Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6712017824

COMBINED SCIENCE **5129/22**

Paper 2 **May/June 2021**

2 hours 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **24** pages. Any blank pages are indicated.

[Turn over

1 A student investigates the different types of organism found in her garden.

She counts the number of each different type of organism.

Her results are shown in Fig. 1.1.

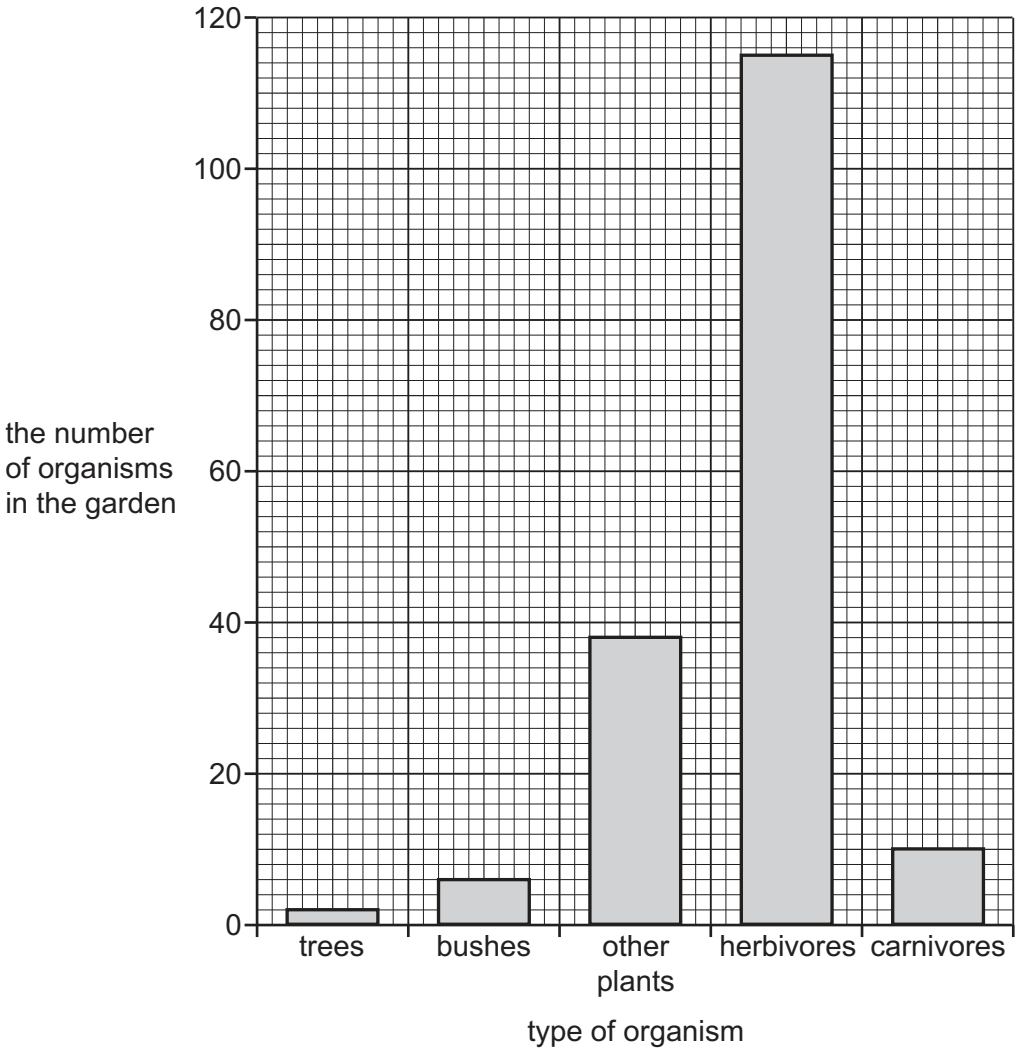

Fig. 1.1

(a) (i) State the number of herbivores and the number of carnivores found in this garden.

number of herbivores .....

number of carnivores .....

[1]

(ii) State the name of the organisms at the start of a food chain.

..... [1]

(b) (i) State the difference between a herbivore and a carnivore.

.....

..... [1]

(ii) Explain why there are more herbivores than carnivores in the garden.

.....

.....

.....

..... [2]

(iii) All the organisms in the garden will die eventually.

