced by the pancreas help in the digestion of food.

.....

.....

.....

.....[3]

(ii) The pancreas also produces the hormone insulin.
In the disease *diabetes mellitus* the pancreas does not produce enough insulin.
Describe the signs of this disease.

.....

.....

.....[2]

[Turn over

5 Fig. 5.1 shows an electrolytic cell used in the extraction of aluminium.

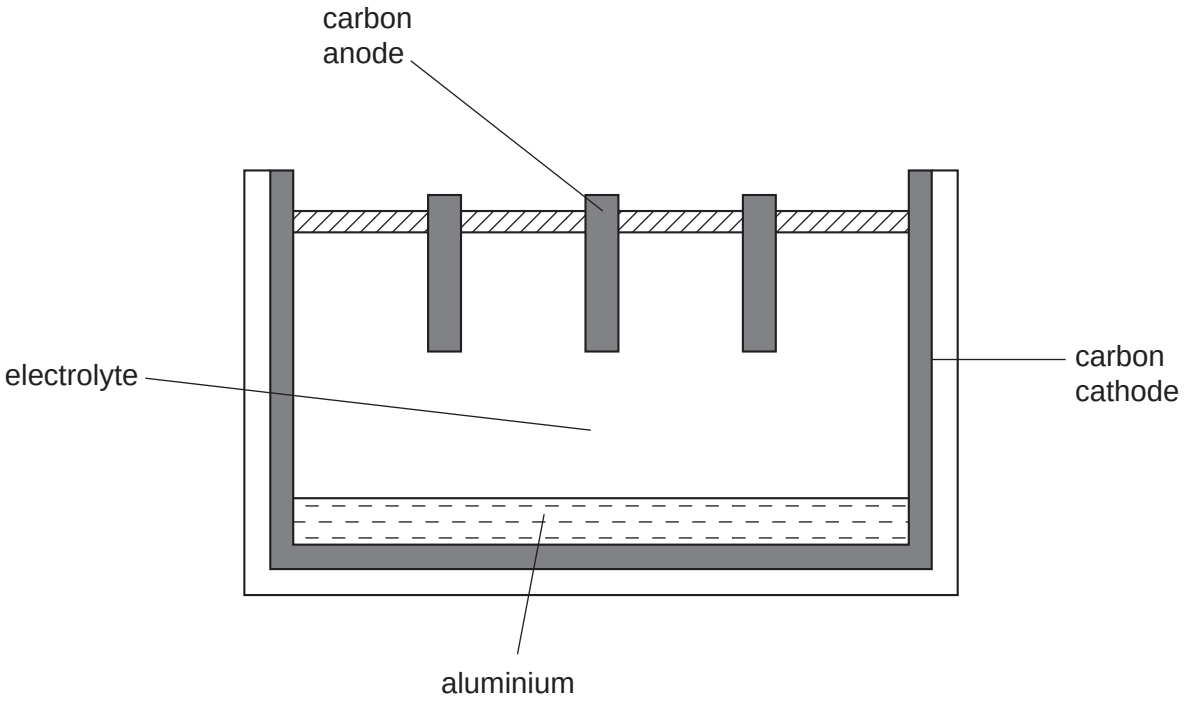


Fig. 5.1

The electrolyte is a mixture of aluminium oxide, Al_2O_3, and cryolite (sodium aluminium fluoride) maintained at a temperature of about 1000 °C.
Aluminium melts at 660 °C, cryolite melts at 880 °C and aluminium oxide melts at 2030 °C.

(a) **(i)** Why is a mixture of aluminium oxide and cryolite used, instead of pure aluminium oxide?

.....

.....

.....[2]

(ii) Suggest how aluminium metal is removed from the cell.

.....

.....[2]

(b) Complete this ionic equation for the reaction at the negative electrode (cathode).

