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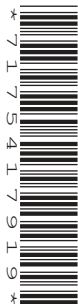
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COMBINED SCIENCE

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.

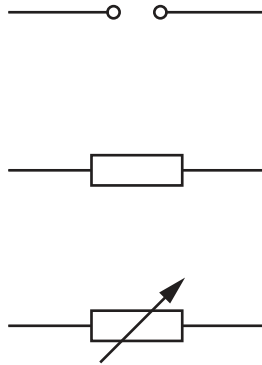


Fig. 3.1

- (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.

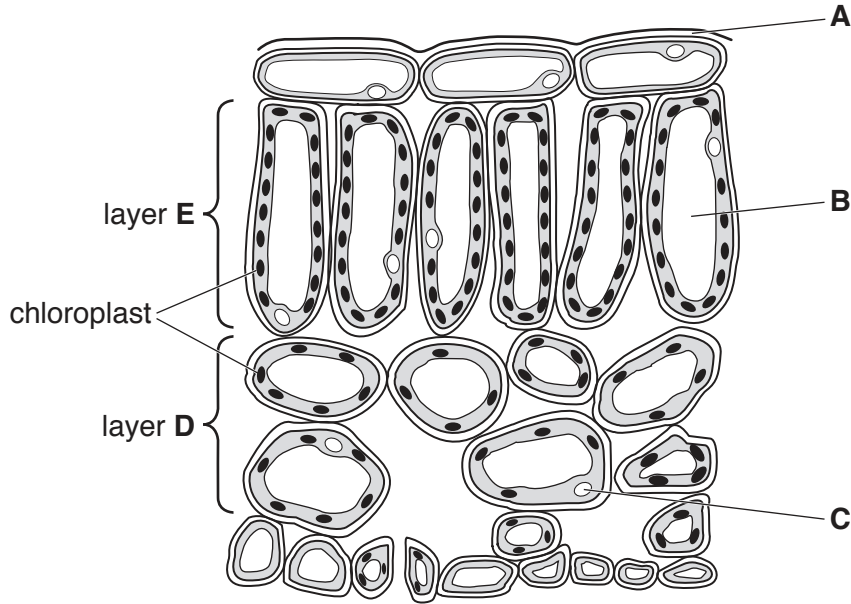


Fig. 4.1

(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.

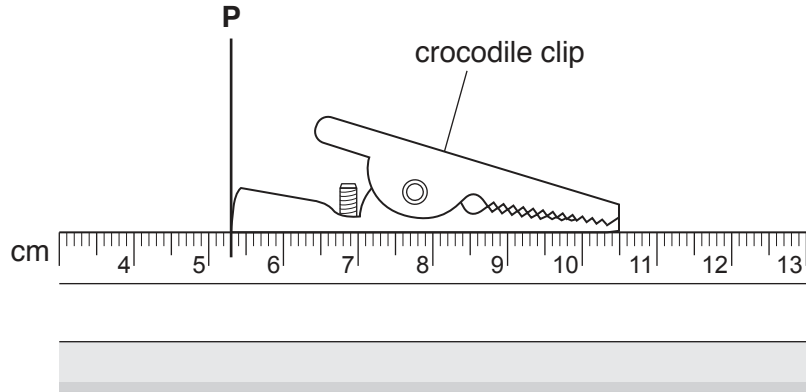


Fig. 6.1

(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.

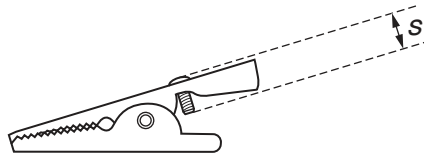


Fig. 6.2 (not to scale)

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.

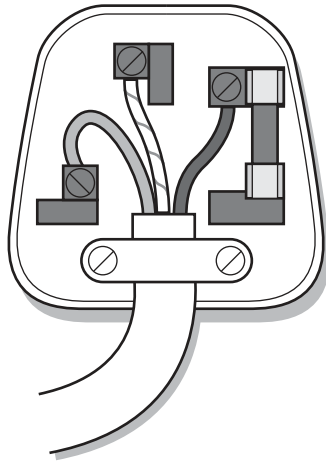


Fig. 9.1

(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.

