Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9043393039

COMBINED SCIENCE **5129/22**

Paper 2 **October/November 2020**

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. Blank pages are indicated.

1 Complete the sentences about non-metals.

Non-metals are found on the ..... hand side of the Periodic Table.

Non-metals have ..... melting points.

Non-metals have a ..... density.

Non-metals ..... electrons to form negative ions.

The electronic structure of the negative ions is stable because the outer electron shell is ..... .

Non-metals combine with metals to form ..... compounds.

[6]

2 Fig. 2.1 shows the decay curve for a radioactive substance.

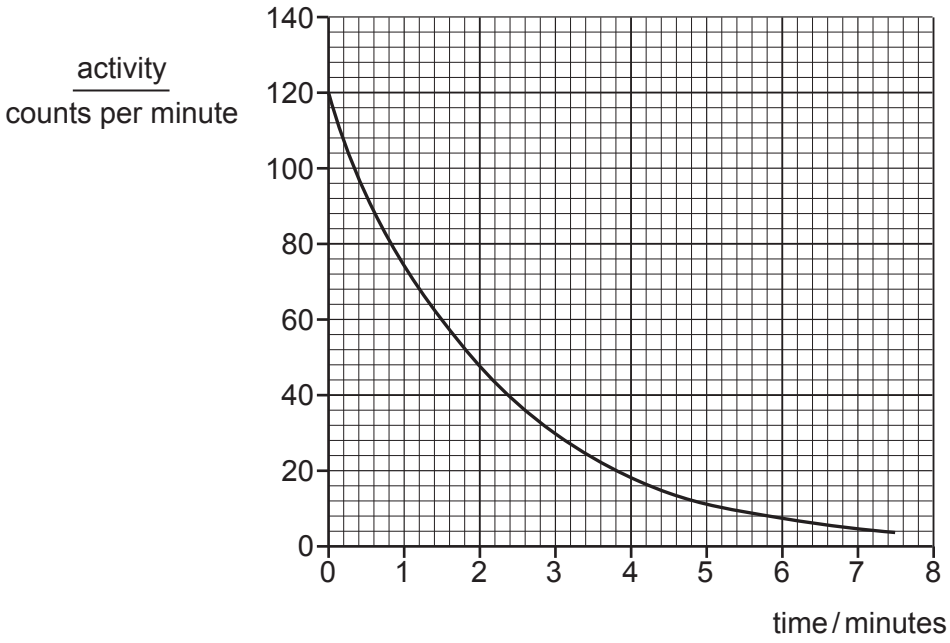

Fig. 2.1

(a) Determine the half-life of the radioactive substance.

half-life = ... minutes [1]

(b) (i) The radioactive substance can be described using nuclide notation.

$$^{A}_{Z}X$$

When a beta-particle is emitted, the number Z increases by one.

State and explain what happens to A.

.....

..... [2]

(ii) The radioactive substance also emits alpha-particles.

Describe the nature of an alpha-particle.

.....

..... [2]

[Total: 5]

3 Certain processes are carried out by specialised parts of organisms.

On Fig. 3.1, draw **one** straight line from each process to the specialised part where the process is carried out.

process	part
absorption of minerals in plants	iris
control of light entering the eye	root hair cell
excretion of urea	kidney
production of sperm	liver
transport of carbohydrate, water and minerals in plants	vascular bundle
formation of urea	testis

Fig. 3.1

[6]

4 When aluminium hydroxide is heated it decomposes and produces aluminium oxide and water.

The equation for the reaction is shown.

$$4Al(OH)_3 \longrightarrow 2Al_2O_3 + 6H_2O$$

The relative molecular mass of aluminium hydroxide is 78.

[A_r: O, 16; A*l*, 27; H, 1]

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

M_r = ... [1]

(ii) Complete the following sentences.

312 g of the aluminium hydroxide produces ..... g of aluminium oxide and

..... g of water.

7.8 g of the aluminium hydroxide produces ..... g of aluminium oxide.

[3]

(b) State the physical property of aluminium which makes it useful for the manufacture of aircraft parts.

..... [1]

(c) Aluminium is often used in the form of an alloy.

(i) State the meaning of the term *alloy*.