Al^{3+} + ... → ..... [2]

(c) Calculate the maximum mass of aluminium that could be extracted from each tonne (1000 kg) of aluminium oxide. Give your answer to the nearest kg.
(Relative atomic masses: A*l* = 27, O = 16.)

mass of aluminium = ... kg [3]

6 Fig. 6.1 shows a simple d.c. electric motor.

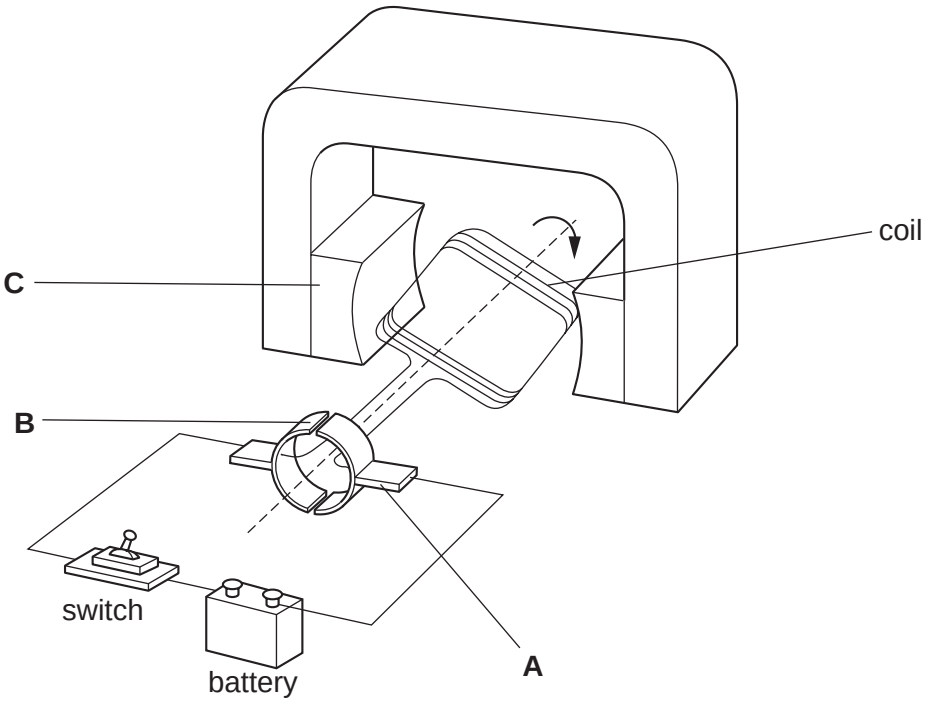


Fig. 6.1

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

A .....

B .....

C ..... [3]

(b) Describe and explain the action of parts **A** and **B** in Fig. 6.1.

.....

.....

.....

.....[2]

(c) Fig. 6.2 shows the coil of the motor in three different positions.
The direction of the forces on the coil are shown in position **Q**.
Mark on the diagrams the direction of the forces in positions **P** and **R**. [2]

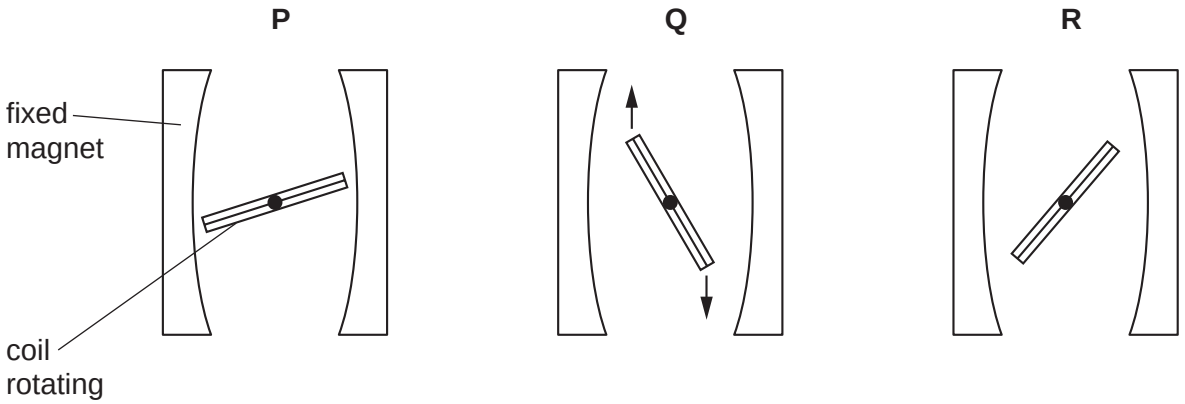


Fig. 6.2

(d) Describe **two** ways to increase the speed of an electric motor.

