UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8423122665

ADDITIONAL COMBINED SCIENCE **5130/02**

Paper 2 **October/November 2009**

2 hours 15 minutes

Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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.
DO **NOT** WRITE IN ANY BARCODES.

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.

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.

For Examiner's Use	
Section A	
10	
11	
12	
Total	

This document consists of **22** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Section A

For Examiner's Use

Answer **all** the questions.

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

1 Fig. 1.1 shows an amoeba, which is a single-celled animal.

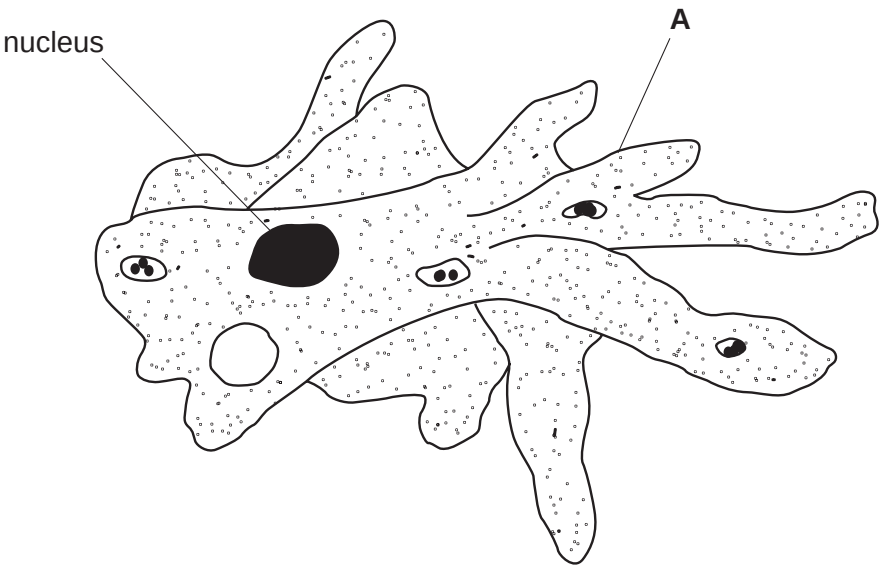


Fig. 1.1

(a) How does Fig. 1.1 show that amoeba is **not** a plant?

.....

.....

..... [2]

(b) State the name and describe the function of the structure labelled **A**.

name .....

function .....

..... [2]

(c) The nucleus contains chromosomes.

Use the terms *gene* and *allele* to briefly describe the structure and function of chromosomes.

.....

.....

..... [3]

For Examiner's Use

2 Different compounds may have different types of bonding.

(a) Lithium reacts with fluorine to make the compound lithium fluoride.

Fig. 2.1 shows the arrangement of electrons in atoms of lithium and fluorine.

lithium atom fluorine atom

Fig. 2.1

(i) Name the type of bonding in lithium fluoride.

..... [1]

(ii) Draw a diagram to show the arrangement of electrons in lithium fluoride.

[2]

(b) In the Haber process, hydrogen and nitrogen react to form ammonia.

For Examiner's Use

(i) Complete Fig. 2.2 to show the arrangement of electrons in ammonia.

Use ○ to represent hydrogen electrons and ● to represent nitrogen electrons.

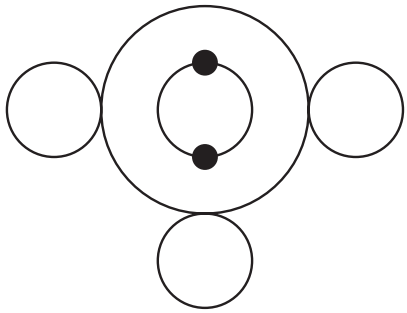


Fig. 2.2 [3]

(ii) Write a balanced equation for the reaction between hydrogen and nitrogen.

..... [2]

(iii) State two essential conditions used in the Haber process.

1. .....

2. .....

[2]

3 Fig. 3.1 shows a vacuum flask, designed to allow liquids such as coffee to remain hot for several hours.

For Examiner's Use

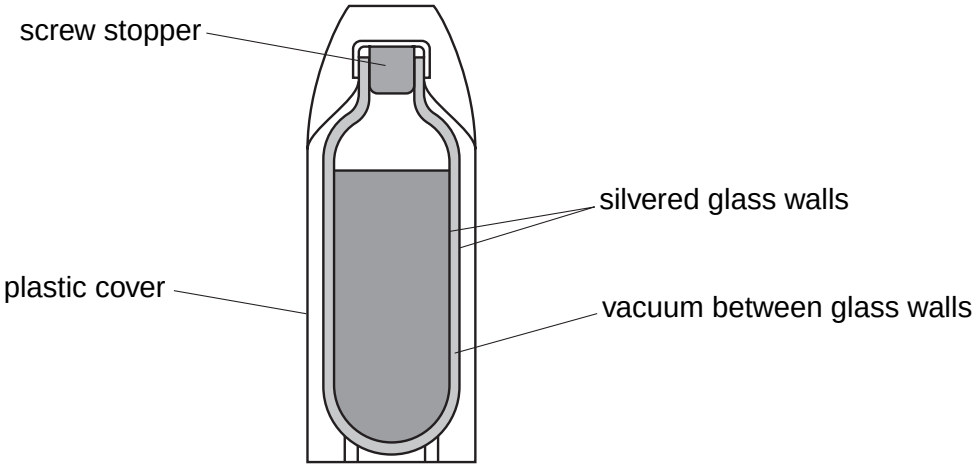


Fig. 3.1

Explain how each of the following helps to keep the coffee hot.

