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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.

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 particle 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_2 .
- C The compound is able to conduct electricity in its aqueous state.
- D The compound is soluble in organic solvent.

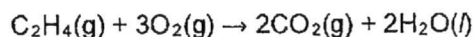
6 Which statement describes what happens when sodium chloride melts?

- 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_2
- B 0.5 moles of carbon dioxide, CO_2
- C 1.0 mole of beryllium oxide, BeO
- D 1.0 mole of sodium, Na

8 20 cm³ of ethene are reacted with 70 cm³ of oxygen as shown in the chemical equation below.



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

- A 40 cm³
- B 50 cm³
- C 80 cm³
- D 90 cm³

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

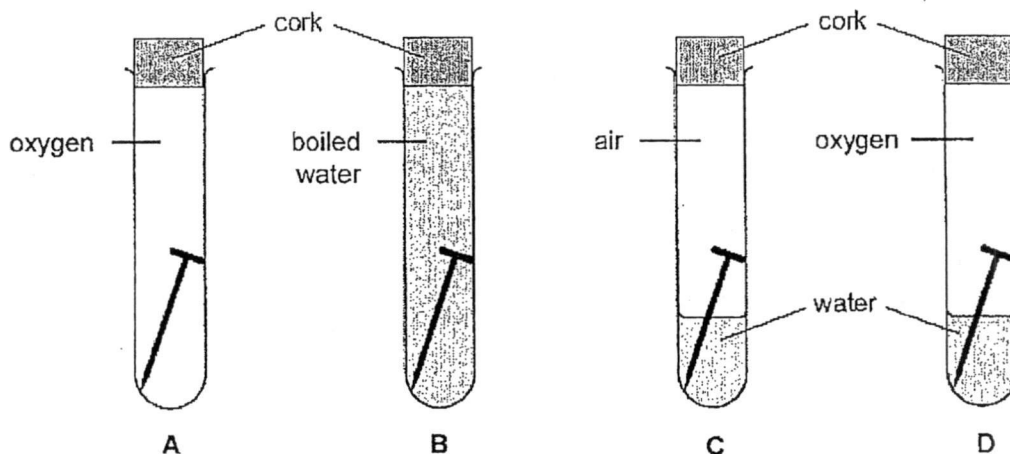
- 10 The waste gases from a coal-burning power station are passed through a wet mixture of powdered calcium carbonate and calcium oxide. This is to reduce the amount of pollutants released into the environment.

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.

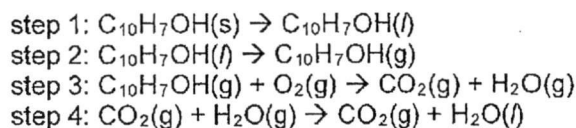
In which test-tube would the iron nail rust first?



- 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.

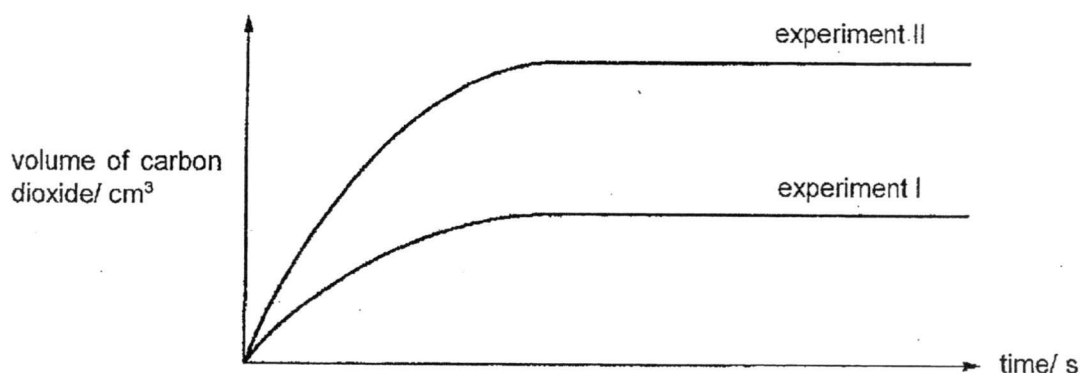
- 16 Naphthol, $C_{10}H_7OH$, is used for making bright-coloured dyes. The following steps shows the conversion of naphthol to carbon dioxide and water.