.....

.....

.....[2]

7 A pool contains large carnivorous fish named perch and small fish named minnows. It also contains microscopic algae and water fleas.

(a) Construct a food chain for these organisms.

[3]

(b) Use an example from your food chain to explain what is meant by the term *herbivore*.

.....

.....

.....[2]

8 Magnesium carbonate reacts with hydrochloric acid giving off carbon dioxide.

A student carries out experiments to find how the rate of this reaction is affected by changing the temperature.

Each time, he adds a mass of 4.2 g of magnesium carbonate to excess hydrochloric acid at a given temperature, and measures the volume of gas given off in one minute.

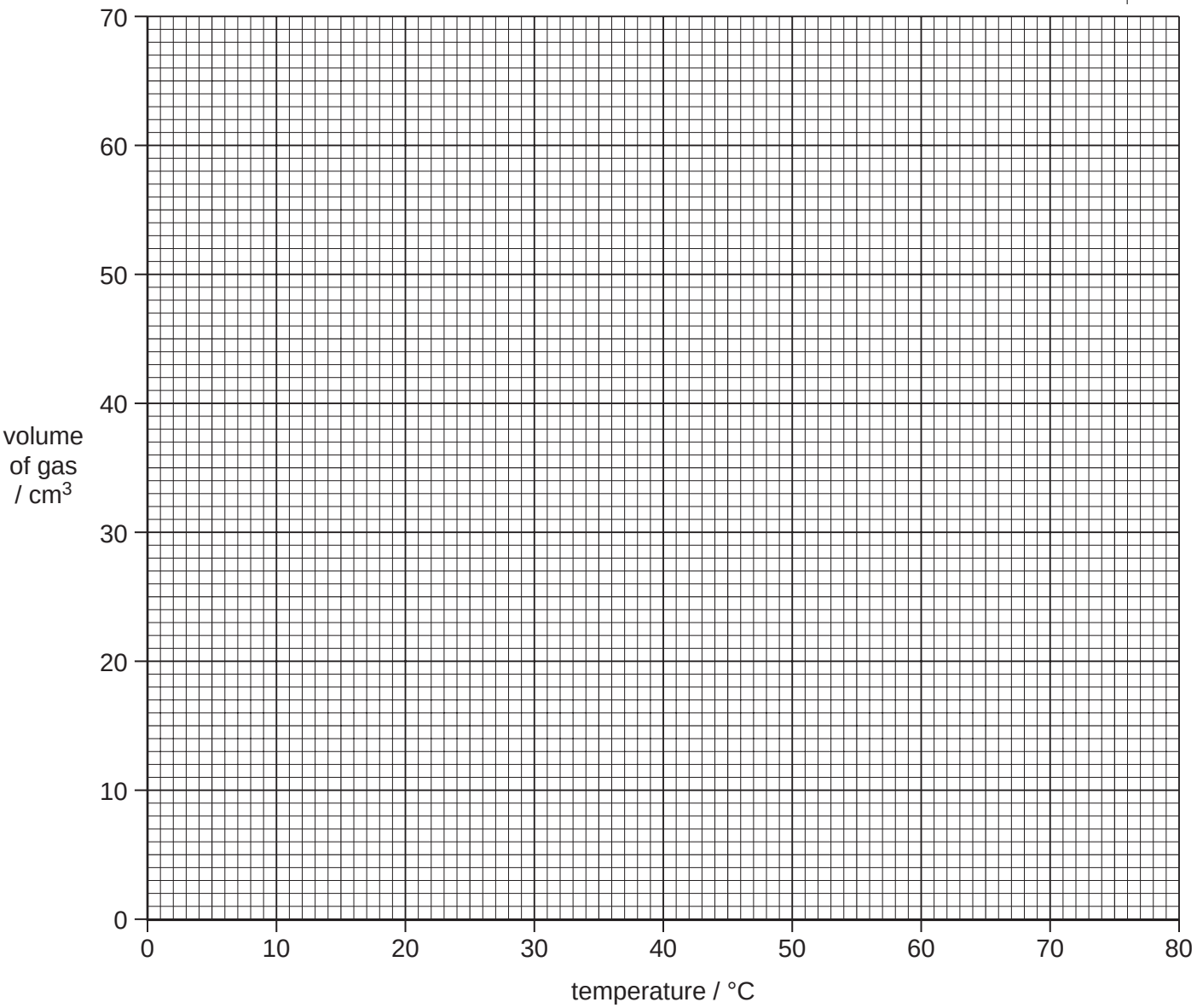
Fig. 8.1 shows the results of his experiments at six different temperatures.