..... [1]

(ii) Explain why aluminium is used in the form of an alloy.

.....

..... [1]

[Total: 7]

5 Fig. 5.1 shows a method used to generate power.

Moving air passes through a turbine which is connected to a generator.

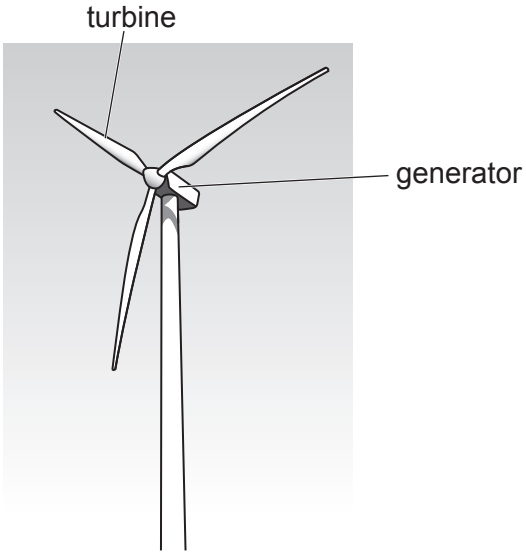

Fig. 5.1

(a) Name the energy source shown in Fig. 5.1.

..... [1]

(b) Complete the following sentence.

..... energy in moving air is transferred to ..... energy in the turbine and then converted to ..... energy in the generator.

[2]

(c) The generator produces 1400 W of power.

Calculate the energy produced by the generator in one minute.

Show your working.

energy = ... J [2]

[Total: 5]

6 Iron ore is reduced to iron by carbon monoxide in a blast furnace.

(a) Name an ore of iron. ..... [1]

(b) Explain the meaning of the term *iron ore is reduced*.

.....

..... [1]

(c) Iron corrodes to form rust.

(i) Name the **two** substances that are required for iron to form rust.

..... and ..... [2]

(ii) Iron can be protected from rusting by coating it with zinc.

State the name of the process where iron is coated with zinc.

..... [1]

(d) Iron is used in the manufacture of ammonia by the Haber process.

State and explain the role of iron in the Haber process.

.....

..... [2]

[Total: 7]

[Turn over

7 Plants store carbohydrates as starch in their leaves.

Fig. 7.1 shows a plant that is kept in a black box in the dark for 48 hours.

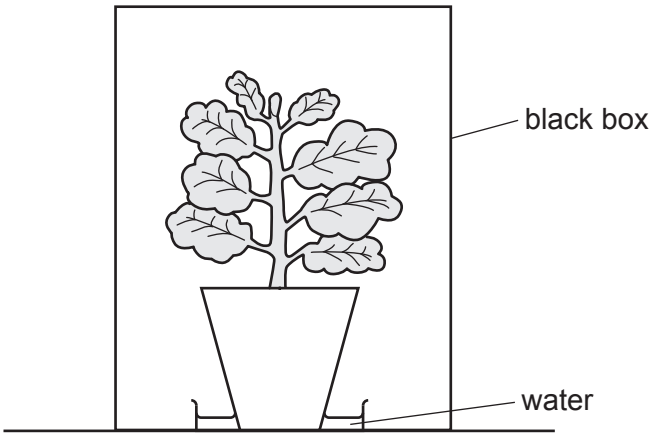

Fig. 7.1

After 48 hours the box is removed.

Part of one leaf is then covered with foil as shown in Fig. 7.2.

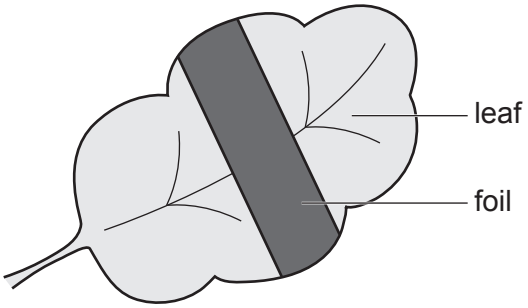

Fig. 7.2

The plant is left in the light for 12 hours and then the foil is removed.

The leaf is removed from the plant and tested for the presence of starch.

The results of the test are shown in Fig. 7.3.

