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Name and Index Number: ()	Class:
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SENG KANG SECONDARY SCHOOL PRELIMINARY EXAMINATION

SCIENCE (CHEMISTRY)

5105/03

Secondary 4 Normal (Academic)

3 August 2018

Paper 3 Multiple Choice

Paper 3 & 4

1 hour 15 min

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **twenty** questions in 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 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 question paper.
The use of an approved scientific calculator is expected, where appropriate.

A copy of the Periodic Table is printed on page 8.

Parent's / Guardian's Signature:

This document consists of **8** printed pages and **0** blank page.

Do not turn over the page until you are told to do so.

[Turn over

1 Which apparatus would be most suitable to measure out 25.50 cm³ of solution?

- A beaker
- B burette
- C measuring cylinder
- D pipette

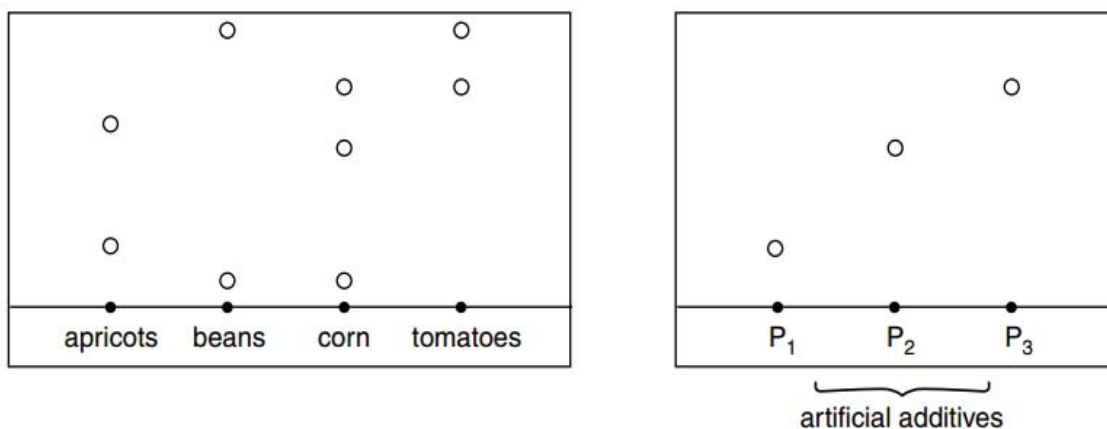
2 Which of the following statements correctly describes the states of substances I to IV at room temperature?

substance	melting point/°C	boiling point/°C
I	-30	69
II	-101	-35
III	-11	12
IV	98	890

- A Substance I is a gas.
- B Substance II is a solid.
- C Substance III is a gas.
- D Substance IV is a liquid.

3 Four samples of canned food, apricots, beans, corns and tomatoes, were tested for additives using chromatography. The chromatograms were compared with three artificial additives, P₁, P₂ and P₃.

The results were as follow.



Which canned food does **not** contain any artificial additives?

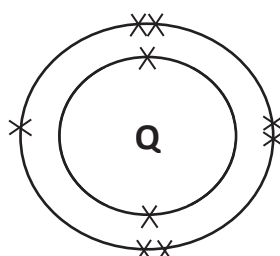
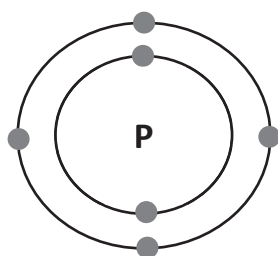
- A apricots
- B beans
- C corn
- D tomatoes

- 4 An atom of element X has 5 neutrons and 4 protons.

Which of the particle is an isotope of element X?

particle	nucleon number	proton number
A	10	4
B	11	5
C	9	5
D	9	4

- 5 The electronic structures of atoms P and Q are shown.



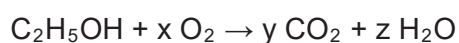
key

● = electron from P
X = electron from Q

P and Q react to form a covalent compound. What is its formula?