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 cm³ of hydrochloric acid at 0.75 mol/dm³ 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/dm³ to 1.50 mol/dm³
 - C increasing the temperature of hydrochloric acid from 30 °C to 60 °C
 - D increasing the volume of hydrochloric acid from 25 cm³ to 50 cm³
- 18 A sample of polluted air contains carbon dioxide, carbon monoxide, nitrogen, sulfur dioxide and water vapour.

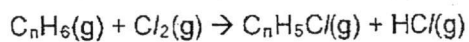
Which gases can also be found in a dry sample of unpolluted air?

- 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 H Hydrogen 1						4 He Helium 2
7 Li Lithium 3	8 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 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	58 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36	
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Tc Technetium 43	106 Ru Ruthenium 44	108 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	128 Te Tellurium 52	127 I Iodine 53	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	192 Ir Iridium 77	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	222 Rn Radon 86	
87 Fr Francium	88 Ra Radium 88	227 Ac Actinium 89																

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	238 Pa Protactinium 91	238 U Uranium 92	244 Pu Plutonium 94	244 Am Americium 95	244 Cm Curium 96	244 Bk Berkelium 97	244 Cf Californium 98	244 Es Einsteinium 99	244 Fm Fermium 100	244 Md Mendelevium 101	244 No Nobelium 102	244 Lr Lawrencium 103

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

a

X

b

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

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

Name: _____ ()

Class: _____



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

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.

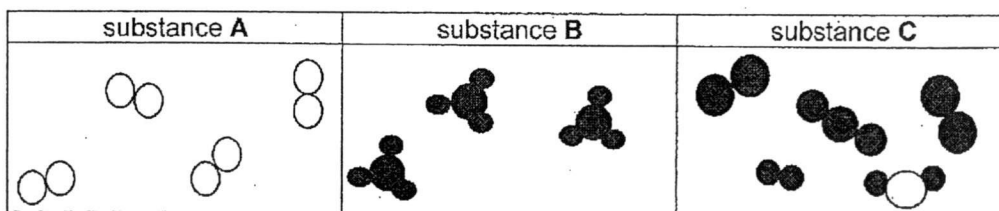


Fig. 1.1

Complete Table 1.1 by

- stating if the substance is an element, compound or mixture,
- 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
A		
B		
C		

[3]

[Total: 3]

2. Seawater contains a variety of dissolved salts.

- (a) The apparatus shown in Fig. 2.1 can be used to separate purified water from seawater by simple distillation.

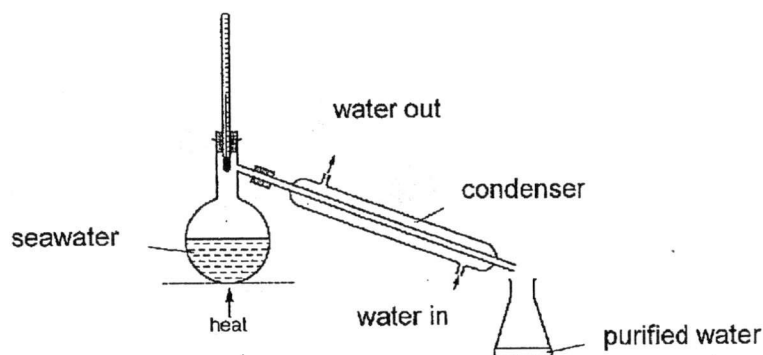


Fig. 2.1

- (i) Explain how distillation purifies seawater.

.....

.....

.....

.....

.....

.....[3]

- (ii) What is the approximate reading on the thermometer during the distillation?

.....[1]

- (b) Magnesium chloride, MgCl_2 , is present in seawater at a concentration of 1.26 g/dm^3 .

- (i) Write the formulae for the ions present in magnesium chloride.

.....[1]

- 2 (b) (ii) Calculate the number of moles of chloride ions arising from the magnesium chloride in 1 dm³ of seawater.

number of moles of Cl⁻ ions = mol [2]

- (c) The concentration of sulfate ions in seawater is 1.24 g/dm³. Excess aqueous barium chloride is added to a 1 dm³ 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, NH₄NO₂, when heated gently.



