Name	Register Number	Class

GREENRIDGE SECONDARY SCHOOL
O LEVEL PRELIMINARY EXAMINATION 2019
Secondary 4 Express / 5 Normal Academic

SCIENCE (CHEMISTRY, BIOLOGY) **5078/01**
Paper 1

3 September 2019 **1 hour**
Tuesday

Additional Materials: Multiple Choice Answer Sheet

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, register number and class on the question booklet and Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The total number of marks for this paper is **40**.

A copy of the Data sheet is printed on page 9.
A copy of the Periodic Table is printed on page 10.

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Total	**/ 40**

This question paper consists of **17** printed pages including this cover page.

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1 Which apparatus is most suitable for measuring 25.0 cm^3 of hydrochloric acid?

A beaker

B burette

C measuring cylinder

D pipette

2 A substance X has the following properties.

- fixed melting point
- conducts electricity when molten
- does not conduct electricity when in solid state

Which row correctly describes substance X**?**

	element, compound or mixture	chemical bonding
A	compound	covalent
B	compound	ionic
C	element	covalent
D	mixture	ionic

3 An unknown oxide M reacts with both sulfuric acid and sodium hydroxide solution to produce salt and water only.

Which oxide is M likely to be?

A aluminium oxide

B barium oxide

C calcium oxide

D magnesium oxide

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4 Ammonia gas can be produced by reacting nitrogen and hydrogen as shown in the equation below.

$$N_2\ (g) + 3H_2\ (g) \rightarrow 2NH_3\ (g)$$

What volume of ammonia is produced when 50 cm^3 of nitrogen is reacted with 90 cm^3 of hydrogen?

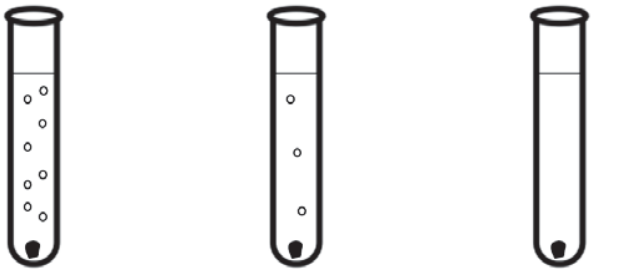
A 60 cm^3

B 100 cm^3

C 140 cm^3

D 150 cm^3

5 Test tubes labelled 1, 2 and 3 respectively were filled with equal volumes of dilute hydrochloric acid. Three different metal strips of same size and mass were added separately to test tubes 1, 2 and 3. The diagram below shows the observations obtained.



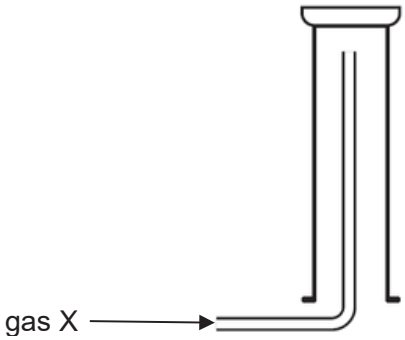
test tube 1 test tube 2 test tube 3

What could be the identities of the metals in each test tube?

	test tube 1	test tube 2	test tube 3
A	calcium	copper	iron
B	calcium	zinc	copper
C	copper	iron	zinc
D	zinc	iron	copper

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6 The ideal method of collecting gas X is shown below.

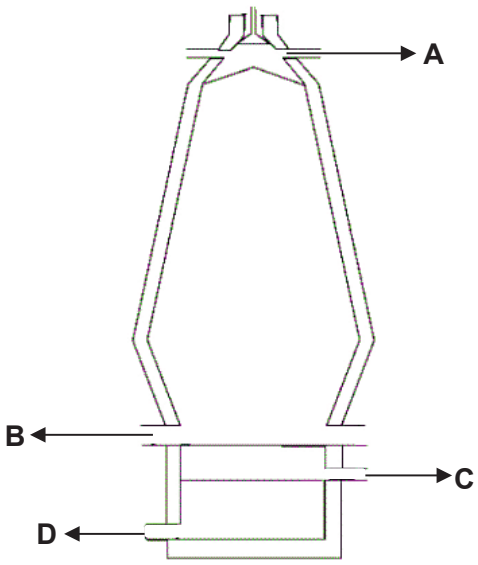


What can be deduced about the density and solubility of gas **X** in water?

	density of gas X	solubility of gas X in water
A	denser than air	insoluble
B	denser than air	soluble
C	less dense than air	insoluble
D	less dense than air	soluble

7 Iron can be extracted from its ore using a blast furnace as shown below.

At which position will molten iron be obtained?



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8 Which substance is used to reduce acidity in soil?

A barium sulfate

B calcium hydroxide

C potassium chloride

D sodium hydroxide

9 Which is the major component of air?

A argon

B carbon dioxide

C nitrogen

D oxygen

10 Which is true about covalent bonds?

A Covalent bonds are formed between metals.

B Covalent bonds are formed by sharing electrons.

C Covalent bonds are formed by transferring electrons.

D Covalent bonds are weak.

11 Which row matches the fraction of crude oil to its use?

	fraction	use
A	bitumen	to produce polishes
B	diesel	to pave roads
C	kerosene	to lubricate engines
D	naphtha	to make plastics

12 Which equation represents a redox reaction?

A $AgNO_3\,(aq) + NaCl\,(aq) \rightarrow AgCl\,(s) + NaNO_3\,(aq)$

B $Ca\,(s) + 2HCl\,(aq) \rightarrow CaCl_2\,(aq) + H_2\,(g)$

C $CuO\,(s) + H_2SO_4\,(aq) \rightarrow CuSO_4\,(aq) + H_2O\,(l)$

D $MgCO_3\,(s) + H_2SO_4\,(aq) \rightarrow MgSO_4\,(aq) + H_2O\,(l)$

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13 When an unknown gas X was bubbled into bromine solution, the solution was decolourised rapidly.

Which could be gas X?

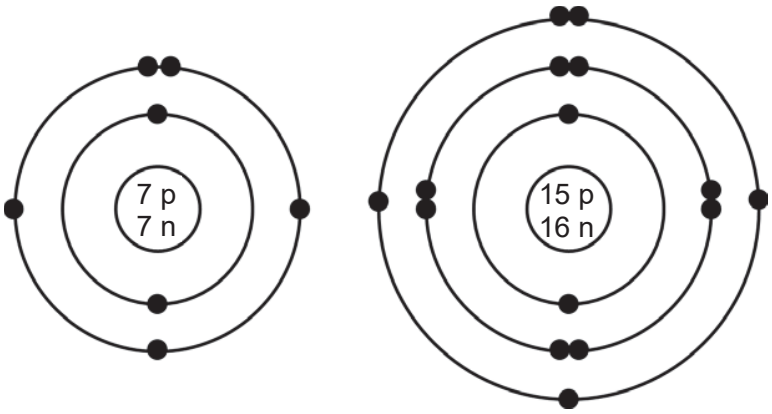
A ethane

B ethanoic acid

C ethanol

D ethene

14 The diagram below shows the structure of two atoms.



Which statement is true about the two atoms?

A Both atoms are isotopes.

B Both atoms are metals.

C Both atoms belong to the same group.

D Both atoms belong to the same period.