- A** PQ₂ **B** PQ₄ **C** P₂Q **D** P₂Q₅
- 6 How does molten sodium chloride conduct electricity?
- A** The movement of positive ions only.
B The flow of mobile electrons.
C The movement of sodium chloride molecules.
D The movement of both negative and positive ions.

- 7 The equation shows the reaction that occurs when ethanol burns in air.



What values of x, y and z would balance the equation?

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

12 An element Z is in Group VI of the Periodic Table. It reacts with oxygen to form an oxide.

- 1 The oxide formed dissolves in water to form an acid.
- 2 The oxide formed has a high boiling point.
- 3 The oxide formed reacts with hydrochloric acid.
- 4 The oxide formed reacts with sodium hydroxide.

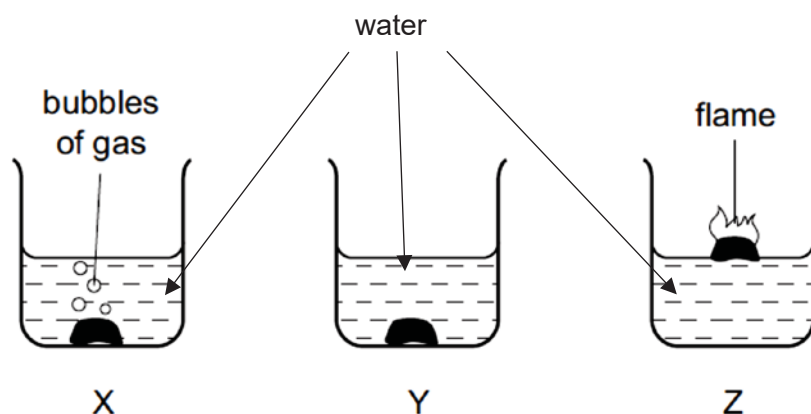
Which statement(s) is/are likely to be true of the oxide?

- A 1 and 2 only
 B 1 and 4 only
 C 2 only
 D 2 and 3 only

13 Which pair of substances could **not** be used in the preparation of copper(II) sulfate?

- A copper and dilute sulfuric acid
 B copper(II) oxide and sulfuric acid
 C copper(II) carbonate and sulfuric acid
 D copper(II) hydroxide and sulfuric acid

14 The results of adding samples of different metals to water are shown.



What could metals X, Y and Z be?

	X	Y	Z
A	calcium	copper	potassium
B	copper	calcium	potassium
C	potassium	calcium	copper
D	potassium	copper	calcium

- 15 Cars made of steel can be protected from rusting by painting.

How does paint prevent rusting?

- A Paint reacts with the steel to form a stable compound.
- B Paint reacts with the air to form a protective layer.
- C Paint forms a barrier preventing the steel from reacting with oxygen and water.
- D Oxygen reacts with the paint instead of with the steel.

- 16 Lithium and caesium are the first and fifth element in Group I of the Periodic Table.

Which of these statements is correct?

- A They have the same number of electrons.
- B Lithium has fewer electrons in the valence shell than caesium.
- C Lithium has a higher melting point than caesium.
- D Lithium reacts more vigorously with water than caesium.

- 17 The table shows the composition of exhaust gases from an internal combustion engine.

gas	% of the gas in the exhaust fumes
gas Y	71
carbon dioxide	14
water vapour	13
carbon monoxide	1
hydrocarbons	0.3
nitrogen oxides	0.2
sulfur dioxide	less than 0.003

What is gas Y most likely to be?

- A ammonia
 - B argon
 - C chlorine
 - D nitrogen
- 18 How do the properties of alkanes change as their molecular masses increase?
- A Their boiling points decrease.
 - B Their flammability decreases.
 - C They become more soluble in water.
 - D They evaporate more easily.

- 19 Some food are described as polyunsaturated.

What does polyunsaturated mean?

- A The molecules in the food are edible.
- B The molecules in the food contain many hydrogen atoms.
- C The molecules in the food contain many double bonds.
- D The molecules in the food contain many single bonds.

