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NAME:		INDEX NO:		CLASS:	
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**NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary Four Normal Academic**

SCIENCE CHEMISTRY

5105/5107

Paper 3

14 August 2018

Additional Materials: OTAS

Paper 3 and 4: 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the work you hand in.

There are **twenty** 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 OTAS Sheet.

Answers to Paper 3 and Paper 4 must be handed in separately.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

You are advised to spend no more than **30 minutes** on **Paper 3**.

You may proceed to answer Paper 4 as soon as you have completed Paper 3.

Any rough working should be done in this booklet.

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

The use of an approved scientific calculator is expected, where appropriate.

Setter: Miss Haw Yubin

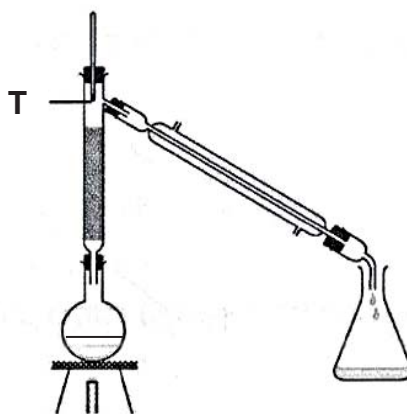
Vetter: Mdm Kumari

- 1 A solid is thought to be pure benzoic acid.

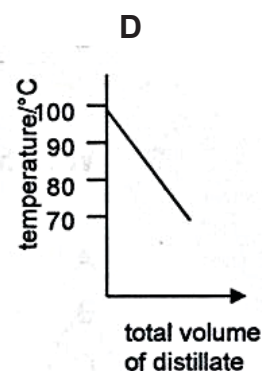
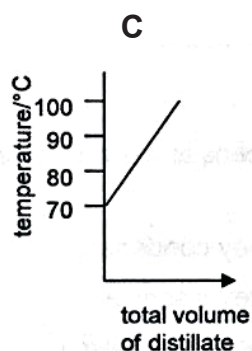
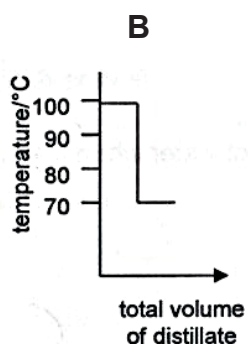
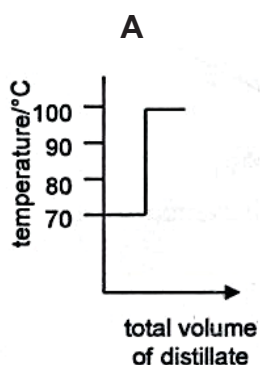
Which of the following is the best way to test its purity?

- A Determine its density and compare it with the actual value.
- B Determine its melting point.
- C Measure its pH.
- D Weigh it, burn it in oxygen, and then weigh the products.

- 2 The diagram shows the apparatus used to separate hexane (boiling point 70°C) and heptane (boiling point 98°C).



Which graph would be obtained if the temperature at point T was plotted against the total volume of distillate collected?



- 3 The table gives data about four substances.

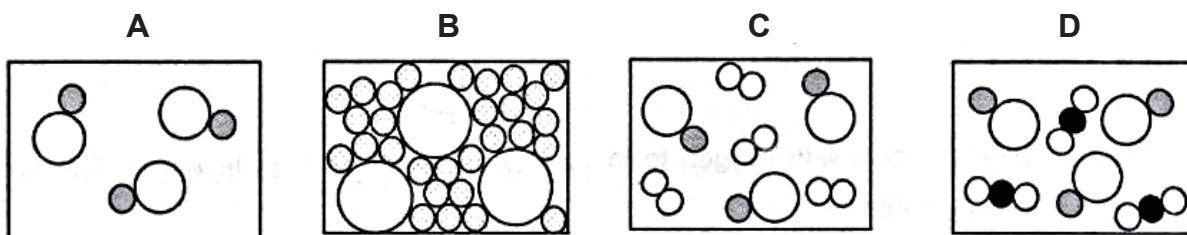
In which substance are the particles arranged randomly at room temperature?

