O

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

5067831891

COMBINED SCIENCE **5129/21**

Paper 2 **May/June 2013**

2 hours 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, graphs or rough working.
Do not use staples, paper clips, highlighters, 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 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.

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

UNIVERSITY of CAMBRIDGE International Examinations

1 Fig. 1.1 shows a vernier scale and a micrometer scale.

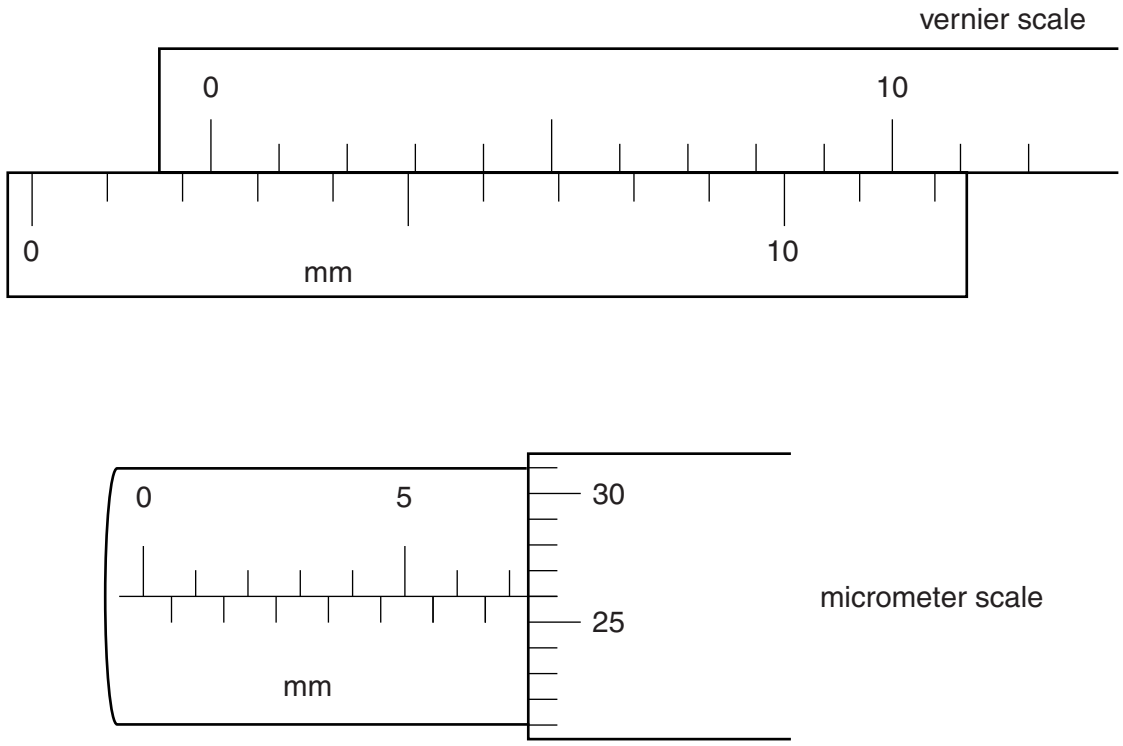


Fig. 1.1

(a) The reading on the vernier scale is .....mm. [1]

(b) The reading on the micrometer scale is .....mm. [1]

2 Fig. 2.1 shows a section through the eye.

For Examiner's Use

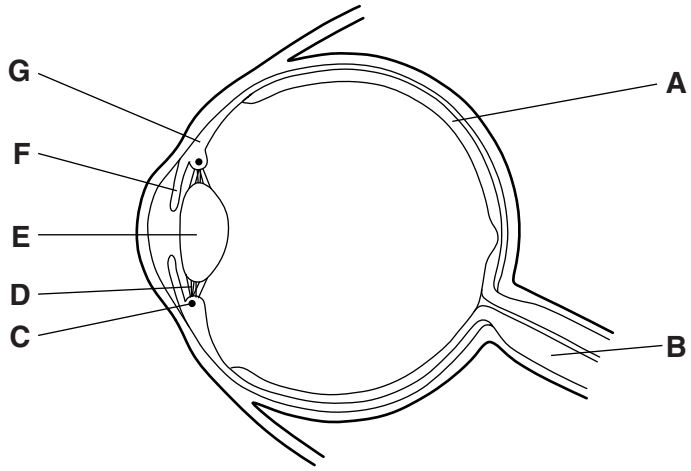


Fig. 2.1

(a) (i) Use letters from Fig. 2.1 to identify

1. the iris, ...
2. the optic nerve, ...
3. the suspensory ligaments. .....