- 20 Hydrocarbons obtained by fractional distillation of petroleum can be cracked to make useful products.

Which substance could **not** be obtained by cracking propane?

- A C_2H_4 B C_3H_6 C C_4H_8 D H_2

END OF PAPER

[Turn over

The Periodic Table of Elements

		Group																																																																															
I	II	III	IV	V	VI	VII	0																																																																										
3 Li lithium 7	4 Be beryllium 9	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 99	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 —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Ts tennessine —	117 Oh oganeson —	118 Og ogesson —

1
H
hydrogen
1

Key
proton (atomic) number
atomic symbol
name
relative atomic mass

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
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 —

lanthanoids

actinoids

Volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

Name and Index Number: ()	Class:
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SENG KANG SECONDARY SCHOOL PRELIMINARY EXAMINATION

SCIENCE (CHEMISTRY)

5105/04

Secondary 4 Normal (Academic)

3 August 2018

Paper 4 Theory

Paper 3 & 4

1 hour 15 min

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

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

You may use a soft pencil for any diagrams, graphs or rough working.

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

Section A

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

Section B

Answer any **two** questions.

Write your answers in the spaces provided.

At the end of the examination, fasten all your work securely together.

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

A copy of the Periodic Table is printed on page 12.

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

For Examiner's use	
Section A	/ 14
1	/ 2
2	/ 3
3	/ 4
4	/ 5
Section B	/ 16
5	/ 8
6	/ 8
7	/ 8
Total	/ 30
Total %	/ 100

Parent's / Guardian's Signature:

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Do not turn over the page until you are told to do so.

[Turn over

Section A

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

- 1 Fig. 1.1 shows the apparatus used to separate a mixture of acetone, ethanol and water.

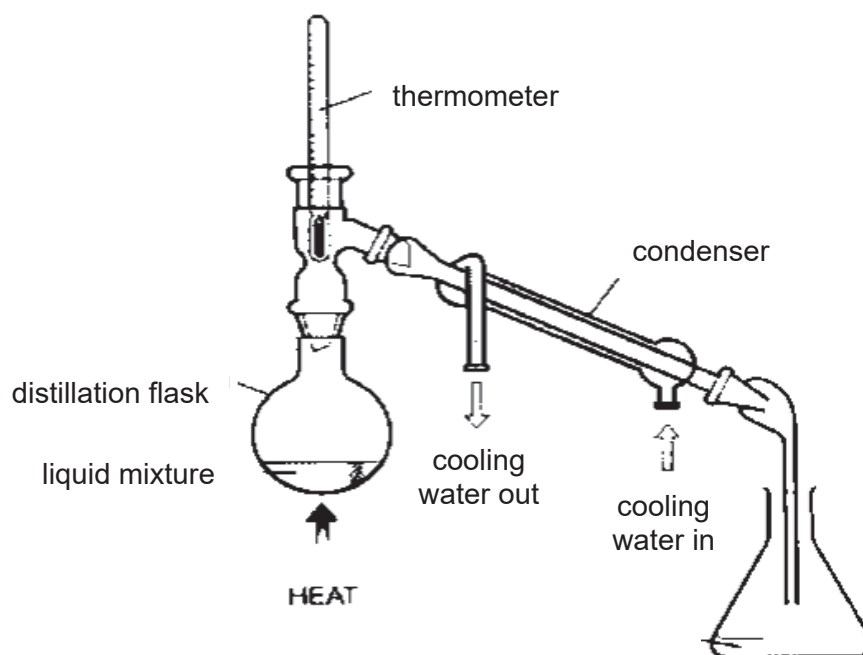


Fig. 1.1

The boiling point of the different liquids is given in Table 1.1.

Table 1.1

liquid	boiling point / °C
acetone	56
ethanol	78
water	100

- (a) State the physical property which makes the separation process possible.

..... [1]

- (b) When the thermometer reading is constant at 56°C, what is the liquid being collected in the conical flask?