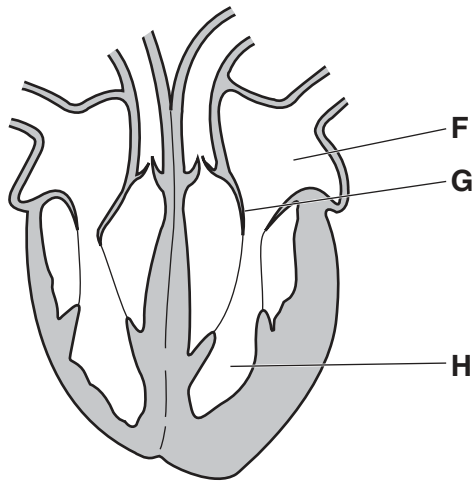


Fig. 10.1

(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.

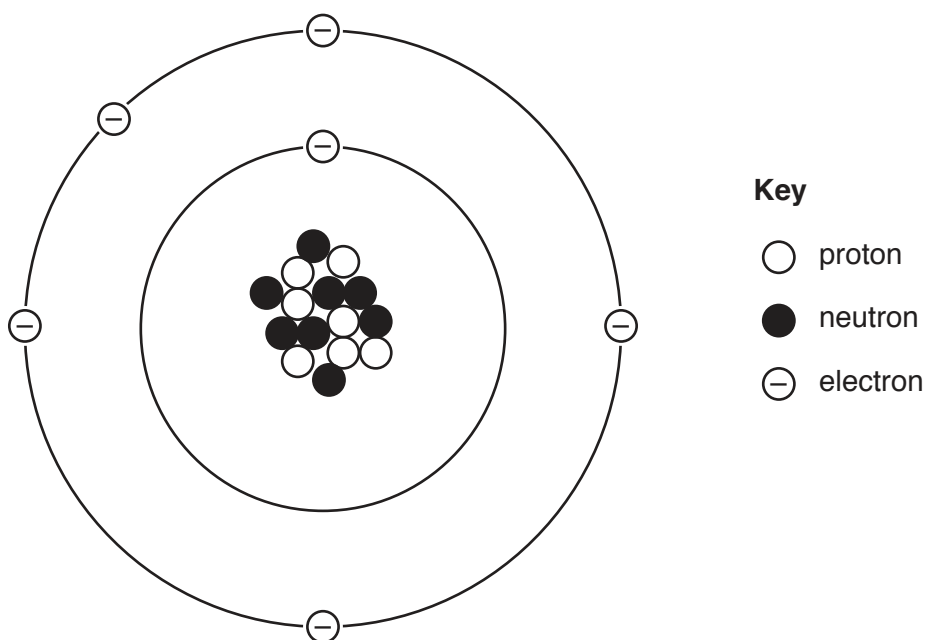


Fig. 11.1

- (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**.

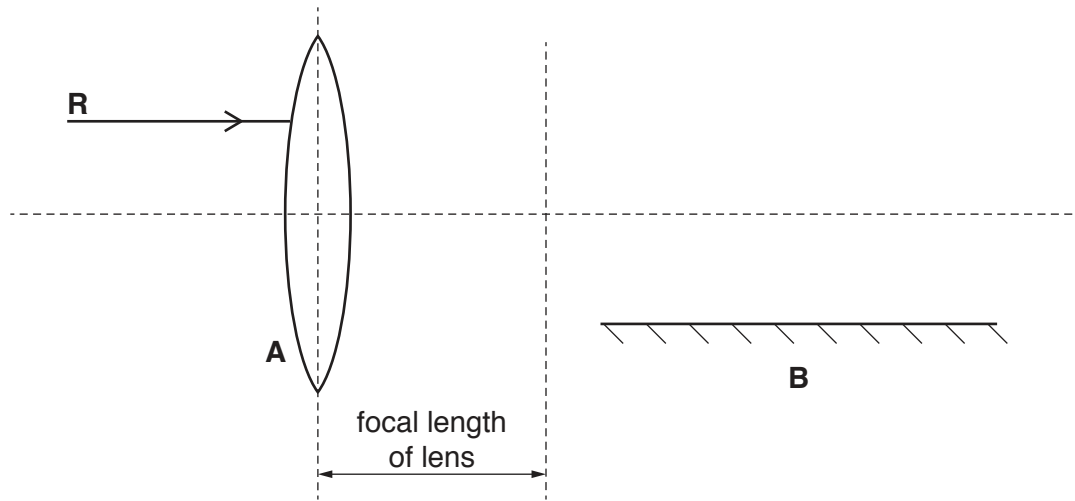


Fig. 12.1

(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.