(a) the screw stopper

.....

.....

..... [2]

(b) the silvered glass walls

.....

.....

..... [2]

(c) the vacuum between glass walls

.....

.....

..... [2]

4 Fig. 4.1 shows human male and female reproductive systems.

For Examiner's Use

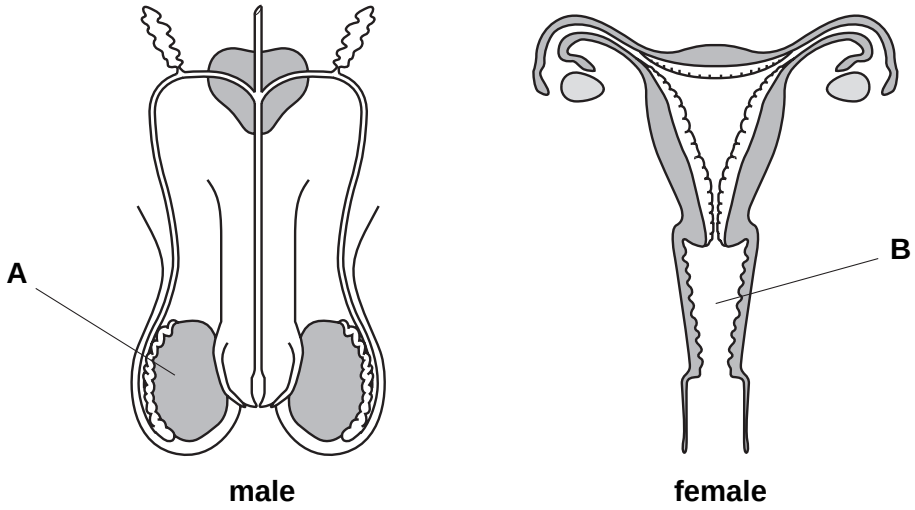


Fig. 4.1

(a) Name and give the functions of the parts labelled **A** and **B**.

A name .....

function .....

.....

B name .....

function .....

.....

[4]

(b) Birth control can be achieved by a surgical procedure on a man or on a woman.

(i) Mark with crosses (**✗**) on Fig. 4.1 where this procedure is carried out on **both** the male and the female reproductive systems. [2]

(ii) Birth control can also be achieved by non-surgical methods.

Name two of these methods.

1. .....

2. ..... [2]

5 Zinc reacts with dilute hydrochloric acid.

For Examiner's Use

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$$

An excess of zinc was added to dilute hydrochloric acid at 25 °C.

The volume of hydrogen produced in this reaction was measured at room temperature and pressure using the apparatus shown in Fig. 5.1.