..... [1]

- 2 Figure 2.1 shows the composition of air samples collected on island **A** on 7th August 2015 and 8th August 2015.

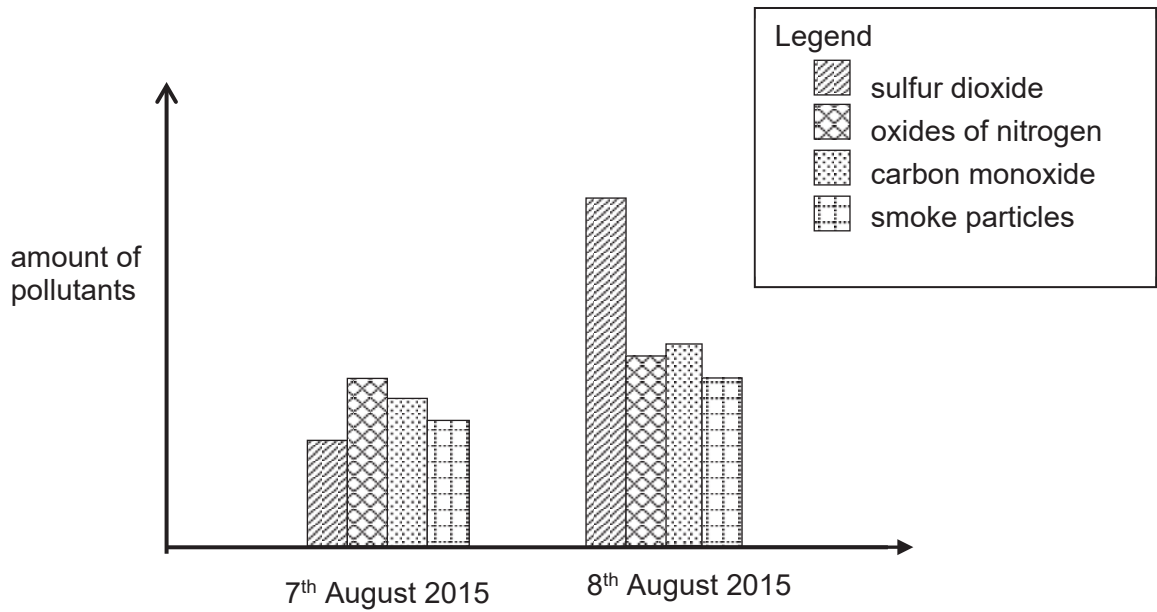


Fig. 2.1

- (a) The residents on island **A** were worried about the possibility of experiencing acid rain. Identify **two** air pollutants from the air samples that cause acid rain.

..... [1]

- (b) Explain **two** harmful effects of acid rain on the environment.

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

3 All the elements in Group VII of the Periodic Table react with sodium.

Fluorine reacts violently with sodium at room temperature.

Chlorine reacts very vigorously when in contact with hot sodium.

Iodine reacts slowly with hot sodium.

(a) Based on the reactions with sodium metal, state the trend in reactivity of the halogen.

..... [1]

(b) Suggest one condition needed for bromine to react with sodium.

..... [1]

(c) Methane gas is bubbled through aqueous bromine under sunlight. The reaction is similar to that of methane with chlorine.

(i) What is the name given to this type of reaction?

..... [1]

(ii) Write the chemical equation for the reaction when one mole of aqueous bromine reacts with one mole of methane gas.

..... [1]

4 When solid iodine crystals are heated, they form dense, purple vapour.

(a) Describe the change in the movement and arrangement of the particles in solid iodine crystals during sublimation.

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

(b) Iodine is in the same Group as fluorine and chlorine. Each element consists of molecules which are **diatomic**.

(i) Explain the meaning of **diatomic**.

..... [1]

(ii) Showing only the valence electrons, draw a diagram to show the arrangement of electrons in a molecule of iodine.

[1]

(iii) Explain why the boiling point of iodine is very low.

.....

.....

