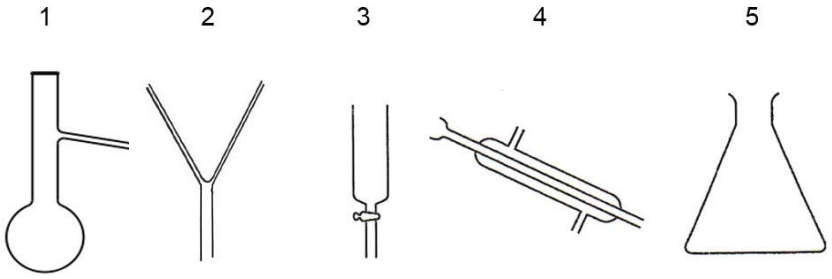
21 The diagram shows some laboratory apparatus.



Which apparatus are needed to produce and collect pure water from seawater?

A 2 and 5 **B** 3 and 5

C 1, 2 and 4 **D** 1, 4 and 5

22 Which substance, **A** to **D** undergoes changes in physical states from room temperature to 0°C?

	Melting point/°C	**Boiling point / °C**
A	-2	65
B	-23	4
C	50	250
D	-187	-165

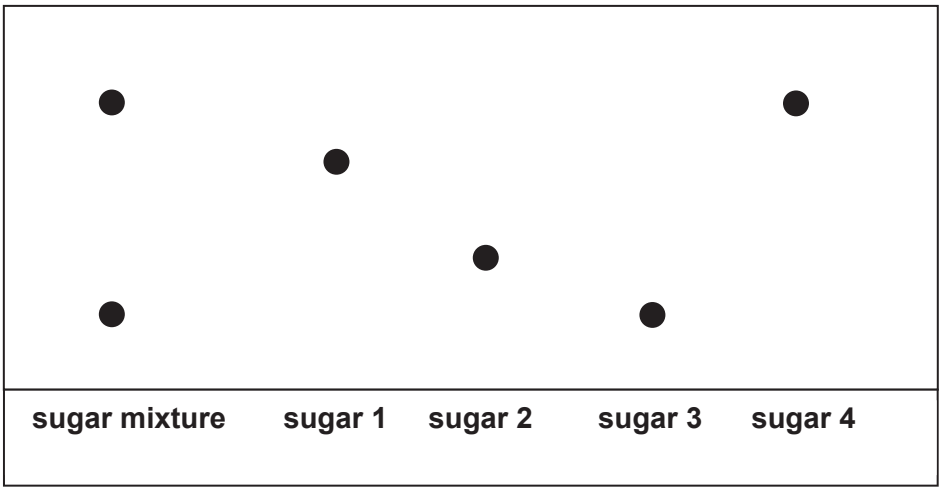
23 Which statements are true about compounds?

1 They can be made from another compound.
2 They can be made from metals alone.
3 They can be made from non-metals alone.
4 They can be made from a metal and a non-metal.

A 1, 2 and 3 **B** 1, 2 and 4

C 1, 3 and 4 **D** 2, 3 and 4

24 A sugar mixture was compared with four different simple sugars using chromatography. The results are shown in diagram below. What types of sugars does the mixture contain?



A sugar 1 and 2 **B** sugar 1 and 4

C sugar 2 and 3 **D** sugar 3 and 4

25 Which compound contains three atoms?

A H_2O **B** HC*l*

C $CaSO_4$ **D** NO

26 Which of the following compounds has the highest percentage of nitrogen by mass?

A NH_4NO_3 **B** $(NH_4)_2CO_3$

C $CO(NH_2)_2$ **D** NH_4Cl

27 A student dissolved 14.9g of potassium chloride, KCl, in 100 cm^3 of water. What is the concentration of the resulting potassium chloride solution in mol/dm^3?

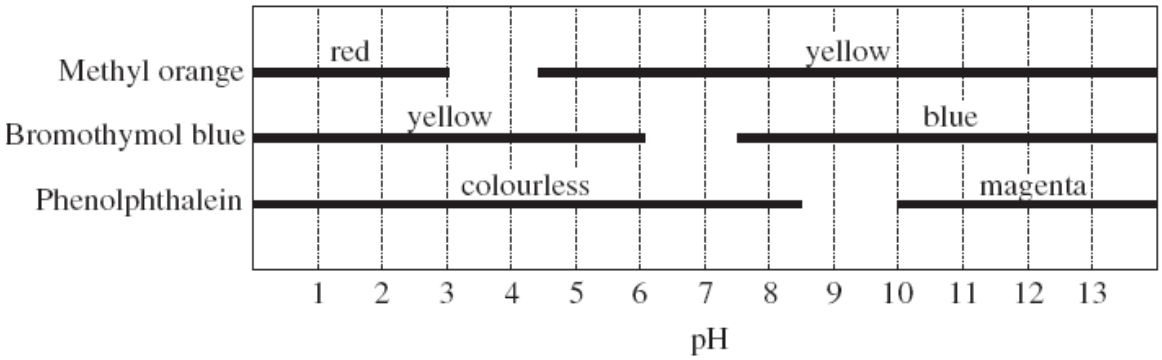
A 0.002 mol/dm^3

B 0.01 mol/dm^3

C 0.15 mol/dm^3

D 2.0 mol/dm^3

28 The graph below shows the colour ranges of the acid-base indicators methyl orange, bromothymol and phenolphthalein.



A solution, when placed in the three indicators separately, is yellow in methyl orange, yellow in bromothymol and colourless in phenolphthalein. What is the pH range of the solution?