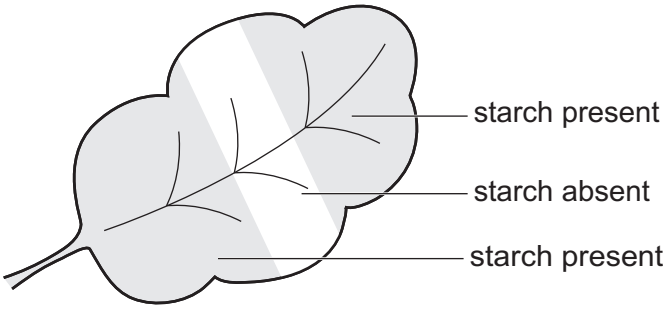

Fig. 7.3

(a) Name the plant process that is being investigated.

..... [1]

(b) Describe what the test results shown in Fig. 7.3 tell us about the effect of the procedure shown in Fig. 7.2.

.....

.....

.....

..... [2]

(c) Explain how starch is produced in leaves.

.....

.....

.....

.....

.....

..... [3]

(d) Suggest why the plant was placed in the dark at the start of the investigation.

.....

..... [1]

(e) Explain why the plant in Fig. 7.1 is in a dish of water.

.....

..... [1]

[Total: 8]

8 Fig. 8.1 shows a digital thermometer.

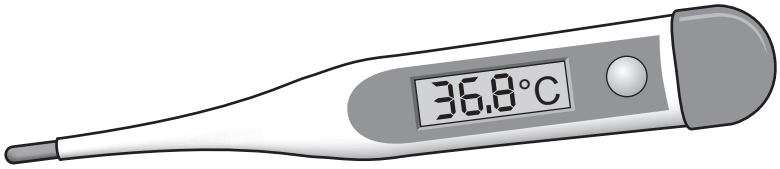

Fig. 8.1

(a) The thermometer is calibrated to the Celsius scale.

One of the fixed points on this scale is 100 °C.

State the other fixed point on the Celsius scale.

..... [1]

(b) The thermometer contains a small battery connected to an electrical component.

Suggest **one** physical property of the electrical component which changes when the temperature changes.

..... [1]

(c) The thermometer is sensitive to a narrow range of temperatures.

Explain what is meant by the terms *range* and *sensitivity*:

- range .....

  .....

- sensitivity. .....

  .....

[2]

[Total: 4]

9 The diameter of a steel nut is measured using a vernier caliper as shown in Fig. 9.1.

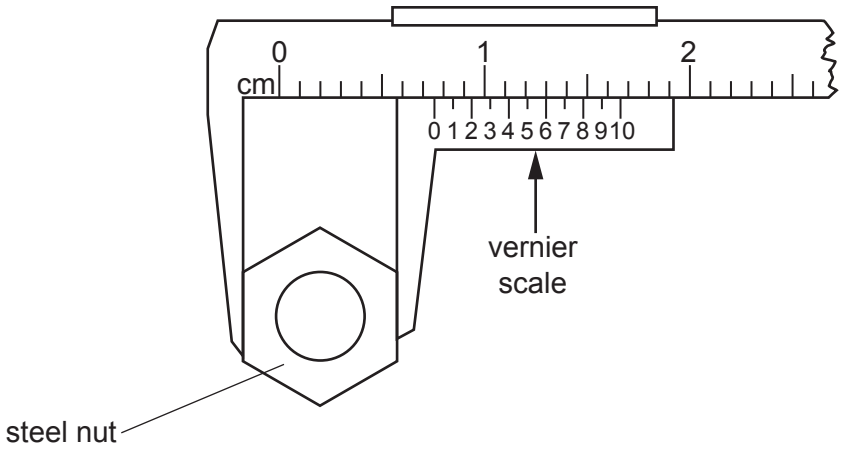

Fig. 9.1

(a) Determine the reading shown on the vernier scale in Fig. 9.1.

reading = ... cm [1]

(b) A spanner is used to attach the steel nut to a bolt as shown in Fig. 9.2.

