Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

COMBINED SCIENCE **5129/21**

Paper 2 **October/November 2018**

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 an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 20.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

DC (KN/SG) 157119/3

CAMBRIDGE
International Examinations

1 Some words about seeds and germination are listed below.

cotyledon	**light**	**minerals**	**oxygen**
pericarp	**placenta**	**plumule**	**radicle**
	testa	**water**	

Use words from the list to complete the following sentences.

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

Flowers produce seeds. The embryo in the seed is surrounded by a protective coat called the ..... .

When a seed germinates it requires a suitable temperature and a supply of ..... and ..... .

The seed contains food stored in the ..... .

The young shoot is called the ..... . [5]

[Total: 5]

2 When a mixture of aluminium and copper(II) oxide is heated, a reaction occurs.

The equation for the reaction is

$$2Al + 3CuO \longrightarrow Al_2O_3 + 3Cu .$$

[A_r: O, 16; A*l*, 27; Cu, 64]

(a) (i) Calculate the relative molecular mass of aluminium oxide.

.....[1]

(ii) 108 g of aluminium produces ..... g of aluminium oxide and ..... g of copper.

2.7 g of aluminium produces ..... g of aluminium oxide. [3]

(b) State **one** use of each of aluminium and copper.

aluminium .....

copper .....
[2]

[Total: 6]

3 Part of a circuit containing a power source, fixed resistor and a variable resistor in parallel is shown in Fig. 3.1.

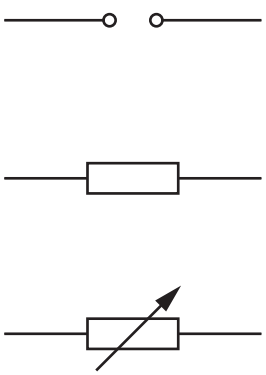

Fig. 3.1

(a) Complete the circuit diagram in Fig. 3.1 to include an ammeter and a voltmeter so that the resistance of the variable resistor can be calculated. [3]

(b) The current in the fixed resistor is 1.6 A and the current in the variable resistor is 0.25 A.

(i) Determine the total current I supplied by the source.

I = ... A [1]

(ii) The resistance of the fixed resistor is 10 Ω.

Calculate the potential difference of the source.

State the unit.

potential difference = ... unit ..... [3]

[Total: 7]

4 Photosynthesis occurs in leaves.

(a) Complete the word equation for photosynthesis.

..... + water ⟶ ..... + ... [2]

(b) Fig. 4.1 shows a section through a leaf.

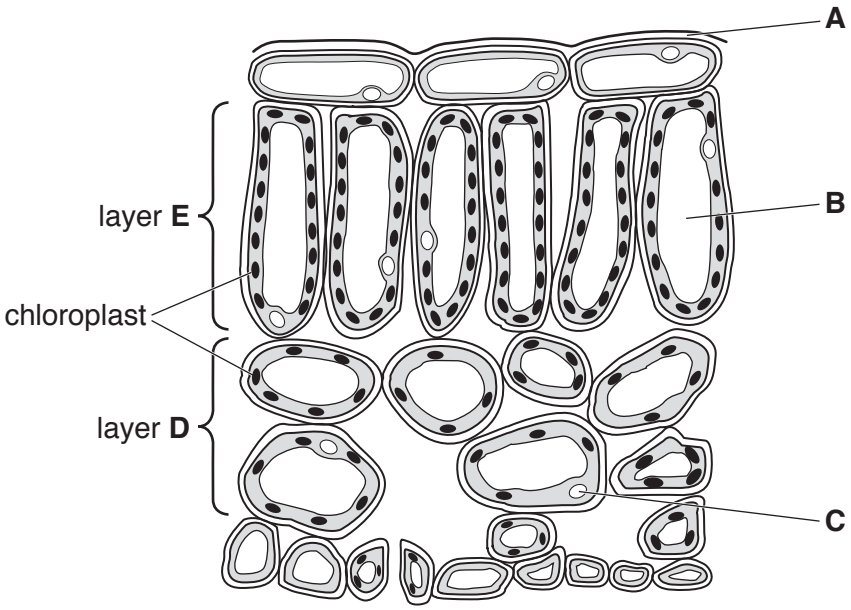

Fig. 4.1

(i) Name the structures **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(ii) Chloroplasts contain chlorophyll.