	melting point/°C	boiling point/°C
A	-120	-10
B	10	40
C	650	1500
D	1800	2400

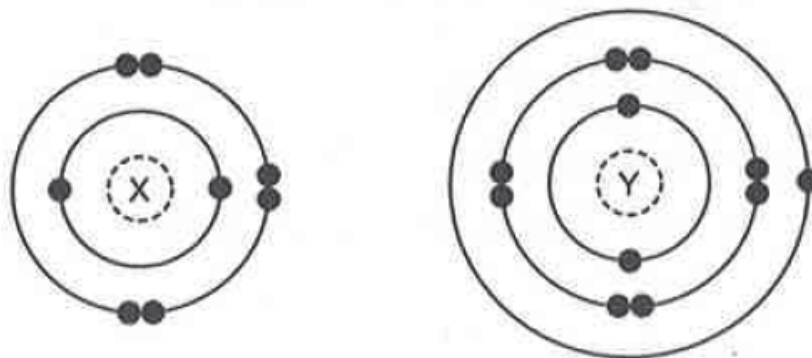
- 4 Which properties of a neutron are correct?

	relative charge	relative mass
A	-1	$\frac{1}{1836}$
B	0	$\frac{1}{1836}$
C	0	1
D	+1	1

- 5 Which diagram represents a mixture of an element and a compound?



- 6 The electronic structures of two atoms **X** and **Y** are shown.

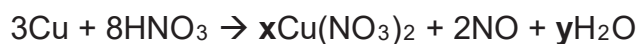


X and **Y** combine together to form a compound.

Which row describes the type of bonding and the formula of the compound?

	type of bonding	formula
A	covalent	YX_2
B	covalent	Y_2X
C	ionic	YX_2
D	ionic	Y_2X

- 7 Copper and nitric acid react together to form copper (II) nitrate, nitrogen monoxide and water as shown below.



What values for **x** and **y** balance the equation?

	x	y
A	3	4
B	3	8
C	4	3
D	4	8

8 Two statements about isotopes are given.

1 Isotopes of the same element have the same number of protons.

2 Isotopes of the same element have the same nucleon number.

Which of the following is true?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is not correct.

D Statement 2 is correct but statement 1 is not correct.

9 The oxide of an element **P** was added separately to sulfuric acid and aqueous sodium hydroxide.

The word equations for the reactions are shown.

P oxide + sulfuric acid → **P** sulfate + water

P oxide + sodium hydroxide → no reaction

Which row describes **P** and its oxide?

	P	P oxide
A	metal	acidic
B	metal	basic
C	non-metal	acidic
D	non-metal	amphoteric

- 10** A student tests four different solutions with Universal Indicator.

solution	W	X	Y	Z
colour with Universal Indicator	blue	violet	green	red

What are the pH values of the four solutions?

	W	X	Y	Z
A	2	7	4	1
B	4	8	9	5
C	9	13	7	2
D	12	14	5	8

- 11** Flowers of a hydrangea bush are blue when grown in acidic soil and pink when the soil is alkaline.

Which substance should be added to the soil of a hydrangea with blue flowers so that it produces pink flowers?

- A** calcium hydroxide
 - B** calcium sulfate
 - C** hydrochloric acid
 - D** sodium chloride
- 12** Element **X** is a solid at room temperature.
It needs to lose one electron per atom to gain the electronic structure of a noble gas.
It has the least reactivity with water in its group.

What is **X**?

- A** astatine
- B** caesium
- C** fluorine
- D** lithium

13 Four elements have the following electronic configurations.

P 2.8.1

Q 2.8.2

R 2.8.6

S 2.8.8

Which statement is correct?

A All four elements are in the same group in the Periodic Table.

B All four elements are in the same period in the Periodic Table.

C **P** is a metal, but **Q**, **R** and **S** are non-metals.

D **Q** is a metal, but **P**, **R** and **S** are non-metals.

14 What is a property of all metals?

A They are soluble in water.

B They conduct electricity.

C They have high melting points.

D They react with dilute sulfuric acid.

15 Part of the Periodic Table is shown.

A blank periodic table grid is shown. The grid consists of 18 columns and 7 rows. The elements are marked as follows:

- W** is located in the second row, second column.
- X** is located in the second row, fifteenth column.
- Y** is located in the third row, fifteenth column.
- Z** is located in the first row, eighteenth column.

There is an additional empty box located above the center of the grid, between the second and third columns.

Which two elements can react with iron (II) chloride separately to undergo a displacement reaction?

A **W** and **X**

B **W** and **Y**

C **X** and **Y**

D Z and X

- 16** The table gives the relative concentrations of polluting gases in the air in four different cities.