temperature / °C	volume of gas / cm^3
20	2.1
30	4.0
40	8.1
50	11.5
60	32.3
70	64.5

Fig. 8.1

For Examiner's Use

(a) **(i)** Plot these results on the grid. [2]



(ii) Draw a best-fit line. [1]

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

.....

.....[1]

(b) How can the results of this experiment be made more reliable?

.....

.....[1]

(c) The equation for the reaction is shown below.

$$MgCO_3(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l) + CO_2(g)$$

What is the total volume of carbon dioxide produced, measured at room temperature and pressure (r.t.p), when the reaction at 20 °C goes to completion?

(Relative atomic masses: H = 1, C = 12, Cl = 35.5, Mg = 24, O = 16; molar gas volume at r.t.p. = 24.0 dm^3.)

volume of carbon dioxide = ... dm^3 [3]

9 **(a)** Fig. 9.1 shows a transverse wave.

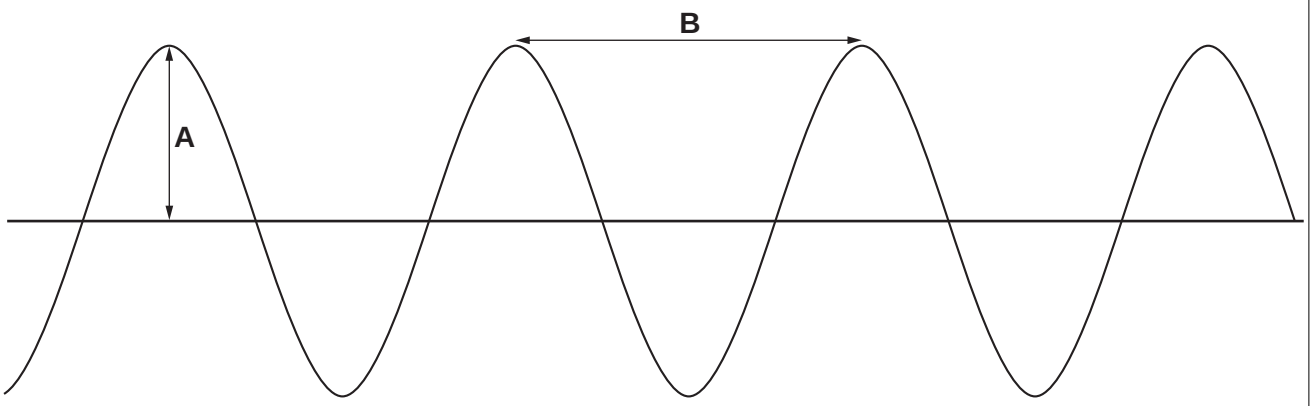


Fig. 9.1

(i) Name the parts of the wave labelled **A** and **B**.

A .....

B ..... [2]

(ii) The energy of the wave is increased, but the frequency remains the same. How will this alter the pattern of the wave shown in Fig. 9.1?

.....

.....[1]

(iii) Calculate the frequency of a wave that has a speed of 18 cm / s and a wavelength of 2 cm.

frequency = ... Hz [2]

(b) Fig. 9.2 shows waves moving across a ripple tank containing water.