[1]

Section B

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

- 5 Julian wishes to prepare sodium sulfate solution in the laboratory. He found an old practical note which describes the preparation of sodium sulfate solution as shown in Fig. 5.1. However, some words were left out.

- (a) Complete the following description by writing in the missing words and/or formulae in Fig. 5.1.

<p>A fixed volume of dilute sulfuric acid is placed in a conical flask. The formula for the ion present in all acid is</p> <p>A few drops of a suitable indicator is added to the solution. Slowly, with swirling, dilute sodium hydroxide is added from a burette into the flask until the solution just changes colour. This method of preparing a salt by adding a solution from a burette is called</p> <p>The resulting solution will now have a pH of This type of reaction is called</p>

Fig. 5.1

[2]

- (b) Write a balanced chemical equation for the reaction between dilute sulfuric acid, H_2SO_4 , and sodium hydroxide, NaOH . State symbols are **not** required.

..... [1]

- (c) When excess sodium hydroxide is added to sulfuric acid, the solution changes from acidic to alkaline.

Samples of the solution are taken before and after the addition of excess sodium hydroxide.

Describe a test that could be carried out on each sample, to show that the solution had changed from acidic to alkaline.

test

observation when solution is acidic

observation when solution is alkaline [2]

[Turn over

(d) Fig. 5.2 shows the heating curve of sodium sulfate.

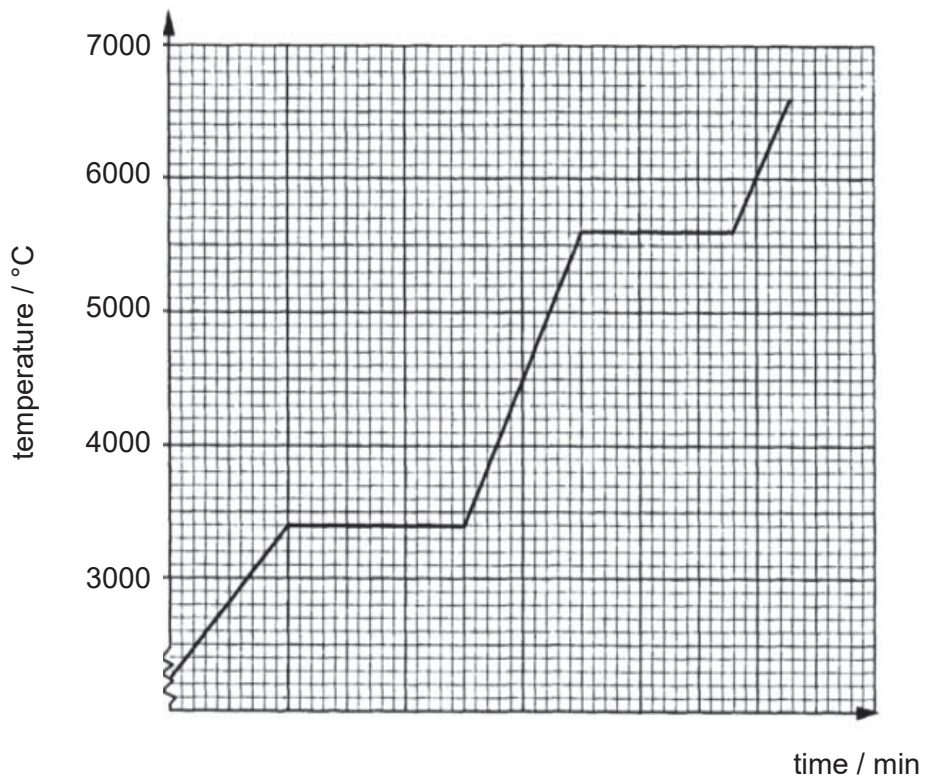


Fig. 5.2

(i) Using Fig. 5.2, determine the melting point of sodium sulfate.

..... [1]

(ii) Explain why the temperature remains constant during the melting of sodium sulfate.

.....

..... [2]

- 6 (a) The boiling points of five hydrocarbons are shown in Table 6.1.