In which city are limestone buildings most threatened by air pollution?

	sulfur dioxide	nitrogen dioxide	methane
A	16	45	23
B	32	33	30
C	38	40	10
D	46	14	25

- 17** Kerosene, lubricating oil and naphtha are three fractions obtained when crude oil is distilled.

Which of the following is the correct order for their boiling points?

	lowest		highest
A	kerosene	lubricating oil	naphtha
B	kerosene	naphtha	lubricating oil
C	lubricating oil	kerosene	naphtha
D	naphtha	kerosene	lubricating oil

- 18** Two gases, **X** and **Y**, have the following properties.

- **X** dissolves in aqueous sodium hydroxide but **Y** is insoluble.
- **Y** burns in excess oxygen to give **X** and water only.
- **Y** does **not** decolourise aqueous bromine.

What are gases **X** and **Y**?

	X	Y
A	carbon dioxide	ethane
B	carbon dioxide	ethene
C	carbon monoxide	ethane
D	carbon monoxide	ethene

- 19** A student investigated the reaction of vegetable oils with hydrogen. 100 cm³ of hydrogen was bubbled through 1 g samples of four different vegetable oils containing a suitable catalyst.

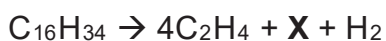
The volume of hydrogen remaining after each experiment was recorded.

vegetable oil	volume of hydrogen remaining/cm ³
P	100
Q	85
R	61
S	0

Which vegetable oil(s) is/are unsaturated?

- A** P, Q and R
- B** Q and R only
- C** Q, R and S
- D** S only
- 20** A hydrocarbon, C₁₆H₃₄, is broken down during the process of cracking to produce ethene, another hydrocarbon **X** and hydrogen.

The equation for the reaction is shown.



Which row describes hydrocarbon **X**?

	formula of X	X belongs to the homologous series
A	C ₈ H ₂₈	alkane
B	C ₈ H ₁₆	alkene
C	C ₁₄ H ₂₈	alkene
D	C ₁₄ H ₃₀	alkane

Learners who Share, Citizens who Care, Leaders who Dare

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

NAME:

INDEX NO:

CLASS:



NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary Four Normal Academic

SCIENCE CHEMISTRY

5105/5107

Paper 4

14 August 2018

Candidates answer on the Question Paper.
 No Additional Materials are required.

Paper 3 and 4: 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions in Section A and any **two** questions in Section B.

The use of an approved scientific calculator is expected, where appropriate.

In calculations, you should show all the steps in your working, giving your answer at each stage.

You are advised to spend no longer than 30 minutes on Paper 3.

You may proceed to answer Paper 4 as soon as you have completed Paper 3.

A copy of the Periodic Table is printed on page 11.

At the end of the examination hand in your answers to Paper 3 and Paper 4 separately.

The number of marks is given in brackets [] at the end of each question or part question.

SECTION		FOR EXAMINER'S USE
A		14
B		8
		8
TOTAL		30

Setter: Miss Haw Yubin

Vetter: Mdm Kumari

Section A

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

- 1** The table lists the number of protons, neutrons and electrons in several different particles.

particle (not chemical symbols)	number of protons	number of neutrons	number of electrons
C	1	0	1
D	3	3	2
E	7	7	7
F	8	9	8
G	8	10	8
H	9	10	10

Which of the particles, **C**, **D**, **E**, **F**, **G** and **H** in the table, fit each of the following descriptions?

- (a) an atom with a mass number of 19 [1]
- (b) an atom with 5 electrons in its outer shell [1]
- (c) an ion of a metal [1]

2 Sodium atom can form Na^+ ions.

- (a) Describe, in terms of electrons, how a sodium atom becomes a sodium ion, Na^+ .

.....
..... [1]

- (b) Name the type of chemical bonding present in sodium oxide.

..... [1]

- (c) Draw a 'dot and cross' diagram to show the arrangement of all the electrons in a molecule of sodium oxide.

[2]

- 3 (a) Each element in Group VII consists of molecules which are diatomic.

Explain the meaning of *diatomic*.

.....
..... [1]

- (b) All the elements in Group VII of the Periodic Table react with hydrogen.

Fluorine reacts in the dark, explosively, at very low temperatures. Chlorine reacts in the presence of sunlight, explosively, at room temperature. Bromine reacts in the presence of sunlight if heated to about 200°C.