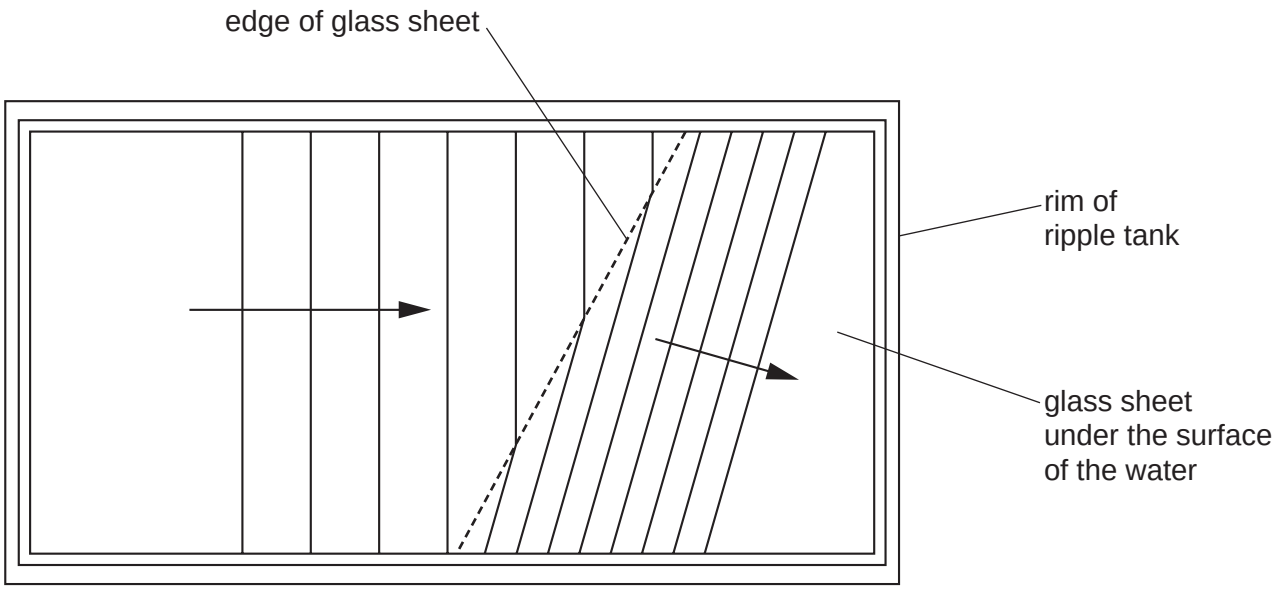


Fig. 9.2

What happens to each of the following as the ripples pass over the glass sheet in the tank?

(i) frequency of the wave

.....[1]

(ii) speed of the wave

.....[1]

(iii) wavelength

.....[1]

Section B

Answer **one** part, **(a)** or **(b)**, of each of the three questions.

Write your answers on the separate answer paper provided.

10 Either

(a) Fig. 10.1 shows an alveolus in a human lung.

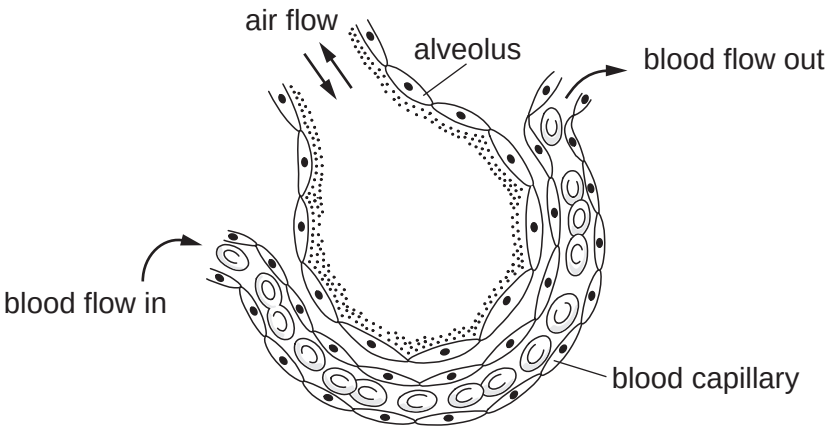


Fig. 10.1

(i) Describe the function of the alveolus and explain how it is adapted to work efficiently. [6]

(ii) Blood supply to the lungs is part of a dual circulation.
Describe the differences between the two circuits and relate these differences to their functions. [4]

Or

(b) (i) Describe complete dominance using the terms *dominant*, *recessive*, *phenotype* and *genotype*. [4]

(ii) Huntington's disease is a rare genetic disorder causing deterioration in mental and physical abilities. An allele for having the disease, **H**, is dominant over an allele for not having the disease, **h**.
A couple, only one of whom suffers from the disease, have a child. Use a labelled diagram to determine the probability that this child will suffer from the disease. [6]

