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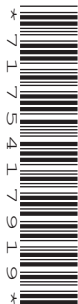
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COMBINED SCIENCE

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.

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

- 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



[A_r: O, 16; Al, 27; Cu, 64]

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

.....[1]

- (ii) 108g of aluminium producesg of aluminium oxide and

.....g of copper.

2.7g of aluminium producesg 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.

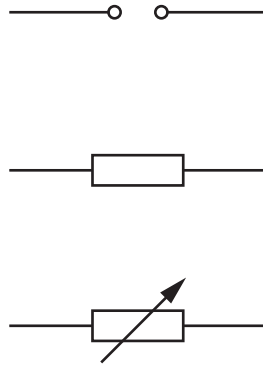


Fig. 3.1

- (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 1.6A and the current in the variable resistor is 0.25A.

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

$$I = \dots\dots\dots \text{ A [1]}$$

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

Calculate the potential difference of the source.

State the unit.

$$\text{potential difference} = \dots\dots\dots \text{ unit } \dots\dots\dots \text{ [3]}$$

[Total: 7]

4 Photosynthesis occurs in leaves.

(a) Complete the word equation for photosynthesis.



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

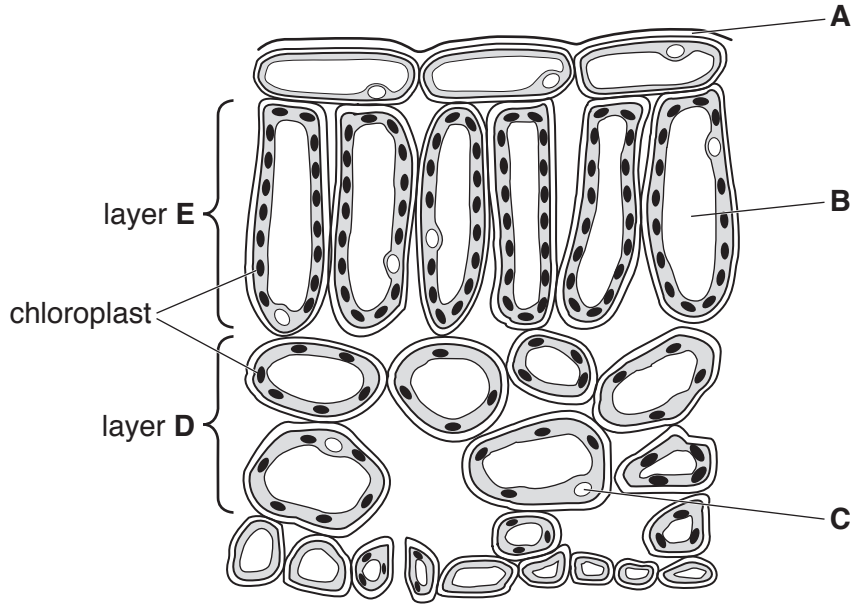


Fig. 4.1

(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.

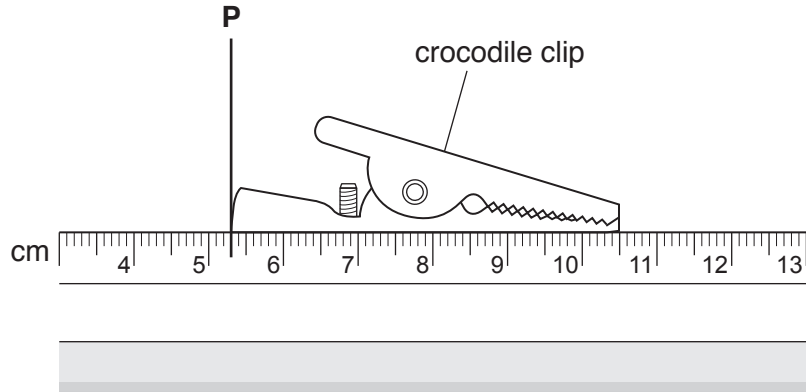


Fig. 6.1

(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.

$l = \dots\dots\dots$ cm [1]

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

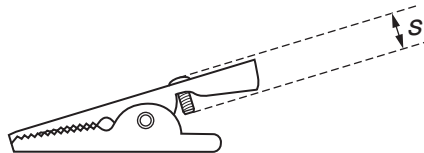


Fig. 6.2 (not to scale)

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.

$s = \dots\dots\dots$ 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.

$$V = \dots\dots\dots \text{ cm}^3 \text{ [1]}$$

- (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.

$$D = \dots\dots\dots \text{ g/cm}^3 \text{ [2]}$$

[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.