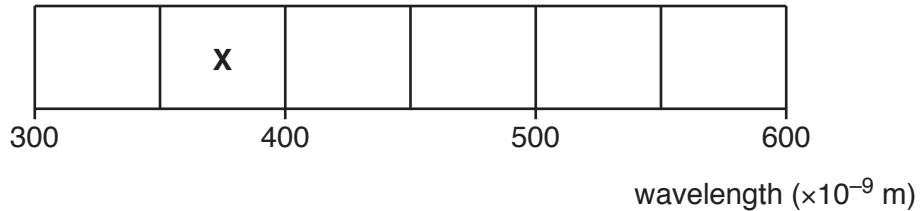


Fig. 12.2

(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.

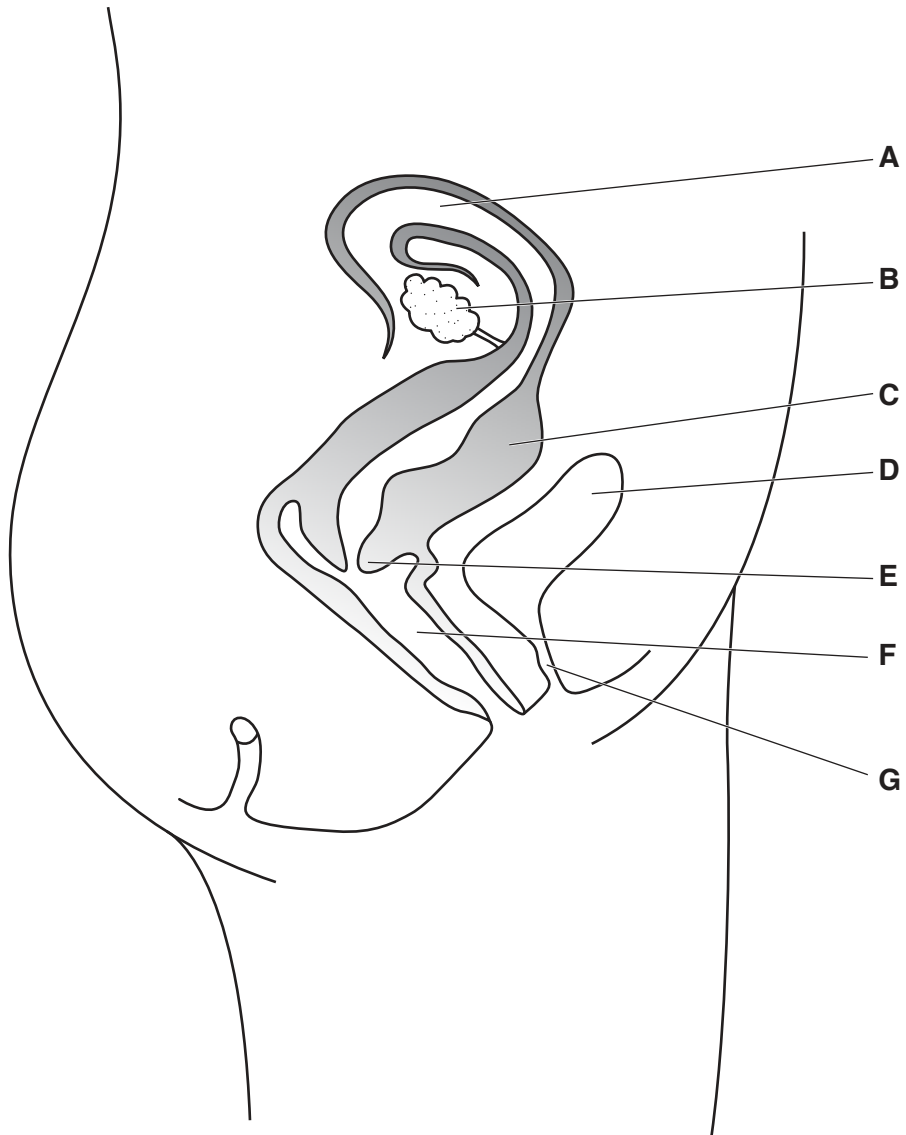


Fig. 13.1

(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.