A 2.5 to 3.5 **B** 4.5 to 5.5

C 7.5 to 8.5 **D** 9.5 to 10.5

29 Which of the following elements burns in air to produce a substance which can react with both hydrochloric acid and sodium hydroxide?

A lead **B** hydrogen

C iron **D** phosphorous

30 Which of the following reagents **cannot** be used to differentiate sodium hydroxide solution from sodium chloride solution?

A Aqueous iron(III) nitrate

B Aqueous copper(II) nitrate

C Aqueous lithium nitrate

D Aqueous ammonium nitrate

31 Separate samples of hydrogen peroxide are added to aqueous potassium iodide and to acidified potassium manganate(VII). It is known that hydrogen peroxide is both an oxidising agent and a reducing agent.

What colour changes are seen?

	aqueous potassium iodide	acidified potassium manganate(VII)
A	colourless to brown	purple to colourless
B	brown to colourless	purple to colourless
C	colourless to brown	orange to green
D	brown to colourless	orange to green

32 **X**, **Y** and **Z** are elements in the same period of the Periodic Table.

X forms an acidic oxide, **Y** forms a basic oxide and **Z** forms an amphoteric oxide.

If **X**, **Y** and **Z** are placed in increasing order of atomic number (lowest atomic number first), which order is correct?

A **X**, **Y**, **Z** **B** **Y**, **Z**, **X**

C **Y**, **X**, **Z** **D** **X**, **Z**, **Y**

33 Rubidium is in the same group as sodium in the Periodic Table. What is a likely property of rubidium?

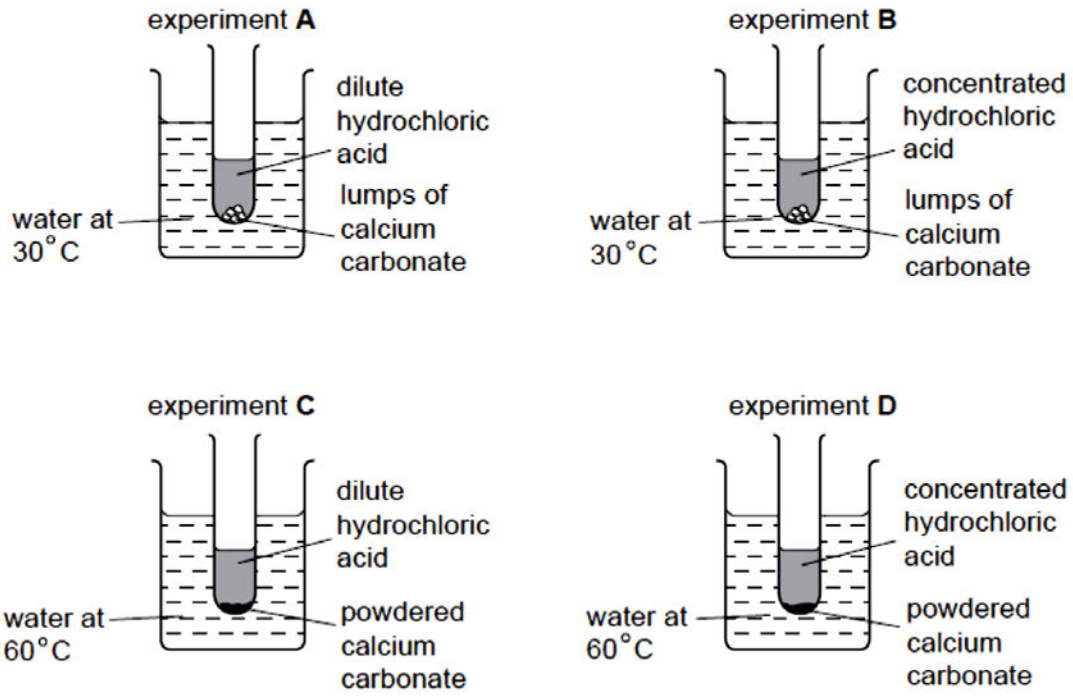
A It reacts with water to form hydrogen gas.

B It cannot be cut by knife.

C It reacts with chlorine gas to form a salt with the formula $RbCl_2$.

D It does not conduct electricity in the molten state.