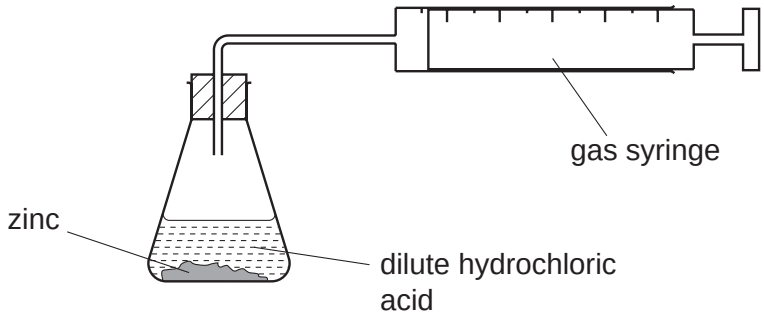
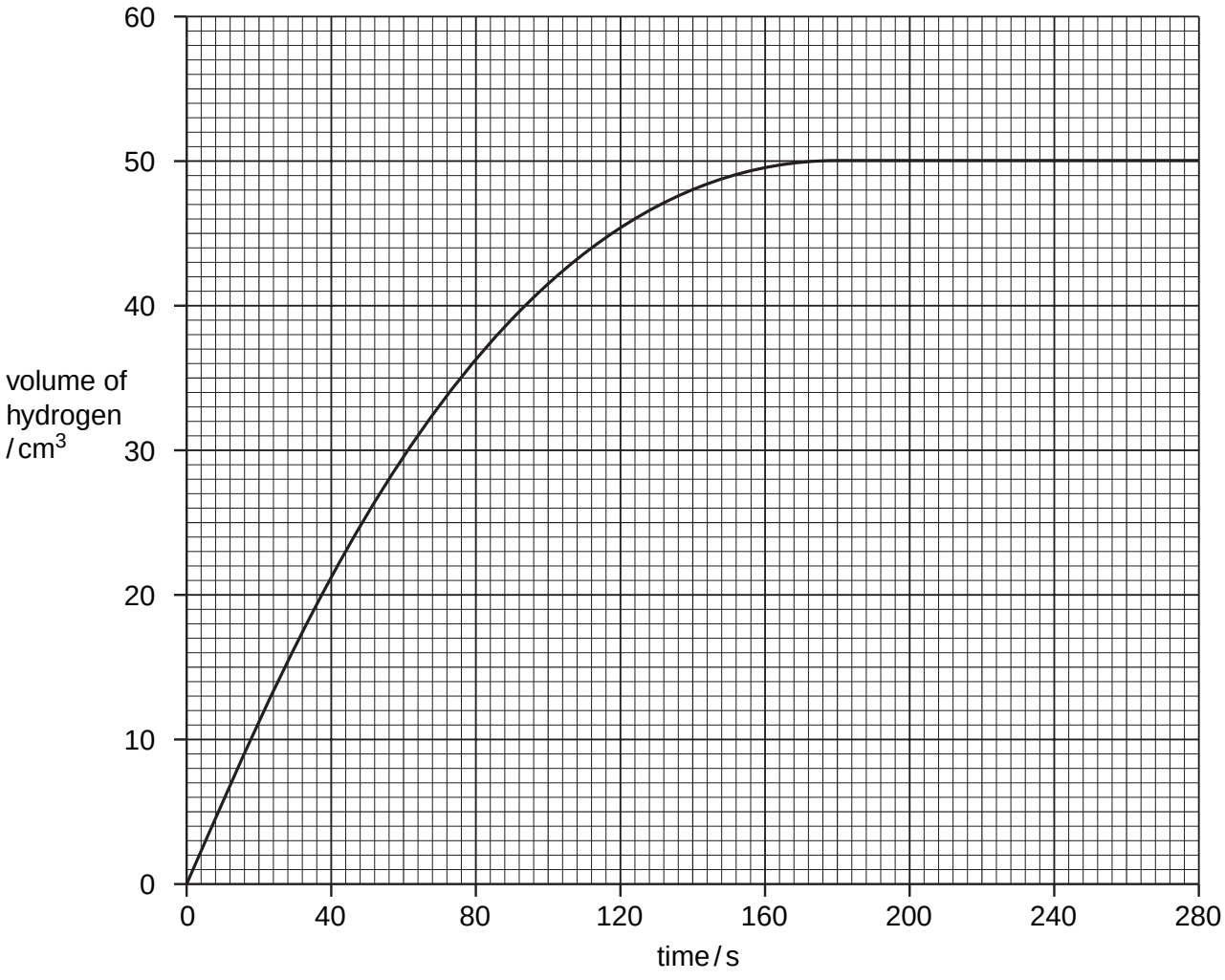


Fig. 5.1

Results from this investigation were used to plot a graph.



(a) What volume of hydrogen was collected after 100 seconds?

..... cm^3 [1]

(b) The reaction stopped after 50 cm^3 of hydrogen had been collected.

(i) Use the graph to state the time at which the reaction stopped.

..... s [1]

(ii) Explain why no more hydrogen was produced after this time.

.....

..... [1]

(c) The investigation is repeated using identical conditions except that the temperature of the hydrochloric acid is 40 °C instead of 25 °C.

Sketch on the graph the curve you would expect for this second investigation. [2]

(d) Calculate the mass of zinc that reacted with hydrochloric acid to release 50 cm^3 of hydrogen.

mass of zinc = ... g [3]

6 Fig. 6.1 shows a crane in operation.

The fixed weight **C** balances the arm of the crane when it has no load.

Moveable weights **A** and **B** balance the load on the crane.