Describe the function of chlorophyll.

.....

.....[1]

(iii) Explain why each cell in layer **E** contains more chloroplasts than each cell in layer **D**.

.....

.....

.....

.....[2]

[Total: 8]

5 The salt sodium chloride is prepared by titrating sodium hydroxide solution with dilute hydrochloric acid.

(a) Complete the sentences about the experiment.

Exactly 25.0 cm^3 of sodium hydroxide solution is added to a conical flask

using a ..... .

A few drops of Universal Indicator are added to the conical flask.

The dilute hydrochloric acid is added drop by drop to the conical flask

from a ..... until the Universal Indicator changes

from red to ..... . [3]

(b) State the type of chemical reaction that occurs between hydrochloric acid and sodium hydroxide solution.

.....[1]

(c) Hydrochloric acid contains hydrogen ions and chloride ions.

Sodium hydroxide contains sodium ions and hydroxide ions.

Construct the ionic equation, including state symbols, for the reaction between hydrochloric acid and sodium hydroxide solution.

.....[2]

[Total: 6]

6 Steel crocodile clips are used to make connections in electrical circuits.

A ruler, marked with 1 mm divisions, is used to measure the length of a crocodile clip, as shown in Fig. 6.1.

A line **P** marks the position of one end of the crocodile clip against the scale.

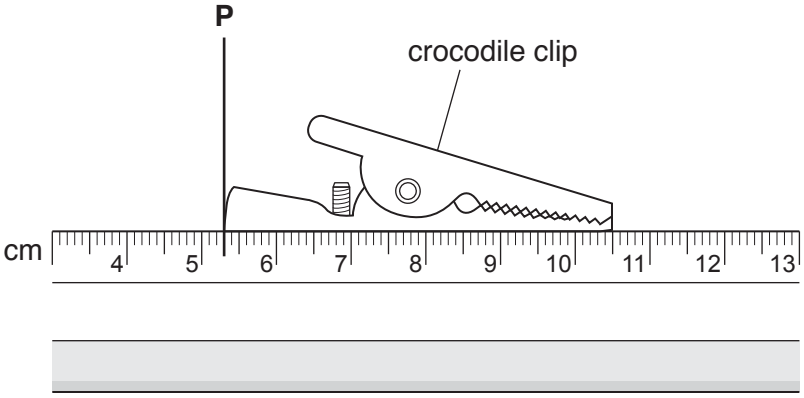

Fig. 6.1

(a) (i) On Fig. 6.1, draw a second line **Q** to mark the position of the other end of the crocodile clip against the scale. [1]

(ii) Determine the length l of the crocodile clip.

l = ... cm [1]

(iii) A small screw of length s is fixed to the crocodile clip, as shown in Fig. 6.2.

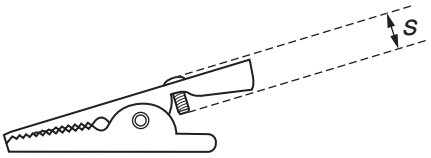

Fig. 6.2 (not to scale)

The ratio of the length s of the screw to the length l of the crocodile clip is 1.5 : 10.

Calculate the length s of the screw in mm.

s = ...mm [1]

(b) The volume of eight identical crocodile clips is determined by placing them in a measuring cylinder containing water.

The volume of eight crocodile clips is found to be 3.0 cm^3.

(i) Calculate the volume V of one crocodile clip.

V = ... cm^3 [1]

(ii) Suggest why eight crocodile clips are used instead of one.

.....