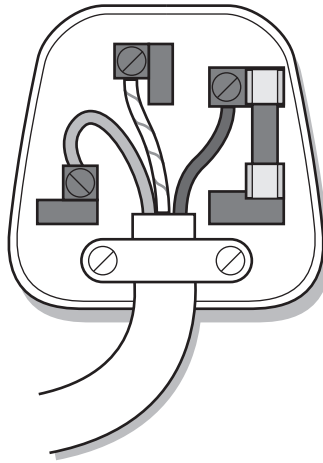


Fig. 9.1

(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.

$I = \dots\dots\dots$ A [2]

[Total: 5]

10 Fig. 10.1 shows a section through the heart.

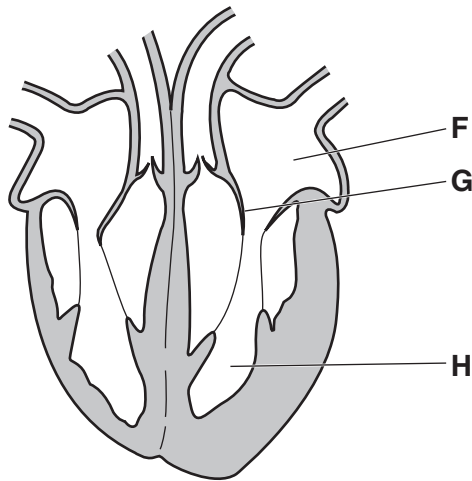


Fig. 10.1

(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.

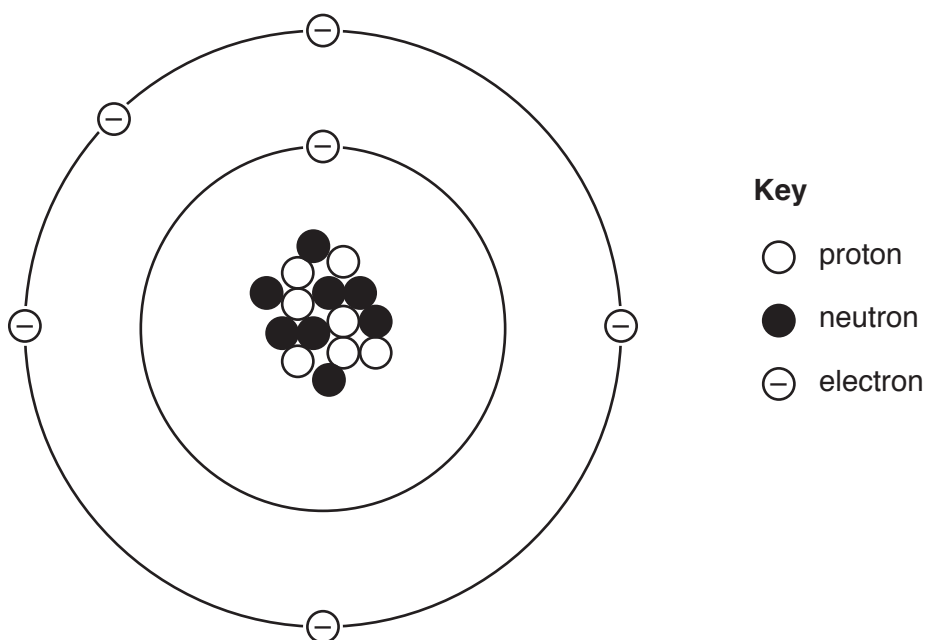


Fig. 11.1

- (a) The atom is represented using the nuclide notation ${}^A_Z\text{X}$.

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 XH_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**.

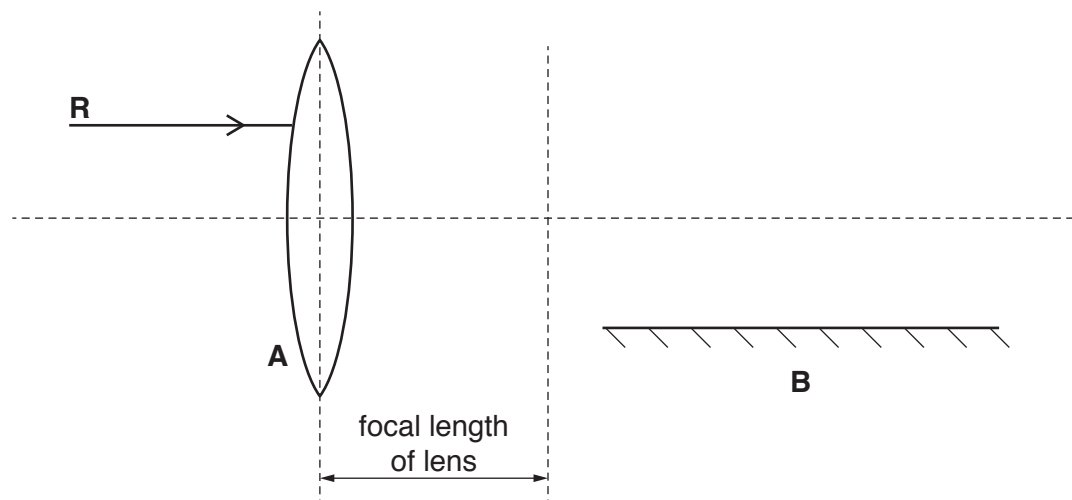


Fig. 12.1

(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.