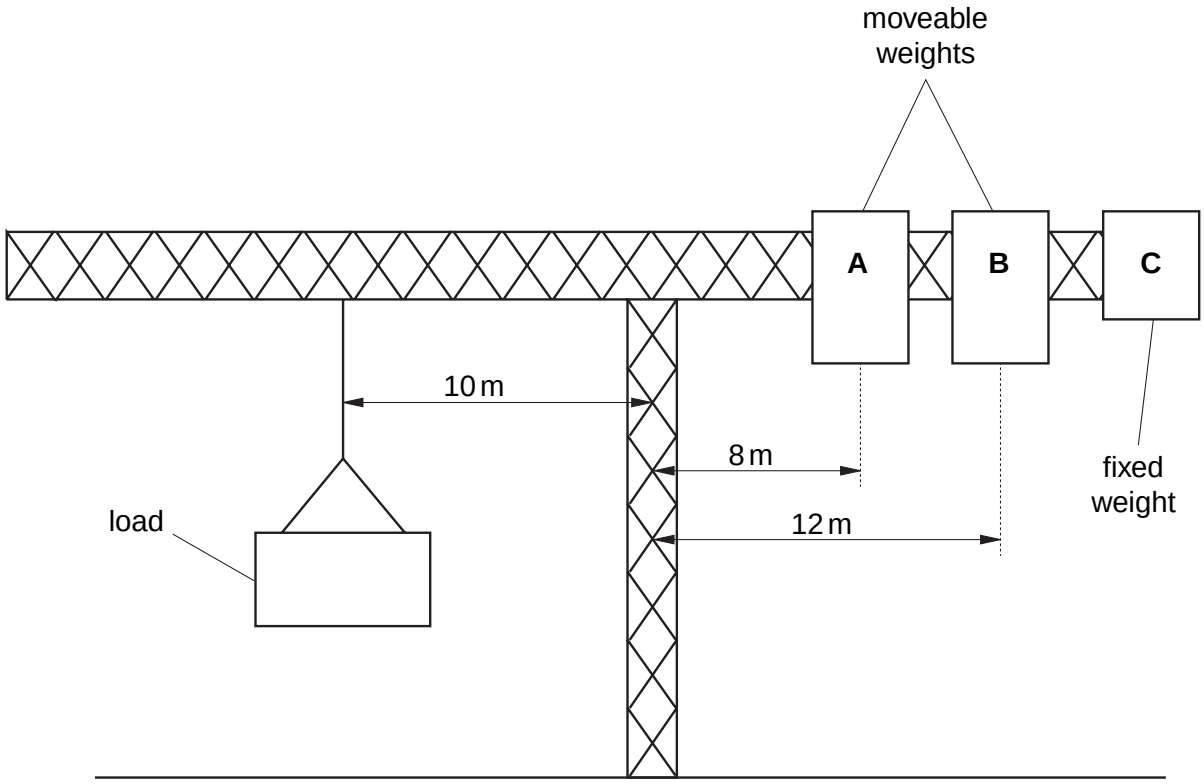


Fig. 6.1

(a) Weight **A** is 3000 N and weight **B** is 5000 N.

Calculate the weight of the load being lifted by the crane, in newtons.

weight of load = ... N [3]

(b) The crane lifts this load a vertical height of 7 m.

Calculate the work done in lifting the load.

For Examiner's Use

work done = ... J [2]

(c) The crane takes 6 seconds to lift the load a vertical height of 7 m.

Show that the power required is 9800 W.

[2]

(d) The crane uses an electric motor with a maximum power output of 15000 W.

Why does the crane need a motor with a power output higher than 9800 W?

.....

.....

.....

..... [2]

7 A student investigates the effect of changing light intensity on the rate of photosynthesis.

For Examiner's Use

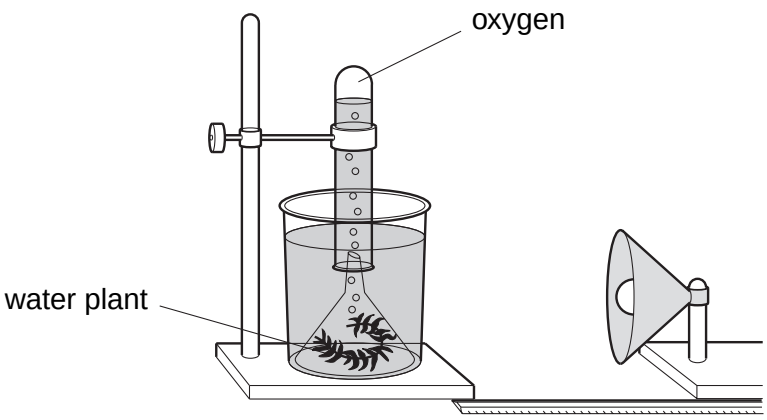


Fig. 7.1

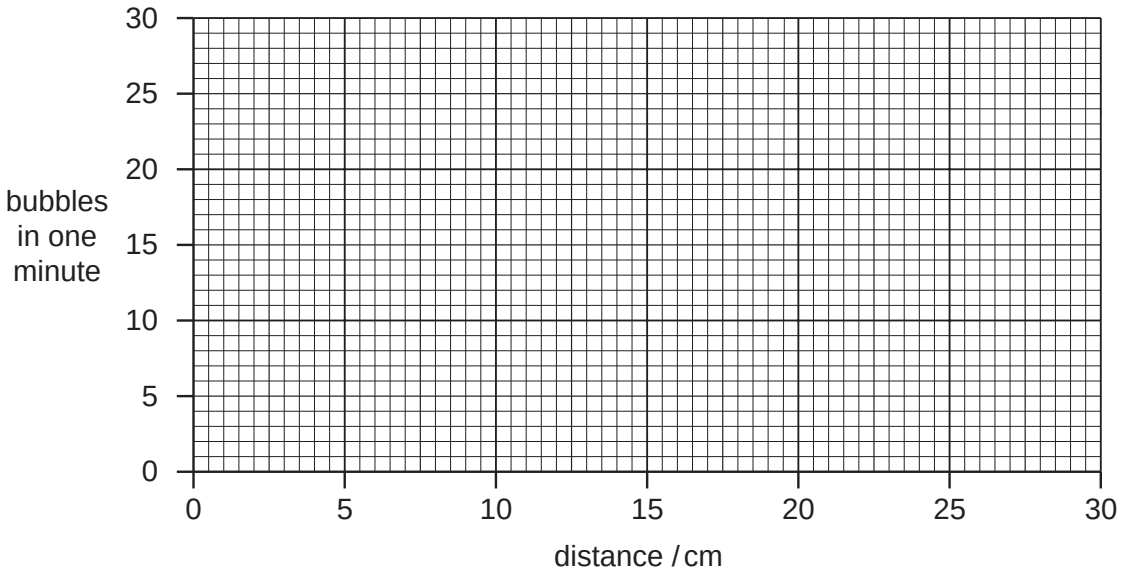
She counts the number of bubbles of oxygen produced in one minute when the lamp is placed at different distances from the water plant.