15 Moving from the left to the right side of the periodic table, elements

A become less metallic.

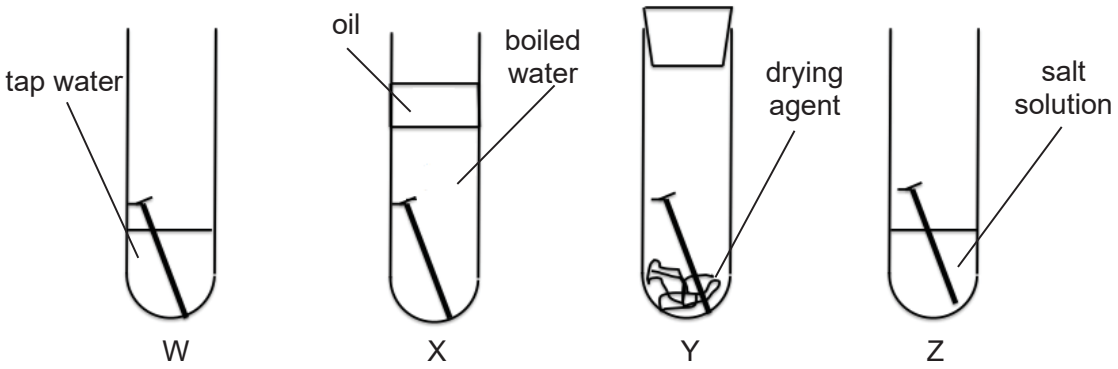
B become more metallic.

C decrease in mass.

D increase in reactivity.

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16 Four set-ups containing iron nails are shown below.



In which order will the nail rust, from the fastest to the slowest?

A W → X → Y → Z

B X → Z → Y → W

C Y → X → Z → W

D Z → W → X → Y

17 As the number of carbon atoms in alkanes increases,

A their melting and boiling points decrease.

B they become more flammable.

C they become more reactive.

D they become more viscous.

18 Long chain alkanes can be cracked into smaller molecules to produce more useful products.

The equation below shows an example of such reactions.

$$C_{35}H_{72} \rightarrow 2C_3H_6 + 2C_4H_8 + C_{15}H_{30} + X$$

What is a possible identity of X?

A C_6H_{12}

B C_6H_{14}

C $C_{23}H_{46}$

D $C_{23}H_{48}$

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19 An equation is shown below.

$$x\text{Fe} + y\text{C}l_2 \rightarrow z\text{FeC}l_3$$

Which numbers will correctly balance the equation?

	x	*y*	*z*
A	1	1	1
B	1	2	1
C	2	2	3
D	2	3	2

20 Which substance will be made up of particles packed closely together in an orderly arrangement at room temperature?

	melting point / °C	boiling point / °C
A	− 20	17
B	0	100
C	15	131
D	40	150

END OF PAPER

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Colours of Some Common Metal Hydroxides

Calcium hydroxide	white
Copper(II) hydroxide	light blue
Iron(II) hydroxide	green
Iron(III) hydroxide	red-brown
Lead(II) hydroxide	white
Zinc hydroxide	white

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (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											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 –		

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.).

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Name	Register Number	Class

GREENRIDGE SECONDARY SCHOOL
O LEVEL PRELIMINARY EXAMINATION 2019
Secondary 4 Express / 5 Normal Academic

SCIENCE **5076/5078/03**
Paper 3 Chemistry

30 August 2019 **1 hour 15 minutes**
Friday

Additional Materials: Nil

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READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on this cover and all the work you hand in.
Write in blue pen or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

Section A
Answer **all** questions in the spaces provided.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the Question Paper.

The total number of marks for this paper is 65.

A copy of the Data sheet is printed on page **14**.
A copy of the Periodic Table is printed on page **15**.

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Section A	**/ 45**
Section B	**/ 20**
Total	**/ 65**

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Section A [45 marks]

Answer **all** the questions in this section in the spaces provided.

A1 Some substances are listed below.

air	**carbon dioxide**	**iodine**	**lithium**
steel	**sulfur dioxide**	**water**	**iron**

Match the substance(s) to the descriptions given below.

(a) A gas that dissolves in water and turns Universal Indicator red.

……. [1]

(b) A mixture of elements and compounds.

……. [1]

(c) A transition metal.

……. [1]

(d) A substance which sublimes when heated.

……. [1]

A2 Chlorine and fluorine both belong to the same group in the Periodic Table.

(a) State the name given to this group of elements.

……. [1]

(b) Explain why chlorine and fluorine are placed in the same group in the Periodic Table.

……. [1]

(c) An element **D** was discovered by scientists and placed beneath astatine in the Periodic Table.

Predict the state of the element at room temperature and its reactivity compared to astatine.

state at room temperature: …….

reactivity compared to astatine: ……. [2]

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A3 Fig. 3.1 shows the chromatogram of food products **1**, **2** and **3** and permitted food dyes **A**, **B** and **C**.

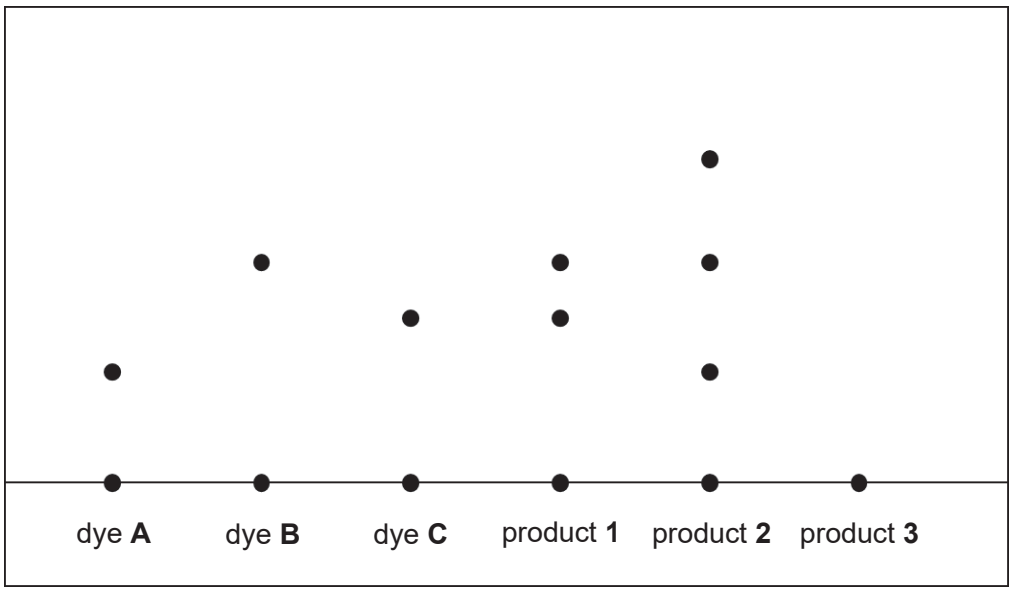


Fig. 3.1

(a) State and explain which food product(s) are safe for consumption.

……

…… [2]

(b) Explain why the sample of product **3** did **not** separate into different spots.

…… [1]

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A4 Aluminium is extracted from its ore by electrolysis.

