



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
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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.



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

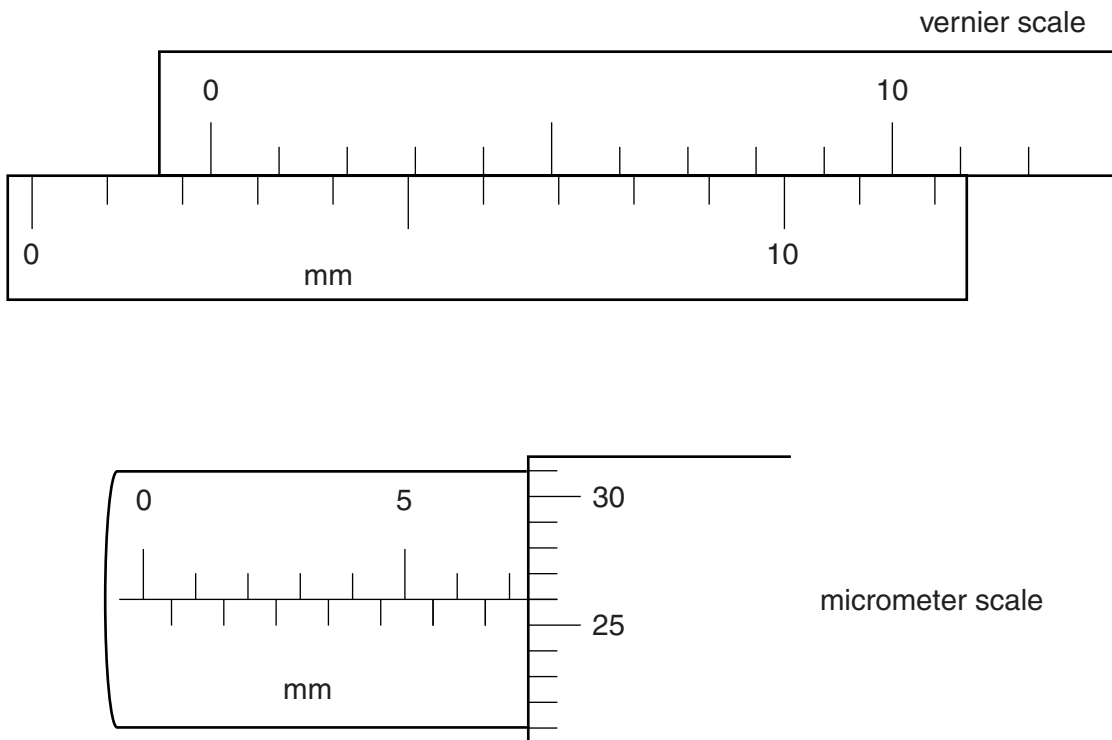


Fig. 1.1

- (a) The reading on the vernier scale ismm. [1]
- (b) The reading on the micrometer scale ismm. [1]

2 Fig. 2.1 shows a section through the eye.

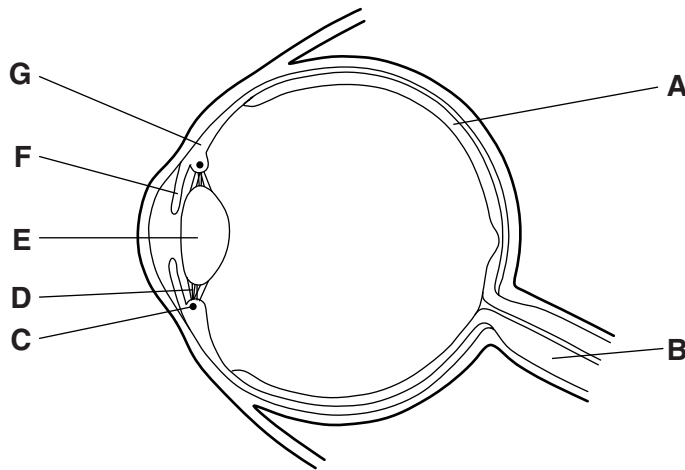


Fig. 2.1

(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.