Suggest **two** conditions needed for iodine to react with hydrogen.

1.
2. [2]

- (c) Describe an observation that could be made when aqueous bromine is added to potassium iodide solution.

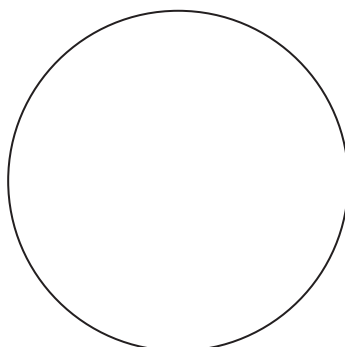
.....
..... [1]

- 4 (a) State why coating iron with grease prevents iron from rusting.

.....
..... [1]

- (b) Using the circle below, sketch a pie chart to show the percentage of each gas in the air.

Label each section with the name of the gas.

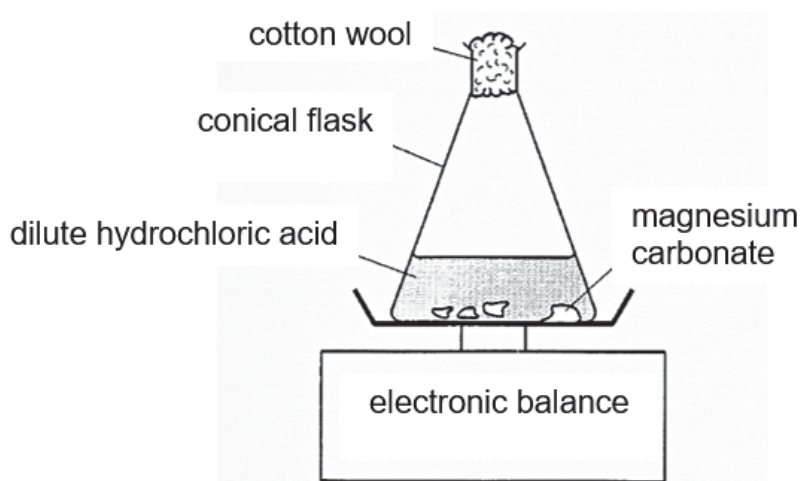


[2]

Section B

Answer any **two** questions from this section in the spaces provided.

- 5 Emily investigated the reaction of magnesium carbonate, MgCO_3 , with dilute hydrochloric acid, HCl .



- (a) (i) At the end of the experiment, a gas is given off.
Name the gas and describe a positive test to identify the gas.

name of gas

positive test for gas

..... [1]

- (ii) A solution of a salt, magnesium chloride, is left at the end of the experiment.

Describe how you can obtain crystals of magnesium chloride from this solution.

.....

.....

.....