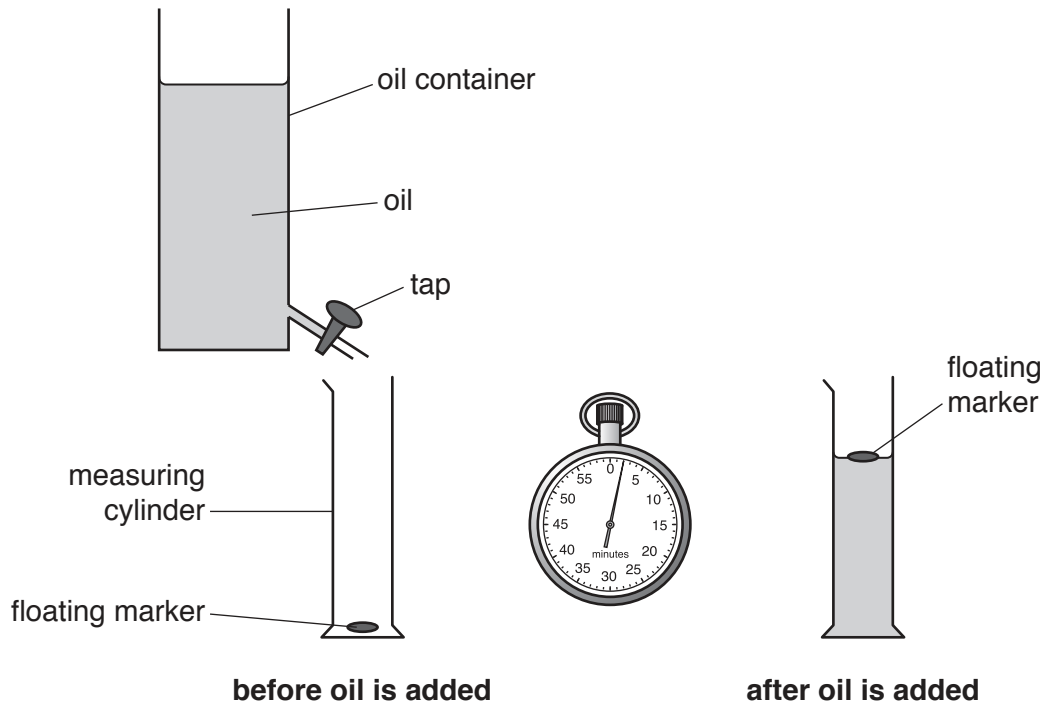


Fig. 15.1

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

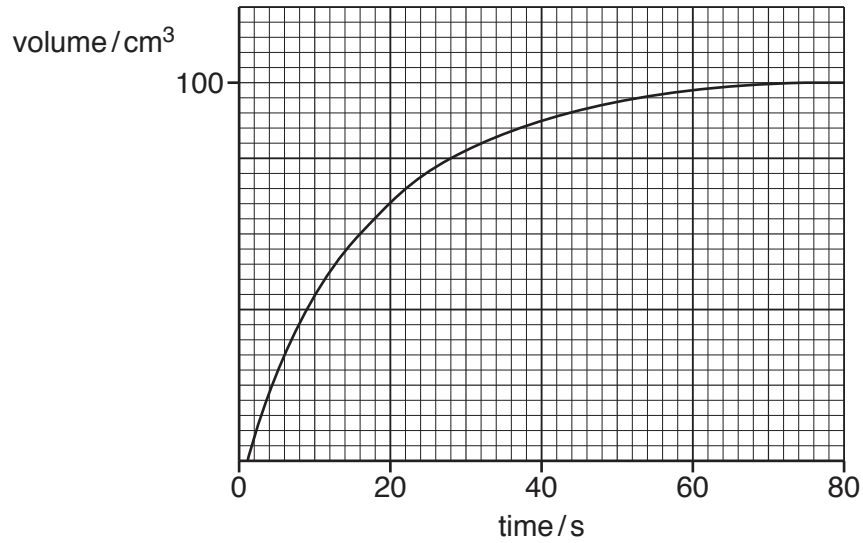


Fig. 15.2

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

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3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										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											1 H hydrogen 1	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 —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganeson —	119 Uue unbinilium —	120 Uub unbinilium —	121 Uut ununilium —	122 Uuq ununilium —	123 Uub ununilium —	124 Uut ununilium —	125 Uuq ununilium —	126 Uur ununilium —	127 Uus ununilium —	128 Uuo ununilium —	129 Uuq ununilium —	130 Uur ununilium —	131 Uus ununilium —	132 Uuo ununilium —	133 Uuq ununilium —	134 Uur ununilium —	135 Uus ununilium —	136 Uuo ununilium —	137 Uuq ununilium —	138 Uur ununilium —	139 Uus ununilium —	140 Uuo ununilium —	141 Uuq ununilium —	142 Uur ununilium —	143 Uus ununilium —	144 Uuo ununilium —	145 Uuq ununilium —	146 Uur ununilium —	147 Uus ununilium —	148 Uuo ununilium —	149 Uuq ununilium —	150 Uur ununilium —	151 Uus 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ununilium —	352 Uuo ununilium —	353 Uuq ununilium —	354 Uur ununilium —	355 Uus ununilium —	356 Uuo ununilium —	357 Uuq ununilium —	358 Uur ununilium —	359 Uus ununilium —	360 Uuo ununilium —	361 Uuq ununilium —	362 Uur ununilium —	363 Uus ununilium —	364 Uuo ununilium —	365 Uuq ununilium —	366 Uur ununilium —	367 Uus ununilium —	368 Uuo ununilium —	369 Uuq ununilium —	370 Uur ununilium —	371 Uus ununilium —	372 Uuo ununilium —	373 Uuq ununilium —	374 Uur ununilium —	375 Uus ununilium —	376 Uuo ununilium —	377 Uuq ununilium —	378 Uur ununilium —	379 Uus ununilium —	380 Uuo ununilium —	381 Uuq ununilium —	382 Uur ununilium —	383 Uus ununilium —	384 Uuo ununilium —	385 Uuq ununilium —	386 Uur ununilium —	387 Uus ununilium —	388 Uuo ununilium —	389 Uuq ununilium —	390 Uur ununilium —	391 Uus ununilium —	392 Uuo ununilium —	393 Uuq