The equation given below represents the process of extraction of aluminium from its ore.

$$2Al_2O_3 \rightarrow 4Al + 3O_2$$

(a) Explain why aluminium **cannot** be extracted from its ore by heating with carbon.

……

…… [2]

(b) State and explain whether the process of extracting aluminium is a redox reaction.

……

……

……

…… [2]

(c) Suggest why aluminium is widely recycled in many countries rather than being extracted.

……

…… [1]

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A5 Table 5.1 shows some information about the atoms of elements **E**, **F**, **G** and **H.**

Table 5.1

element	proton	neutron	electron	mass
E	6	6		12
F		20	19	
G			6	14
H	18		18	40

(a) Complete Table 5.1. [3]

(b) State which element(s) is/are

(i) noble gas(es),

……. [1]

(ii) isotopes.

……. [1]

A6 When stoves are operated in an enclosed area, carbon monoxide may be produced, which can harm human health.

(a) Explain how carbon monoxide is produced when stoves are operated in an enclosed area.

……. [1]

(b) Describe the effects of carbon monoxide on human beings.

……

……

……. [2]

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A7 When yeast is added to hydrogen peroxide, it decomposes into water and oxygen as shown by the chemical equation below.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Fig. 7.1 shows the graph of the volume of oxygen gas collected against time when 50 cm^3 of hydrogen peroxide with concentration of 0.50 mol/dm^3 is allowed to decompose in the presence of yeast.

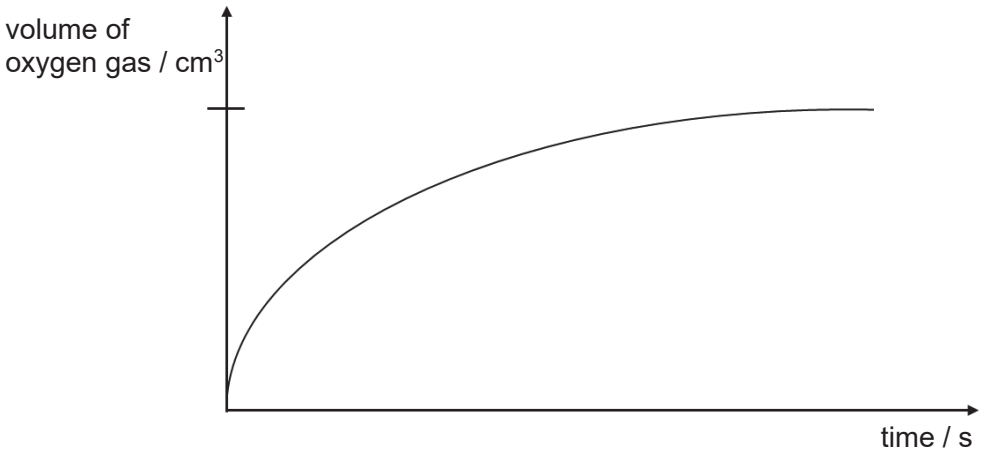


Fig. 7.1

(a) Explain why the volume of oxygen stops rising after some time.

……..

……. [1]

(b) **(i)** On Fig. 7.1, sketch a curve of what would happen if the concentration of hydrogen peroxide was decreased to 0.25 mol/dm^3. [1]

(ii) Using your knowledge of collision theory, explain your answer in **(b)(i)**.

……

……

……

……. [2]

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A8 Potassium hydroxide solution was slowly added to 40 cm^3 of nitric acid with a concentration of 1.00 mol / dm^3 and the temperature of the solution was measured and plotted on Fig. 8.1.

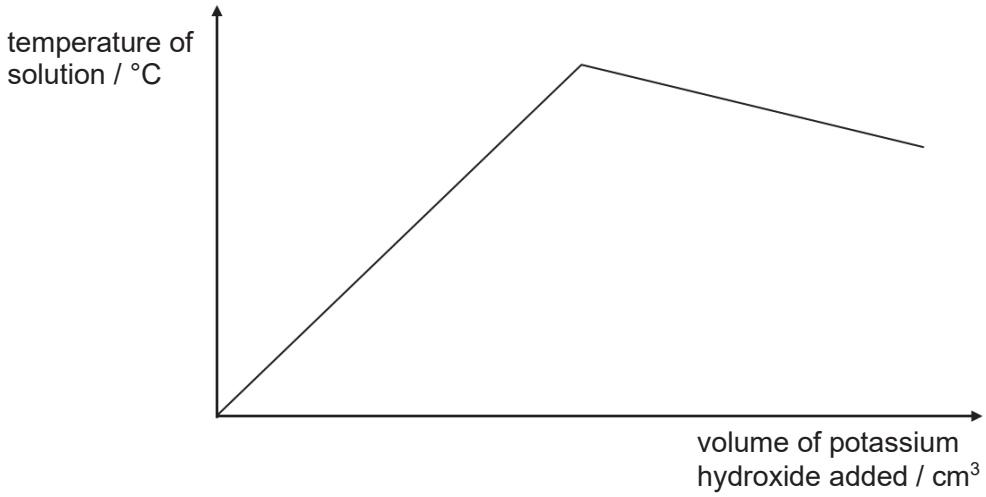


Fig. 8.1

The reaction between potassium hydroxide and nitric acid can be represented by the equation below.

$$KOH + HNO_3 \rightarrow KNO_3 + H_2O$$

(a) Name the type of reaction between potassium hydroxide and nitric acid.

……. [1]

(b) State whether the reaction is exothermic or endothermic. Explain your answer using Fig. 8.1.

…….

……. [2]

(c) Given that 30 cm^3 of potassium hydroxide was required to react with 40 cm^3 of nitric acid, find the concentration of the potassium hydroxide solution.

[3]

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A9 **(a)** Fig. 9.1 shows part of the structure of an addition polymer.

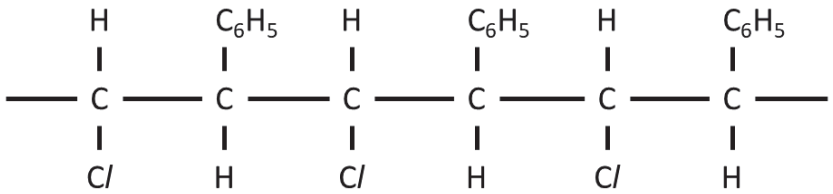


Fig. 9.1

(a) Draw the structural formula of the monomer that makes up the polymer in Fig. 9.1.

[1]

(b) Poly(ethene) is an example of an addition polymer that is widely used.

(i) State the condition(s) required for poly(ethene) to be formed from its monomer.

……. [1]

(ii) State **one** common use of poly(ethene).

……. [1]

(c) Disposal of polymers by burying them in landfills causes land pollution to occur.

Explain why polymers cause land pollution when buried.

……. [1]

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A10 Fig. 10.1 describes some properties and reactions of several substances.