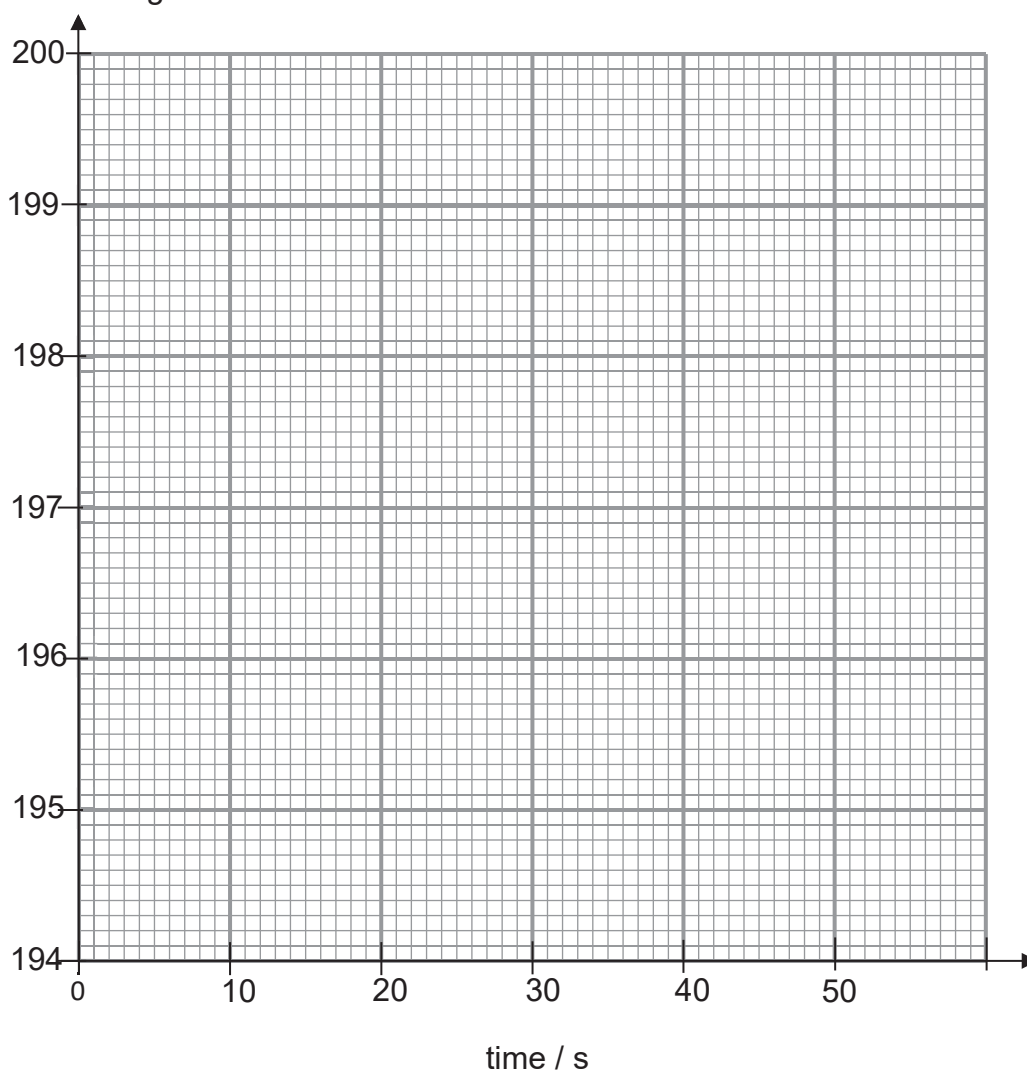
..... [2]

- (b) Emily measured the decrease in mass of the reaction mixture with time and recorded the readings obtained in the table.

time / s	0	10	20	30	40	50
mass of reaction mixture / g	200	198.5	196.5	196.2	196	196

- (i) Plot a graph of mass of the reaction mixture against the time taken, marking each point with a cross (x). [1]
- (ii) Draw a curved line of best fit, taking into account all your plotted points. [1]

Mass of reaction mixture / g



- (iii) Use your graph to determine the time in which the reaction stopped.

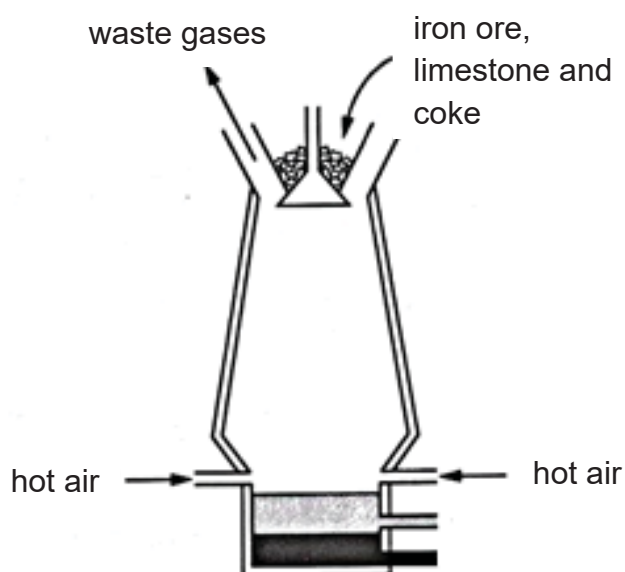
..... s [1]

- (c) At the start of the experiment there is 37.8 g of magnesium carbonate.

Calculate the amount of magnesium carbonate, in moles.
[relative atomic masses, Ar: Mg, 24; C, 12; O, 16]

amount of magnesium carbonate = mol [2]

- 6 (a) The diagram shows a blast furnace.



- (i) Suggest two gases likely to be present in the waste gases emitted from the blast furnace.

..... and [1]

- (ii) Why is limestone used in the extraction of iron?

.....
 [1]

- (b) Cupronickel is an alloy of copper and nickel.

