

Name: \_\_\_\_\_ ( )

Class: \_\_\_\_\_



**CHIJ KATONG CONVENT**  
**PRELIMINARY EXAMINATIONS 2017**  
**Secondary Four Express and**  
**Secondary Five Normal (Academic)**

**SCIENCE (CHEMISTRY)**

**5078/01**

Paper 1 Multiple Choice

Duration: 1 hour

Classes: 403, 404, 405, 501 and 502

Additional Materials: Optical Answer Sheet

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

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

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

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 Optical Answer Sheet.

**Complete the Chemistry and Biology sections on separate Optical Answer Sheets provided.**

**Read the instructions on the Optical 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.

A copy of the Data Sheet is printed on page 8.

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

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

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This question paper consists of 9 printed pages

[Turn over

- 1 The melting and boiling points of four substances are given.

In which substance are the particles vibrating about their fixed positions at 10 °C?

	melting point / °C	boiling point / °C
A	-110	-50
B	-4	25
C	0	100
D	58	203

- 2 Which row shows an **increasing** order of accuracy in measuring the volume of a solution?

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

- 3 A mobile phone with stainless steel casing contains the neurotoxin mercury and highly carcinogenic gallium arsenide.

Which row correctly classifies the materials found in the phone?

	element	mixture	compound
A	mercury	gallium arsenide	stainless steel
B	mercury	stainless steel	gallium arsenide
C	stainless steel	gallium arsenide	mercury
D	stainless steel	mercury	gallium arsenide

- 4 Particle X has 3 protons, 4 neutrons and 3 electrons.  
 Particle Y has 3 protons, 4 neutrons and 2 electrons.

Which statement best describes particle Y?

- A Particle Y and article X are not atoms of the same element.  
 B Particle Y has a larger relative atomic mass than particle X.  
 C Particle Y is an ion of particle X.  
 D Particle Y is an isotope of particle X.

- 5 Element X has an electronic configuration of 2,8,8,1.  
 Element Y has an electronic configuration of 2,8,6.

Which statement describes the compound formed between element X and Y?

- A The compound has a low melting point.  
 B The compound has formula XY<sub>2</sub>.  
 C The compound is able to conduct electricity in its aqueous state.  
 D The compound is soluble in organic solvent.

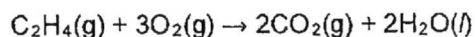
6 Which statement describes what happens when sodium chloride melts?

- A Covalent bonds in a giant lattice are broken.
- B Electrons are released from atoms.
- C Electrostatic forces of attraction between ions are overcome.
- D Molecules are separated into ions.

7 Which has the greatest mass?

- A 0.1 moles of iodine molecules, I<sub>2</sub>
- B 0.5 moles of carbon dioxide, CO<sub>2</sub>
- C 1.0 mole of beryllium oxide, BeO
- D 1.0 mole of sodium, Na

8 20 cm<sup>3</sup> of ethene are reacted with 70 cm<sup>3</sup> of oxygen as shown in the chemical equation below.



What is total volume of gas remaining at the end of the reaction?

- A 40 cm<sup>3</sup>
- B 50 cm<sup>3</sup>
- C 80 cm<sup>3</sup>
- D 90 cm<sup>3</sup>

9 The table shows information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
congo red	blue	5	red
thymol blue	red	3	yellow
phenolphthalein	colourless	10	pink

Each indicator was added to separate samples of water.

Which colour would be obtained for each indicator?

	congo red	thymol blue	phenolphthalein
A	blue	red	pink
B	blue	yellow	colourless
C	red	yellow	pink
D	red	yellow	colourless

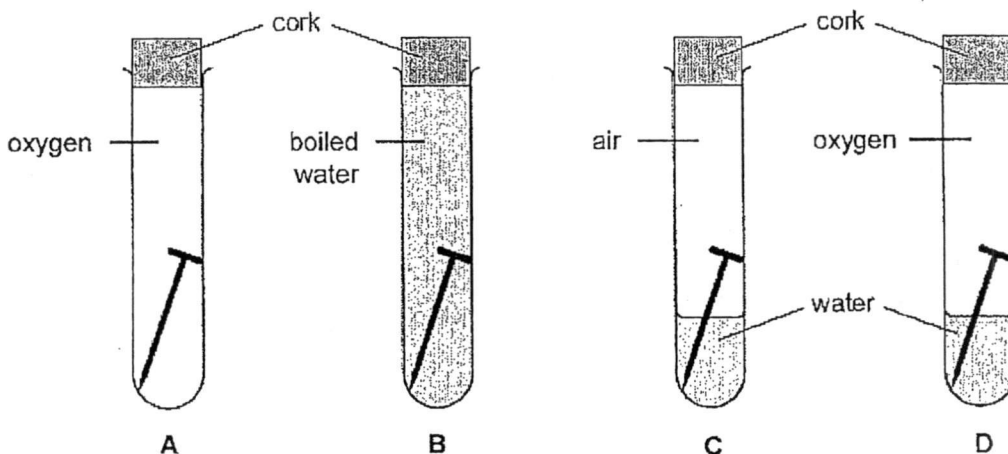
- 10 The waste gases from a coal-burning power station are passed through a wet mixture of powdered calcium carbonate and calcium oxide. This is to reduce the amount of pollutants released into the environment.