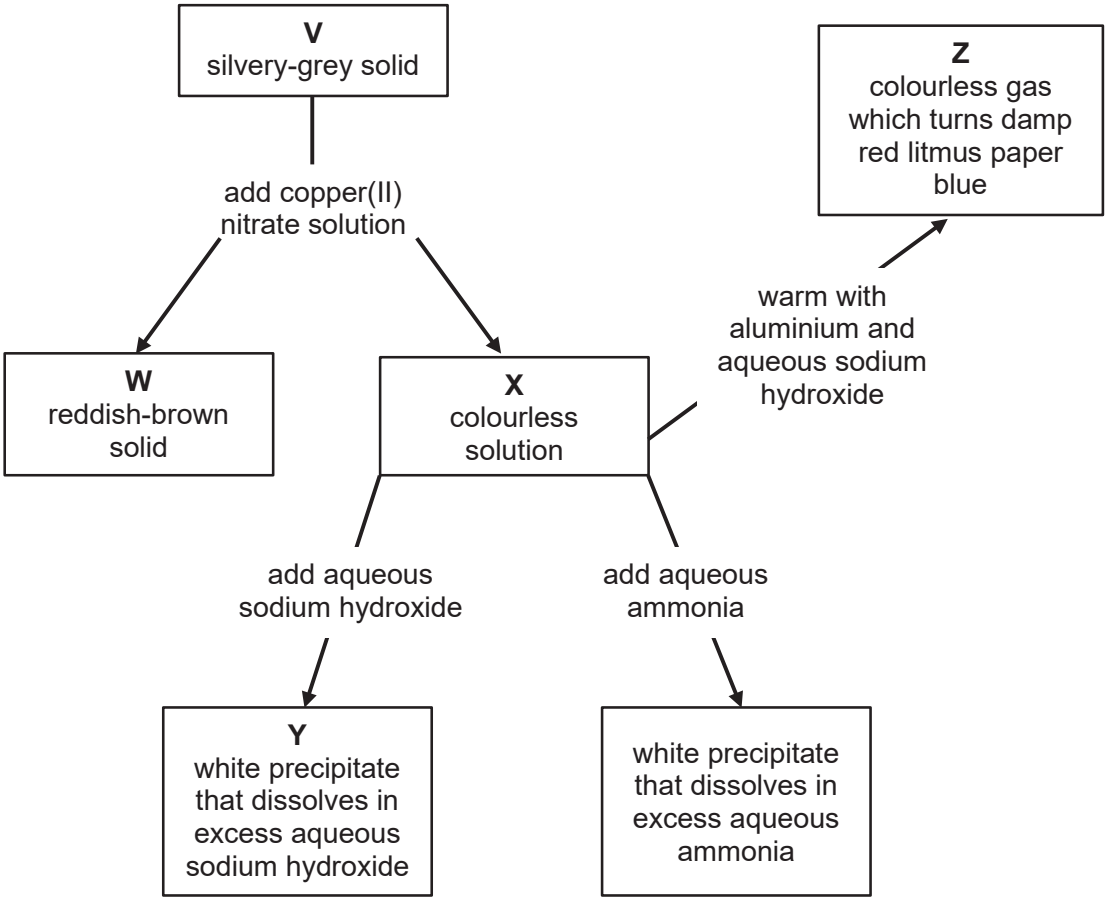


Fig. 10.1

(a) Name **V**, **W**, **X**, **Y** and **Z**.

V .....

W .....

X .....

Y .....

Z ..... [5]

(b) Write a balanced chemical equation for any **one** of the reactions in Fig. 10.1.

..... [2]

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Section B [20 marks]
Answer any **two** questions.

B11 (a) Alkanes can react with halogens to produce other organic compounds.

(i) State the condition(s) required for halogens to react with alkanes.

…… [1]

(ii) When methane is reacted with chlorine, hydrogen chloride is produced.
Name another product of the reaction and show its structural formula.

name:
structural formula:

[2]

(iii) Write a balanced chemical equation to describe the reaction of methane with oxygen.

…… [2]

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(b) Another hydrocarbon, ethene, has the chemical formula C_2H_4.

(i) Draw the 'dot-and-cross' diagram of ethene.

[2]

(ii) Explain, using your knowledge of chemical bonding, why ethene is a gas at room temperature and pressure.

……

……

……

…… [2]

(iii) Explain why ethene is classified as an unsaturated hydrocarbon.

…… [1]

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B12 **(a)** Describe, in terms of the arrangement and movement of particles, the process of ice melting.

……

……

……

……

……

……

…… [4]

(b) Water can be formed by the reaction between hydrogen and oxygen. The reaction can be described by the equation below.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Find the mass of oxygen required to react with 32.0 cm^3 of hydrogen.

mass of oxygen required: …… g [3]

(c) With the aid of a diagram, explain why alloys are harder and stronger than pure metals.

……

……

……

…… [3]

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B13 **(a)** Describe how you can prepare a pure dry sample of copper(II) chloride. You may use the following information to help you.

- copper(II) chloride is soluble in water
- copper metal does **not** react with dilute acids

……

……

……

……

……

……

……

…… [5]

(b) Ethanol can be used as a fuel for vehicle and other machines.

(i) Name the process by which ethanol is made from glucose.

…… [1]

(ii) State the chemical equation of the reaction named in **(b)(i)**.

…… [1]

(iii) State the condition(s) required for the reaction in **(b)(i)** to occur.

……

…… [2]

(iv) Write a balanced chemical equation for the combustion of ethanol.

…… [1]

END OF PAPER

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Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							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

proton (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.)

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Name	Register Number	Class

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O LEVEL PRELIMINARY EXAMINATION 2019
Secondary 4 Express / 5 Normal Academic

SCIENCE (CHEMISTRY, BIOLOGY) **5078/01**
Paper 1

4 September 2019 **1 hour**
Wednesday

Additional Materials: Multiple Choice Answer Sheet

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, register number and class on the question booklet and Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The total number of marks for this paper is **40**.

A copy of the Data sheet is printed on page 9.
A copy of the Periodic Table is printed on page 10.

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Total	**/ 40**

This question paper consists of **17** printed pages including this cover page.

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1 Which apparatus is most suitable for measuring 25.0 cm^3 of hydrochloric acid?

A beaker

B burette

C measuring cylinder

D pipette

2 A substance X has the following properties.

- fixed melting point
- conducts electricity when molten
- does not conduct electricity when in solid state

Which row correctly describes substance X**?**

	element, compound or mixture	chemical bonding
A	compound	covalent
B	compound	ionic
C	element	covalent
D	mixture	ionic

3 An unknown oxide M reacts with both sulfuric acid and sodium hydroxide solution to produce salt and water only.

Which oxide is M likely to be?

A aluminium oxide

B barium oxide

C calcium oxide

D magnesium oxide

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4 Ammonia gas can be produced by reacting nitrogen and hydrogen as shown in the equation below.

$$N_2\ (g) + 3H_2\ (g) \rightarrow 2NH_3\ (g)$$

What volume of ammonia is produced when 50 cm^3 of nitrogen is reacted with 90 cm^3 of hydrogen?

A 60 cm^3

B 100 cm^3

C 140 cm^3

D 150 cm^3

5 Test tubes labelled 1, 2 and 3 respectively were filled with equal volume of dilute hydrochloric acid. Three different metal strips of same size and mass were added separately to test tubes 1, 2 and 3. The diagram below shows the observations obtained.



test tube 1 test tube 2 test tube 3

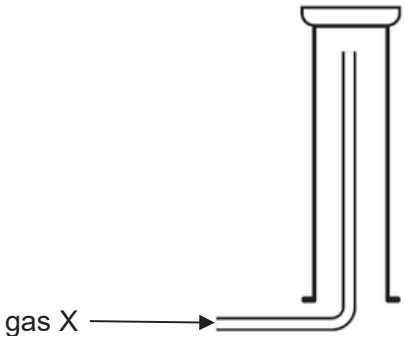
What could be the identities of the metals in each test tube?

	test tube 1	test tube 2	test tube 3
A	calcium	copper	iron
B	calcium	zinc	copper
C	copper	iron	zinc
D	zinc	iron	copper

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6 The ideal method of collecting gas X is shown below.