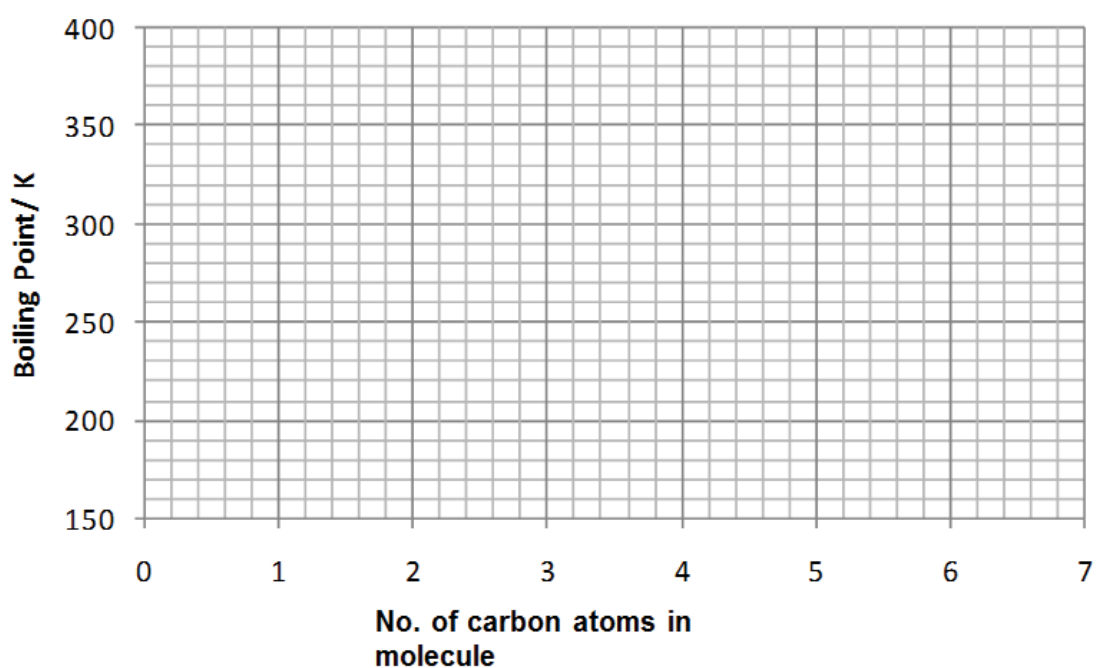
Four of the hydrocarbons are alkanes and the remaining hydrocarbon is an alkene.

Table 6.1

hydrocarbon	A	B	C	D	E
number of carbon atoms per molecule	2	3	4	5	6
boiling point / K	170	235	250	290	330

- (i) Plot a graph of boiling point against number of carbon atoms for these hydrocarbons.

Mark each point with a cross (X). Draw a straight line of best fit.



[2]

- (ii) Using the plotted graph in (a)(i), deduce which hydrocarbon is **not** an alkane?

..... [1]

- (iii) Give the chemical name of the hydrocarbon in (a)(ii).

..... [1]

- (b) Dodecane, $C_{12}H_{26}$ is a large molecule that can be broken down into **X** and ethene in the laboratory using the setup, shown in Fig. 6.1.