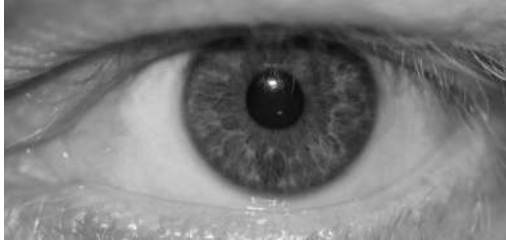


Fig. 2.2

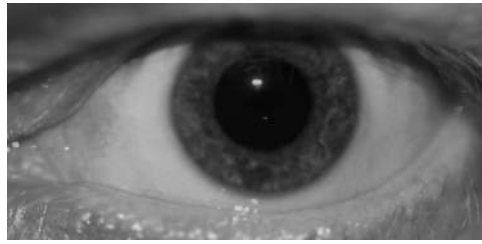


Fig. 2.3

(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.

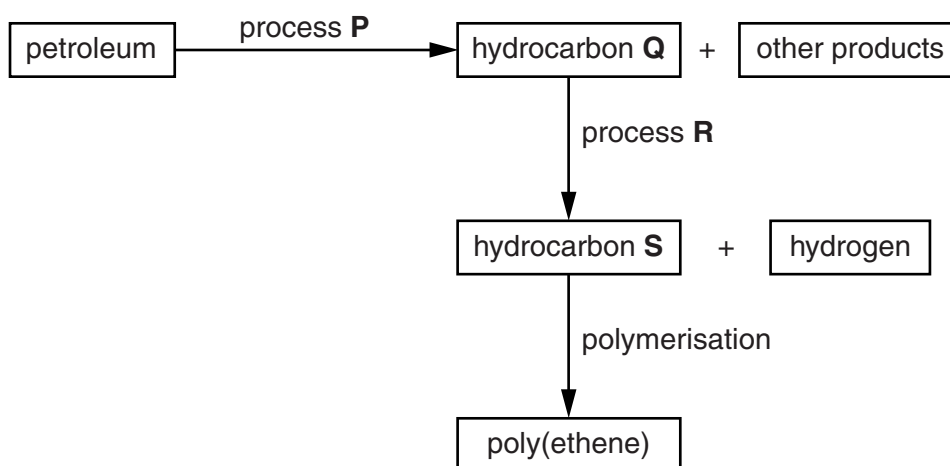


Fig. 3.1

- (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.



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.