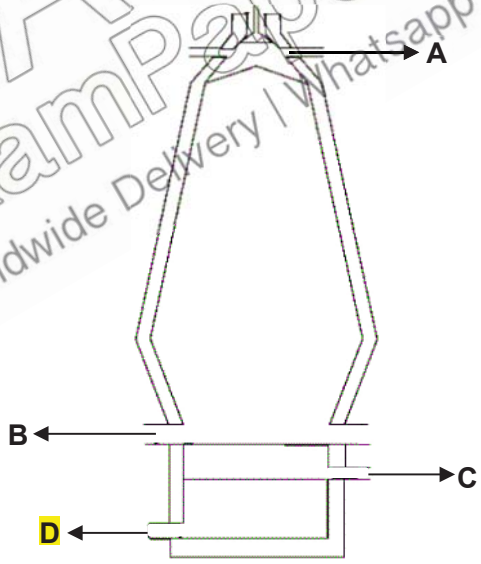


What can be deduced about the density and solubility of gas **X** in water?

	density of gas X	solubility of gas X in water
A	denser than air	insoluble
B	denser than air	soluble
C	less dense than air	insoluble
D	less dense than air	soluble

7 Iron can be extracted from its ore using a blast furnace as shown below.

At which position will molten iron be obtained?



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8 Which substance is used to reduce acidity in soil?

A barium sulfate

B calcium hydroxide

C potassium chloride

D sodium hydroxide

9 Which is the major component of air?

A argon

B carbon dioxide

C nitrogen

D oxygen

10 Which is true about covalent bonds?

A Covalent bonds are formed between metals.

B Covalent bonds are formed by sharing electrons.

C Covalent bonds are formed by transferring electrons.

D Covalent bonds are weak.

11 Which matches the fraction of crude oil to its use?

	fraction	use
A	bitumen	to produce polishes
B	diesel	to pave roads
C	kerosene	to lubricate engines
D	naphtha	to make plastics

12 Which equation represents a redox reaction?

A $AgNO_3\,(aq) + NaCl\,(aq) \rightarrow AgCl\,(s) + NaNO_3\,(aq)$

B $Ca\,(s) + 2HCl\,(aq) \rightarrow CaCl_2\,(aq) + H_2\,(g)$

C $CuO\,(s) + H_2SO_4\,(aq) \rightarrow CuSO_4\,(aq) + H_2O\,(l)$

D $MgCO_3\,(s) + H_2SO_4\,(aq) \rightarrow MgSO_4\,(aq) + H_2O\,(l)$

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13 When an unknown gas X was bubbled into bromine solution, the solution was decolourised rapidly.

Which could be gas X?

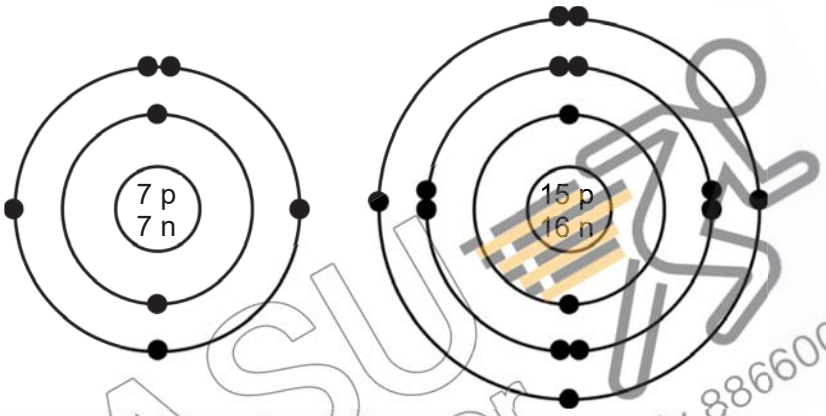
A ethane

B ethanoic acid

C ethanol

D ethene

14 The diagram below shows the structure of two atoms.



Which is true about the two atoms?

A Both atoms are isotopes.

B Both atoms are metals.

C Both atoms belong to the same group.

D Both atoms belong to the same period.

15 Moving from the left to the right side of the periodic table, elements

A become less metallic.

B become more metallic.

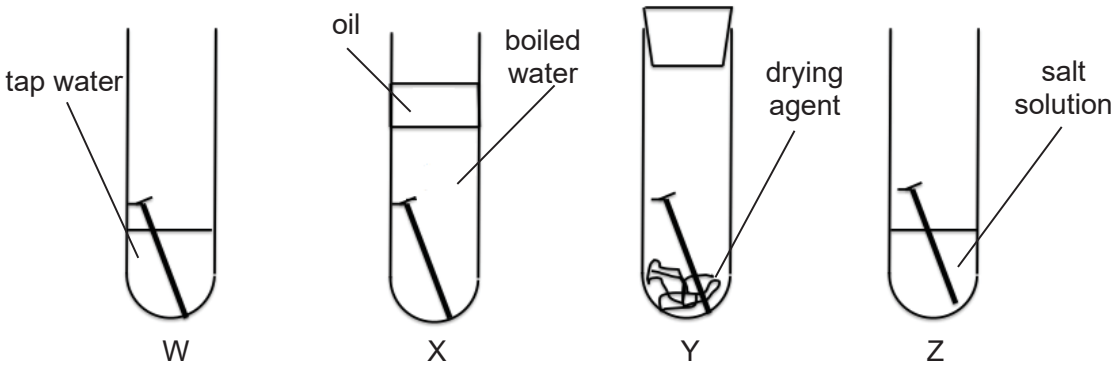
C decrease in mass.

D increase in reactivity.

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16 Four set ups containing iron nails are shown below.



In which order will the nail rust from the fastest to the slowest?

A W → X → Y → Z

B X → Z → Y → W

C Y → X → Z → W

D Z → W → X → Y

17 As the number of carbon atoms in alkanes increase,

A their melting and boiling points decrease.

B they become more flammable.

C they become more reactive.

D they become more viscous.

18 Long chain alkanes can be cracked into smaller molecules to produce more useful products.

The equation below shows an example of such reactions.

$$C_{35}H_{72} \rightarrow 2C_3H_6 + 2C_4H_8 + C_{15}H_{30} + X$$

What is a possible identity of X?

A C_6H_{12}

B C_6H_{14}

C $C_{23}H_{46}$

D $C_{23}H_{48}$

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19 An equation is shown below.

$$x\text{Fe} + y\text{C}l_2 \rightarrow z\text{FeC}l_3$$

Which numbers will correctly balance the equation?

	x	*y*	*z*
A	1	1	1
B	1	2	1
C	2	2	3
D	2	3	2

20 Which substance will be made up of particles packed closely together in an orderly arrangement at room temperature?

	melting point / °C	boiling point / °C
A	− 20	17
B	0	100
C	15	131
D	40	150

~ End of Paper ~

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Colours of Some Common Metal Hydroxides

Calcium hydroxide	white
Copper(II) hydroxide	light blue
Iron(II) hydroxide	green
Iron(III) hydroxide	red-brown
Lead(II) hydroxide	white
Zinc hydroxide	white

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The Periodic Table of Elements

Group																	
I	II										III	IV	V	VI	VII	0
						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

proton (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.).