Which gas will not be removed by this mixture?

- A carbon dioxide
  - B carbon monoxide
  - C nitrogen dioxide
  - D sulfur dioxide
- 11 Which reaction requires the use of a burette in the experimental set-up?
- A  $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
  - B  $\text{CuO}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$
  - C  $\text{KOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{KCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
  - D  $\text{MgCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{MgSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
- 12 To obtain the salt copper(II) carbonate by precipitation, 1 mol of aqueous copper(II) nitrate was mixed with 1.5 mol of aqueous ammonium carbonate.
- Apart from copper(II) carbonate, which other substance(s) would be present in the reaction flask at the end of the reaction?
- A ammonium nitrate only
  - B ammonium nitrate and ammonium carbonate only
  - C ammonium nitrate and copper(II) nitrate only
  - D ammonium nitrate, ammonium carbonate and copper(II) nitrate
- 13 Which reaction is not a redox reaction?
- A combustion of hydrogen
  - B ethanol turning into ethanoic acid after being exposed to air
  - C neutralisation of aqueous sodium hydroxide and dilute hydrochloric acid
  - D rusting of iron nails

- 14 Four iron nails were placed into four different test-tubes to investigate the rate of rusting under different conditions.

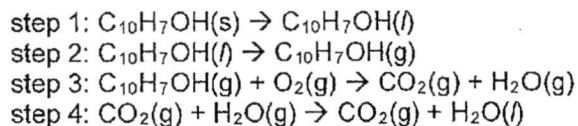
In which test-tube would the iron nail rust first?



- 15 Which statement about the elements in the Periodic Table is correct?

- A Group 0 elements are unreactive metals.
- B Group I elements form covalent chlorides.
- C Group VII elements form ions when combined with other elements.
- D The elements become more metallic from right to left across a period.

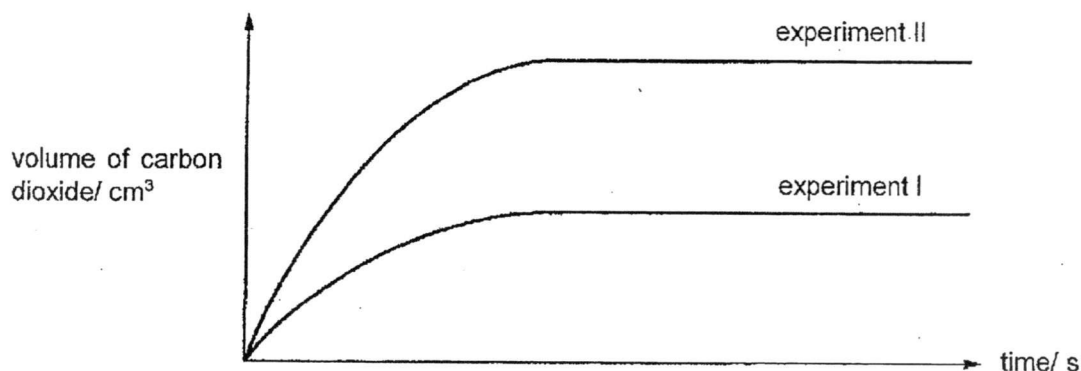
- 16 Naphthol,  $C_{10}H_7OH$ , is used for making bright-coloured dyes. The following steps shows the conversion of naphthol to carbon dioxide and water.



Which steps are endothermic processes?

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

- 17 Two experiments were carried out at 30 °C. In experiment I, 25 cm<sup>3</sup> of hydrochloric acid at 0.75 mol/dm<sup>3</sup> was reacted with excess calcium carbonate. The volume of carbon dioxide collected in experiment II was double that of experiment I. The results obtained were plotted into a graph as shown.

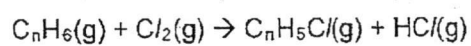


- Which factor best accounts for the shape of the graph of experiment II?
- A addition of a catalyst
  - B increasing the concentration of hydrochloric acid from 0.75 mol/dm<sup>3</sup> to 1.50 mol/dm<sup>3</sup>
  - C increasing the temperature of hydrochloric acid from 30 °C to 60 °C
  - D increasing the volume of hydrochloric acid from 25 cm<sup>3</sup> to 50 cm<sup>3</sup>
- 18 A sample of polluted air contains carbon dioxide, carbon monoxide, nitrogen, sulfur dioxide and water vapour.
- Which gases can also be found in a dry sample of unpolluted air?
- A carbon dioxide and nitrogen
  - B carbon dioxide, carbon monoxide and nitrogen
  - C carbon dioxide, nitrogen and water vapour
  - D carbon monoxide, nitrogen and sulfur dioxide
- 19 Crude oil is fractionally distilled into useful fractions.