- (a) A sample of 25.0 cm³ of 0.500 mol/dm³ aqueous ammonium nitrite is heated.

Calculate the volume of nitrogen formed in dm³ at room temperature and pressure.

volume of nitrogen =dm³ [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.

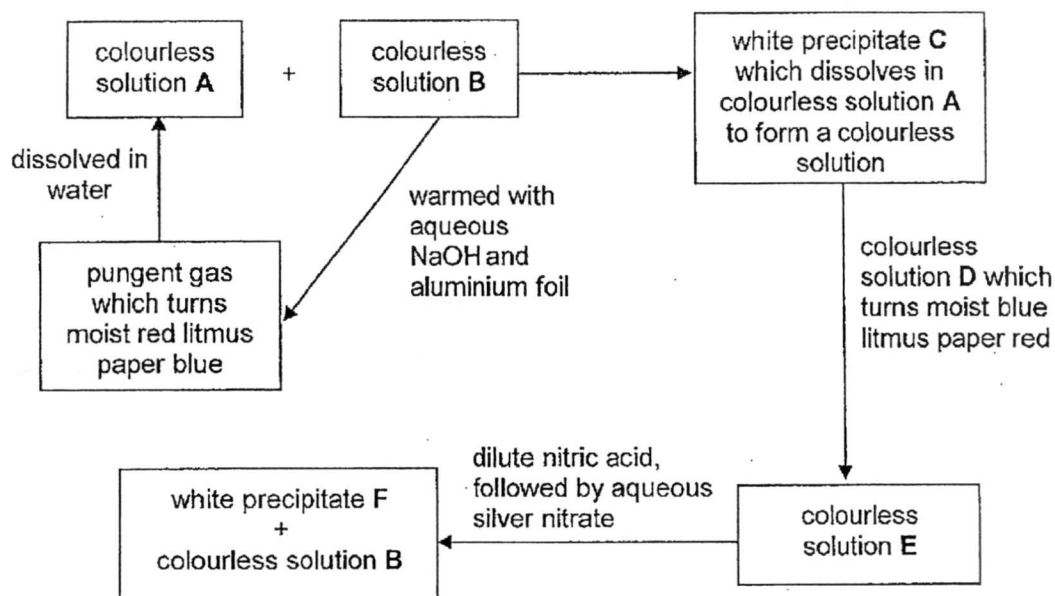


Fig. 4.1

(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]

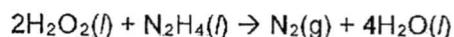
- (b) Explain why environmentalist are advocating for the recycling of metals.

.....

.....[1]

[Total: 3]

- 6 When liquid hydrogen peroxide, H_2O_2 , is mixed with liquid hydrazine, N_2H_4 , 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]

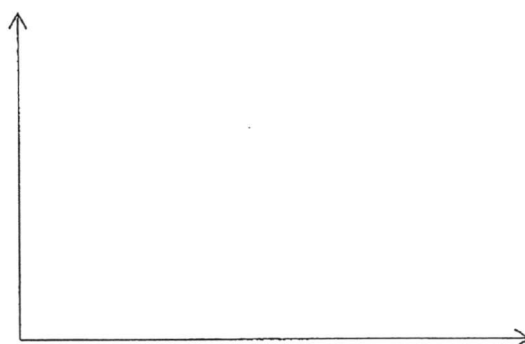
[Total: 6]

- 7 Four separate experiments were conducted using excess calcium carbonate and 100 cm³ of 1.0 mol/dm³ 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.