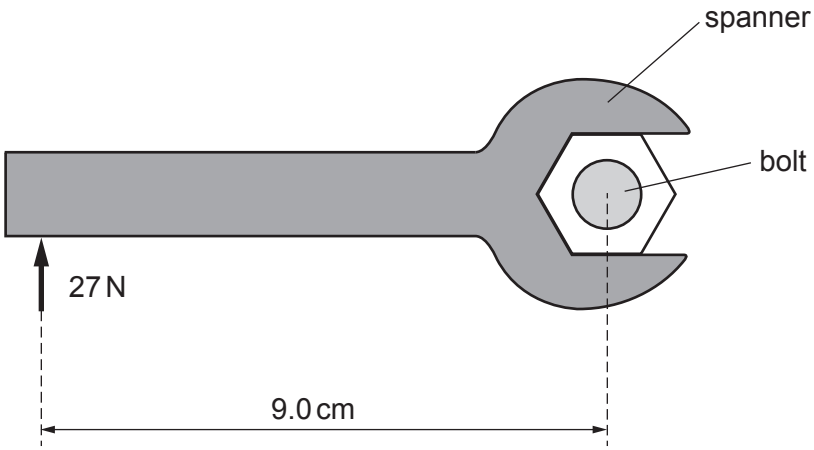

Fig. 9.2

Calculate the moment of the force shown in Fig. 9.2.

moment = ... N cm [2]

[Total: 3]

10 **(a)** Describe the process of fertilisation in the oviduct leading to the production of a zygote.

.....

.....

.....

.....

.....

..... [3]

(b) Complete Table 10.1 by giving **one** example of each method of birth control.

Table 10.1

method of birth control	example of method
hormonal	.....
mechanical	.....
natural	.....
surgical	.....

[4]

[Total: 7]

11 Octane decomposes when it is heated in the presence of phosphoric acid.

It forms ethene and another hydrocarbon, C_xH_y.

(a) (i) Name the process used to decompose octane.

..... [1]

(ii) The equation for the decomposition of octane is shown.

$$C_8H_{18} \rightarrow C_xH_y + 2C_2H_4$$

Determine the values of x and y in the formula C_xH_y.

x = ... y = ... [2]

(b) (i) Ethene reacts with hydrogen to produce ethane.

The reaction is an addition reaction.

Suggest why ethene can undergo an addition reaction.

..... [1]

(ii) State the name of the reagent used to distinguish between ethene and ethane.

..... [1]

(c) State **one** use of ethene.

..... [1]

[Total: 6]

[Turn over

12 Fig. 12.1 shows a magnet falling through a coil of wire.

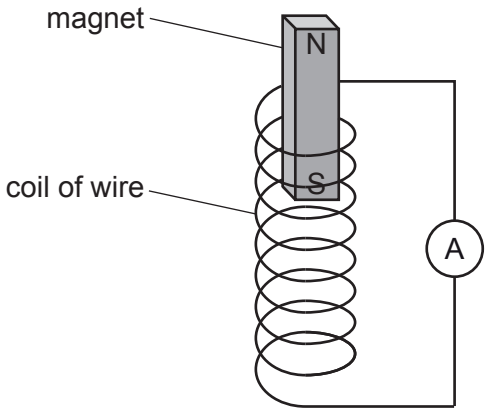

Fig. 12.1

The coil of wire is connected to a meter.

(a) State the name of this meter.

..... [1]

(b) Explain why there is a reading on the meter when the magnet falls through the coil of wire.

.....

..... [2]

(c) Explain why the magnet experiences a repelling force as it enters the coil of wire.

.....

..... [1]

[Total: 4]