.....[1]

(iii) The mass of one crocodile clip is 2.7 g.

Use your answer to **(i)** to calculate the density D of the steel used to make the crocodile clip.

D = ... g/cm^3 [2]

[Total: 7]

7 **(a)** Name **two** substances that are produced in the liver.

1 .....

2 .....
[2]

(b) Name **two** substances that are broken down in the liver.

1 .....

2 .....
[2]

[Total: 4]

8 **(a)** Alkanes are obtained from petroleum.

Name the process used to manufacture alkenes from alkanes.

.....[1]

(b) **(i)** State the general formula of alkenes.

.....[1]

(ii) State the difference in chemical structure between alkenes and alkanes.

.....[1]

(iii) State the name of the reagent used to distinguish between alkenes and alkanes.

.....[1]

(c) Ethene reacts with steam in the presence of a catalyst to produce ethanol.

State the type of reaction that ethene undergoes.

.....[1]

(d) Ethanol is used as a fuel.

State the names of the products when ethanol burns in excess oxygen.

..... and ..... [1]

[Total: 6]

9 The inside of an electrical plug is shown in Fig. 9.1.

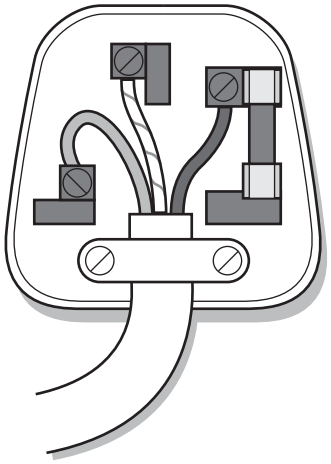

Fig. 9.1

(a) On Fig. 9.1 draw a line to identify the neutral wire. Label the line **N**. [1]

(b) Describe the functions of the live wire and of the neutral wire.

live wire .....

.....

neutral wire .....

.....
[2]

(c) When plugged into a socket, the plug supplies mains electricity at 230 V to an electric kettle.

The power produced in the kettle is 3000 W.

Calculate the current I in the fuse.

I = ... A [2]

[Total: 5]

10 Fig. 10.1 shows a section through the heart.

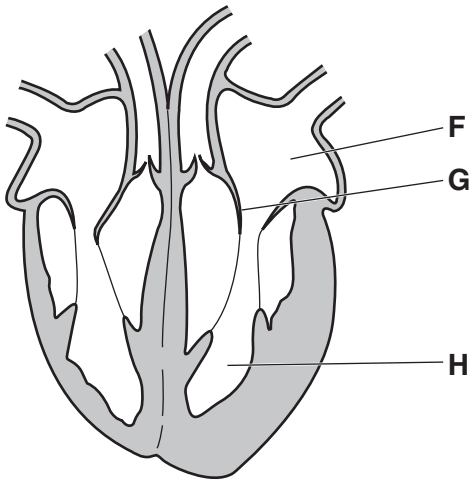

Fig. 10.1

(a) Identify the structures labelled **F**, **G** and **H**.

F .....

G .....

H ..... [3]

(b) On Fig. 10.1, draw a labelled arrow to show the direction of blood flow along the aorta. [1]

[Total: 4]

11 The atomic structure of an atom of element **X** is shown in Fig. 11.1. **X** is not the usual chemical symbol for the element.