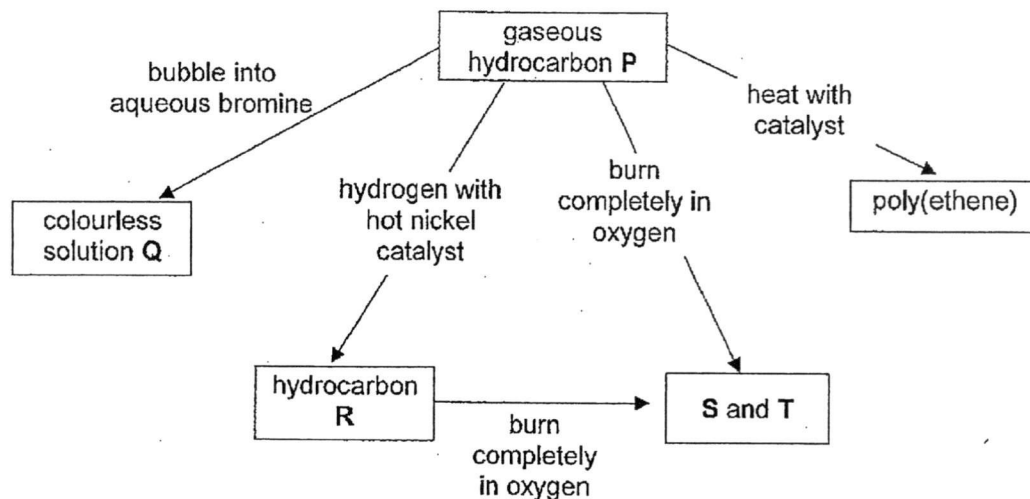


Fig. 9.1

- (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]

Name: _____ ()

Class: _____

Section B [20 marks]

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

10 Two isotopes of sulfur are $^{32}_{16}\text{S}$ and $^{33}_{16}\text{S}$.

(a) (i) Explain what is meant by the term *isotopes*.

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

(ii) Describe the similarities and differences in the atomic structures and electronic configurations of the two isotopes.

.....
.....
.....
.....
.....
.....
.....
.....[5]

(b) Sulfur forms simple molecules which have a relative molecular mass of 256.

Suggest the formula of a sulfur molecule.

..... [1]

10 (c) Sulfur reacts with hydrogen to form hydrogen sulfide, H_2S .

- (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.

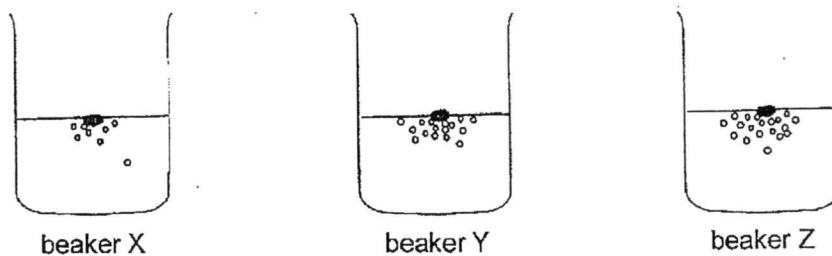


Fig.11.1

- (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.

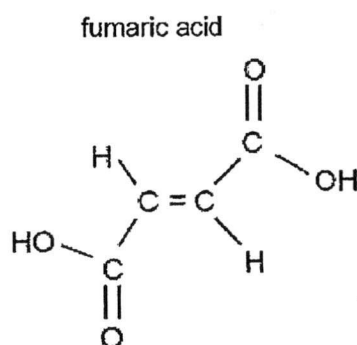


Fig. 12.1

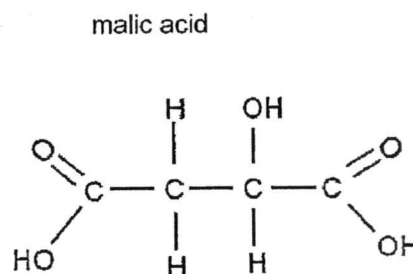


Fig. 12.2

(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																	
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 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	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	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	98 Tc Technetium 43	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	127 I Iodine 53	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	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	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
Fr Francium 87	Ra Radium 88	227 Ac actinium 89															

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	159 Tb Terbium 65	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 Np Neptunium 93	238 Pm Promethium 61	238 Sm Samarium 62	238 Eu Europium 63	238 Gd Gadolinium 64	238 Tb Terbium 65	238 Dy Dysprosium 66	238 Ho Holmium 67	238 Er Erbium 68	238 Tm Thulium 69	238 Yb Ytterbium 70	238 Lu Lutetium 71	238 La Lanthanum 57