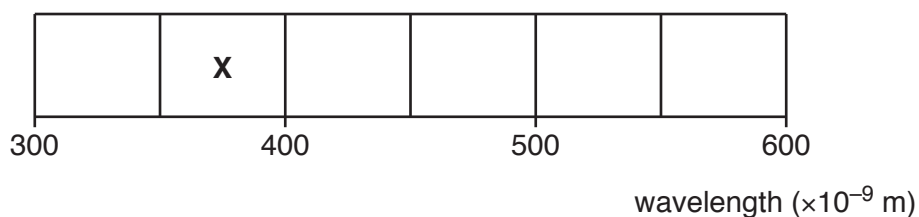


Fig. 12.2

(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.

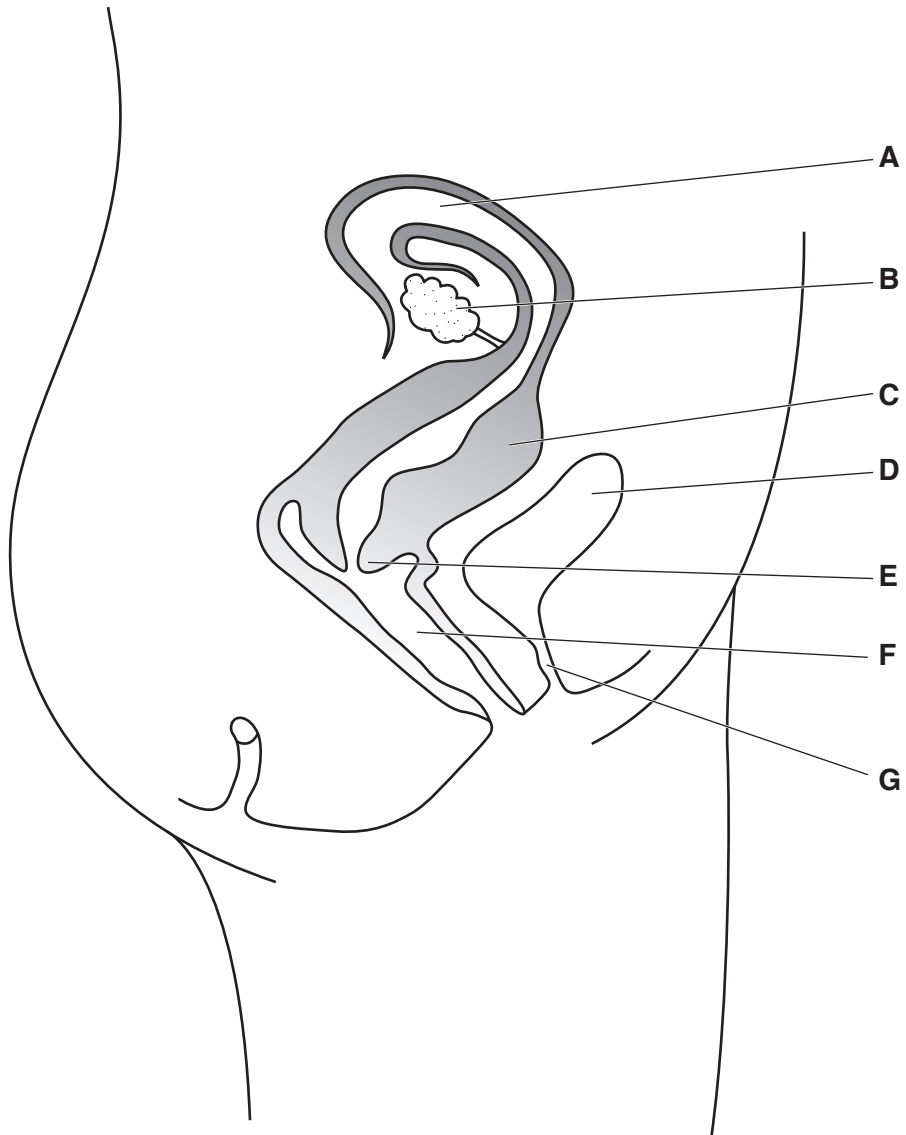


Fig. 13.1

(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.