34 Which of the following experiment will have the fastest speed of reaction?

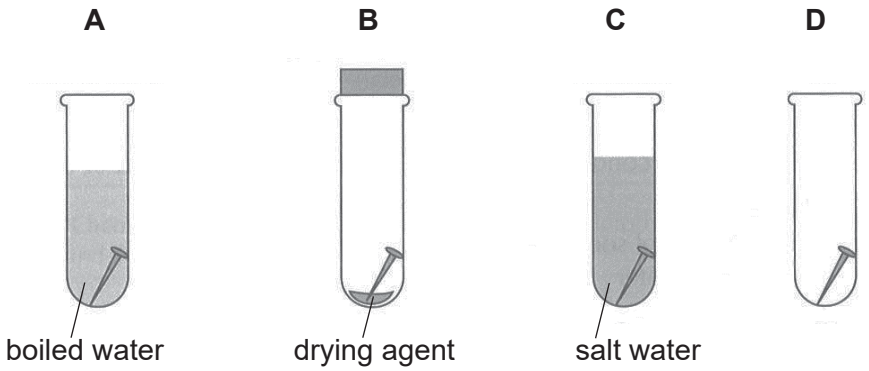


35 The element chromium produces hydrogen from dilute hydrochloric acid but it does not react with cold water. When a piece of chromium is placed in lead(II) nitrate solution, solid of lead appear.

What is the order of **decreasing** reactivity of the metals lead, calcium and chromium?

A	calcium, chromium, lead	**B**	calcium, lead, chromium
C	chromium, calcium, lead	**D**	lead, chromium, calcium

36 In which tube is the iron nail **not** likely to rust?



37 Which of the following shows the correct percentage composition of oxygen, nitrogen and carbon dioxide found in dry unpolluted air?

	Oxygen	Nitrogen	Carbon dioxide
A	78	21	1
B	1	78	21
C	21	78	1
D	78	21	78

38 Which of the following shows the correct use of the different fractions of petroleum?

	Fraction	**Uses**
A	Petrol	used for making chemical feedstock
B	Bitumen	used for lubricating machine parts
C	Kerosene	used as fuel for aircraft
D	naphtha	used to pave road

39 Which of the following hydrocarbon undergoes substitution reaction?

A C_2H_4 **B** C_2H_6

C C_2H_5COOH **D** C_2H_5OH

40 Which of the following is the same for both ethanol and ethanoic acid?

A empirical formula

B functional group

C number of carbon

D homologous series

Data Sheet

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

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.).

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018

4E/5NA

CANDIDATE NAME

CLASS

REGISTER NUMBER

SCIENCE (CHEMISTRY)

Paper 3 Chemistry

5076/03 & 5078/03

31 July 2018

Candidates answer on the Question Paper.
No additional materials are required.

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all work you hand in.
You may use an 2B pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate unites.

Section A (45 marks)
Answer **all** questions.
Write your answers in the space provided on the question paper.

Section B (20 marks)
Answer any **two** questions.
Write your answers in the space provided on the question paper.

A copy of Data Sheet is printed on page 15.
A copy of the Periodic Table is printed on page 16.

At the end of the exam, fasten all your work securely together.
The number of marks in given in brackets [ ] at the end of each question or part question.

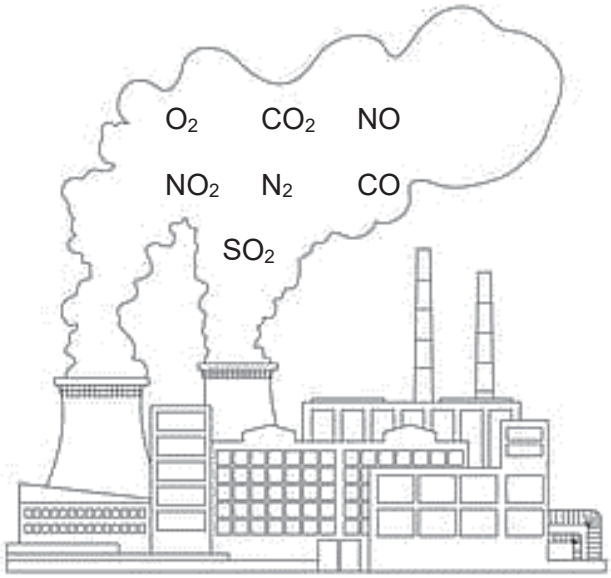
For Examiner's Use	
Section A	
Section B	
Section C	
Total	

Setter: Ms Cynthia Chong

Section A

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

A1 The diagram below shows the formulae of some gases found in polluted air.



Choose formulae from the diagram to answer the following questions **(a)** to **(d)**. Each may be use once, more than once or not at all.

(a) Give the formula of a gas that is produced by incomplete combustion of fuels. State the harmful health effect of this gas.

……...
……... [2]

(b) Give the formulae of two gases that are produced by reactions in catalytic converters.

…… and ……... [1]

(c) Give the formulae of two gases that are involved in both respiration and photosynthesis.