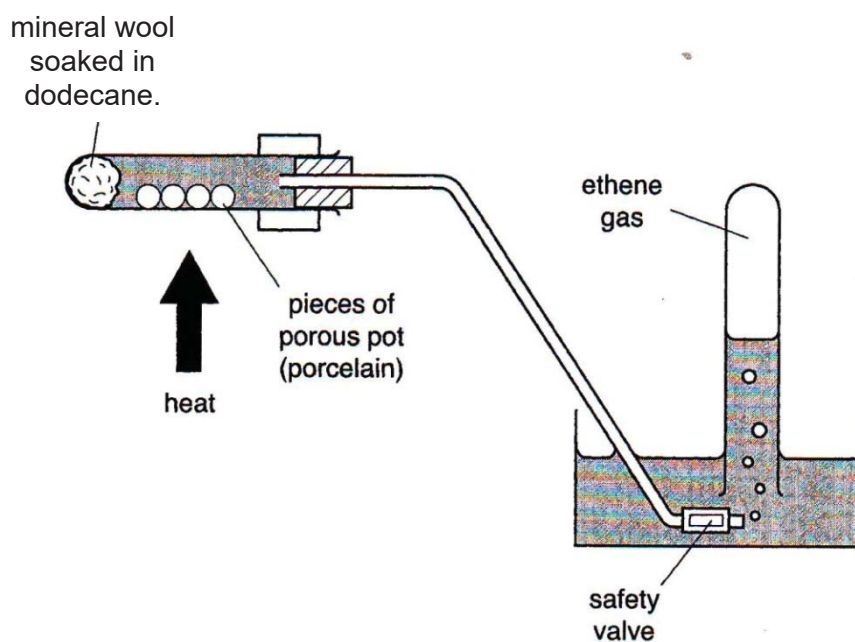


Fig. 6.1

- (i) Give the chemical formula of **X**.

..... [1]

- (ii) Ethene can undergo further reactions, as shown in Fig. 6.2.

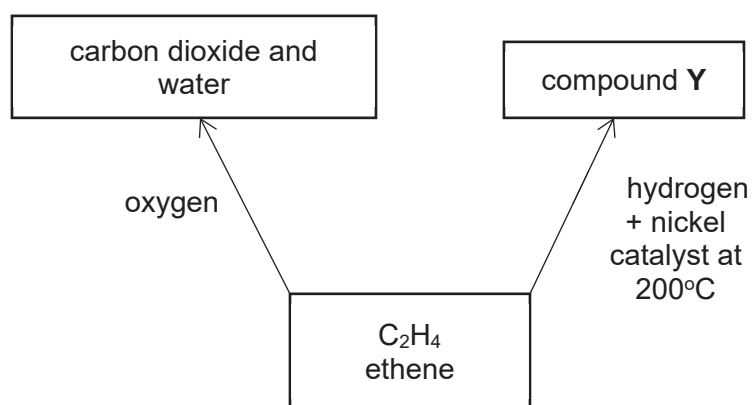


Fig. 6.2

Draw the full structural formula of compound **Y**.

- (iii) Describe one test that could be used to distinguish between a sample of ethane and ethene.

Name the reagent used and state the results obtained.

reagent

result with ethane

result with ethene [2]

- 7 Four different metals of the same surface area were separately added to equal volumes of excess dilute hydrochloric acid.

Fig. 7.1 shows the volume of gas collected in the first 30 seconds in each experiment.

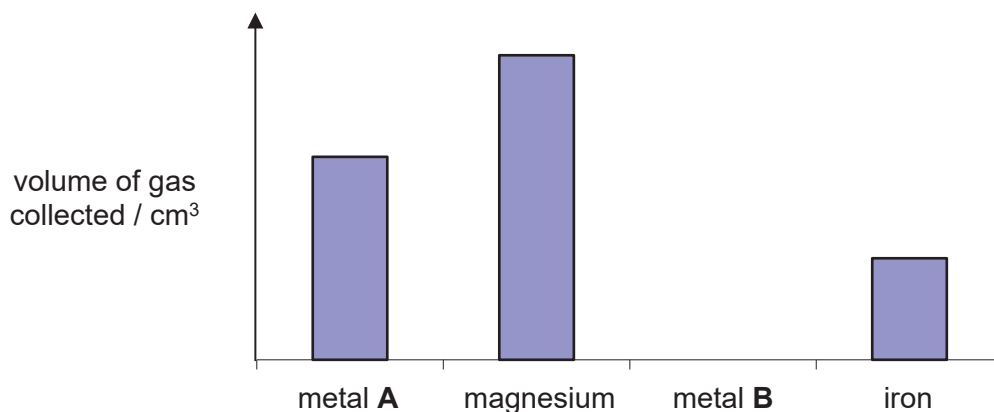


Fig. 7.1

- (a) Name the laboratory apparatus that should be used to measure the volume of gas produced at the end of each reaction.