Describe what happens to the remains of all organisms when they are dead.

.....

.....

.....

..... [2]

[Total: 7]

2 Carbon monoxide is a gas produced in car engines.
It causes pollution of the atmosphere.

(a) (i) Describe how carbon monoxide is produced in a car engine.

.....

..... [1]

(ii) State why carbon monoxide is a dangerous pollutant.

..... [1]

(b) (i) Carbon monoxide burns in air to produce carbon dioxide.

Complete the equation for the combustion of carbon monoxide.

..... CO + O_2 ⟶ ..... CO_2 [1]

(ii) Describe a test to show that carbon dioxide is produced in this reaction.

State the result of the test.

test .....

result .....

.....
[2]

(c) Carbon monoxide is used in the extraction of iron from iron ore in a blast furnace. The carbon monoxide reduces the iron ore to iron.

(i) State the name of an ore of iron. ..... [1]

(ii) Explain how the carbon monoxide reduces the iron ore.

.....

..... [1]

[Total: 7]

3 A cyclist accelerates from 0 m / s at time t = 0 s to a speed of 10 m / s at t = 5 s.

From t = 5 s to t = 9 s, her speed decreases in a non-constant way to 4 m / s.

From t = 9 s to t = 12 s, she accelerates at 1 m / s^2.

From t = 12 s, she travels at a constant speed.

On Fig. 3.1, plot the speed–time graph of her journey.

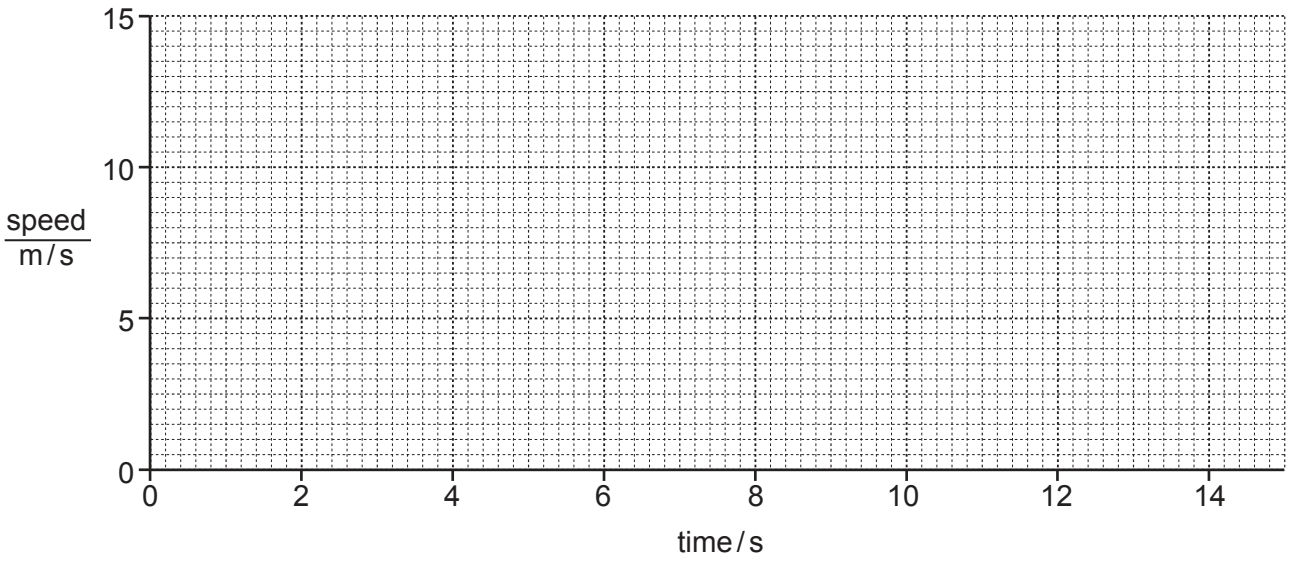

Fig. 3.1

[4]

4 Many substances are transported in the human body.

Draw **one** straight line on Fig. 4.1 to link each structure to the substance it transports

structure	substance transported
capillary	feces
oesophagus	blood
rectum	food
urethra	bile
	sperm in liquid

Fig. 4.1

[4]

5 Potassium burns in oxygen to form potassium oxide.

The equation for the reaction is shown.

$$4K + O_2 \longrightarrow 2K_2O$$

[A_r: K, 39; O, 16]

(a) **(i)** Calculate the relative molecular mass M_r of potassium oxide.