…… and ……... [1]

(d) Give the formulae of two gases that produce acid rain.

…… and ……... [1]

[Total: 5 marks]

A2 Sulfur and sulfur compounds are common in the environment.

(a) A sample of sulfur from a volcano contained two different types of sulfur isotopes: sulfur-32 and sulfur-34.

(i) Complete the table below to show the atomic structure of each isotope of sulfur.

Isotope	Number of		
	Proton	Neutron	Electron
Sulfur-32			
Sulfur-34			

[2]

(ii) The relative atomic mass of sulfur is 32.2. Explain why does the relative atomic mass of sulfur is not a whole number.

……...

……..… [2]

(b) One of the gases produced during volcanic eruptions is hydrogen sulfide. H_2S. Hydrogen sulfide is a poisonous, colourless gas which smells of rotten eggs.

(i) Draw a dot-and-cross diagram to represent the bonding in a hydrogen sulfide molecule. Show outer electrons only.

[2]

(ii) Explain, in terms of bonding and structure, why hydrogen sulfide gas does not conduct electricity.

……

…….. [2]

[Total: 8 marks]

A3 The table below shows some salts and products that contain them.

Salt	product
Silver chloride	Photographic film
Potassium nitrate	fertiliser
Zinc sulfate	Health supplement

(a) **(i)** Which salt in the table can be made by **precipitation**?
Explain your reasoning.

Salt: ……

Reason: …… [2]

(**ii**) Which salt in the table can be made by **titration**? Suggest two reagents needed to make this salt.

Salt: ……

Reagent 1: …… Reagent 2: …… [2]

(b) Other substances are used to make a range of useful products.
Put a tick (√) in one box in each row to show a correct use of each substance.

Substance	Use			
	to make car battery	**to make road surface**	**to reduce acidity in soil**	**to fill filament bulb**
Calcium silicate				
Calcium hydroxide				
Argon				
Sulfuric acid				

[2]

[Total: 6 marks]

A4 In an oil refinery petroleum is separated into useful fractions by fractional distillation.

(a) What is the physical property that allows the various fractions in crude oil to be separated?

…….. [1]

(b) To meet the world's demand for petrol, heavier fraction such as diesel undergoes cracking to produce lighter fractions as shown in the equation below.

$C_{12}H_{26}$ → C_6H_{14} + C_2H_4 product **P**

Give the chemical name and formula of the product **P**.

Chemical name: …….

Chemical formula: ……. [2]

[Total: 3 marks]

A5 The Thermit reaction is used to weld railway rails together.

In Thermit reaction, aluminium powder reacts with iron(III) oxide to make small amounts of molten iron which runs into the gaps between the rails. Solid aluminium oxide is made at the same time.

(a) Complete the equation for the reaction by filling in missing state symbols.

2 Al (……..) + Fe_2O_3 (……..) → 2Fe (……..) + Al_2O_3 (……..) [1]

(b) **(i)** The table shows some information about oxidation state changes during the reaction. Complete the table.

Element	Oxidation state at the start	Oxidation state at the end	Oxidised or reduced?
Oxygen	-2	-2	unchanged
Aluminium			
iron			

[2]

(ii) Hence, or otherwise, explain why Thermit reaction is a redox reaction.

……

…… [1]

(c) Is Thermit reaction an endothermic or exothermic reaction? Explain your answer.

.....

..... [2]

(d) Predict if the melting point of aluminium oxide is high or low. Explain your answer in terms of structure and bonding.

.....

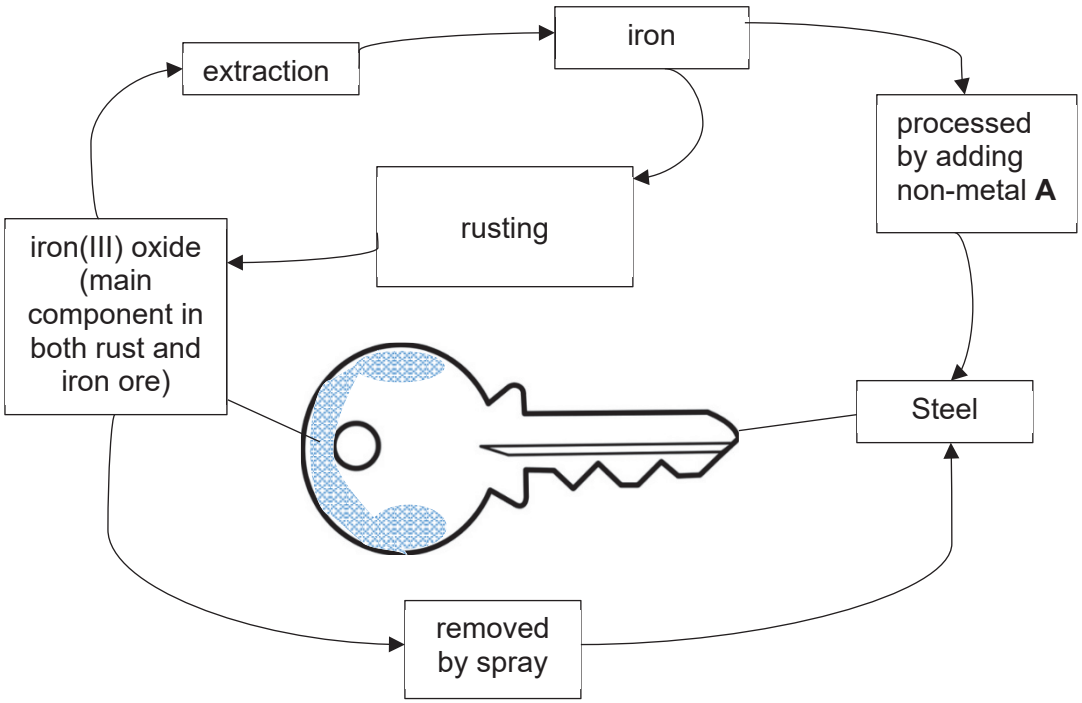
.....