Which option matches the fraction to its use?

	fraction	use
A	bitumen	feedstock for the petrochemical industry
B	diesel oil	fuel for aircraft engines
C	petrol	fuel for engines in buses, lorries and trains
D	petroleum gas	fuel for cooking and heating

- 20 The reaction between a hydrocarbon,  $C_nH_6$ , and chlorine can be represented by the equation:



Which statement about the reaction is correct?

- A It is an addition reaction.
- B Nickel is used as a catalyst in the reaction.
- C The molecular formula of the hydrocarbon is  $C_3H_6$ .
- D UV light is required for the reaction to take place.

**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 the Elements

		Group																																																																																				
I	II	III	IV	V	VI	VII	0																																																																															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																																																																					
Li Lithium	Be Beryllium	B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon	Na Sodium	Mg Magnesium	Al Aluminium	Si Silicon	P Phosphorus	S Sulphur	Cl Chlorine	Ar Argon	K Potassium	Ca Calcium	Sc Scandium	Ti Titanium	V Vanadium	Cr Chromium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	Zn Zinc	Ga Gallium	Ge Germanium	As Arsenic	Se Selenium	Br Bromine	Kr Krypton	Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium	Nb Niobium	Mo Molybdenum	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	Cd Cadmium	In Indium	Sn Tin	Sb Antimony	Te Tellurium	I Iodine	Xe Xenon	Cs Caesium	Ba Barium	La Lanthanum	Hf Hafnium	Ta Tantalum	W Tungsten	Re Rhenium	Os Osmium	Ir Iridium	Pt Platinum	Au Gold	Hg Mercury	Tl Thallium	Pb Lead	Bi Bismuth	Po Polonium	At Astatine	Rn Radon	Fr Francium	Ra Radium	Ac Actinium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium

\*58-71 Lanthanoid series  
†90-103 Actinoid series

Key  $\begin{matrix} a \\ X \\ b \end{matrix}$   
 a = relative atomic mass  
 X = atomic symbol  
 b = proton (atomic) number

140	141	144	150	152	157	159	162	165	167	169	173	175
Ce Cerium	Pr Praseodymium	Nd Neodymium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	Lu Lutetium
58	59	60	62	63	64	65	66	67	68	69	70	71
232	238	238	238	238	238	238	238	238	238	238	238	238
Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium
90	91	92	93	94	95	96	97	98	99	100	101	103

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

Name: \_\_\_\_\_ ( )

Class: \_\_\_\_\_



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**SCIENCE (CHEMISTRY)**

**5078/03**

Duration: 1 hour 15 minutes

Classes: 403, 404, 405, 406, 501 and 502

Candidates answer on the Question Paper.

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and registration number 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 or graphs.  
Do not use staples, paper clips, highlighters, glue or correction fluid/ tape.

**Section A**

Answer **all** questions.  
Write your answers in the spaces provided on the Question Paper.

**Section B**

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

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 Data Sheet is printed on page 17.  
A copy of the Periodic Table is printed on page 18.

FOR EXAMINER'S USE	
Paper 1	/ 20
Paper 3	
Section A	/ 45
Section B	/ 20
TOTAL	/ 85

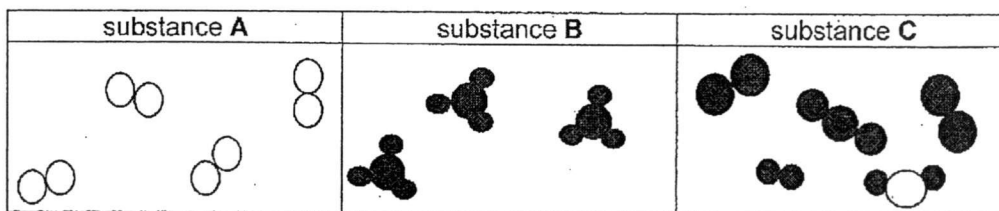
This question paper consists of 18 printed pages.

[Turn over

**Section A [45 marks]**

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

1 Fig. 1.1 represents the structures of three unknown substances, **A**, **B** and **C**.



**Fig. 1.1**

Complete Table 1.1 by

- (a) stating if the substance is an element, compound or mixture,
- (b) determining a possible identity of the substance by selecting a substance from the list given below.

ammonia   air   argon   brass   carbon dioxide   nitrogen

**Table 1.1**

substance	element, compound or mixture	possible identity of substance
<b>A</b>		
<b>B</b>		
<b>C</b>		

[3]

[Total: 3]



- 2 (b) (ii) Calculate the number of moles of chloride ions arising from the magnesium chloride in 1 dm<sup>3</sup> of seawater.

number of moles of Cl<sup>-</sup> ions = ..... mol [2]

- (c) The concentration of sulfate ions in seawater is 1.24 g/dm<sup>3</sup>. Excess aqueous barium chloride is added to a 1 dm<sup>3</sup> sample of seawater.