Her results are shown in the table.

distance / cm	5	10	15	20	25	30
bubbles in one minute	28	19	11	6	3	2

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

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



(b) **(i)** Suggest the relationship between the rate of photosynthesis and the distance of the lamp from the water plant.

For Examiner's Use

.....

.....

..... [2]

(ii) Explain this relationship.

.....

.....

..... [2]

(c) Suggest another factor that has an effect on the rate of photosynthesis.

..... [1]

8 Fig. 8.1 shows apparatus used in the electrolysis of dilute sulfuric acid.

For Examiner's Use

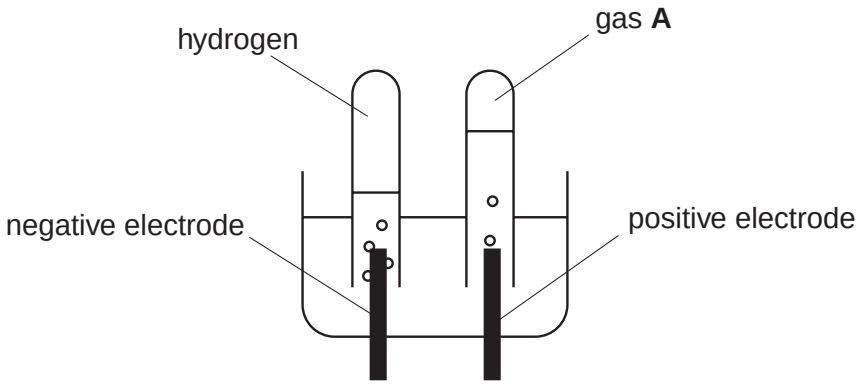


Fig. 8.1

(a) At the negative electrode hydrogen gas is released.

(i) Describe a test to prove that this gas is hydrogen.

test .....

result ..... [2]

(ii) Write an equation for the formation of hydrogen gas from hydrogen ions at the negative electrode.

..... [1]

(b) **(i)** What is the name of gas **A**, produced at the positive electrode?

..... [1]

(ii) Explain why the volume of gas **A** is only half the volume of hydrogen produced in the same time.

.....

.....

..... [2]

9 Fig. 9.1 shows a coal-fired power station used to generate electricity for supply to homes and factories.

For Examiner's Use

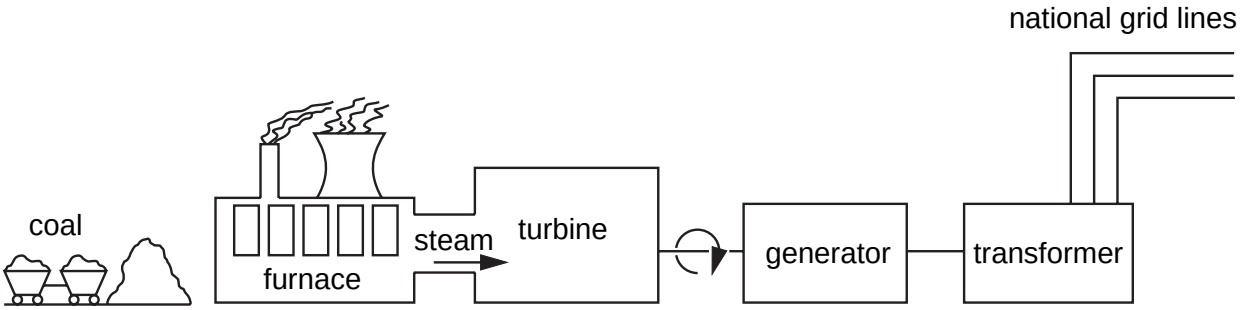


Fig. 9.1

(a) Describe the energy transfers that take place at each of the following stages.

coal is burned ..... energy to ..... energy

water turns into steam ..... energy to ..... energy

generators make electricity ..... energy to ..... energy [3]

(b) The transformer is used to step up the voltage of the electricity before it is sent to customers via the National Grid.