.....

..... [2]

[Total: 8 marks]

A6 Common keys are made from steel. One problem with using steel is that the iron in steel will rust. The diagram shows the cycle of changes that happens when iron in a steel key rust and then extracted.



(a) **(i)** Identify non-metal **A**. ..... [1]

(ii) Explain the importance of adding **A** to iron in making steel key.

.....

.....

…….. [2]

(b) A shop sells a spray-on rust treatment. The spray contains particles of zinc. Explain how zinc prevents rust from forming.

……...

……

……..… [2]

(c) Write a balanced chemical equation for the extraction of iron in the blast furnace.

……..…….. [1]

(d) Though the extraction of iron from blast furnace is a relatively cheap process, steels are still widely recycled.

Explain the importance of recycling of metals such as iron.

……...

……..… [1]

[Total: 7 marks]

A7 **(a)** Propane burns completely in oxygen to form carbon dioxide and water.

The equation for the reaction is

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

(i) Calculate the number of moles in 44 g of propane.

[1]

(ii) Hence, calculate the volume of carbon dioxide that is produced from 44 g of propane at room temperature and pressure.

[2]

(b) **(i)** State why propene can be made into polymer but propane cannot.

……

…… [1]

(ii) Describe a test to distinguish between propene and propane.

……

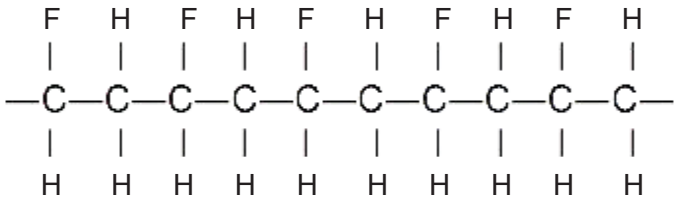
…… [2]

(iii) State one harmful effect of polymer to the environment.

…… ……

…… [1]

(c) The figure below shows the structure formula of part of an addition polymer.



Deduce and draw the structural formula of the **monomer** from which this polymer is made.

[1]

[Total: 8 marks]

Section B

Answer any **two** questions in this section.
Write your answers in the spaces provided.

B8 **(a)** Explain why sulfuric acid can act as an acid and why potassium hydroxide can act as an alkali. Give examples of chemical reaction that sulfuric acid and potassium hydroxide undergo.