Calculate the mass of barium sulfate precipitated in this reaction.

mass = ..... g [2]

[Total: 9]

- 3 The equation shows the decomposition of ammonium nitrite, NH<sub>4</sub>NO<sub>2</sub>, when heated gently.



- (a) A sample of 25.0 cm<sup>3</sup> of 0.500 mol/dm<sup>3</sup> aqueous ammonium nitrite is heated.

Calculate the volume of nitrogen formed in dm<sup>3</sup> at room temperature and pressure.

volume of nitrogen = .....dm<sup>3</sup> [2]

- (b) Name the apparatus that is used to measure the volume of the gas produced.

.....[1]

[Total: 3]

4 Study the series of chemical reactions shown in the Fig. 4.1.

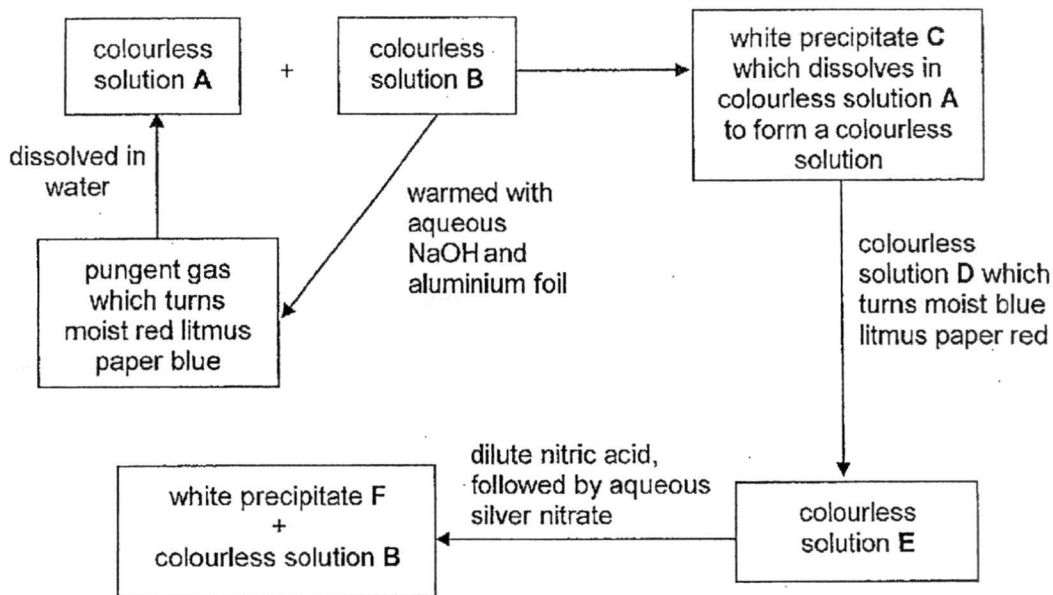


Fig. 4.1

(a) Identify substances A to E.

- A .....
- B .....
- C .....
- D .....
- E .....

[5]

(b) Write the ionic equation for the formation of white precipitate F.

.....[1]

[Total: 6]

- 5 (a) The ease of obtaining a metal from its ore is related to the metal's position in the reactivity series.

Using suitable examples, explain why this is true.

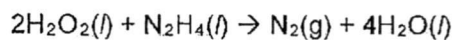
.....  
 .....  
 .....  
 ..... [2]

- (b) Explain why environmentalist are advocating for the recycling of metals.

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

[Total: 3]

- 6 When liquid hydrogen peroxide, H<sub>2</sub>O<sub>2</sub>, is mixed with liquid hydrazine, N<sub>2</sub>H<sub>4</sub>, a highly exothermic reaction takes place which can propel a rocket. The reaction is represented by the chemical equation:



- (a) Draw and label the energy level diagram for the reaction between hydrogen peroxide and hydrazine.

[2]

6 (b) Name the substance that is reduced. Explain your answer in terms of oxidation state.

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

(c) State the observation, if any, that would be observed when a few drops of potassium iodide is added to a sample of colourless liquid hydrazine. Explain your answer.