[3]

(ii) State **one** function for each of the following structures.

lens .....

.....

ciliary muscles .....

.....

retina .....

.....

[3]

(b) Fig. 2.2 shows a student's eye in normal conditions.

Fig. 2.3 shows the eye after a particular event.

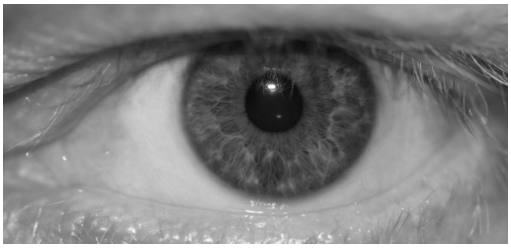


Fig. 2.2

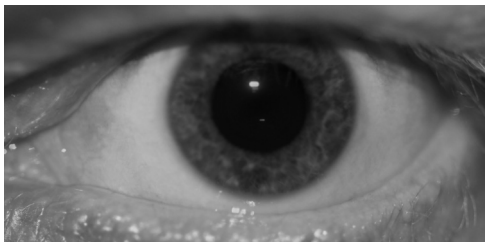


Fig. 2.3

(i) Describe the difference in the appearance of the eye.

.....

..... [1]

(ii) Suggest what may cause the change shown between Fig. 2.2 and Fig. 2.3.

.....

..... [1]

(iii) For this change to take place, state which muscles

1. contract, ...

.....

2. relax. .....

..... [2]

3 Fig. 3.1 shows the processes used to manufacture poly(ethene) from petroleum.

For Examiner's Use

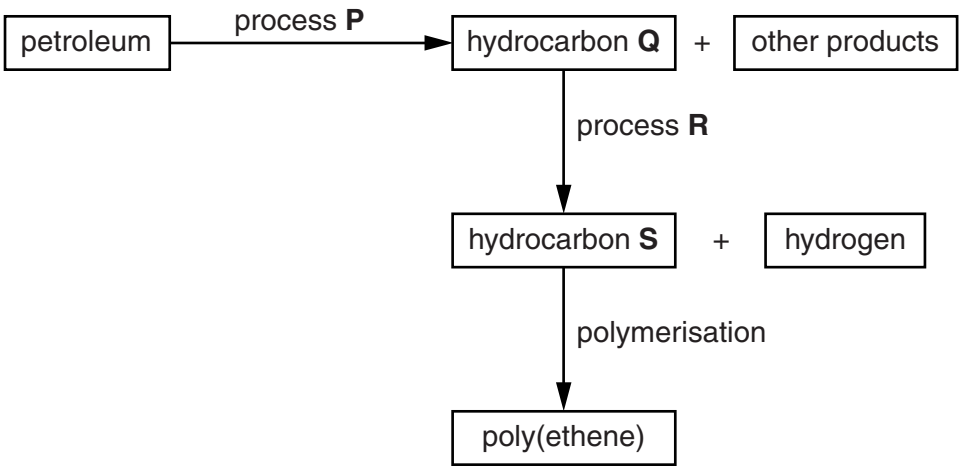


Fig. 3.1

(a) (i) Identify processes **P** and **R**.

process **P** .....

process **R** ..... [2]

(ii) Identify the types of hydrocarbon **Q** and **S**.

hydrocarbon **Q** .....

hydrocarbon **S** ..... [2]

(b) The following is a balanced equation for the complete combustion of a hydrocarbon.

$$C_xH_y + 8O_2 \longrightarrow 5CO_2 + 6H_2O$$

Calculate the values of x and y in the formula C_xH_y.

x = ...

y = ... [2]

4 A metre rule is balanced horizontally on a pivot.

A wooden cube is then placed so that its centre is 0.45 m from the pivot.