..... [1]

(ii) Complete the following sentences.

78 g of potassium reacts with ..... g of oxygen and produces ..... g of potassium oxide.

3.9 g of potassium produces ..... g of potassium oxide. [3]

(b) Potassium oxide dissolves in water to produce an alkaline solution.

The solution turns universal indicator purple.

(i) State the name of the ion which causes the solution to be alkaline.

..... [1]

(ii) Suggest the pH of the alkaline solution. ..... [1]

[Total: 6]

6 A ball falls towards a ramp as shown in Fig. 6.1.

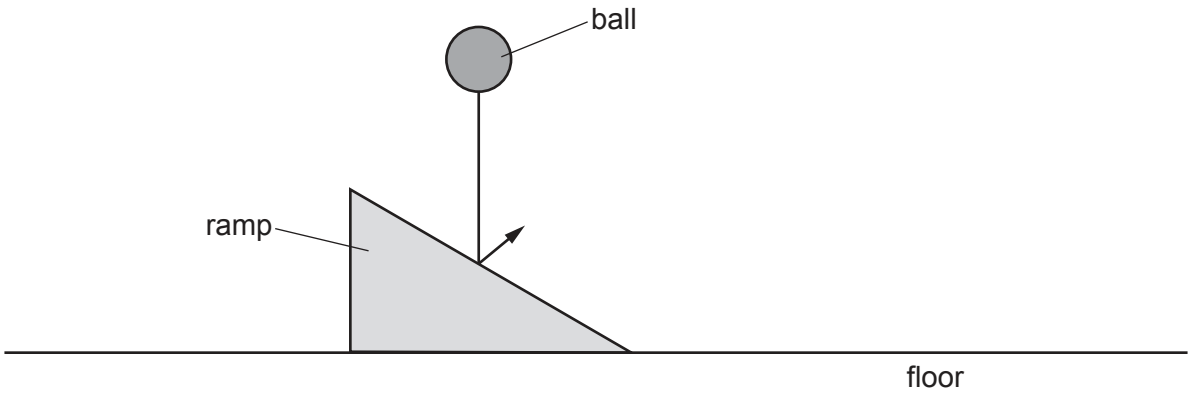

Fig. 6.1

(a) The ball bounces off the ramp.

The ball then bounces once off the floor.

On Fig. 6.1 continue the line to show the path of the ball:

- from the ramp to the floor
- from the floor to the top of its bounce.

[2]

(b) The ball has a mass of 2.0 kg.

When the ball hits the ramp, there is a force of 60 N in the direction that the ball bounces.

Calculate the acceleration of the ball in this direction.

acceleration = ... m/s^2 [2]

[Total: 4]

7 Fig. 7.1 shows a section through the heart.

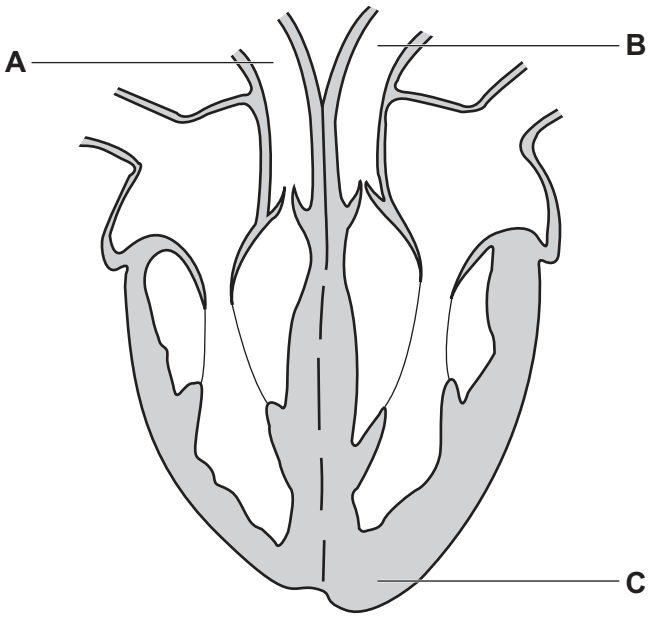

Fig. 7.1

(a) Name the type of tissue found at **C** on Fig. 7.1.