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

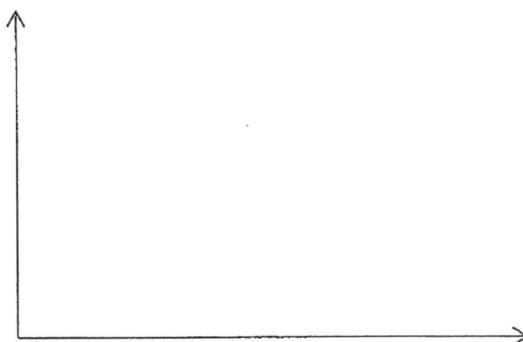
[Total: 6]

7 Four separate experiments were conducted using excess calcium carbonate and 100 cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> hydrochloric acid. The particle size of calcium carbonate and temperature are different for each experiment as shown in Table 7.1.

**Table 7.1**

experiment	particle size of calcium carbonate	temperature/ °C
I	lumps	30
II	powder	30
III	powder	40
IV	lumps	40

(a) Sketch and label, on the same axes, the graphs of two experiments to show the effect of temperature on the speed of reaction.



[2]



- 7 (b) State and explain, using the collision theory, which two experiments can be used to show the effect of particle size on the speed of reaction.

.....  
.....  
.....  
.....[3]

- (c) Describe, with the aid of a labelled diagram, an experiment to study the effect of concentration on the speed of reaction.

.....  
.....  
.....  
.....  
.....  
.....  
.....[3]

[Total: 8]

**8 Explain why**

**(a)** not recycling plastics can cause pollution,

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

**(b)** the incomplete combustion of hydrocarbons can be dangerous to people,

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

**(c)** the combustion of fossil fuels can harm aquatic life.

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

[Total: 3]

9 Fig. 9.1 describes some of the reactions of the hydrocarbon P.

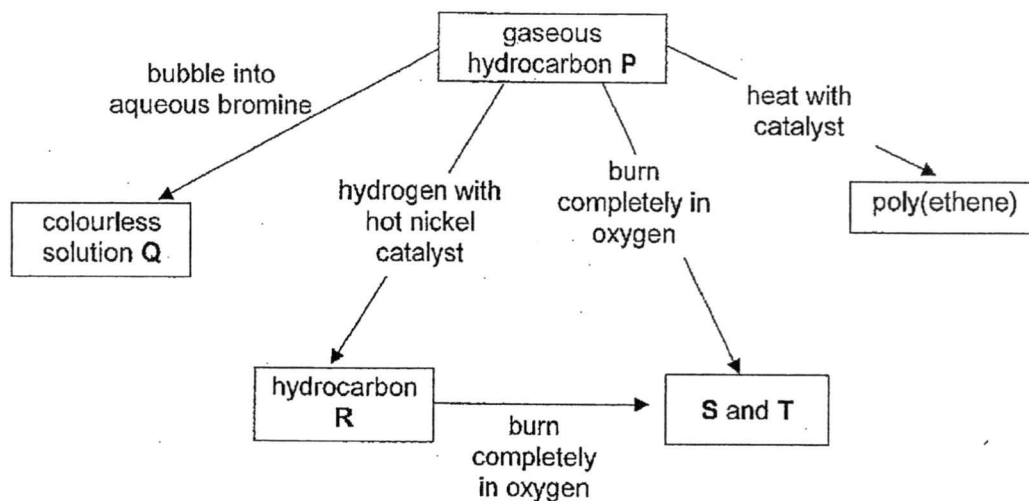


Fig. 9.1

(a) What does the reaction with aqueous bromine tell you about hydrocarbon P?

..... [1]

(b) Draw the full structural formula of compound Q.

[1]

(c) Name hydrocarbon R.

..... [1]

(d) Write a chemical equation for the formation of S and T in Fig. 9.1.

..... [1]

[Total: 4]



10 (c) Sulfur reacts with hydrogen to form hydrogen sulfide,  $\text{H}_2\text{S}$ .

- (i) Draw the 'dot-and-cross' diagram to show the bonding in a molecule of hydrogen sulfide, showing the outer shell electrons.

- (ii) State one physical property of hydrogen sulfide.

[2]

.....[1]

[Total: 10]

- 11 (a) Three Group I metals of the same mass were simultaneously added to water in beakers X, Y and Z. Fig. 11.1 shows the bubbles of gas produced as the reaction took place.

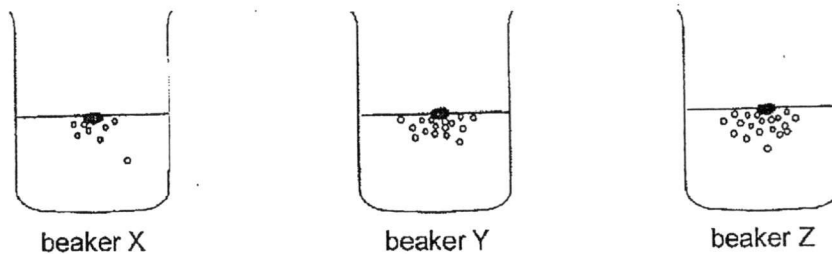


Fig.11.1

- (i) Given that potassium was added to beaker Z, identify the metal added to beaker X.  
 ..... [1]
- (ii) Describe a test to identify the gas produced during the reaction. State the expected observation.  
 .....  
 .....  
 .....  
 ..... [2]
- (iii) Before the metals were added, a few drops of Universal Indicator were added to the beakers of water.  
 State the colour change, if any, that would be observed in the three beakers as the Group I metals react with water.  
 .....  
 ..... [1]
- (iv) In a fourth beaker, copper of the same mass was added to water and a few drops of Universal Indicator were added.  
 Describe two differences that would be observed compared to the other three beakers.  
 1 .....  
 .....  
 2 .....  
 ..... [2]

11 (b) Chlorine, bromine and iodine are found in Group VII of the Periodic Table.