A stretched spring is attached to the rule at a distance of 0.20 m from the pivot, as shown in Fig. 4.1.

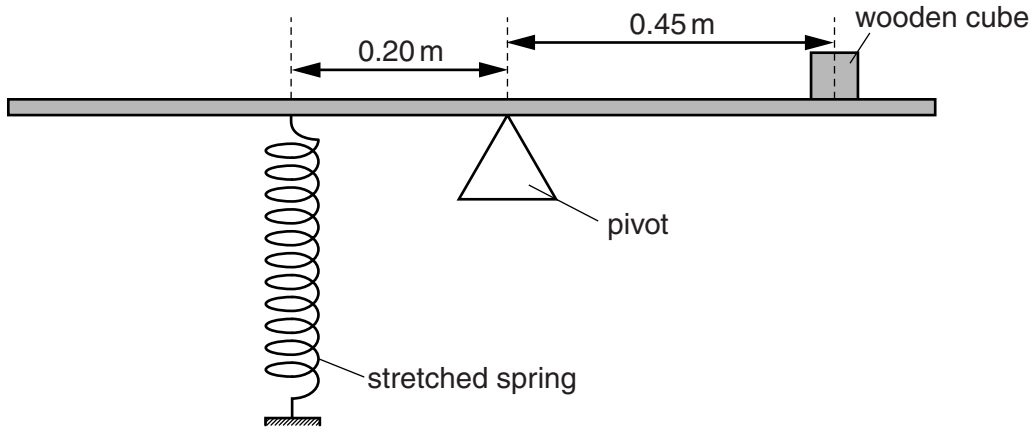


Fig. 4.1

The spring exerts a downward force of 4.5 N on the metre rule to keep it balanced horizontally.

(a) Calculate the anticlockwise moment of the 4.5 N force about the pivot.

moment = ... Nm [1]

(b) Calculate the weight of the wooden cube.

weight = ... N [2]

(c) On Earth, the gravitational field strength *g* is 10 N/kg.

Calculate the mass of the wooden cube.

mass = ... kg [1]

(d) The extension-load graph for the spring is shown in Fig. 4.2.

For Examiner's Use

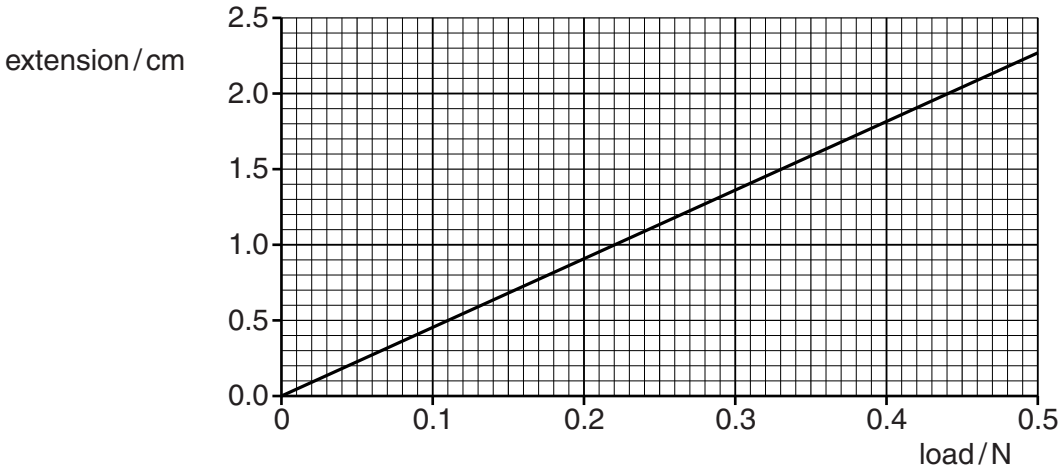


Fig. 4.2

(i) Use Fig. 4.2 to determine the extension of the spring for a load of 0.44N.

extension = ... cm [1]

(ii) When the load on the spring is zero, the length of the spring is 10.0cm.