..... [1]

(b) On Fig. 7.1 draw arrows to show the direction of blood flow along blood vessel **A** and along blood vessel **B**. [2]

(c) **(i)** There are four heart valves shown on Fig. 7.1.

Draw a line on one of the valve flaps between an atrium and a ventricle.
Label this line **V**. [1]

(ii) Describe how the valve between an atrium and a ventricle functions.

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

8 Chlorine is found in Group VII of the Periodic Table.

The electronic structure of chlorine is 2,8,7.

(a) Complete Fig. 8.1 to show the outer electrons in a molecule of chlorine.

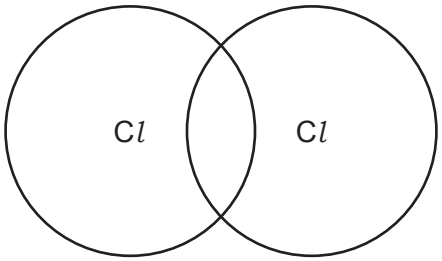

Fig. 8.1

[2]

(b) (i) State why chlorine is in Group VII of the Periodic Table.

..... [1]

(ii) Describe the trend in reactivity and in the colour of the elements in Group VII as the group is descended.

reactivity .....

colour .....

[2]

(c) Chlorine reacts with heated iron wool to produce a brown solid, iron(III) chloride.

Complete the equation for the reaction by adding the state symbols.

$$2Fe\ (.....) + 3Cl_2\ (.....) \longrightarrow 2FeCl_3\ (.....)$$ [1]

(d) Explain why chlorine is used in the treatment of water supplies.

.....

..... [1]

[Total: 7]

9 Fig. 9.1 shows some of the apparatus used to investigate the elastic deformation of a spring.

Additional masses may be placed on the mass hanger.

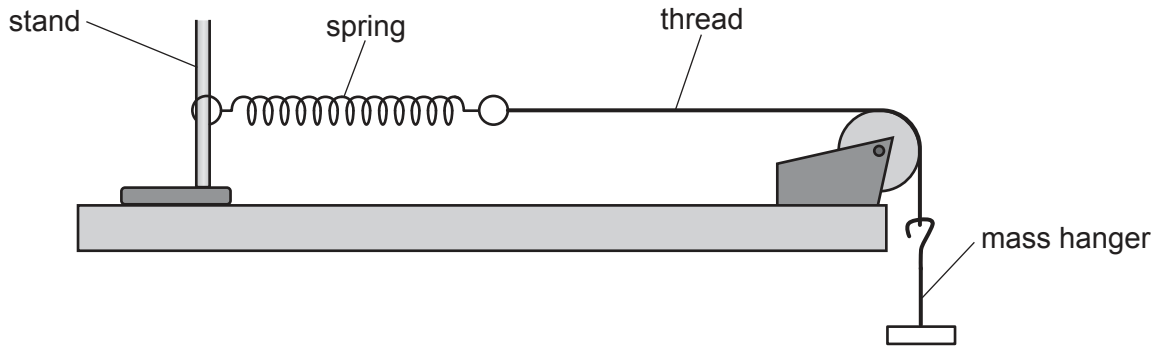

Fig. 9.1

(a) Describe how you would measure the length of the coiled part of the spring.

.....

.....

.....

..... [3]

(b) Describe how the apparatus in Fig. 9.1 is used to show that a spring is elastic.

.....

.....

.....

..... [3]

[Total: 6]

10 **(a)** State why carbon dioxide and urea must be excreted from the body.

.....

..... [1]

(b) Fig. 10.1 shows some organs in the human body.

The organs are numbered 1 – 6.