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Name	Register Number	Class

GREENRIDGE SECONDARY SCHOOL
O LEVEL PRELIMINARY EXAMINATION 2019
Secondary 4 Express / 5 Normal Academic

SCIENCE 5076/5078/03

Paper 3 Chemistry

30 August 2019 **1 hour 15 minutes**
Friday

Additional Materials: Nil

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Write your name, register number and class on this cover and all the work you hand in.
Write in blue pen or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

Section A
Answer **all** questions in the spaces provided.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the Question Paper.

The total number of marks for this paper is 65.

A copy of the Data sheet is printed on page **14**.
A copy of the Periodic Table is printed on page **15**.

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Section A	**/ 45**
Section B	**/ 20**
Total	**/ 65**

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Section A [45 marks]

Answer **all** the questions in this section in the spaces provided.

A1 Some substances are listed below.

air	**carbon dioxide**	**iodine**	**lithium**
steel	**sulfur dioxide**	**water**	**iron**

Match the substance(s) to the descriptions given below.

(a) A gas that dissolves in water and turns Universal Indicator red.

Sulfur dioxide [1]

(b) A mixture of elements and compounds.

air [1]

(c) A transition metal.

iron [1]

(d) A substance which sublimes when heated.

iodine [1]

A2 Chlorine and fluorine both belong to the same group in the Periodic Table.

(a) State the name given to this group of elements.

halogens [1]

(b) Explain why chlorine and fluorine are placed in the same group in the Periodic Table.

Both have 7 valence electrons/they have same number of valence electrons [1]

(c) An element **D** was discovered by scientists and placed beneath astatine in the Periodic Table.

Predict the state of the element at room temperature and its reactivity compared to astatine.

state at room temperature: solid

reactivity compared to astatine: less reactive [2]

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A3 Fig. 3.1 shows the chromatogram of food products **1**, **2** and **3** and permitted food dyes **A**, **B** and **C**.

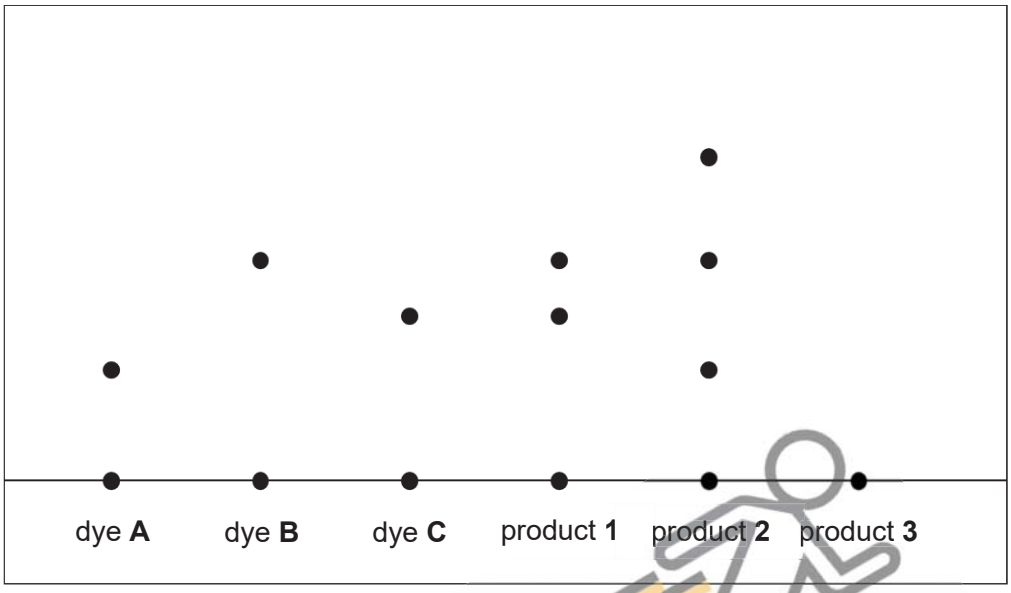


Fig. 3.1

(a) State and explain which food product(s) are safe for consumption.

Product 1. Contains only permitted food dyes.

..... [2]

(b) Explain why the sample of product **3** did **not** separate into different spots.

The dye is insoluble. [1]

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A4 Aluminium is extracted from its ore by electrolysis.

The equation given below represents the process of extraction of aluminium from its ore.

$$2Al_2O_3 \rightarrow 4Al + 3O_2$$

(a) Explain why aluminium **cannot** be extracted from its ore by heating with carbon.

Aluminium is above carbon in the reactivity series.
Carbon cannot reduce aluminium oxide as it is less reactive than aluminium.
..... [2]

(b) State and explain if the process of extracting aluminium is a redox reaction.

Extraction of aluminium is a redox reaction as aluminium is reduced from +3 in Al_2O_3 *to* 0 in *Al* and oxygen is oxidized from -2 in in Al_2O_3 *to* 0 in *Al.*
Oxidation and reduction occurs simultaneously hence the process is a redox reaction.

.....

..... [2]

(c) Suggest why aluminium is widely recycled in many countries rather than being extracted.

Extraction of aluminium requires large amounts of energy which can be expensive, recylcying reduces the cost of production. [1]

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A5 Table 5.1 shows some information about the atoms of elements **E**, **F**, **G** and **H.**

Table 5.1

element	proton	neutron	electron	mass
E	6	6	6	12
F	19	20	19	39
G	6	8	6	14
H	18	22	18	40

(a) Complete Table 5.1. [3]

(b) State which element(s) is/are

(i) noble gas(es),

H [1]

(ii) isotopes.

E and G [1]

A6 When stoves are operated in an enclosed area, carbon monoxide may be produced which can harm human health.

(a) Explain how carbon monoxide is produced when stoves are operated in an enclosed area.

Incomplete combustion of fuels due to lack of oxygen. [1]

(b) Describe the effects of carbon monoxide on human beings.

Carbon monoxide binds irreversibly to haemoglobin, reducing ability of blood to carry oxygen throughout body.
Causes fatigue, headache and death.

…… [2]

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A7 When yeast is added to hydrogen peroxide, it decomposes into water and oxygen as shown by the chemical equation below.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Fig. 7.1 shows the graph of the volume of oxygen gas collected against time when 50 cm^3 of hydrogen peroxide with concentration of 0.50 mol / dm^3 is allowed to decompose in the presence of yeast.