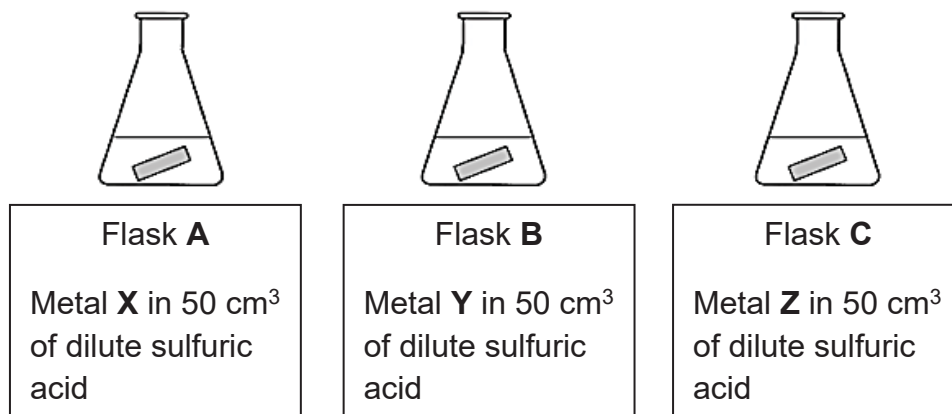
Explain why cupronickel is harder and stronger than pure copper.

.....

 [2]

- (c) Three conical flasks labelled **A**, **B** and **C** were each filled with 50 cm³ of dilute sulfuric acid.

5.0 g of metals **X**, **Y** and **Z** were placed in the respective flasks as shown.



After 5 minutes, the metals were removed from the flasks. The metals were dried and weighed. The masses of the metals before and after placing in the flasks were recorded in the table below.

	mass of X / g	mass of Y / g	mass of Z / g
before	5.0	5.0	5.0
after	2.4	5.0	3.6

- (i) Place these metals in order of their reactivity.

most reactive $\longrightarrow$ least reactive

--	--	--

[1]

- (ii) Suggest a possible identity for metal **Y**.

..... [1]

- (d) An element in Period 4 of the Periodic Table sinks when added to cold water. The element reacts slowly with water to produce hydrogen gas.

- (i) Identify the element.

..... [1]

- (ii) Write a balanced chemical equation for the reaction between cold water and the element named in (d) (i).

..... [1]

7 (a) Members of a homologous series show a gradation in physical properties with an increase in molecular size.

(i) How does the boiling point of propane differ from the boiling point of ethane?

..... [1]

(ii) Suggest a possible explanation for this difference.

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

(b) Ethene, when added to hydrogen, will produce ethane.

(i) Draw the full structural formula of ethene showing all the atoms and bonds present.

[1]

(ii) State **two** conditions for the addition of hydrogen to ethene to take place.

1.
2. [1]

(iii) Describe a test to distinguish between ethene and ethane.

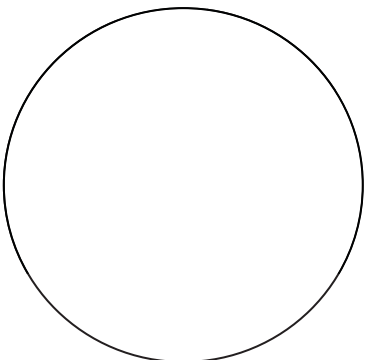
test
.....
observation with ethene
.....
observation with ethane
..... [3]