Calculate the length of the spring for the load of 0.44N.

length = ... cm [1]

5 Fig. 5.1 shows the structure of an **ion** of element Z.

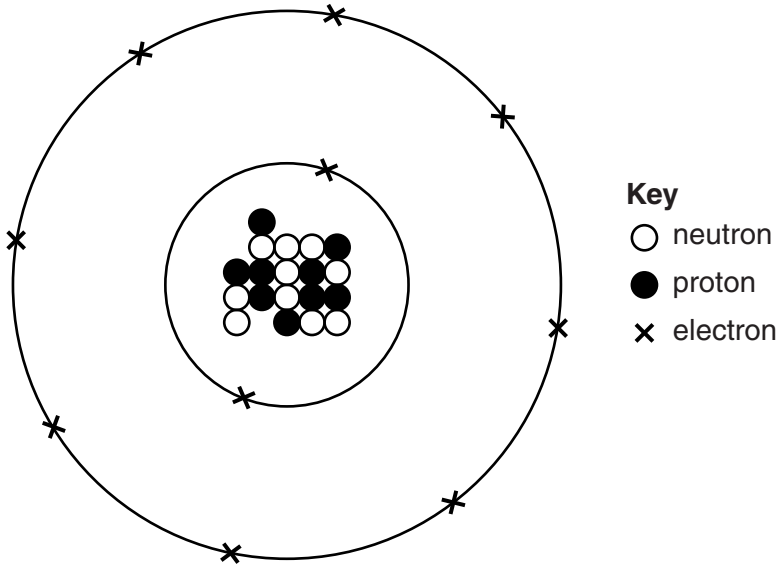


Fig. 5.1

(a) For this ion, state

(i) the nucleon number, ...

(ii) the proton number. .....

[2]

(b) **(i)** State in which group of the Periodic Table element Z is found.

.....

(ii) State the charge on the ion in Fig 5.1. .....

[2]

For Examiner's Use

6 In an experiment, a solution of sodium chloride is made by adding dilute hydrochloric acid to aqueous sodium hydroxide.

(a) Complete the following sentences which describe this experiment.

An exact volume of aqueous sodium hydroxide is added to a flask using a

..... .

Universal Indicator is added to the solution and the solution turns a

..... colour.

The hydrochloric acid is added to the solution using a .....

until the solution turns a ..... colour and the volume of the acid

used is noted. [4]

(b) The experiment is repeated using exactly the same volumes but without the indicator.

The solution obtained is evaporated to produce solid sodium chloride.

Suggest why the experiment is repeated without the indicator.

.....

..... [1]