..... [1]

- (b) Place the metals in order of increasing reactivity.

..... [1]

- (c) Suggest the possible identity of metal A.

..... [1]

- (d) (i) Write a balanced chemical equation, with state symbols, for the reaction between magnesium metal with hydrochloric acid.

..... [2]

- (ii) Given that 28.5g of magnesium chloride crystals were produced, calculate the number of moles of magnesium chloride crystals.

[2]

- (e) Some calcium metal was added into a solution of metal **B** nitrate.

Explain, using the reactivity series of metals, whether any displacement reaction will take place.

.....

..... [1]

The Periodic Table of Elements

		Group																																																																					
I	II	III	IV	V	VI	VII	0																																																																
3 Li lithium 7	4 Be beryllium 9	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px;">1 H hydrogen 1</div> <div style="border: 1px solid black; padding: 5px;"> Key proton (atomic) number atomic symbol name relative atomic mass </div> </div>										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 -

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
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 -

actinoids


Volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

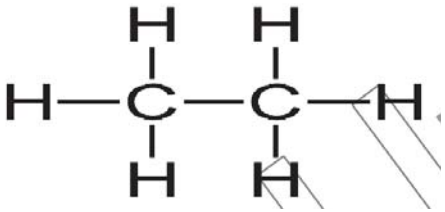
**PRELIM
SECONDARY 4 NORMAL ACADEMIC
SCIENCE CHEMISTRY 5105**

Paper 3

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

Section A and B (Paper 4)

Qn	Answer	Marks
1a	Difference in Boiling points	[1]
1b	acetone	[1]
2a	Sulfur dioxide and oxides of nitrogen	[1]
2b	Acids rain: corrode limestone building Kill marine life Kill plant	[1] [1]
3a	Reactivity decreases down the group.	[1]
3b	Hot sodium needed	[1]
3ci	Substitution reaction	[1]
3cii	$\text{CH}_4 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{HBr}$	[1]
4a	During sublimation, the particles move further apart. <u>From vibrating at fixed position to moving freely in all directions at high speed.</u> (if students only state move further apart, give 1 mark)	[2]
4bi	Made up of only <u>2 atoms</u>	[1]
4bii		[1]
4biii	The weak intermolecular forces between iodine molecules thus <u>small amount of energy</u> is needed to overcome these forces.	[1]
5a	H ⁺ titration seven / 7 neutralisation	2 correct answers – [1] 4 correct answers – [2]
5b	$\text{H}_2\text{SO}_4 + 2 \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$	[1]
5c	test: addition of methyl orange / litmus / universal indicator observation when acidic: red / red / red observation when alkaline: yellow / blue / blue	[1] [1] for both observations
5di	3400 °C	[1]
5dii	<u>Heat energy is absorbed to overcome the attractive forces</u> between the solid particles so that the solid can be change to liquid state. Thus temperature remains constant.	[2]
6ai	All points plotted correctly. Best fit straight line	[1] [1]

6aii	Hydrocarbon B	[1]
6aiii	Propene	[1]
6bi	C ₁₀ H ₂₂	[1]
6bii		[1]
6biii	reagent: bromine solution result with ethane: remain reddish brown result with ethene: bromine decolourised	[1] [1] for both observation
7a	Gas syringe	[1]
7b	metal B, iron, metal A, magnesium	[1]
7c	Zinc / Aluminium	[1]
7di	$\text{Mg (s)} + 2 \text{HCl (aq)} \rightarrow \text{MgCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$ 1m for balanced chemical equation 1m for correct state symbols	[2]
7dii	number of moles = $\frac{28.5}{24 + 35.5 \times 2}$ = 0.3mol [1]	Calculation of Mr: [1] Answer: [1]
7e	Yes, calcium <u>will displace</u> metal B because <u>Calcium is more reactive</u> than metal B [1]	[1]