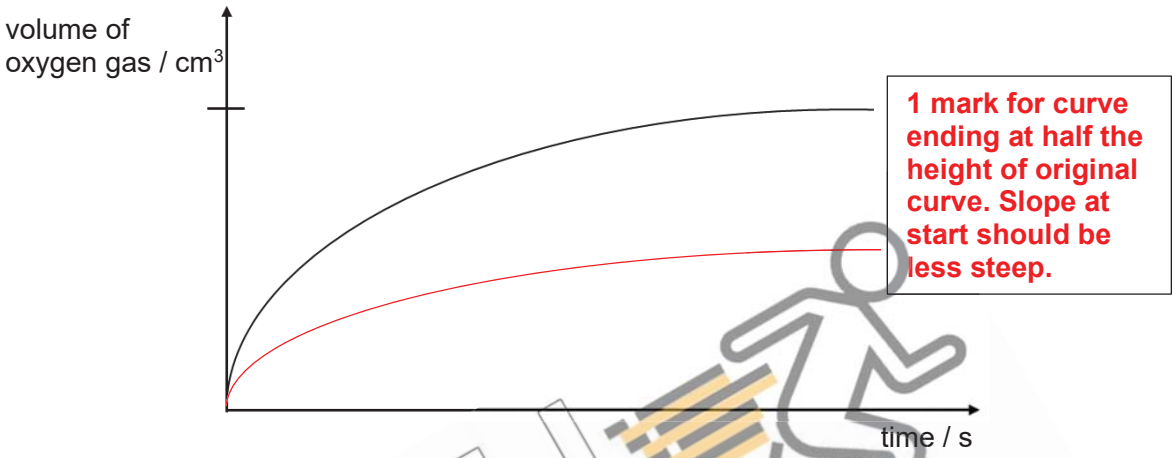


Fig. 7.1

(a) Explain why the volume of oxygen stops rising after some time.

All the hydrogen peroxide is used up/decomposed.

..... [1]

(b) **(i)** On Fig. 7.1, sketch a curve of what would happen if the concentration of hydrogen peroxide was decreased to 0.25 mol / dm^3. [1]

(ii) Using your knowledge of collision theory, explain your answer in **(b)(i)**.

Number of particles decreased in the same volume.

Lower rate of effective collisions, hence lower rate of reaction.

.....

..... [2]

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A8 Potassium hydroxide solution was slowly added to 40 cm^3 of nitric acid with a concentration of 1.00 mol / dm^3 and the temperature of the solution was measured and plotted on Fig. 8.1.

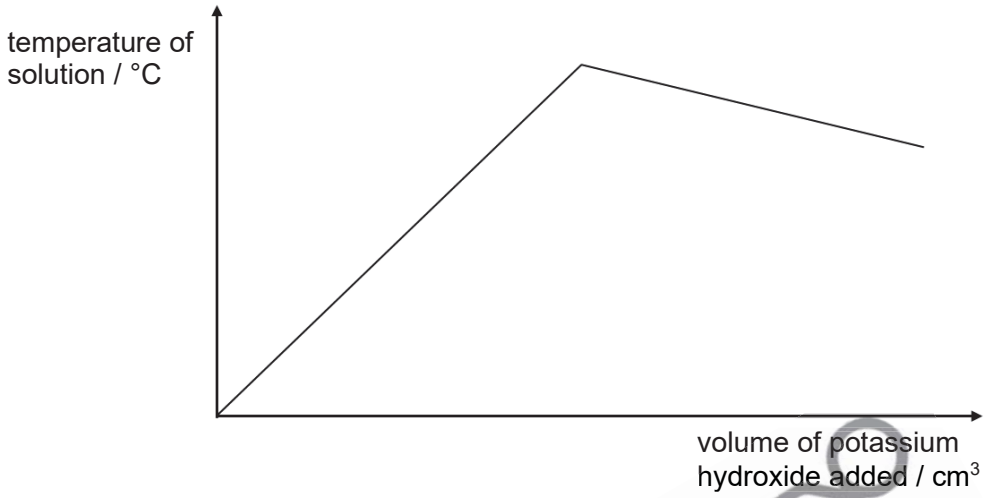


Fig. 8.1

The reaction between potassium hydroxide and nitric acid can be represented by the equation below.

$$KOH + HNO_3 \rightarrow KNO_3 + H_2O$$

(a) Name the type of reaction between potassium hydroxide and nitric acid.

Neutralisation [1]

(b) State if the reaction is exothermic or endothermic. Explain your answer using Fig. 8.1.

Exothermic. Temperature of solution increased when potassium hydroxide was added to nitric acid.

..... [2]

(c) Given that 30 cm^3 of potassium hydroxide was required to react with 40 cm^3 of nitric acid, find the concentration of the potassium hydroxide solution.

No. of moles of HNO_3 = 1.00 x 0.04 = 0.04 mol [1]
HNO_3 : KOH
1:1
No. of moles of KOH = 0.04 mol [1]
Concentration of KOH = 0.04 / 0.03
= 1.33 mol/dm^3 [1] (must be in 3s.f. NOT fraction)

[3]

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A9 **(a)** Fig. 9.1 shows part of the structure of an addition polymer.

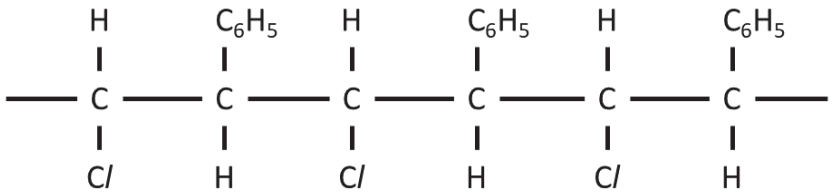
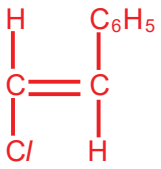


Fig. 9.1

(a) Draw the structural formula of the monomer that makes up the polymer in Fig. 9.1.



[1]

(b) Poly(ethene) is an example of an addition polymer that is widely used.

(i) State the condition(s) required for poly(ethene) to be formed from its monomer.

High temperature and pressure, presence of catalyst. [1]

(ii) State **one** common use of poly(ethene).

Plastic bags (accept reasonable answers) [1]

(c) Disposal of polymers by burying them in landfills causes land pollution to occur.

Explain why polymers cause land pollution when buried.

Polymers are usually non-biodegradable. [1]

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A10 Fig. 10.1 below describes some properties and reactions of several substances.