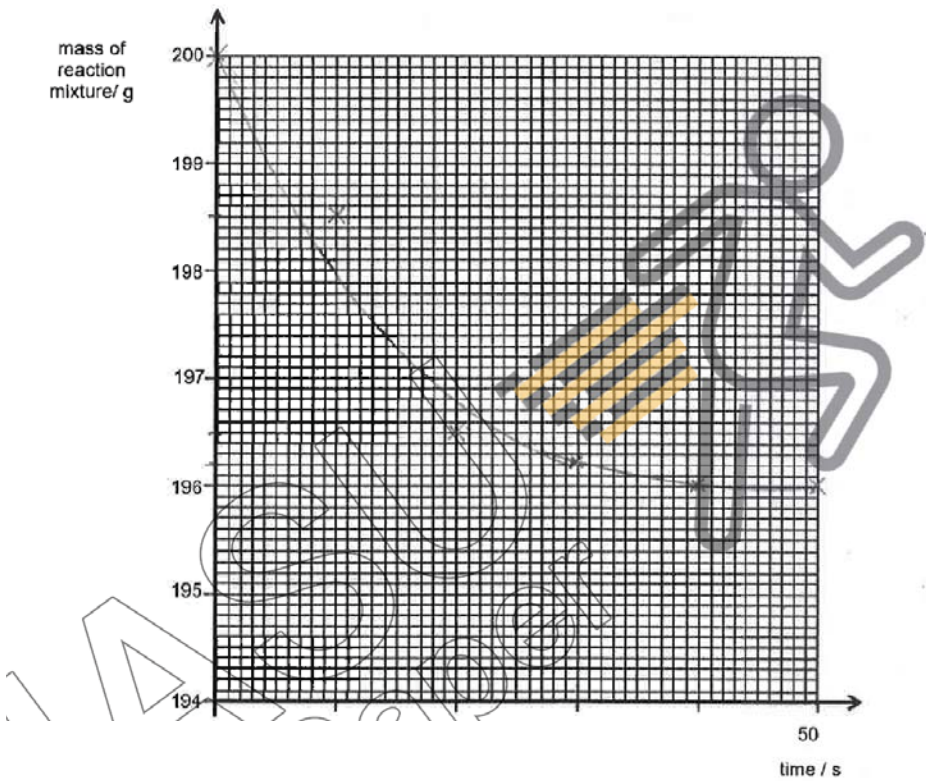
Learners who Share, Citizens who Care, Leaders who Dare

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

2018 Secondary Four Normal Academic Science Chemistry
Preliminary Examination Answer Scheme

1. B	2. A	3. A	4. C	5. C	6. D	7. A	8. C	9. B	10.C
11.A	12. D	13.B	14.B	15.A	16.C	17.D	18.A	19. C	20. B

1	(a)	H	1
	(b)	E	1
	(c)	D	1
2	(a)	A sodium atom loses one electron to become a sodium ion.	1
	(b)	Ionic bonding	1
	(c)		2
3	(a)	Diatomic means two atoms in a molecule	1
	(b)	In the presence of sunlight Heated to about 400°C	1 1
	(c)	The colourless potassium iodide solution turns brown.	1
4	(a)	It acts as a protective layer to prevent oxygen and water from getting into contact with the iron.	1
	(b)		2

5	(a) (i)	carbon dioxide; white precipitate is formed when carbon dioxide gas is present.	1
	(a) (ii)	Heat the solution to 1/3 of its original volume to form a saturated solution. Allow the solution to cool. Filter and wash the crystals with distilled water. Dry the crystals in between 2 sheets of filter paper.	1 1
	(b) (i) (b) (ii)		Plot all points correctly – 1 Shape of the graph – 1
	(b) (iii)	40	1
	(c)	$M_r = 84$ No of moles = $37.8 / 84 = 0.45$ mol	1 1
6	(a) (i)	carbon monoxide, carbon dioxide and nitrogen (any two)	1
	(a) (ii)	Limestone is used to remove impurities.	1
	(b)	Cupronickel is an alloy containing atoms of different sizes. The <u>atoms of different sizes disrupts the orderly arrangement of atoms</u> . As a result, it is <u>difficult for the atoms to slide past</u> each other. But, for pure copper, it is made up of atoms of same size. This <u>ensures the orderly arrangement of atoms</u> and hence, it is <u>easier for the atoms to slide past</u> one another.	1 1

	(c) (i)	$X > Z > Y$	1
	(c) (ii)	Copper, silver, platinum (any one)	1
	(d) (i)	Calcium	1
	(d) (ii)	$\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$	1
7	(a) (i)	The boiling point of propane is higher than the boiling point of ethane.	1
	(a) (ii)	From ethane to propane, the molecular size increases. As the molecular size increases, the <u>intermolecular forces of attraction between the molecules also increases</u> . Hence <u>more energy is needed to overcome the intermolecular forces of attraction between the molecules</u> .	1 1
	(b) (i)		1
	(b) (ii)	1. 200°C 2. Nickel catalyst	1
	(b) (iii)	Test: Add a few drops of aqueous bromine into a sample of ethene / ethane in the test tube.	1
		Observation with ethene: Reddish brown aqueous bromine turns colourless.	1
		Observation with ethane: Reddish brown aqueous bromine remains the same.	1