……

……

……

……

……

……

……

……

……

……

……

……

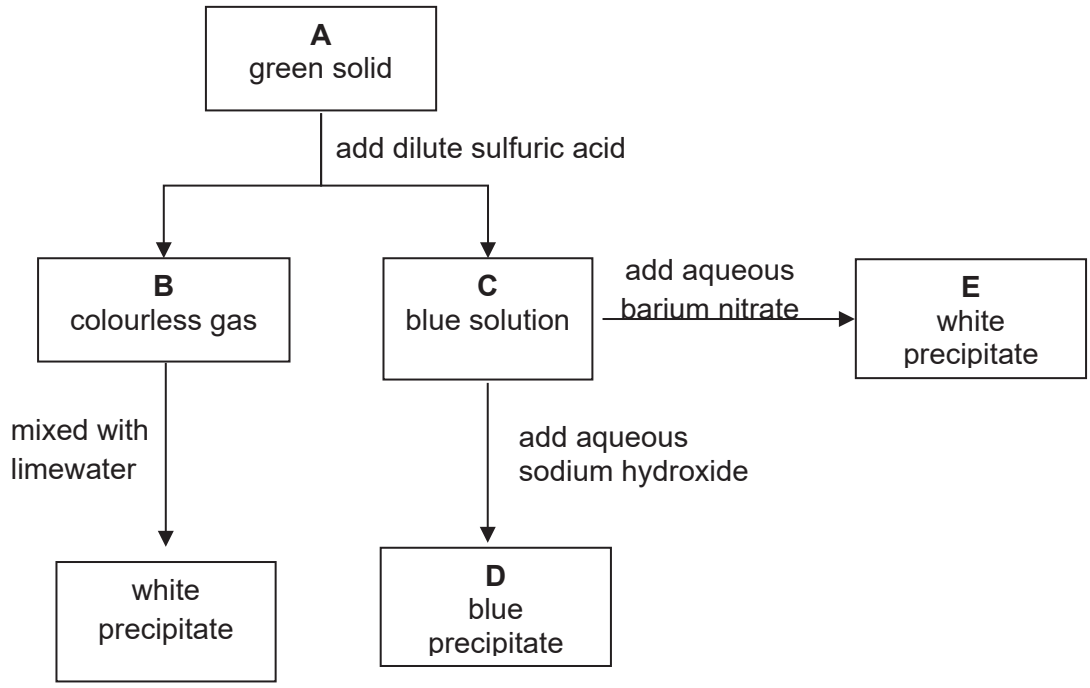
……

…… [4]

(b) Write the ionic equation that describes the reaction of an acid with an alkali

…… [1]

(c) The diagram below shows some of the properties and reactions of the substances **A**, **B**, **C**, **D** and **E**.



Identify these substances.

(i) green solid **A**, ...

(ii) colourless gas **B**, ...

(iii) blue solution **C**, ...

(iv) blue precipitate **D**. ..... [4]

(d) The formation of white precipitate **E** shows the presence of sulfate ions.

Why does this **not** prove that sulfate ions are present in solid **A**?

.....

..... [1]

[Total: 10 marks]

B9 **(a)** The speed of a chemical reaction can be changed by

- increasing the temperature of the reaction,
- decreasing the concentrations of reacting solutions.

(i) State the effect that each of these has on the speed of a reaction.

(ii) Use your knowledge of reacting particles to explain your answer to **(a)(i)**.

……

……

……

……

……

……

……

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……

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……

……

……

……

…… [5]

(b) A student carried out an experiment to investigate how the speed of reaction between magnesium and hydrochloric acid will change with time.

(i) Draw a labelled diagram to show the experiment setup that the student use.

(ii) Describe how the student will carry out the experiment, clearly stating the physical quantity he will measure.

(iii) Describe how the speed of this reaction would change with time.

……

……

……

……

……

……

……

……

……

……

……

…… [5]

[Total: 10 marks]

B10 **(a)** What is the common name given to elements in Group VII?

…… [1]

(b) Give the electronic structures of fluorine and chlorine and use these to explain why they are placed in Group VII.

……

……

…… [2]

(c) Chlorine was discovered by Carl William Scheele in 1774 at Sweden. The origin of the name came from the Greek word "chloros" meaning "pale green".

In 1886, a new element was discovered. Based on its electronic structure, colour and its reaction with zinc chloride, this new element was placed above chlorine in Group VII of the Periodic Table and given the name fluorine.

(i) Predict the colour of fluorine.

…… [1]

(ii) Suggest how the colour of fluorine could help explain its position in the Periodic Table.

…… [1]

(iii) Describe what would be observed when fluorine is bubbled into a solution of potassium bromide. Explain your observation.

……

……

…… [2]

(d) The element with an atomic number of 85 is so unstable that it has never been seen by the naked human eye.

(i) Consider the properties of other elements in the same group as this element, predict **one** physical and **one** chemical property of the element with atomic number 85.

……

……

……

…… [2]

(ii) Give the chemical formula of the compound formed between magnesium and the element with atomic number 85.

…… [1]

[Total: 10 marks]

End of Paper

Data Sheet

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

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.).

2018 Bedok South Secondary School Secondary 4
Science(Chemistry) PRELIM Marking Scheme

Paper 1: 30 Marks

21	22	23	24	25	26	27	28	29	30
D	**B**	**C**	**D**	**A**	**C**	**D**	**B**	**A**	**C**
31	32	33	34	35	36	37	38	39	40
A	**B**	**A**	**D**	**A**	**B**	**C**	**C**	**B**	**C**

Answer

A1 **(a)** CO — 1
Prevents blood from absorbing oxygen which causes headaches, giddiness or may lead to death. — 1

(b) N_2 and CO_2 (both must be correct) — 1

(c) CO_2 and O_2 (both must be correct) — 1

(d) NO_2 and SO_2 (both must be correct) — 1

[Total: 5 marks]

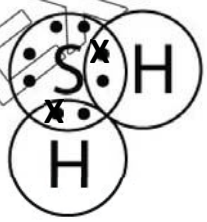
A2 **(ai)**

Isotope	Number of		
	Proton	Neutron	Electron
Sulfur-32	16	32 - 16 = 16	16
Sulfur-34	16	34 – 16 = 18	16