(i) State two similarities in the physical properties of chlorine, bromine and iodine.

- 1 .....
- .....
- 2 .....
- ..... [2]

(ii) Describe and explain the observation, if any, when chlorine gas is bubbled through potassium iodide solution.

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

[Total: 10]

12 (a) Organic compounds are placed in a homologous series.

(i) Give two general properties of a homologous series.

- 1.....  
 .....  
 2.....  
 .....[2]

(ii) Write the general formula for the homologous series of alkanes.

.....[1]

(iii) Name and write the chemical formula for the third member of the alkanes.

.....[2]

(b) Fig. 12.1 shows the structure of fumaric acid. It is produced by human skin when exposed to sunlight and is a food additive generally used in beverages and baking powders.

Fig. 12.2 shows the structure of malic acid. It is made by all living organisms and is used as a food additive too. Malic acid contributes to the pleasantly sour taste of fruits.

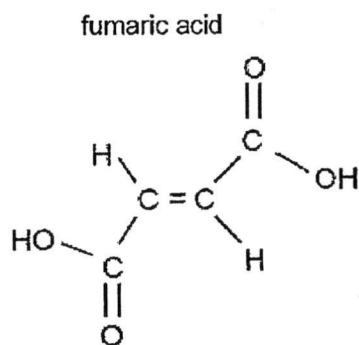


Fig. 12.1

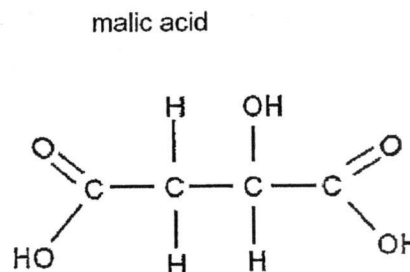


Fig. 12.2

(i) Other than the test for carbon-carbon double bond, suggest one chemical test to distinguish between fumaric and malic acids.

chemical test

.....[1]

results

.....

.....[1]



12 (b) (ii) Predict which acid, fumaric or malic acid, can form a polymer.

.....[1]

(iii) Draw the repeat unit and structural formula of the polymer in (b)(ii).

[2]

[Total: 10]

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 the Elements

		Group														
I	II	III	IV	V	VI	VII						0				
		1 H Hydrogen 1											4 He Helium 2			
7 Li Lithium 3	9 Be Beryllium 4												20 Ne Neon 10			
23 Na Sodium 11	24 Mg Magnesium 12												36 Ar Argon 18			
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	73 Ga Gallium 31	75 As Arsenic 33	79 Se Selenium 34	84 Kr Krypton 36	
85 Rb Rubidium 37	86 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	126 Te Tellurium 52	131 Xe Xenon 54	
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	188 Re Rhenium 75	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86
87 Fr Francium 87	226 Ra Radium 88	*58-71 Lanthanoid series †90-103 Actinoid series														

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	175 Lu Lutetium 71		
232 Th Thorium 90	238 Pa Protactinium 91	238 U Uranium 92	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103

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

a	X	b
---	---	---

Key  
 a = relative atomic mass  
 X = atomic symbol  
 b = proton (atomic) number

	E: zinc chloride/ $ZnCl_2$ ; F: silver chloride/ $AgCl$ ;  R: ammonium hydroxide/ ammonia hydroxide/ $NH_4OH$	
4(b)	$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$  A: no state symbols R: partial state symbols, wrong state symbols	[1]
5 (a)	Reactive metals such as sodium, which are high up in the reactivity series can only be extracted by electrolysis;  Less reactive metals such as iron, lower down in the reactivity series can be easily extracted by reduction with coke;  Unreactive metals such as gold, at the bottom of the reactivity series are found in the uncombined state;  Any 2, max 2 marks  A: metals high up in the reactivity series/ more reactive metals are more difficult to obtain/ extract than metals low in the reactivity series/ less reactive metals (1m)  Note: 2 <sup>nd</sup> mark to be awarded if correct example from each group given	[1]  [1]  [1]  max 2
5(b)	Recycling metals uses less energy, thus reduces carbon emissions; Reduces emission of greenhouse gases/ toxic gases/ harmful gases; Uses less water compared with using raw materials; Metals such as lead and mercury are toxic and if placed in landfill, will leach and contaminate the soil and water system; A: any other possible answers R: cheaper/ cost effective/ reduces pollution/ metals are finite resources that will run out one day	[1]
6(a)	Energy level diagram for exothermic reaction; Correct labels for enthalpy, reactants and products; R: $-\Delta H$	[1] [1]
6(b)	Hydrogen peroxide; Oxidation state of oxygen in $H_2O_2$ decreases from -1 to -2 in $H_2O$ ; A: oxidation state of oxygen decreases from -1 to -2 R: H in $H_2O_2$ is reduced	[1] [1]
6(c)	Colourless solution remains colourless/ no visible change/ no observation/ no change observed; Hydrazine is a reducing in nature/ a reducing agent and will have no effect on/ will not react with/ will not oxidise potassium iodide; A: both hydrazine and potassium iodide are reducing/ reducing agents R: potassium iodide is used to test for oxidising agent	[1] [1]
7(a)		[1] [1]