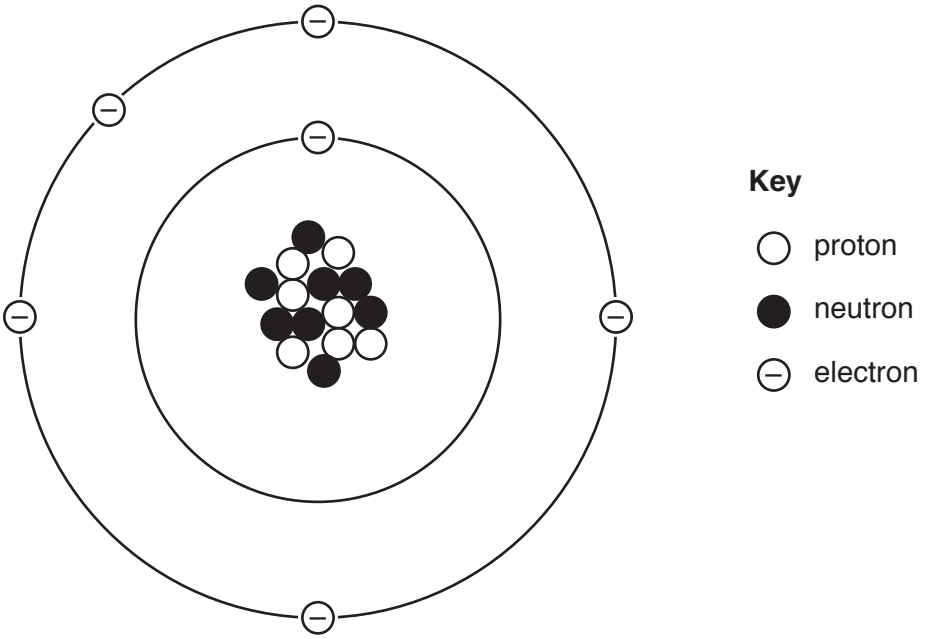

Fig. 11.1

(a) The atom is represented using the nuclide notation $^{A}_{Z}\mathbf{X}$.

Use Fig. 11.1 to deduce the values of **A** and of **Z**.

A = ...

Z = ... [2]

(b) Explain why element **X** is placed in Group V of the Periodic Table.

.....

.....

.....[2]

(c) State the type of oxide formed when element **X** reacts with oxygen.

.....[1]

(d) Element **X** forms the compound $\mathbf{X}H_3$ with hydrogen.

Suggest the type of bonding in this compound and give a reason for your answer.

type of bonding .....

reason .....

.....[2]

[Total: 7]

12 Fig. 12.1 shows a lens **A** and plane mirror **B**.

A ray of light **R** is incident on lens **A**.

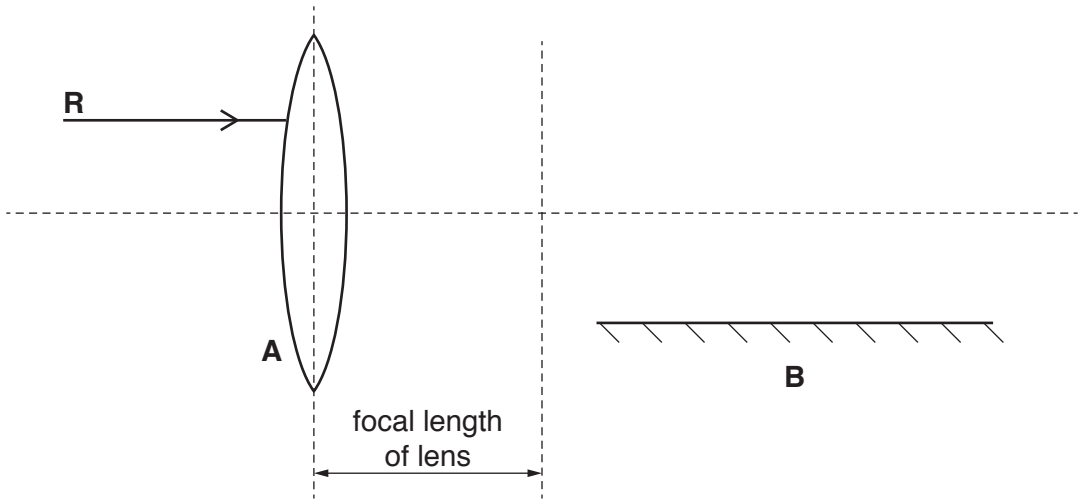

Fig. 12.1

(a) Ray **R** passes through the lens and is reflected from the mirror.