1
1

(aii) Each sulfur isotope has different **relative abundance/ percentage/ amount**. — 1
When the **average** of the masses of the 2 sulfur isotope is taken, there is decimal. (any phrase to the effect) — 1

(bi)

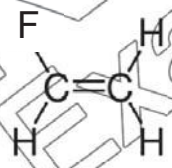


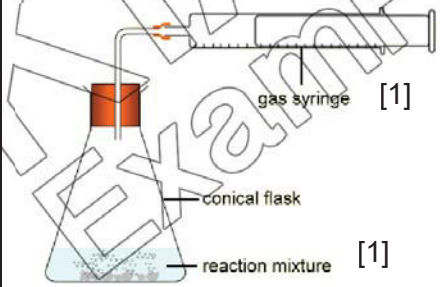
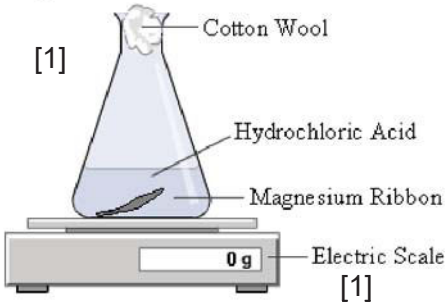
Correct valence electron for sulfur and hydrogen — 1
Correct number of shared electrons (2 single bond) — 1

(bii) [structure] hydrogen sulfide is a **simple covalent molecule/compound** — 1
[charge carrier] there are **no free moving electrons/charge carrier** to conduct electricity. [bonding] — 1

[Total: 8 marks]

<table>
<tr><td>A3 (salt pre)</td><td>(ai)</td><td>Salt: Silver chloride
Reason: It is an <u>insoluble</u> salt.</td><td>1
1</td></tr>
<tr><td></td><td>(aii)</td><td>Salt: Potassium nitrate (SPA – titration (neutralisation))
Reagent 1: <u>potassium hydroxide</u> Reagent 2: <u>nitric acid</u> (both correct)</td><td>1
1</td></tr>
<tr><td></td><td>(b)</td><td>
<table>
<tr><th rowspan="2">Substance</th><th colspan="4">Use</th></tr>
<tr><th>to make car battery</th><th>to make road surface</th><th>to reduce acidity in soil</th><th>to fill filament bulb</th></tr>
<tr><td>Calcium silicate (SLAG)</td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>Calcium hydroxide(slaked lime)</td><td></td><td></td><td>√</td><td></td></tr>
<tr><td>Argon</td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Sulfuric acid</td><td>√</td><td></td><td></td><td></td></tr>
</table>
All correct – 2 marks 3/2 correct – 1 mark 1 correct – 0 marks</td><td>2</td></tr>
<tr><td></td><td></td><td>[Total: 6 marks]</td><td></td></tr>
<tr><td>A4</td><td>(a)</td><td>Difference in boiling point</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>Name: <u>Butene</u>
formula: <u>C_4H_8</u></td><td>1
1</td></tr>
<tr><td></td><td></td><td>[Total: 3 marks]</td><td></td></tr>
<tr><td>A5</td><td>(a)</td><td>$2\ Al\ (\underline{s}) + Fe_2O_3\ (\underline{s}) \rightarrow 2Fe\ (\underline{l}) + Al_2O_3\ (\underline{s})$ (all must be correct)</td><td>1</td></tr>
<tr><td></td><td>(bi)</td><td>
<table>
<tr><td>Element</td><td>Oxidation state at the start</td><td>Oxidation state at the end</td><td>Oxidised or reduced?</td></tr>
<tr><td>Oxygen</td><td>-2</td><td>-2</td><td>unchanged</td></tr>
<tr><td>Aluminium</td><td>0</td><td>+3</td><td>Oxidised</td></tr>
<tr><td>iron</td><td>+3</td><td>0</td><td>reduced</td></tr>
</table>
</td><td>1
1</td></tr>
<tr><td></td><td>(bii)</td><td>Aluminium is oxidised while iron is reduced, since oxidation and reduction occur <u>simultaneously</u>, Thermit reaction is a redox reaction.</td><td>1</td></tr>
<tr><td></td><td>(c)</td><td>Exothermic reaction. (heat given out , hot)
Temperature must be high for iron to be in liquid state. (any phrasing to the effect)</td><td>1
1</td></tr>
<tr><td></td><td>(d)</td><td>[P1] Aluminium oxide has a <u>high</u> melting point
[P2] Aluminium oxide is an <u>ionic</u> compound/ has <u>giant lattice</u> structure,
[P3] <u>large amount of heat</u> is needed to overcome the <u>strong electrostatic forces of attraction</u> between the oppositely-charged ions. (bonding)</td><td>3 pt – 2 M
2 pt – 1M</td></tr>
<tr><td></td><td></td><td>[Total: 8 marks]</td><td></td></tr>
<tr><td>A6</td><td>(ai)</td><td>carbon</td><td>1</td></tr>
</table>