[Turn over

11 Either

(a) (i) When an iron nail is dipped into copper(II) sulphate solution for a few seconds and then removed, it is found to have a red deposit of copper on its surface. A redox reaction has taken place.
Write ionic half equations for this reaction, and use these equations to illustrate a definition of the term *redox*. [5]

(ii) The elements chlorine, bromine and iodine are in Group VII of the Periodic Table.
The lower the position of a halogen in this group, the lower is its reactivity.
Describe how you could show this experimentally.
Include equations for the reactions you mention. [5]

Or

(b) (i) In the USA, large reserves of natural gas are tapped to obtain ethane.
Much of this ethane is used to produce ethene and hydrogen by the process of catalytic cracking.
Write an equation for this process.
Give brief details of **two** uses for the hydrogen produced. [6]

(ii) Ethene is used to make the polymer poly(ethene).
Use graphical formulae to write an equation for the formation of this polymer.
Suggest a use for poly(ethene).
State the property of poly(ethene) on which this use depends. [4]

12 Either

(a) An electrically powered elevator (lift) in an office block has a car of mass 1000 kg, and carries passengers with a total mass of 500 kg. Each floor in the block is 4 m above the floor below it. The elevator carried all of the passengers from the second floor to the seventeenth floor. The total journey took 120 seconds.

(i) Calculate the average speed of the elevator and the total work done during the journey. (Force of gravity on 1 kg mass = 10 N.) [6]

(ii) A switch in the elevator car activates a relay to turn on the electric motor.
Draw a simple circuit diagram to show how the switch, relay and motor are connected.
Suggest why a relay is used to turn on the elevator motor. [4]

Or

(b) Fig. 12.1 shows an arrangement to control the thickness of aluminium foil as it is rolled out.

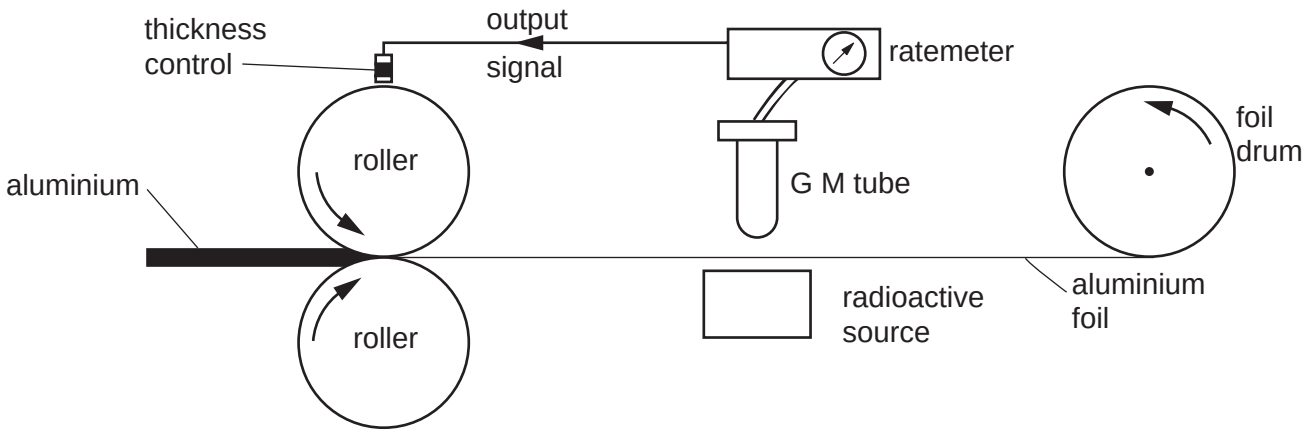


Fig. 12.1

(i) The radioactive source used is thorium-234, which emits β-particles.
Write an equation for the decay of thorium-234.
Use the Periodic Table on page 16 to help you.
Use information in the diagram to suggest how this isotope is used to prevent excess thickness of the aluminium foil. [6]

(ii) Cobalt-60 emits gamma radiation and is used as a radioactive source in the sterilisation of medical instruments.
Suggest why cobalt-60 is unsuitable for use in the aluminium foil thickness controller and why thorium-234 is unsuitable for use in the sterilisation of medical instruments. [4]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 = 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.).