On Fig. 12.1, draw the path of ray **R**. [3]

(b) Fig. 12.2 shows a range of wavelengths in one part of the electromagnetic spectrum.

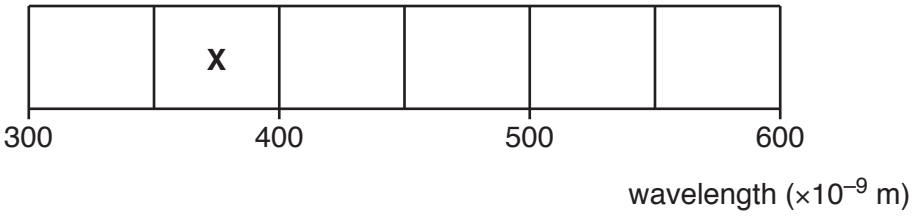

Fig. 12.2

(i) Estimate the range of wavelengths in the region marked **X**.

.....[1]

(ii) State the speed of light in a vacuum.

.....[1]

(iii) Calculate the lowest **frequency** of the electromagnetic spectrum shown in Fig. 12.2.

frequency = ... Hz [3]

[Total: 8]

Question 13 begins on the next page.

13 Fig. 13.1 shows the reproductive organs of a woman.

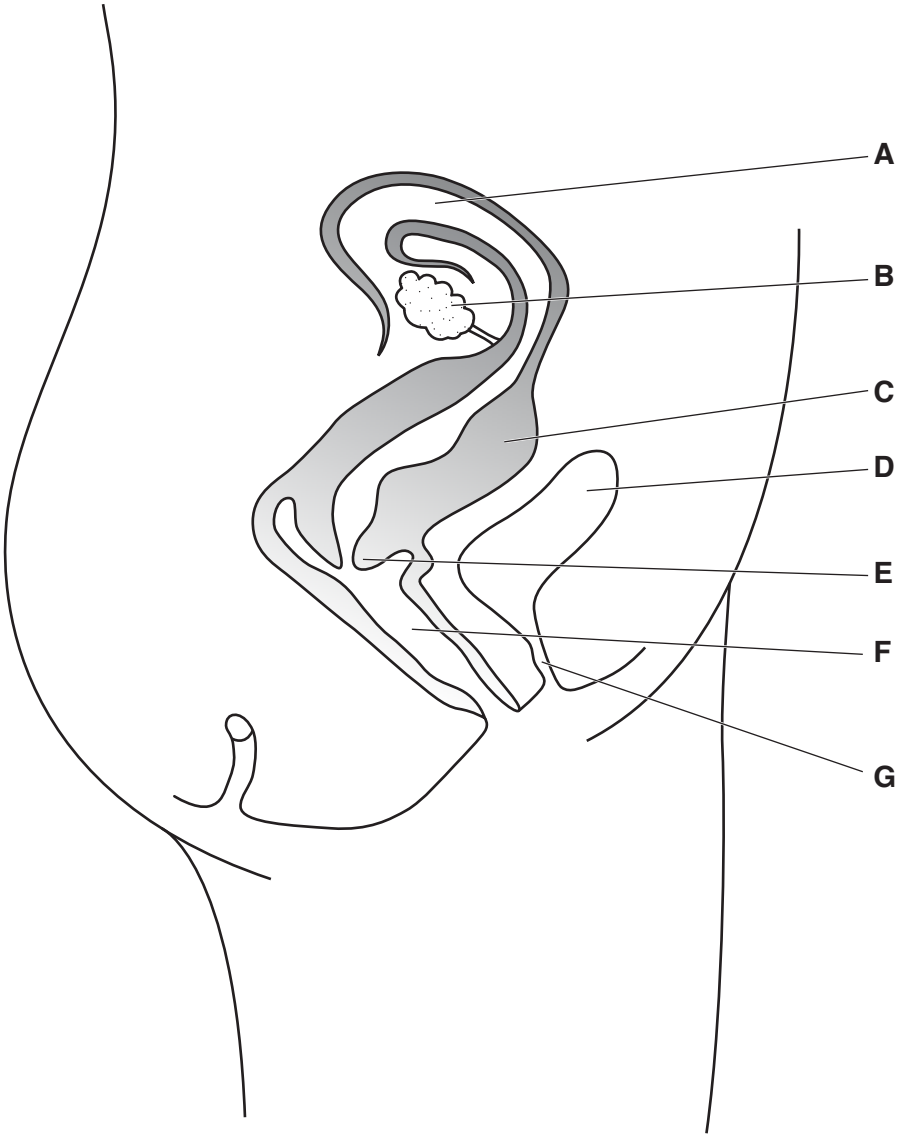

Fig. 13.1

(a) State the letter in Fig. 13.1 that identifies

the cervix .....

an ovary .....

the vagina. ..... [3]

(b) Describe the function of the oviduct and of the uterus.

the oviduct .....

.....

the uterus .....

.....

[2]

(c) Some babies are fed on breast milk. Other babies are fed either on milk from another animal or on formula milk.

Describe **two** advantages of breast feeding a baby.

1 .....

.....

2 .....

.....

[2]

[Total: 7]

14 A list of gases is shown.

argon	**carbon dioxide**	**carbon monoxide**	**chlorine**
helium	**hydrogen**	**nitrogen dioxide**	**oxygen**

Use the list to complete the following sentences.

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

(a) The gas produced during respiration is ..... . [1]

(b) The gas that turns Universal Indicator red is ..... . [1]

(c) The gas that is used to sterilize drinking water is ..... . [1]

(d) The non-flammable gas used to fill balloons is ..... . [1]

(e) The gas that relights a glowing splint is ..... . [1]

[Total: 5]

15 Oil is stored in a container. A tap at the bottom of the container is opened and oil flows into a measuring cylinder. A floating marker indicates the volume of oil in the measuring cylinder.

The volume of oil in the measuring cylinder is recorded at regular intervals of time.

The tap is closed when the volume of oil in the measuring cylinder is 100 cm^3.

The experiment is shown in Fig. 15.1.