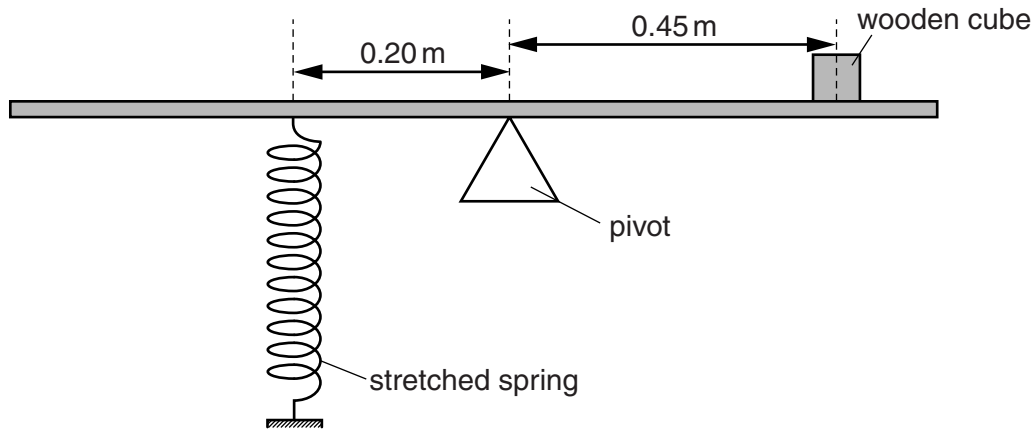


Fig. 4.1

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

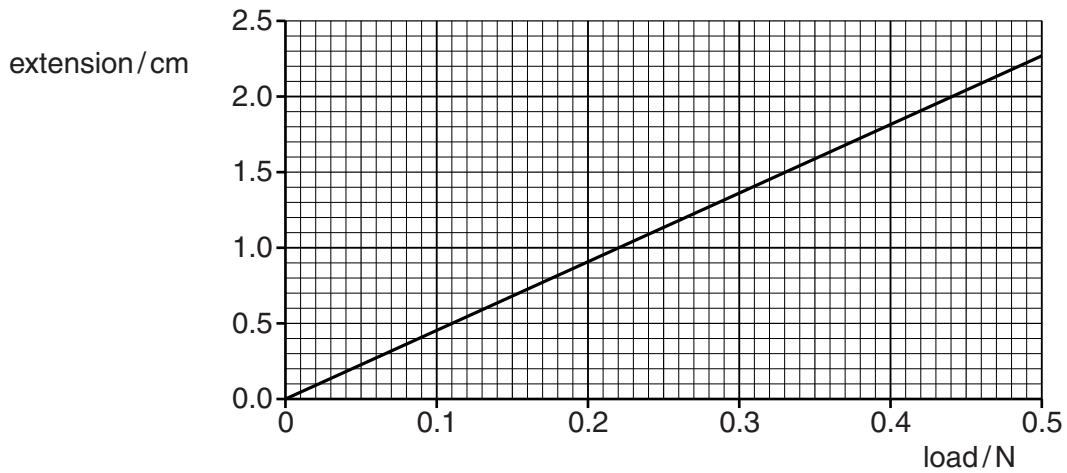


Fig. 4.2

(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.

For
Examiner's
Use

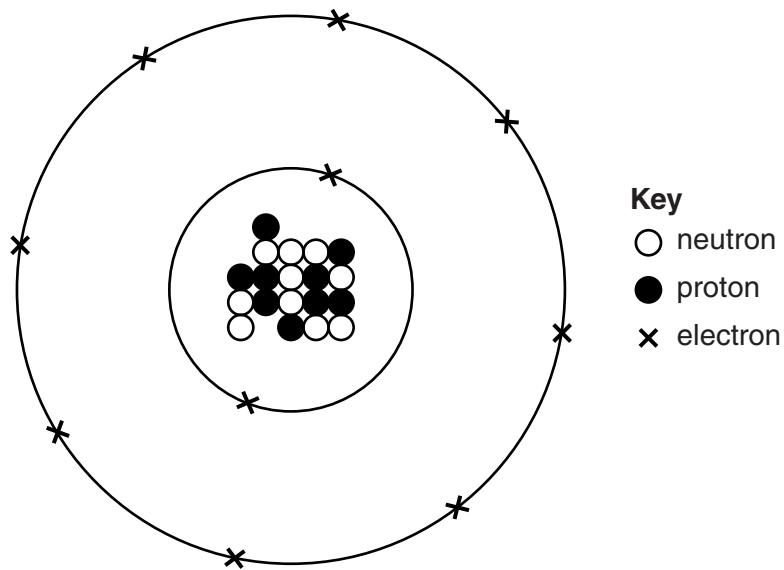


Fig. 5.1

(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]

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.