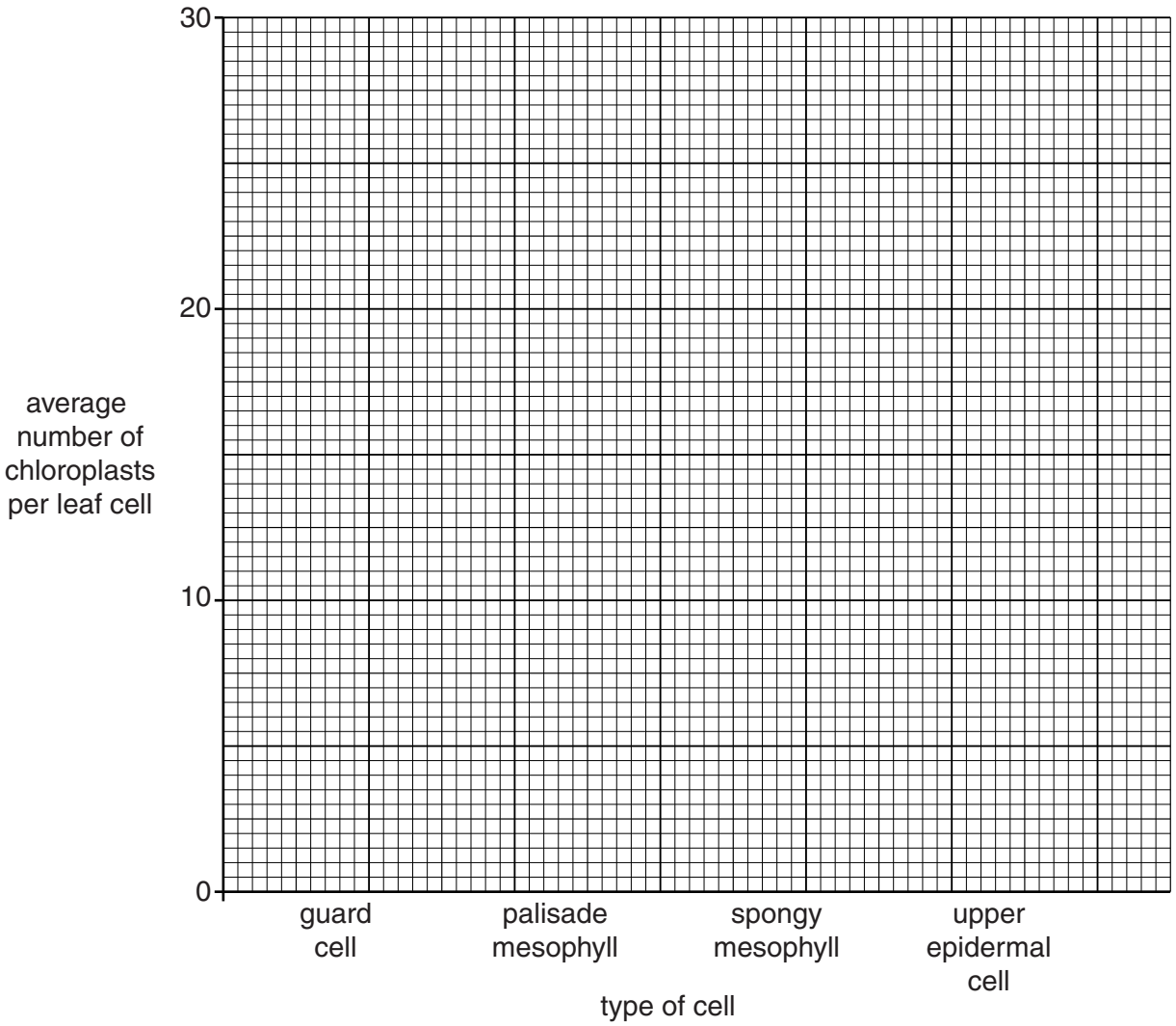
7 Table 7.1 shows the average number of chloroplasts found in four different types of cell in a leaf.

For Examiner's Use

Table 7.1

cell type	average number of chloroplasts per cell
guard cell	4
palisade mesophyll cell	28
spongy mesophyll cell	16
upper epidermal cell	0

(a) (i) On the axes of Fig. 7.1, draw a bar chart to show the data in Table 7.1.



[3]

Fig. 7.1

(ii) Calculate the number of chloroplasts in a spongy mesophyll cell as a percentage of the number in a palisade mesophyll cell.

For Examiner's Use

percentage = ... [1]

(b) State and explain which type of cell shown in Table 7.1 forms the most glucose.

type of cell .....

explanation .....

.....

.....

..... [2]

(c) State and explain why it is important for a young plant to obtain nitrogen-containing ions from the soil.

.....

.....

.....

..... [2]

8 An electrical heater is used to warm water in a metal can, as shown in Fig. 8.1.

The heater is placed at the bottom of the can.

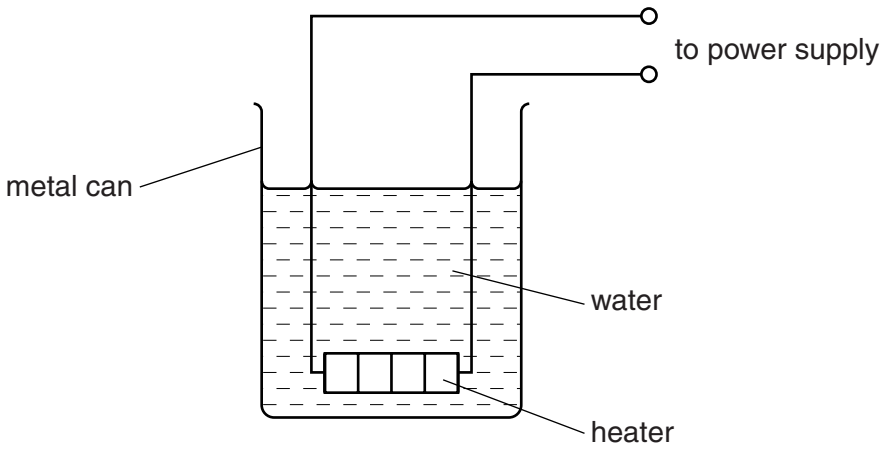


Fig. 8.1

(a) The 6.5V heater has a power of 13W.