Fig. 9.2 shows a laboratory model of a step-up transformer.

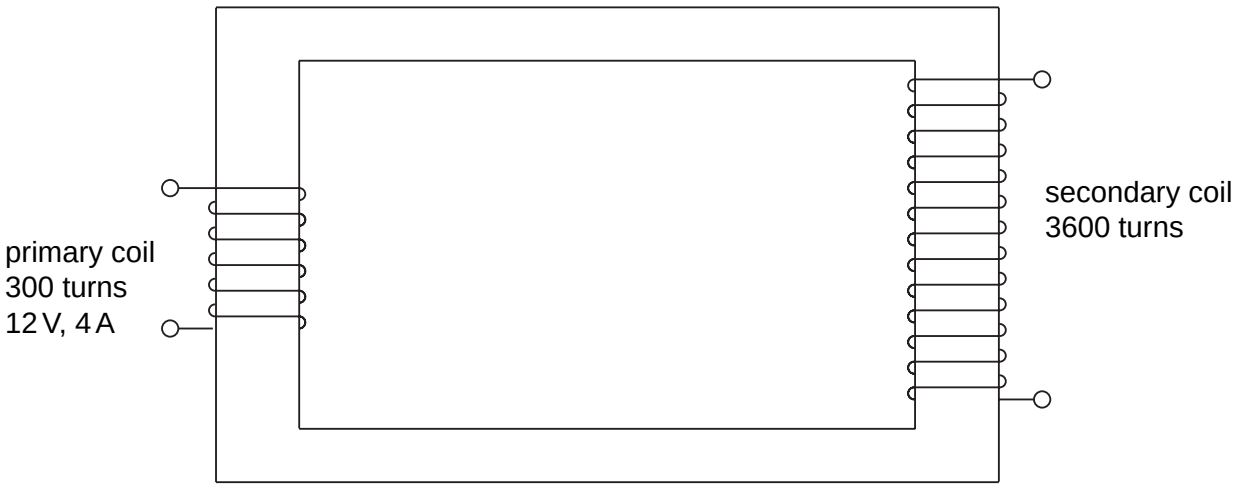


Fig. 9.2

(i) Calculate the output voltage of the secondary coil of this model transformer.

voltage = ... V [3]

(ii) The voltage of the National Grid power lines is 250 000 V.

For Examiner's Use

A step-down transformer converts this to 240 V for use in homes.

Explain why the voltage used for the National Grid is much higher than that used in homes.

.....

.....

.....

..... [2]

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 the carbon cycle.

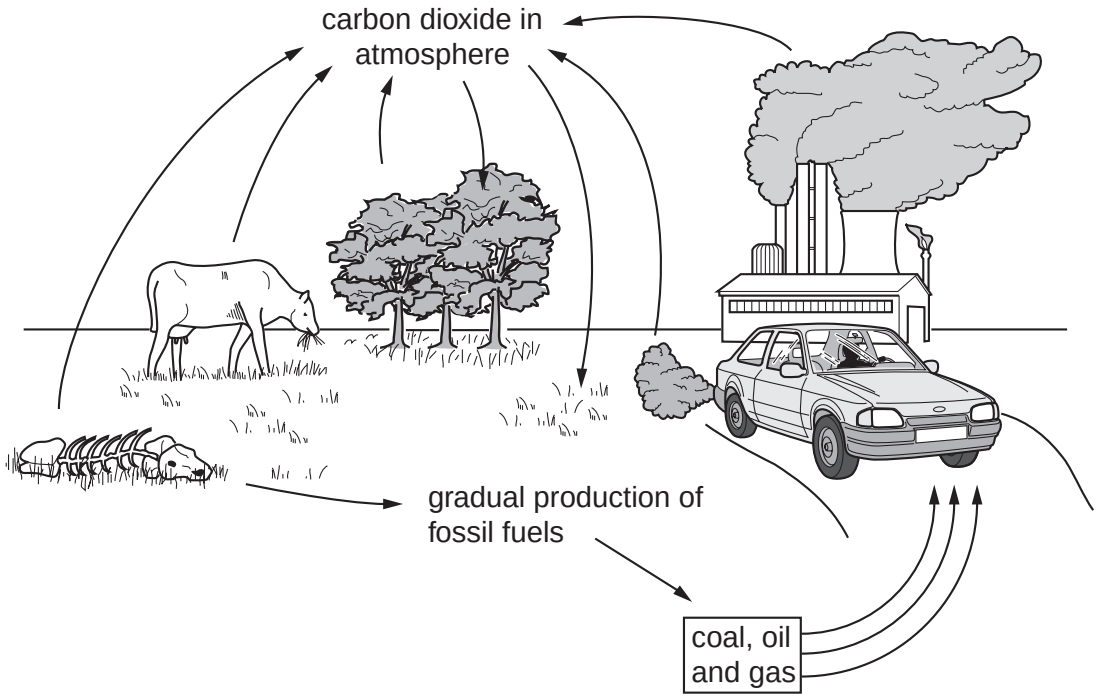


Fig. 10.1

(i) Explain how photosynthesis, animal nutrition, respiration and combustion are involved in the carbon cycle. [7]

(ii) The carbon cycle maintained a constant percentage of carbon dioxide in the atmosphere for thousands of years, but during the past 100 years this has increased.