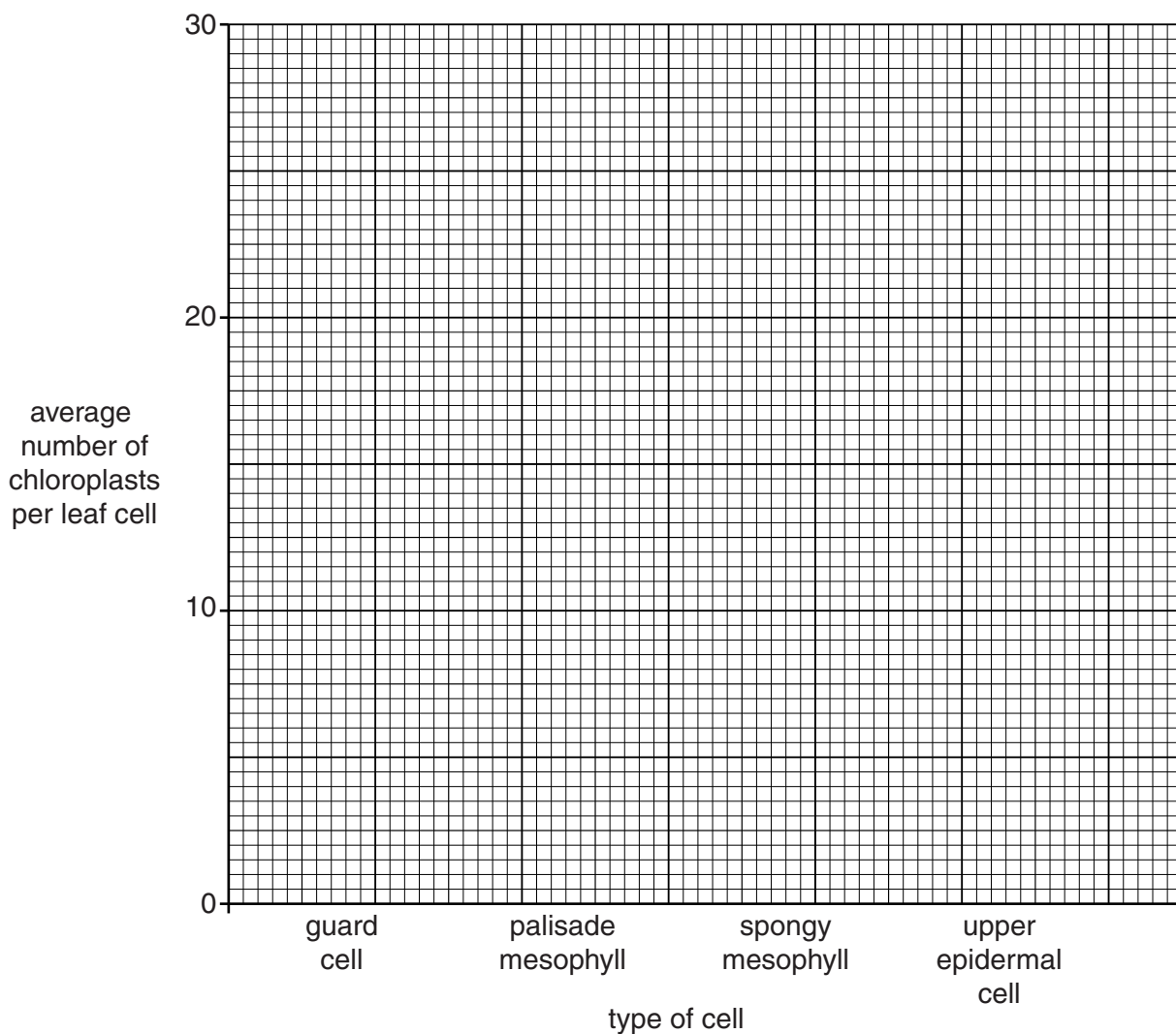


Fig. 7.1

[3]

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

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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.

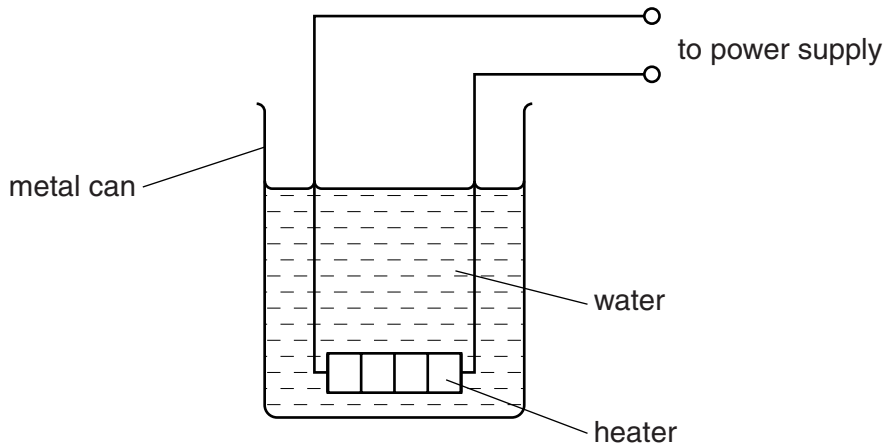


Fig. 8.1

- (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.