Calculate the current in the heater.

current = ... A [2]

(b) The water at the bottom of the can is warmed directly by the heater.

Explain, in detail, how the rest of the water is heated by convection.

.....

.....

.....

..... [3]

(c) State how thermal energy is transferred through the metal of the can.

..... [1]

(d) When the heater is switched off, the water cools.

The can has a white surface.

Explain why the water cools more quickly if the outside of the can is black.

.....

..... [1]

9 Fig. 9.1 shows a pin in front of a plane mirror and a ray of light from the pin that is incident on the surface of the mirror.

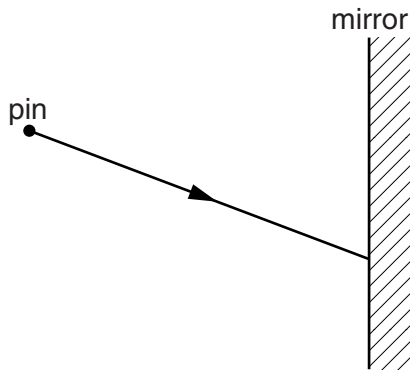


Fig. 9.1

(a) On Fig. 9.1 draw,

(i) the normal where the ray is incident on the surface of the mirror, [1]

(ii) the reflected ray of light. [1]

(b) On Fig. 9.1, mark with the letter **X** the position of the image of the pin. [2]

[Turn over

For Examiner's Use

10 Ammonia is manufactured by reacting nitrogen and hydrogen together in the presence of a catalyst.

(a) (i) Name the catalyst and explain why this catalyst is used.

catalyst .....

explanation .....

..... [2]

(ii) State values for the temperature and the pressure used in this process.

temperature .....°C

pressure .....atm [2]

(b) State the source of the hydrogen used in the manufacture of ammonia.

..... [1]

(c) State one use of ammonia.

..... [1]

(d) Ammonia dissolves in water to produce ammonium hydroxide which is an alkaline solution.

Name the ion present in the solution responsible for it being an alkali.

..... [1]

11 Use words from the list to complete the sentences below.

cervix	**cotyledon**	**egg cell**	**ovary**
prostate gland	**scrotum**	**seed**	**testes**
uterus	**vagina**	**zygote**	

Each word may be used once, more than once or not at all.

Sperm are produced in the ..... of the male.

During sexual intercourse sperm are released into the ..... of the female.

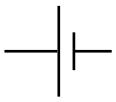
At fertilisation the sperm fuses with the ..... and this results in a ..... being formed. [4]

12 A student connects a cell, a resistor, an ammeter and a lamp in series.

He adds a voltmeter to measure the potential difference across the lamp.

For Examiner's Use

(a) In the space below, complete the circuit diagram for the circuit that the student uses.



[4]

(b) The ammeter reads 0.30A and the voltmeter reads 1.5V.

(i) Calculate the resistance of the lamp.

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

(ii) State the current in the resistor.

.....A [1]

13 Calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, carbon dioxide and water.

For Examiner's Use

The equation for the reaction is

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

The relative molecular mass, M_r, of calcium carbonate is 100.
[A_r: Ca, 40; Cl, 35.5; O, 16; C, 12; H, 1]

(a) Complete the following sentences.

100 g of calcium carbonate produces .....g of calcium chloride and .....g of carbon dioxide.

10 g of calcium carbonate produces .....g of calcium chloride and .....g of carbon dioxide.

2.5 g of calcium carbonate produces .....g of calcium chloride. [4]

(b) State the test for carbon dioxide.

test .....

result .....