ununilium —	394 Uur ununilium —	395 Uus ununilium —	396 Uuo ununilium —	397 Uuq ununilium —	398 Uur ununilium —	399 Uus ununilium —	400 Uuo ununilium —	401 Uuq ununilium —	402 Uur ununilium —	403 Uus ununilium —	404 Uuo ununilium —	405 Uuq ununilium —	406 Uur ununilium —	407 Uus ununilium —	408 Uuo ununilium —	409 Uuq ununilium —	410 Uur ununilium —	411 Uus ununilium —	412 Uuo ununilium —	413 Uuq ununilium —	414 Uur ununilium —	415 Uus ununilium —	416 Uuo ununilium —	417 Uuq ununilium —	418 Uur ununilium —	419 Uus ununilium —	420 Uuo ununilium —	421 Uuq ununilium —	422 Uur ununilium —	423 Uus ununilium —	424 Uuo ununilium —	425 Uuq ununilium —	426 Uur ununilium —	427 Uus ununilium —	428 Uuo ununilium —	429 Uuq ununilium —	430 Uur ununilium —	431 Uus ununilium —	432 Uuo ununilium —	433 Uuq ununilium —	434 Uur ununilium —	435 Uus ununilium —	436 Uuo ununilium —	437 Uuq ununilium —	438 Uur ununilium —	439 Uus ununilium —	440 Uuo ununilium —	441 Uuq ununilium —	442 Uur ununilium —	443 Uus ununilium —	444 Uuo ununilium —	445 Uuq ununilium —	446 Uur ununilium —	447 Uus ununilium —	448 Uuo ununilium —	449 Uuq ununilium —	450 Uur ununilium —	451 Uus ununilium —	452 Uuo ununilium —	453 Uuq ununilium —	454 Uur ununilium —	455 Uus ununilium —	456 Uuo ununilium —	457 Uuq ununilium —	458 Uur ununilium —	459 Uus ununilium —	460 Uuo ununilium —	461 Uuq ununilium —	462 Uur ununilium —	463 Uus ununilium —	464 Uuo ununilium —	465 Uuq ununilium —	466 Uur ununilium —	467 Uus ununilium —	468 Uuo ununilium —	469 Uuq ununilium —	470 Uur ununilium —	471 Uus ununilium —	472 Uuo ununilium —	473 Uuq ununilium —	474 Uur ununilium —	475 Uus ununilium —	476 Uuo ununilium —	477 Uuq ununilium —	478 Uur ununilium —	479 Uus ununilium —	480 Uuo ununilium —	481 Uuq ununilium —	482 Uur ununilium —	483 Uus ununilium —	484 Uuo ununilium —	485 Uuq ununilium —	486 Uur ununilium —	487 Uus ununilium —	488 Uuo ununilium —	489 Uuq ununilium —	490 Uur ununilium —	491 Uus ununilium —	492 Uuo ununilium —	493 Uuq ununilium —	494 Uur ununilium —	495 Uus ununilium —	496 Uuo ununilium —	497