Use ideas from Fig. 10.1 to suggest why this has happened. [3]

Part (b) of this question is on p18.

Or

(b) Fig. 10.2 shows the results of five independent investigations into the effect of physical activity on heart disease.

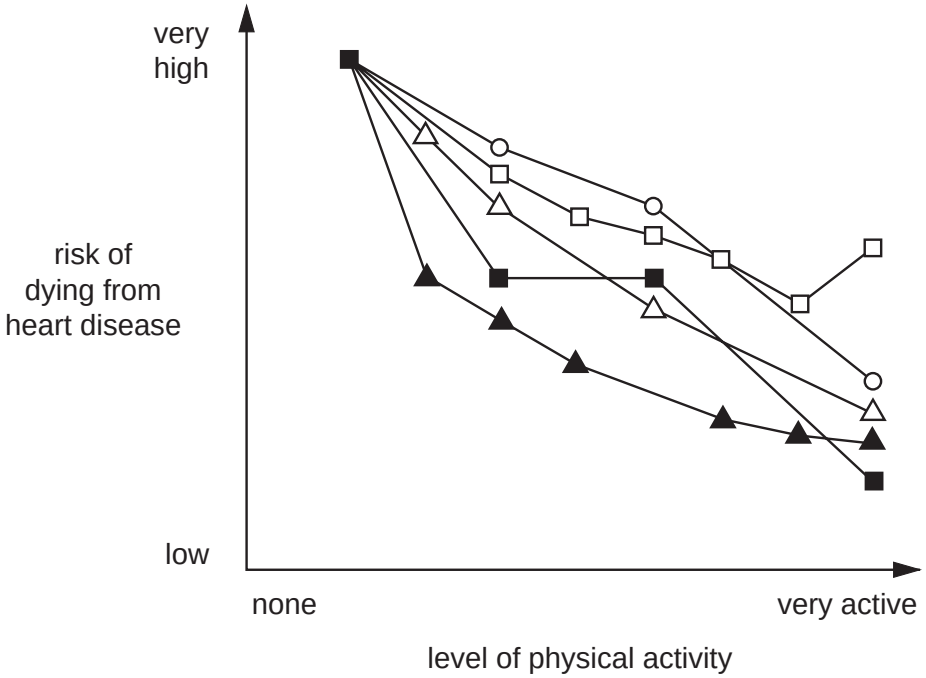


Fig. 10.2

(i) Describe coronary heart disease.

What do the results shown in Fig. 10.2 suggest about the effect of physical activity on the risk of heart disease?

Use ideas about the circulatory system to suggest why physical activity may have this effect. [6]

(ii) It has been suggested that eating a balanced diet may help to prevent heart disease. Suggest why this may be true.

What other factor, not related to diet or physical activity, may **increase** the risk of heart disease? [4]

11 Either

(a) A laboratory technician is unsure whether he has put the correct labels on the three bottles shown in Fig. 11.1

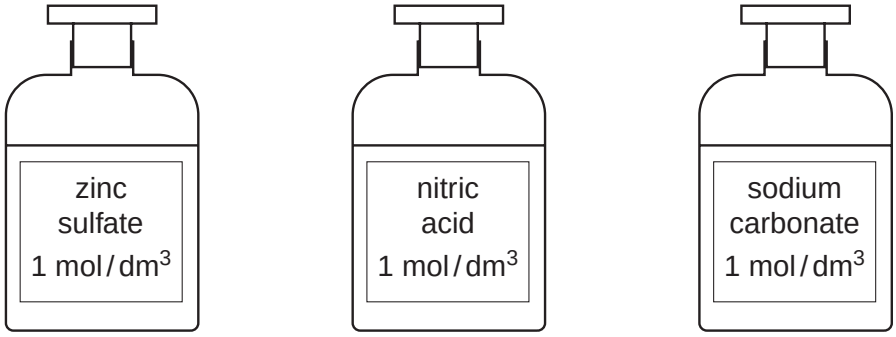


Fig. 11.1

Explain how the technician could use chemical tests to identify the solution in each bottle. [10]

Or

(b) The flow diagram in Fig. 11.2 shows how lime and slaked lime are manufactured from limestone.