..... [2]

14 **(a)** State two differences in **structure** between arteries and veins

1. .....

.....

2. .....

.....
[2]

(b) State two differences in **function** between arteries and veins.

1. .....

.....

2. .....

.....
[2]

15 One isotope of carbon is carbon-14 ($^{14}_{6}C$).

For Examiner's Use

(a) State the number of neutrons in a nucleus of carbon-14. ..... [1]

(b) The isotope $^{14}_{6}C$ is radioactive and emits beta-particles.

(i) What is a beta-particle? ..... [1]

(ii) State the changes that occur to the number of protons and to the number of neutrons in a nucleus when a beta-particle is emitted.

.....

.....

..... [2]

(c) The half-life of a sample of carbon-14 is 5700 years.

A sample of carbon-14 initially emits 10 000 beta-particles per second.

Complete Table 15.1 for this sample of carbon-14.

Table 15.1

time / years	number of beta-particles emitted per second
0	10 000
5700	
	2500
17 100	

[3]

[Turn over

16 Fig. 16.1 shows representations of elements, compounds and mixtures.

For Examiner's Use

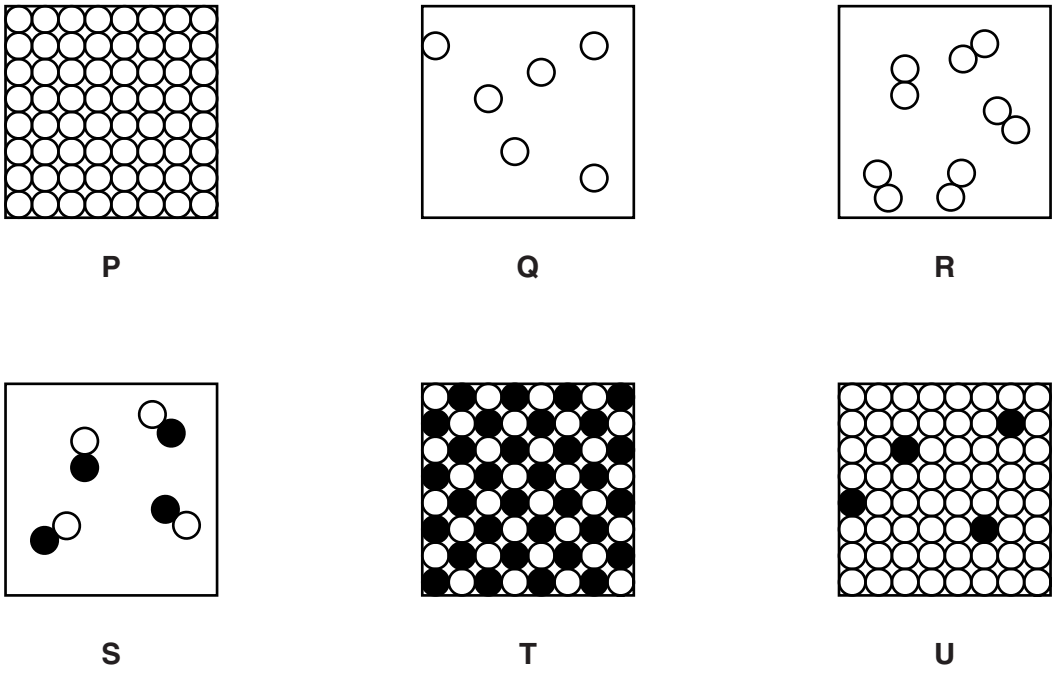


Fig. 16.1

In questions **(a)** to **(e)**, each letter can be used once, more than once, or not at all.

Choose the letter which represents

(a) an alloy, ...

(b) an ionic compound, ...

(c) a diatomic element, ...

(d) an inert gas, ...

(e) a mixture. ..... [5]

17 Famines occur in some parts of the world.

For Examiner's Use

(a) Explain what is meant by *famine*.

.....

..... [1]

(b) State three problems which contribute to famine.

For each problem, explain how it produces famine conditions.

problem 1 .....

explanation .....

.....

problem 2 .....

explanation .....

.....

problem 3 .....

explanation .....

.....

[6]

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	98 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.).