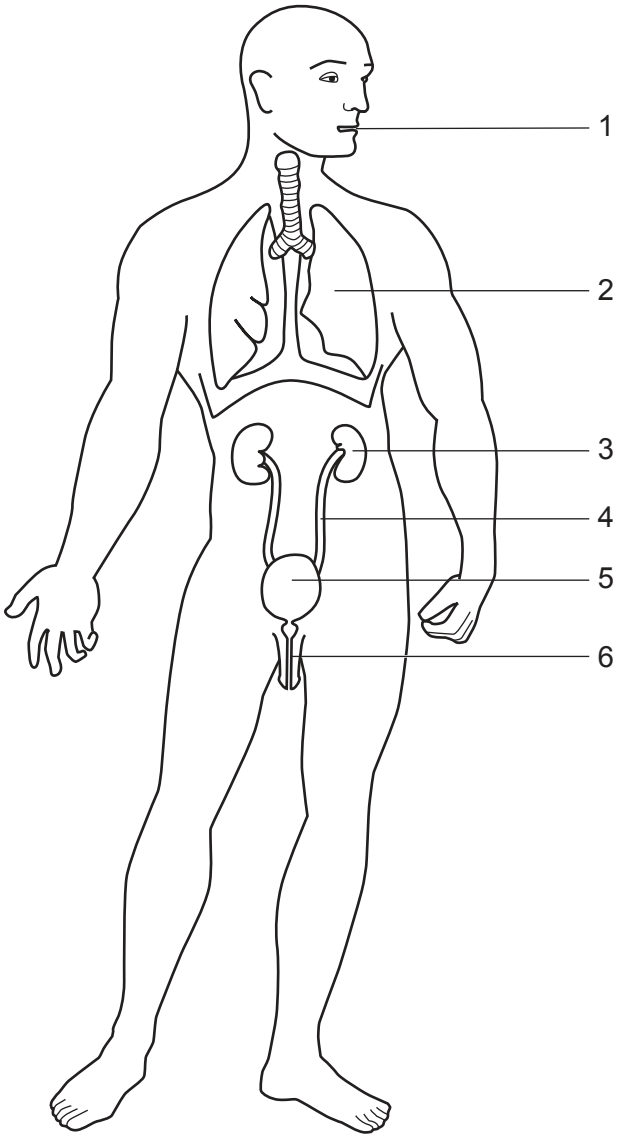

Fig. 10.1

Table 10.1 shows three substances excreted by the body.

Complete Table 10.1 by using numbers from Fig. 10.1 to show the organ that excretes the substance.

Table 10.1

substance excreted	number of organ responsible for excretion
carbon dioxide	
urea	
water	

[3]

[Total: 4]

11 Fig. 11.1 shows the processes used to manufacture ethanol from petroleum.

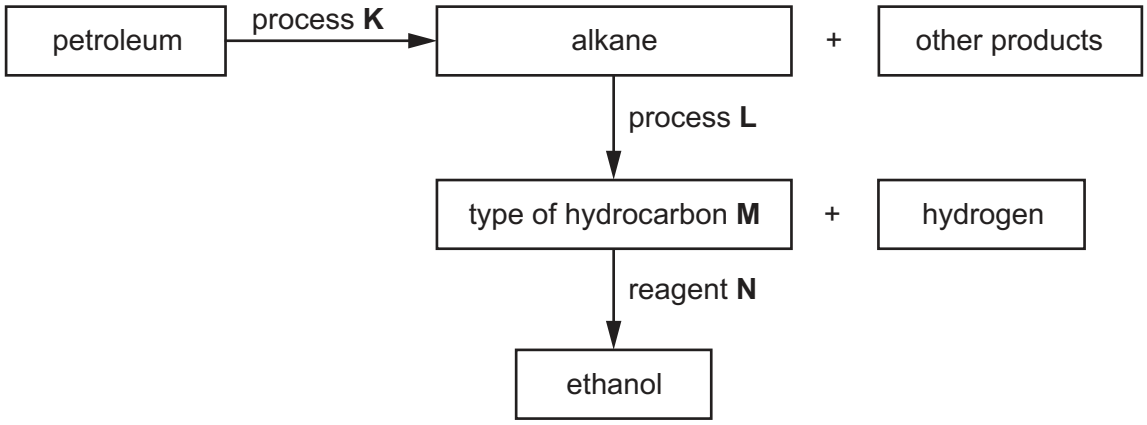

Fig. 11.1

(a) Identify the:

process **K** .....

process **L** .....

type of hydrocarbon **M** .....

reagent **N**. .....

[4]

(b) An alkane, C_yH_z, burns completely in oxygen.

The balanced equation is shown.

$$C_yH_z + 11O_2 \longrightarrow 7CO_2 + 8H_2O$$

Determine the values of y and z in the formula C_yH_z.

y = ...

z = ...