CHIJ Katong Convent Secondary  
4E/5N Science Chemistry Prelim Exam 2017

Answer scheme

Paper 1

1	2	3	4	5	6	7	8	9	10
D	B	B	C	C	C	A	B	D	B

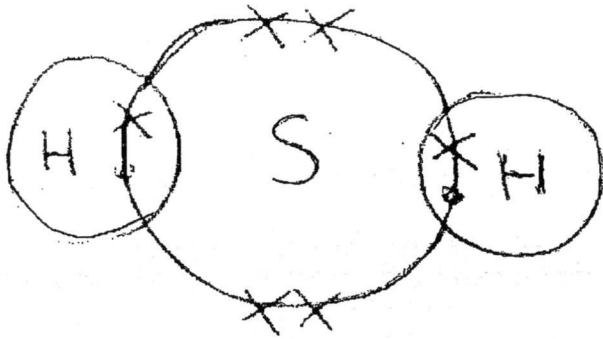
11	12	13	14	15	16	17	18	19	20
C	B	C	D	D	A	B	A	D	D

Section A

Q. No.	Answers	Marks/ Remarks												
1(a)(b)	<table border="1"> <thead> <tr> <th>substance</th> <th>element, compound or mixture</th> <th>possible identity of substance</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>element</td> <td>nitrogen</td> </tr> <tr> <td>B</td> <td>compound</td> <td>ammonia</td> </tr> <tr> <td>C</td> <td>mixture</td> <td>air</td> </tr> </tbody> </table>	substance	element, compound or mixture	possible identity of substance	A	element	nitrogen	B	compound	ammonia	C	mixture	air	[1] for each correct row
substance	element, compound or mixture	possible identity of substance												
A	element	nitrogen												
B	compound	ammonia												
C	mixture	air												
2(a)(i)	<p>Water boils/ vaporises, steam rises and enters the condenser. In the condenser, the water vapour is cooled. Pure water can be collected in the conical flask OR The salts / residues / impurities / solids left in round-bottomed flask</p> <p>R: water evaporates into vapour R: water vapour is converted into water in the condenser R: evaporated seawater condenses</p>	[1] [1] [1]												
2(a)(ii)	100 °C	[1]												
2(b)(i)	Mg <sup>2+</sup> and Cl <sup>-</sup>	[1]												
2(b)(ii)	<p>Number of moles of magnesium ions = <math>1.26 \div (24 + 71) = 0.013263</math> mol Number of moles of chloride ions = <math>0.013263 \times 2 = 0.0265</math> mol (3s.f)</p>	[1] [1]												
2(c)	<p>Number of moles of SO<sub>4</sub><sup>2-</sup> = <math>1.24 \div 96 = 0.012917</math> mol Mass of BaSO<sub>4</sub> precipitated = <math>0.012917 \times 233 = 3.01</math> g (3s.f)</p>	[1] [1]												
3(a)	<p>Moles of NH<sub>4</sub>NO<sub>2</sub> = <math>0.025 \times 0.500 = 0.0125</math> mol</p> <p>Volume of N<sub>2</sub> = <math>0.0125 \times 24 \text{ dm}^3 = 0.3 \text{ dm}^3</math></p>	[1] [1]												
3 (b)	Gas syringe	[1]												
4(a)	<p>A: aqueous ammonia/ ammonia/ NH<sub>3</sub>; B: zinc nitrate/ Zn(NO<sub>3</sub>)<sub>2</sub>; C: zinc hydroxide/ Zn(OH)<sub>2</sub>; D: hydrochloric acid/ HCl;</p>	[1] each												