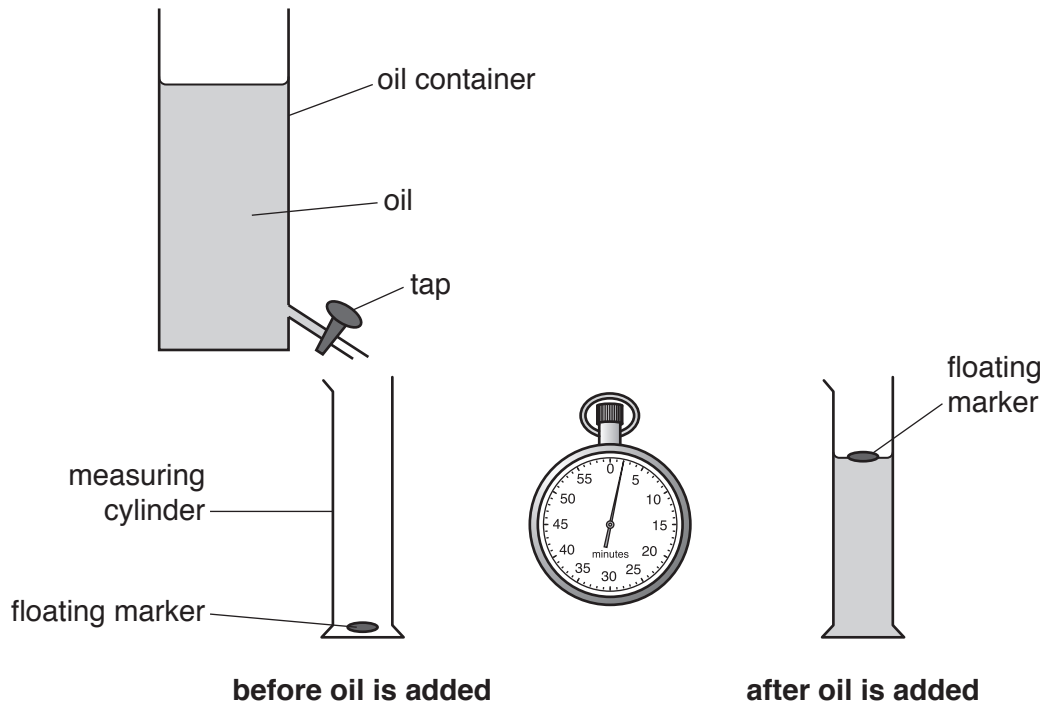


Fig. 15.1

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

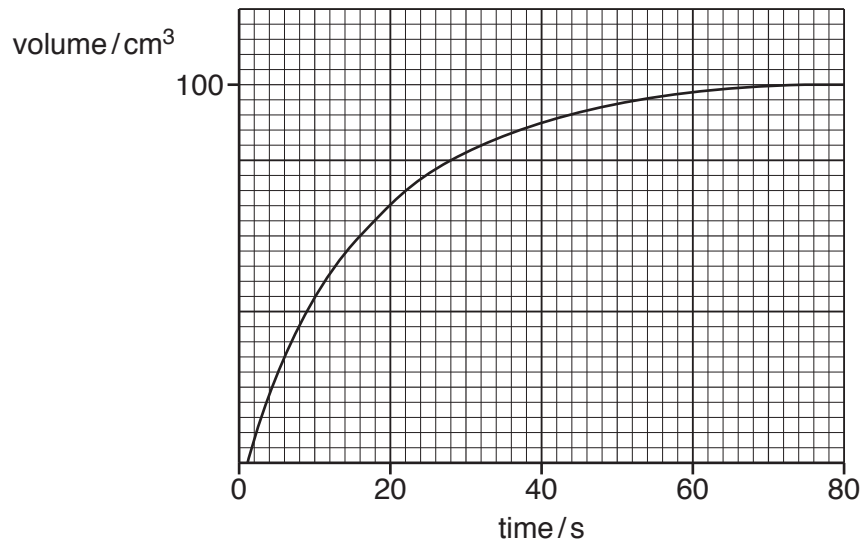


Fig. 15.2

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

$t = \dots\dots\dots$ 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.

$W = \dots\dots\dots$ unit $\dots\dots\dots$ [3]

[Total: 6]

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]

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The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| I | II | Key | | | | | | | | | | III | IV | V | VI | VII | VIII | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | atomic number atomic symbol name relative atomic mass | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Li lithium 7 | 4 Be beryllium 9 | 1 H hydrogen 1 | 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 | 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 | 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 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 — | 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 — | 113 Nh nihonium — | 114 Fl flerovium — | 115 Mc moscovium — | 116 Lv livermorium — | 117 Ts tennessine — | 118 Og oganeson — |
| 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 dm³ at room temperature and pressure (r.t.p.).