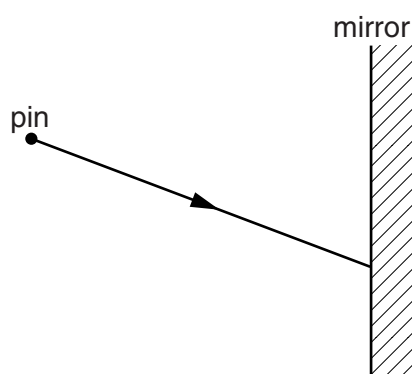


Fig. 9.1

- (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]

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.

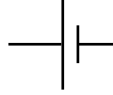
Sperm are produced in the of the male.

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.

(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.

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Use

The equation for the reaction is



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 producesg of calcium chloride andg of carbon dioxide.

10 g of calcium carbonate producesg of calcium chloride andg of carbon dioxide.

2.5 g of calcium carbonate producesg 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 ($^{14}_6\text{C}$).

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

(b) The isotope $^{14}_6\text{C}$ 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.

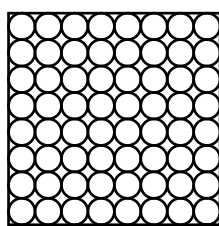
Table 15.1

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

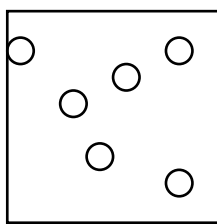
[3]

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

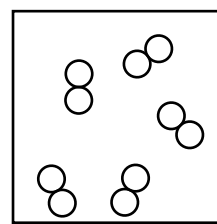
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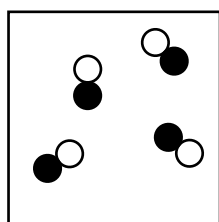
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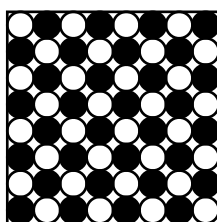
Q



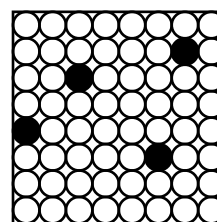
R



S



T



U

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.

(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]

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DATA SHEET
The Periodic Table of the Elements

		Group																								
		I	II	III	IV	V	VI	VII	0																	
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">1 H Hydrogen 1</td> </tr> </table>										1 H Hydrogen 1														
1 H Hydrogen 1																										
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">4 He Helium 2</td> </tr> </table>										4 He Helium 2														
4 He Helium 2																										
3	4	7 Li Lithium	9 Be Beryllium											20 Ne Neon												
11	12	23 Na Sodium	24 Mg Magnesium											19 F Fluorine												
19	20	39 K Potassium	40 Ca Calcium											17 Cl Chlorine												
37	38	85 Rb Rubidium	86 Sr Strontium	45 Sc Scandium	46 Ti Titanium	47 V Vanadium	48 Ti Titanium	49 Zr Zirconium	50 Hf Hafnium	51 Nb Niobium	52 Mo Molybdenum	53 Tc Technetium	54 Ru Ruthenium	55 Mn Manganese	56 Fe Iron	57 Co Cobalt	58 Ni Nickel	59 Cu Copper	60 Zn Zinc	61 Ga Gallium	62 Ge Germanium	63 As Arsenic	64 Sb Antimony	65 Te Tellurium	66 I Iodine	67 Xe Xenon
55	56	133 Cs Caesium	137 Ba Barium	87 Fr Francium	88 Ra Radium	139 La Lanthanum	140 Ce Cerium	141 Pr Praseodymium	142 Nd Neodymium	143 Pm Promethium	144 Nd Neodymium	145 Sm Samarium	146 Eu Europium	147 Pm Promethium	148 Os Osmium	149 Ir Iridium	150 Pt Platinum	151 Au Gold	152 Hg Mercury	153 Tl Thallium	154 Pb Lead	155 Bi Bismuth	156 Po Polonium	157 At Astatine	158 Rn Radon	
87	88	223 Fr Francium	226 Ra Radium	227 Ac Actinium											86 Rn Radon											
		* 58–71 Lanthanoid series												† 90–103 Actinoid series												
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">a</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">b</td> <td style="text-align: center;">b</td> </tr> </table>		a	X	b	b											a = relative atomic mass X = atomic symbol b = atomic (proton) number								
a	X																									
b	b																									

The volume of one mole of any gas is 24dm³ at room temperature and pressure (r.t.p.).