	(aii)	[P1] Carbon will **disrupt the orderly** arrangement of iron, (ALLOY) [P2] making it more **difficult** for the iron atoms to slide past each other, [P3] thus **increasing the strength** of iron. (any phrasing to the effect)	3 pt – 2 M 2 pt – 1M
	(b)	[P1] zinc is **more reactive** than iron / zinc has higher tendency to lose its electrons, [P2] zinc will preferentially **corrode in place of iron**.	1 1
	(c)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	1
	(d)	The earth's mineral ores are limited and are non-renewable. Recycling helps to conserve the limited resources in our earth and make them last longer. With a decrease of mining for ores, land will be free for other uses eg, agriculture. Recycling means saves the environment from pollution as unsightly scrap metals is removed from the environment. [any one, reject any answer about saving cost]	1
		[Total: 7 marks]	
A7	**(ai)**	Number of moles of propane: 44/44 = 1 mole	1
	(aii)	Number of moles of CO_2: 3 moles Volume of CO_2: 3 x 24 = 72 dm^3 (must include correct units, no ecf)	1 1
	(bi)	Propene is **unsaturated/ contains C=C double bond**, thus it is able to undergo **addition reaction**. OR Propane is saturated, contains all single covalent bond, thus unable to undergo addition reaction. (any phrasing with similar meaning)	1
	(bii)	[test] Add (aqueous) bromine solution to propane and propene. [result] reddish brown colour of bromine will become colourless in propene but remains unchanged in propane.	1 1
	(biii)	Polymer is non-biodegradable and thus will [effect] remain in the environment for a long time, thus causing land pollution/ constantly in need to find land to bury them. Polymer, when burnt, will release toxic gases to the environment thus, causing air pollution. [any one]	1
	(c)	 **monomer (alkene)**	1
		[Total: 8 marks]	
B8	**(a)**	[P1] An acid is a substance which produces **hydrogen ions** when it is dissolved in **water**. [P2] Example: Sulfuric acid reacts with reactive metal to produce salt and hydrogen gas/ sulfuric acid reacts with carbonates to produce salt,	1 Any

		water and carbon dioxide gas. Sulfuric acid react with base/alkali to produce salt and water. [P3] An alkali is a substance which <u>produces **hydroxide** ions when it is dissolved in **water**</u>. [P4] Example: sodium hydroxide reacts with ammonium salt to form salt, water and ammonia gas. (full credit if formulae/ chemical equation given)	one 1 1 1
	(b)	H^+ (aq) + OH^- (aq) → H_2O (l)	1
	(c)	Green solid **A**: **<u>copper(II) carbonate</u>** colourless gas **B**: **<u>carbon dioxide</u>** blue solution **C**: **<u>Copper(II) sulfate</u>** blue precipitate **D**: **<u>copper(II) hydroxide</u>**	1 1 1 1
	(d)	Sulfuric acid was added to the green solid, thus the sulfate ion might have come from sulfuric acid instead.	1
		[Total: 10 marks]	
B9	**(a)**	[Etemp] when temperature is increases, speed of chemical reaction **<u>increases</u>**. [Econc] when concentration decreases, speed of chemical reaction **<u>decreases</u>**. [Rtemp] when temperature increases, particles gains kinetic energy and **<u>move faster.</u>** Frequency of effective collision will increases. [Rconc] when concentration decreases, **<u>number of particles per unit volume decrease</u>**. Frequency of effective collision will decreases. [collision theory – 1 mark]	1 1 1 1 1
	(b)	Measurement of volume of hydrogen gas  [1] [1] Student will record the **<u>volume of hydrogen gas</u>** [1] produced **<u>at regular interval</u>**. [1] Measurement of decrease in mass  [1] [1] Student will record the decrease in **<u>mass of reaction mixture</u>** [1] at **<u>regular interval</u>** [1]. Speed of reaction will decrease with time.	Apparatus 1M Set up 1M 2 1

		[Total: 10 marks]	
B10	**(a)**	halogen	1
	(b)	[electronic configuration] E.C of Fluorine: 2.7, E.C of chlorine is 2.8.7 (state both to get 1 mark) Since they both have **7 valence electron**, thus they are placed in group VII.	1 1
	(ci)	Yellow	1
	(cii)	It is **lighter** in colour than chlorine, thus Fluorine is placed **above chlorine** in group VII.	1
	(ciii)	[observation] colourless solution turns reddish brown. [explanation] fluorine is **more reactive** than bromine, thus it will **displace** bromine from potassium bromide and **produce bromine**.	1 1
	(di)	[physical] cannot conduct electricity/ black colour/ solid at room temperature [any one] (do NOT write "high/low" melting point) [chemical] gain 1 electron to form anion/ least reactive in group VII/ reacts wth metal to form ionic compound/ reacts with non-metal to form covalent compounds. [any one]	1 1
	(dii)	$MgAt_2$	1
		[Total: 10 marks]	