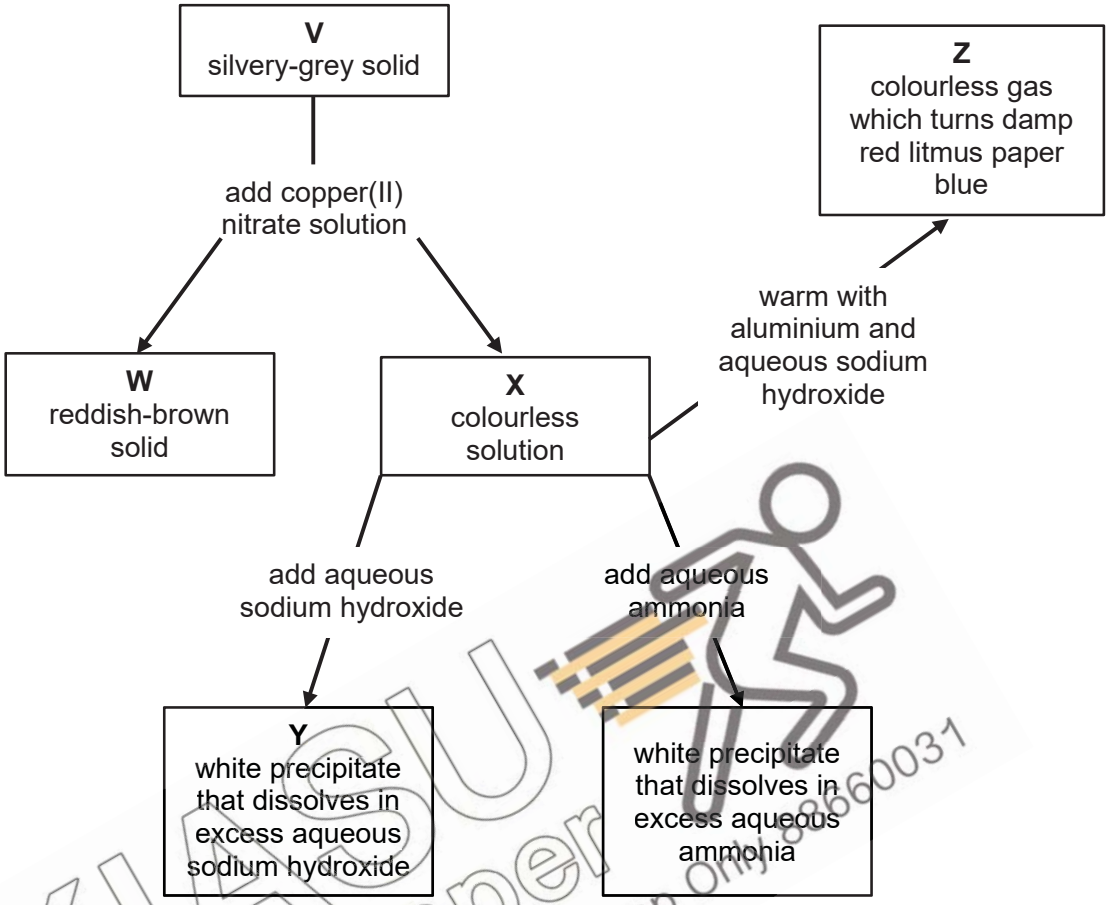


Fig. 10.1

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(a) Name **V**, **W**, **X**, **Y** and **Z**.

V zinc

W copper

X zinc nitrate

Y zinc hydroxide

Z ammonia [5]

(b) Write a balanced chemical equation for any **one** of the reactions in Fig. 10.1.

$Zn + Cu(NO_3)_2 \rightarrow Zn(NO_3)_2 + Cu$ [2]

$Zn(NO_3)_2 + 2NaOH \rightarrow Zn(OH)_2 + 2NaNO_3$

~End of Section A~

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Section B [20 marks]

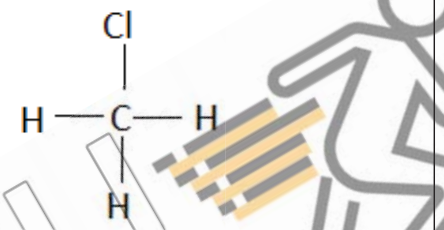
Answer any **two** questions.

B11 (a) Alkanes can react with halogens to produce other organic compounds.

(i) State the condition(s) required for halogens to react with alkanes.

Presence of UV light. [1]

(ii) When methane is reacted with chlorine, hydrogen chloride is produced.
Name another product of the reaction and show its structural formula.

name: chloromethane
structural formula: 

[2]

(iii) Write a balanced chemical equation, to describe the reaction of methane with oxygen.

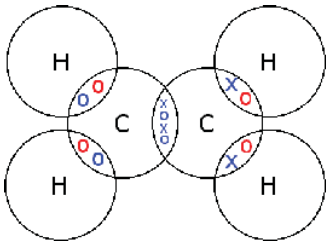
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ [2]

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(b) Another hydrocarbon, ethene, has the chemical formula C_2H_4.

(i) Draw the 'dot-and-cross' diagram of ethene.



[2]

(ii) Explain, using your knowledge of chemical bonding, why ethene is a gas at room temperature and pressure.

Ethene exists as a simple covalent molecule which is held together by weak intermolecular forces of attraction.
Little energy is required to overcome it. Hence, it has low melting and boiling point, therefore it is a gas at room temperature.

……

…… [2]

(iii) Explain why ethene is classified as an unsaturated hydrocarbon.

Ethene contains carbon-carbon double bond. [1]

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B12 **(a)** Describe in terms of the arrangement and movement of particles, the process of ice melting.

Particles in ice are held together closely in an orderly manner and they vibrate and rotate about a fixed position. [1]
As they absorb energy from the surroundings, the particles begin vibrating faster and start moving apart. [1]
When it reaches the melting point, energy absorbed is sufficient to overcome the intermolecular forces of attraction holding the particles together and the particles break apart from their fixed positions. [1]
The particles can now move around freely by sliding across each other. [1]
……

……

…… [4]

(b) Water can be formed by the reaction between hydrogen and oxygen. The reaction can be described by the equation below.

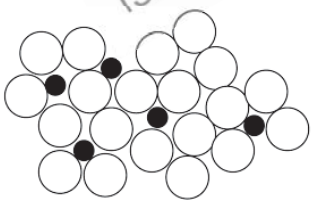
$$2H_2 + O_2 \rightarrow 2H_2O$$

Find the mass of oxygen required to react with 32.0 cm^3 of hydrogen.

No. of moles of H_2 = 32.0 / 24 000 = 0.00133 mol [1]
H_2 : O_2
2 : 1
0.00133 : 0.000666
No. of moles of O_2 = 0.000666 mol [1]
Mass of O_2 = 0.000666 x 32 = 0.0213 g [1]

mass of oxygen required: …… g [3]

(c) With the aid of a diagram, explain why alloys are harder and stronger than pure metals.



[1] for diagram

Different sized atoms disrupt the orderly arrangement of metals. [1]
This makes it difficult for the layers atoms to slide across each other when a force is applied. [1]
Therefore, alloys are stronger and harder than pure metals.
……

…… [3]

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B13 **(a)** Describe how you can prepare a pure dry sample of copper(II) chloride. You may use the following information to help you.

- copper(II) chloride is soluble in water
- copper metal does **not** react with dilute acids

To 50 cm^3 of hydrochloric acid, add excess copper(II) oxide/copper(II) carbonate and stir. [1]
Continue adding copper(II) oxide/copper(II) carbonate while stirring until no more dissolves. [1]
Filter the mixture to obtain copper(II) chloride as the filtrate. [1]
Heat the filtrate until it is saturated.
Let the filtrate cool and crystallise. [1]
Filter the mixture to obtain the crystals and wash with cold distilled water.
Dry the crystals between sheets of filter paper. [1]

.....

.....

.....

.....

[5]

(b) Ethanol can be used as a fuel for vehicle and other machines.

(i) Name the process by which ethanol is made from glucose.

Fermentation [1]

(ii) State the chemical equation of the reaction named in **(b)(i)**.

$C_6H_{12}O_6$ (aq) → $2C_2H_5OH$ (aq) + $2CO_2$ (g) [1]

(iii) State the condition(s) required for the reaction in **(b)(i)** to occur.

Temperature maintained at 37 °C [1]
Absence of air/oxygen [1]
Presence of yeast [2]

.....

(iv) Write a balanced chemical equation for the combustion of ethanol.

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ [1]

~ End of Paper ~

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Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
						1 H hydrogen 1											2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key: proton (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											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 –		

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.)

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