	1m for correct labels for both axes (units not required) 1m for correct graphs of experiments R: amount of gas for y-axis	
7(b)	Experiments I and II/ III and IV; Calcium carbonate lumps have smaller surface area to volume ratio than calcium carbonate powder OR vice versa; Decreases the frequency/ probability/ chance/ rate of effective collisions, thus decreases the speed of reaction OR vice versa; R: number of effective collisions	[1] [1] [1]
7(c)	Labelled diagram for collection of gas using gas syringe or mass loss method; Collect the gas produced/ record the mass/ weight of the reaction mixture at regular intervals as excess calcium carbonate reacts with hydrochloric acid; Repeat the experiment with hydrochloric acid of a different concentration while keeping all other variables constant; A: amount of gas instead of volume of gas if gas syringe was drawn or mentioned in answer A: drawings with 2 beakers containing acid and metal/ insoluble metal carbonate, but need to describe how to determine the end of reaction Note: no penalty if amount instead of specific physical quantities of measurements used	[1] [1] [1]
8(a)	Burning plastics releases toxic gases which causes air pollution; Improper disposal of plastics can cause water and land pollution.	[1] for any one suitable answer
8(b)	Carbon monoxide produced reacts with haemoglobin in blood to form carboxyhaemoglobin, which reduces the ability of haemoglobin to transport oxygen; Carbon monoxide causes breathing difficulties and death.	[1] for any one suitable answer
8(c)	Sulfur dioxide produced reacts with water to form acid rain, causing water bodies to become too acidic hence harm aquatic life.	[1]
9(a)	P is unsaturated or it contains carbon-carbon double bond.	[1]
9(b)	$\begin{array}{c} \text{H} \quad \quad \text{H} \\   \quad \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad \quad   \\ \text{Br} \quad \quad \text{Br} \end{array}$	[1]
9(c)	ethane	[1]
9(d)	$2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$ Or $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$  * state symbols not required. State symbols must be correct if students give state symbols. $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$	[1]

**Section B**

Q. No.	Answers	Marks/ Remarks
10(a)(i)	Atoms of the same element with same number of protons and different number of neutrons / atoms with same atomic number and different mass number	[1]
10(a)(ii)	Both isotopes have - 16 protons - 16 electrons - Electronic configuration 2,8,6 S-32 has 16 neutrons but S-33 has 17 neutrons.  R: They have different number of neutrons R: They have same number of protons. R: They have same number of electrons. R: S-32 has one less neutron than S-33. R: They have same number of electron shells. R: They are in the same group of the Periodic Table	[1] [1] [1] [2]
10(b)	S <sub>8</sub>	[1]
10(c)(i)	 <p>Key:                      x sulfur electron                      • hydrogen electron</p>	[1] for correct sharing of electron between S and H [1] for the 2 non-bonding electrons in S. Minus [1] if no key.
10(c)(ii)	Low melting/boiling point; Cannot conduct electricity; Insoluble in water; Soluble in organic solvent	[1]
11(a)(i)	Lithium;	[1]
11(a)(ii)	Insert a lighted splint to a sample of the gas evolved; Light splint/flame will be extinguished with a 'pop' sound;	[1] [1]
11(a)(iii)	Green solution will turn blue/purple;	[1]
11(a)(iv)	It will sink to the bottom of the beaker; No bubbles will be observed/ effervescence not produced; Green solution remains green/ no change in colour of universal indicator; No visible change/ no change observed; Any 2, max 2m  A: copper will not extinguish the lighted splint with a 'pop' sound R: no reaction/ no colour change (only)/ wrong spelling effervescence/ no flame produced	[1] [1] [1]

11(b)(i)	Coloured/ produce coloured gas when heated; Low melting point and/or boiling point; Do not conduct electricity/ heat OR poor heat/ electrical conductors; Low densities; Any 2, max 2m  R: diatomic molecules	[1] [1] [1]
11(b)(ii)	Colourless solution turns brown; Chlorine is more reactive than iodine, thus it displaces iodine from potassium iodide to form iodine solution;	[1] [1]
12(a)(i)	1. have the same functional group, 2. have similar chemical properties, 3. show a gradual change in their physical properties, 4. have the same general formula, 5. each member of the series differs from the next by a $-CH_2-$ unit.	[2] any 2 answers
12(a)(ii)	$C_nH_{2n+2}$	[1]
12(a)(iii)	Propane $C_3H_8$	[1] [1]
12(b)(i)	Acidified potassium manganate (VII) Solution turns from purple to colourless in malic acid but remains purple in fumaric acid.	[1] [1]
12(b)(ii)	fumaric acid	[1]
12(b)(iii)	Repeat unit $\begin{array}{c} \text{H} \quad \text{COOH} \\   \quad   \\ \text{--- C --- C ---} \\   \quad   \\ \text{HOOC} \quad \text{H} \end{array}$ Structural formula $\left[ \begin{array}{c} \text{H} \quad \text{COOH} \\   \quad   \\ \text{--- C --- C ---} \\   \quad   \\ \text{HOOC} \quad \text{H} \end{array} \right]_n$	[1]  [1]