13 The speed–time graph of a moving object is shown in Fig. 13.1.

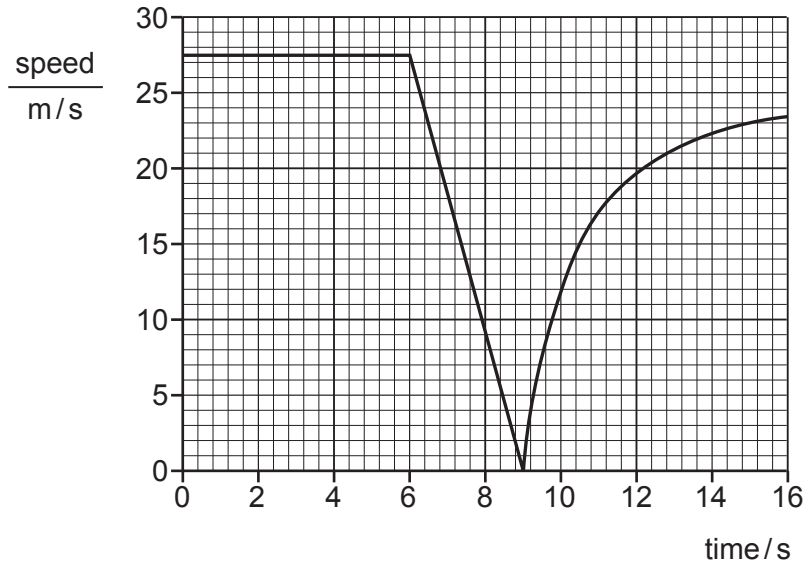

Fig. 13.1

(a) Use Fig. 13.1 to determine:

(i) the time at which the object is stationary

time = ... s [1]

(ii) the amount of time for which the object travels at constant speed.

time = ... s [1]

(b) Determine the speed and the type of motion at 8 seconds.

speed = ... m / s

type of motion .....
[1]

(c) State the type of motion between 10 and 16 seconds.

..... [1]

[Total: 4]

14 Use words or phrases from the list to complete the sentences about cells.

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

cell wall **chlorophyll** **cytoplasm** **permeable membrane**

haemoglobin **nucleus** **plumule** **sap vacuole**

Animal and plant cells both have a partially permeable cell membrane, ... and a nucleus.

In addition, plant cells also have a ..... around them and contain a large ..... .

Red blood cells are unusual as they do not have a ..... and they contain the chemical ..... .

[5]

15 Propane, C_3H_8, burns in a plentiful supply of air to produce carbon dioxide and water.

(a) Balance the equation for the combustion of propane.

$$C_3H_8 \ + \ .....O_2 \longrightarrow .....CO_2 \ + \ .....H_2O \qquad [1]$$

(b) Carbon dioxide is soluble in water.

The solubility of carbon dioxide in 100 cm^3 of water at different temperatures is shown in Fig. 15.1.

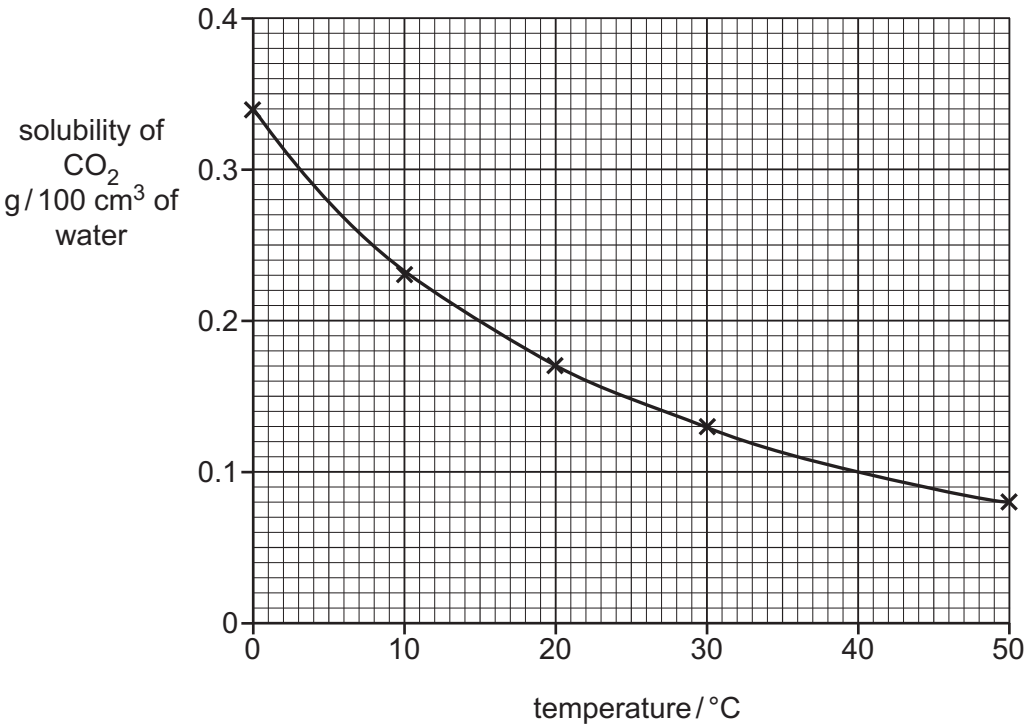

Fig. 15.1

(i) Use Fig. 15.1 to determine the solubility of carbon dioxide in 100 cm^3 of water at 40 °C.