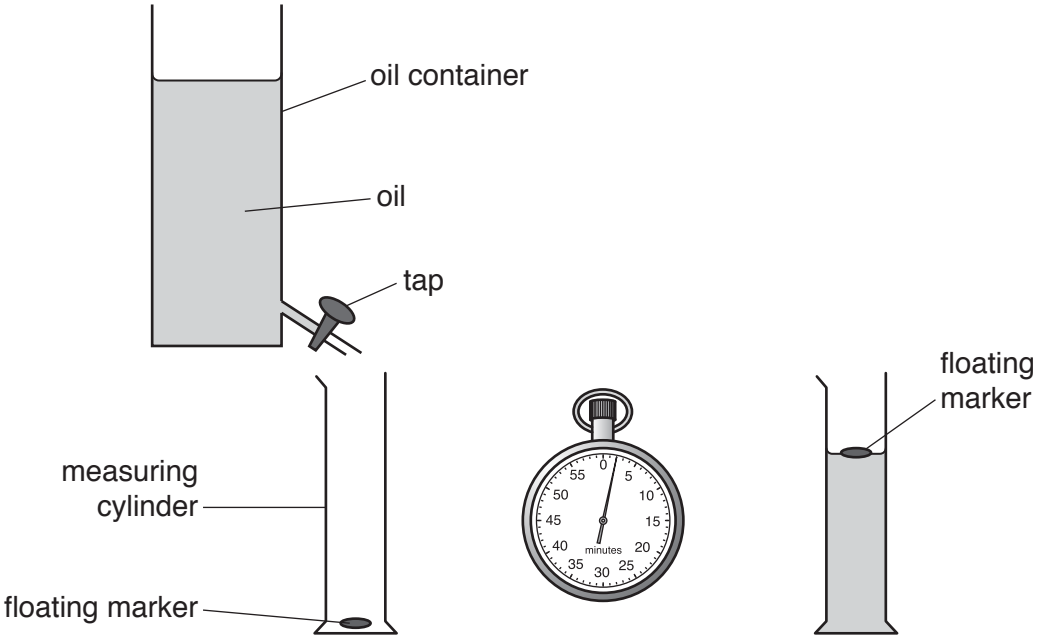

Fig. 15.1

(a) The volume of oil in the measuring cylinder is plotted against time taken to reach that volume as shown in Fig. 15.2.

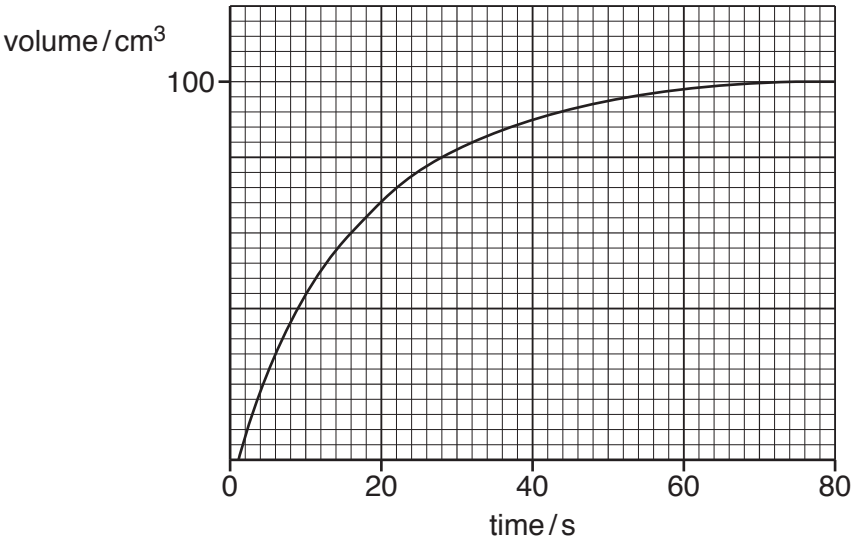

Fig. 15.2

Determine the time t at which the floating marker reaches 100 cm^3 in the measuring cylinder.

t = ... s [1]

(b) The experiment is repeated using oil at a higher temperature.

On Fig. 15.2 sketch a second line to suggest how the volume–time graph changes. [2]

(c) In one experiment, the floating marker rises 0.15 m in a time of 45 s.

The weight of the floating marker is 0.1 N.

Calculate the work done W in lifting the floating marker.

State the unit.

W = ... unit ..... [3]

[Total: 6]

[Turn over

16 Table 16.1 shows some information about the blood of four students.

Student **J** is healthy.

Students **K**, **L** and **M** suffer from ill health.

Table 16.1

blood component numbers per mm^3	student			
	J (healthy)	**K**	**L**	**M**
red blood cells / numbers per mm^3	8 million	5 million	8.1 million	8 million
white blood cells / numbers per mm^3	8600	8700	5500	8600
blood platelets / numbers per mm^3	250 000	245 000	246 000	150 000

(a) (i) State the letter of the student who has blood which takes an unusually long time to clot.

..... [1]

(ii) State the letter of the student who becomes exhausted very quickly when running a short distance.

..... [1]

(b) Suggest why student **L** suffers from frequent infections.

.....

.....

.....

.....[3]

[Total: 5]

17 The names and properties of some substances are shown in Fig. 17.1.

On Fig. 17.1, draw one line from each substance to a property of the substance. [4]

substance	property
iodine	conducts electricity when molten but not when solid
magnesium	is a solid which melts at a low temperature
chlorine	conducts electricity when solid
sodium chloride	is a diatomic gas

Fig. 17.1

[Total: 4]

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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