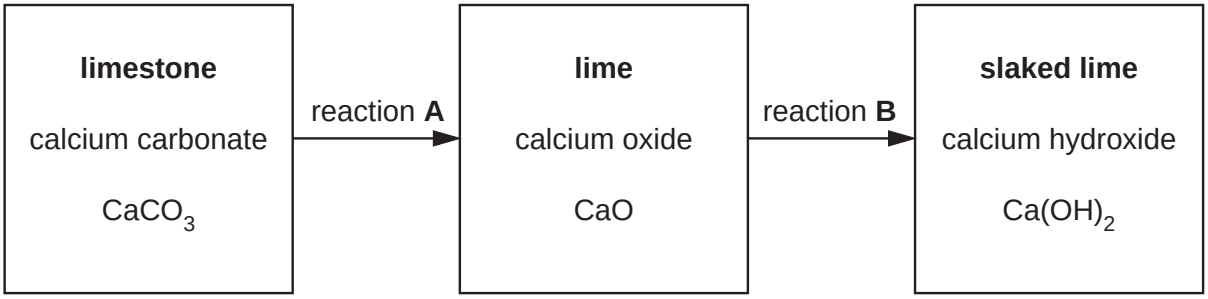


Fig. 11.2

Reaction **A** is endothermic and reaction **B** is exothermic.

(i) Using information from Fig. 11.2, describe how lime and slaked lime are manufactured.

Include balanced equations for the reactions involved.

Other than in this process, state a commercial use for limestone and a *different* use for slaked lime. [7]

(ii) Calculate the maximum mass of calcium hydroxide that can be made from one tonne of calcium carbonate. [3]

12 Either

(a) The isotope strontium-90 decays by β-emission to yttrium-90.

Yttrium-90 decays by β-emission to zirconium-90.

An atom of strontium-90 is $^{90}_{38}Sr$.

The half-life of strontium-90 is 29 years. Fig. 12.1 shows how the activity of a sample of strontium-90 decreases with time.

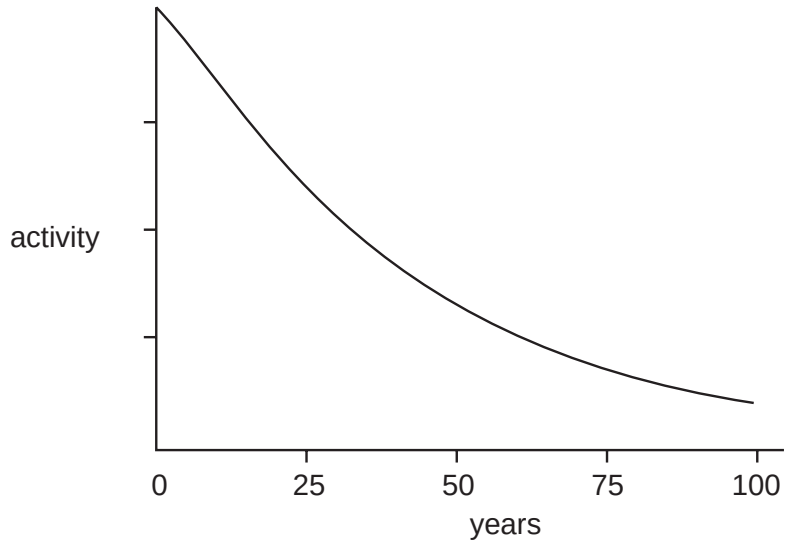


Fig. 12.1

(i) Explain what is meant by the terms *radioactive decay* and *half-life*.

Write equations for the radioactive decay of strontium-90 to zirconium-90.

How long would it take for the mass of strontium-90 in a 52 mg sample to decrease to 13 mg? [6]

(ii) Describe an experiment that you could perform to show that strontium-90 emits only β-particles rather than α-particles or gamma rays during its radioactive decay. [4]

Or

(b) Fig. 12.2 shows the paths of light rays from a fish in a river to the eye of a fisherman.

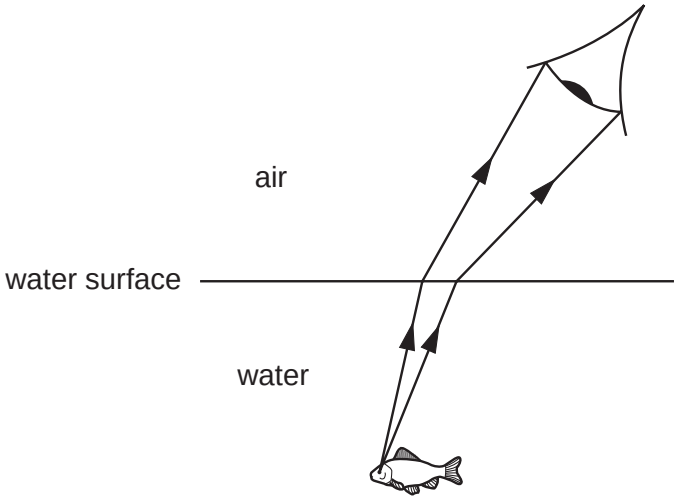


Fig. 12.2

(i) Explain what happens to these rays of light as they travel from the fish to the fisherman's eye.

Why may this cause a problem as the fisherman tries to spear the fish? [5]

(ii) Draw a ray diagram to show the formation of a virtual image by a single convex lens.

Explain how this lens may be used as a magnifying glass. [5]

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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 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 †															

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

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