[2]

[Total: 6]

12 Some types and features of waves and their descriptions are shown in Fig. 12.1.

Draw **one** straight line from each description to a correct type or feature of a wave.

description	type or feature
wavelength less than visible light	amplitude
wavelength greater than visible light	frequency
the distance between the peak and the equilibrium point	X-ray
the number of oscillations every second	longitudinal
oscillations are parallel to the direction of the wave	radio
	transverse

Fig. 12.1

[5]

13 **(a)** If people do not have balanced diets, they can suffer from malnutrition.

Two examples of the effects of malnutrition are constipation and obesity.

Explain which part of an unbalanced diet causes the condition of:

(i) constipation

..... [1]

(ii) obesity.

..... [1]

(b) **(i)** Explain how drought can contribute towards famine.

.....

.....

.....

..... [2]

(ii) State **two** other causes of famine.

1 .....

.....

2 .....

.....

[2]

[Total: 6]

14 Table 14.1 shows some uses of metals.

Complete Table 14.1 by naming the metals that match the uses.

Table 14.1

use of metal	metal
mixed with copper to make brass	
making cutlery	
making food containers	
a catalyst in the manufacture of ammonia	

[4]

15 Fig. 15.1 shows a series circuit.

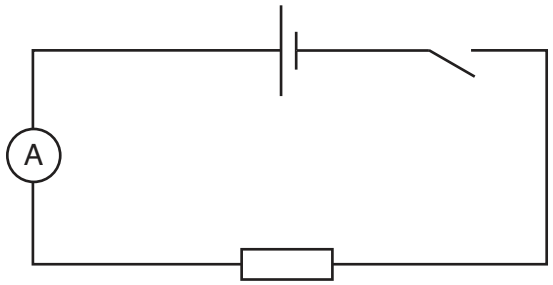

Fig. 15.1

The circuit is used to investigate different resistors **X**, **Y** and **Z**. The resistors in the circuit are exchanged but all of the other components remain the same. The reading on the ammeter is recorded for each resistor.

The results are shown in Table 15.1.

Table 15.1

resistor	current /A
X	0.12
Y	0.24
Z	0.36

(a) (i) State which resistor has the lowest resistance.

resistor ..... [1]

(ii) The e.m.f. of the cell is 1.2 V.

Calculate the resistance of resistor **Y** and state the unit.

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

(b) The experiment is repeated using resistor **Y** and two cells with a combined e.m.f. of 2.4 V.

Determine:

(i) the current in the circuit

current = ... A [1]

(ii) the charge transferred per second

charge = ... C [1]

(iii) the power produced by the cells.

power = ... W [2]

[Total: 8]

16 Complete the sentences using words or phrases from the list.

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

blood	**carbohydrates**	**gall bladder**	**gland**
kidney	**liver**	**muscle**	**plasma**
protein	**stomach**	**white blood cells**	

A hormone is a chemical substance produced in a ..... .

Hormones are carried round the body in the ..... and are destroyed by the ..... .

Excess amino acids and alcohol are broken down by the ..... .

Amylase is an enzyme which breaks down ..... .

[5]

17 Table 17.1 shows data about five substances.

Table 17.1

substance	conducts electricity when solid	conducts electricity when molten	melting point / °C	boiling point / °C
A	yes	yes	770	1367
B	no	no	–114	78
C	no	yes	857	1502
D	no	no	–78	–33
E	no	yes	–114	–85

(a) Choose letters from Table 17.1 to complete the sentences below.

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

(i) The substance that is a liquid at room temperature is ..... . [1]

(ii) The substance that is a metal is ..... . [1]

(iii) The solid substance that is soluble in water is ..... . [1]

(b) A sample of substance **C** melts between 845 °C and 854 °C.

Suggest why this sample of substance **C** melts over a range of temperatures rather than at the melting point shown in Table 17.1.

.....

..... [1]

[Total: 4]

18 Three types of radioactive emission are alpha-particles, beta-particles and gamma-rays.

(a) Complete Table 18.1 by putting **one** tick (✓) in each column.

Table 18.1

type of emission	least mass	highest penetrating power	most ionizing
alpha			
beta			
gamma			

[3]

(b) Describe the nature of each of these three types of radioactive emission.

(i) alpha-particles

.....

..... [1]

(ii) beta-particles

.....

..... [1]

(iii) gamma-rays

.....

..... [1]

[Total: 6]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	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.).