solubility = ... g / 100 cm^3 of water [1]

(ii) Carbon dioxide dissolves in sea water.

Suggest how the amount of carbon dioxide in the atmosphere changes if the temperature of the sea water increases.

Explain your answer.

.....

.....

..... [2]

[Total: 4]

16 A lamp is supplied with 12 000 J of electrical energy when a current of 12 A passes through it in 50 s.

(a) Energy is conserved.

Determine the total amount of energy given out by the lamp in this time.

..... J [1]

(b) Calculate:

(i) the quantity of charge delivered to the lamp in 50 s

charge = ... C [2]

(ii) the potential difference (p.d.) across the lamp.

p.d. = ... V [2]

[Total: 5]

17 Parallel rays of light are shown in Fig. 17.1.

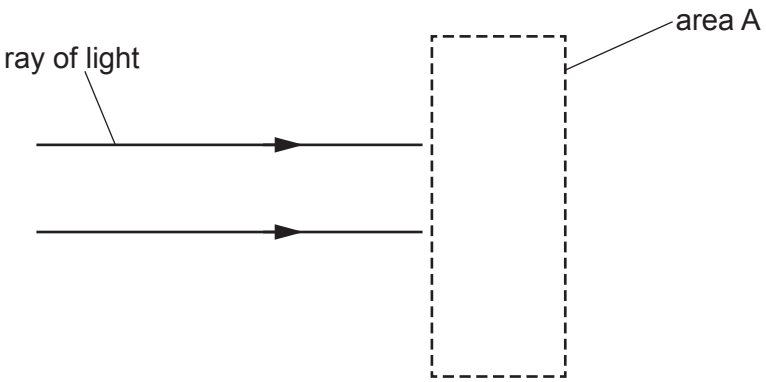

Fig. 17.1

(a) The rays of light pass through a thin converging lens in area A.

On Fig. 17.1:

(i) draw, in area A, the thin converging lens [1]

(ii) draw the paths of the rays of light after they pass through the lens. [1]

(b) This question is about the speeds of blue and red light in a vacuum.

Table 17.1 shows four different pairs of values for these speeds.

Put **one** tick in the last column to show which pair is correct.

Table 17.1

blue light	red light	
3×10^8 m/s	3×10^8 m/s	
3×10^8 m/s	8×10^3 m/s	
8×10^3 m/s	3×10^8 m/s	
8×10^3 m/s	8×10^3 m/s	

[1]

[Total: 3]

18 (a) A balanced diet contains sufficient quantities of certain chemical groups.

Two of these are minerals and vitamins.

State the name of **four** other components of a balanced diet.

1 .....

2 .....

3 .....

4 .....

[4]

(b) Suggest **three** advantages of breast-feeding a baby, apart from the nutritional advantages.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

[Total: 7]

19 The three states of matter are shown in Fig. 19.1.

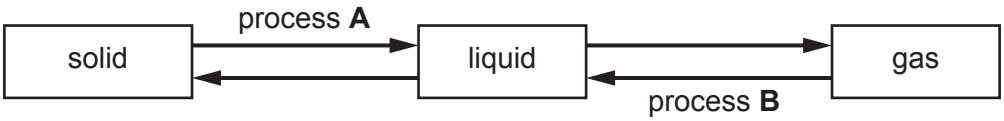

Fig. 19.1

(a) Name processes **A** and **B**.

process **A** .....

process **B** ..... [2]

(b) Describe, in terms of movement and bunching, how the particles in a gas differ from the particles in a liquid.

.....

.....

..... [2]

[Total: 4]

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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.).