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

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

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

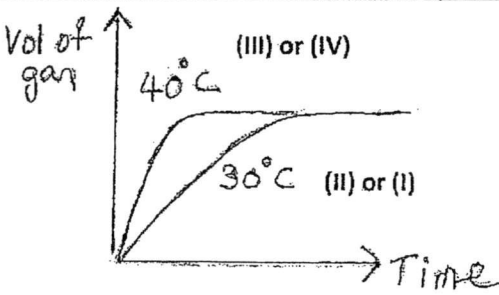
Key

a	X
b	

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

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

140	Ce	141	Pr	144	Nd	150	Sm	152	Eu	157	Gd	159	Tb	162	Dy	165	Ho	167	Er	169	Tm	173	Yb	175	Lu		
58	Cerium	59	Praseodymium	60	Neodymium	61	Promethium	62	Samarium	63	Europium	64	Gadolinium	65	Terbium	66	Dysprosium	67	Holmium	68	Erbium	69	Thulium	70	Ytterbium	71	Lutetium
232	Th	238	Pa	238	U	238	Np	238	Pu	238	Am	238	Cm	238	Bk	238	Cf	238	Es	238	Fm	238	Md	238	No	238	Lr
90	Thorium	91	Protactinium	92	Uranium	93	Neptunium	94	Plutonium	95	Americium	96	Curium	97	Berkelium	98	Californium	99	Einsteinium	100	Fermium	101	Mendelevium	102	Nobelium	103	Lawrencium

	E: zinc chloride/ ZnCl_2; F: silver chloride/ AgCl; R: ammonium hydroxide/ ammonia hydroxide/ NH_4OH	
4(b)	$\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$ 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: 2nd 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

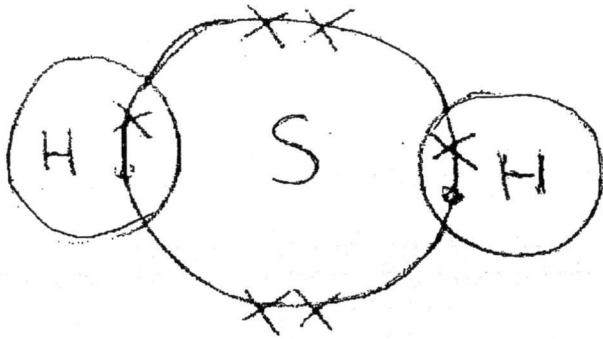
11	12	13	14	15	16	17	18	19	20
C	B	C	D	D	A	B	A	D	D

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)	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 R: water evaporates into vapour R: water vapour is converted into water in the condenser R: evaporated seawater condenses	[1] [1] [1]												
2(a)(ii)	100 °C	[1]												
2(b)(i)	Mg ²⁺ and Cl ⁻	[1]												
2(b)(ii)	Number of moles of magnesium ions = $1.26 \div (24 + 71) = 0.013263 \text{ mol}$ Number of moles of chloride ions = $0.013263 \times 2 = 0.0265 \text{ mol}$ (3s.f)	[1] [1]												
2(c)	Number of moles of SO₄²⁻ = $1.24 \div 96 = 0.012917 \text{ mol}$ Mass of BaSO₄ precipitated = $0.012917 \times 233 = 3.01 \text{ g}$ (3s.f)	[1] [1]												
3(a)	Moles of NH₄NO₂ = $0.025 \times 0.500 = 0.0125 \text{ mol}$ Volume of N₂ = $0.0125 \times 24 \text{ dm}^3 = 0.3 \text{ dm}^3$	[1] [1]												
3 (b)	Gas syringe	[1]												
4(a)	A: aqueous ammonia/ ammonia/ NH₃; B: zinc nitrate/ Zn(NO₃)₂; C: zinc hydroxide/ Zn(OH)₂; D: hydrochloric acid/ HCl;	[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}{cc} \text{H} & \text{H} \\ & \\ \text{H}-\text{C} & -\text{C}-\text{H} \\ & \\ \text{Br} & \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 ₈	[1]
10(c)(i)	 Key: x sulfur electron • hydrogen electron	[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]

