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南洋女子中學校
Nanyang Girls' High School

End-of-Year Examination 2022 Secondary 3

IP CHEMISTRY

Paper 1 Multiple Choice

Wednesday 5 October

Additional Materials: Multiple Choice Answer Sheet

45 minutes
0845 – 0930

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, register number and class in the spaces at the top of this page and on the Answer Sheet in the spaces provided.

There are **thirty** 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 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.

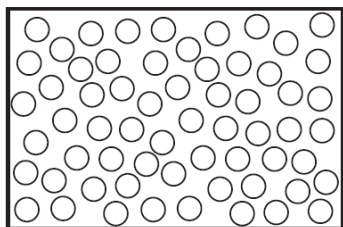
Any rough working should be done in this booklet.

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

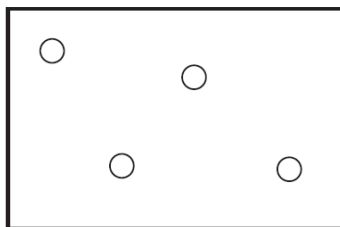
The use of approved scientific calculators is expected, where appropriate.

This document consists of **11** printed pages and **1** blank page.

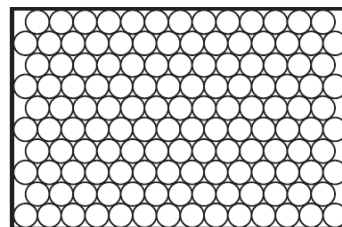
- 1 The diagrams below show how particles in a substance are arranged in three different states.



state 1



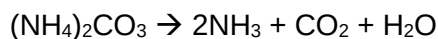
state 2



state 3

Which statement is correct?

- A** State 1 can be changed to state 2 by melting.
- B** State 3 can be changed to state 2 by sublimation.
- C** Particles in state 2 are sliding over each other.
- D** Substance in state 3 can be compressed.
- 2 A solid sample of ammonium carbonate was heated in a test tube to form ammonia, carbon dioxide and water vapour.



A moist blue litmus paper was placed at the mouth of the test tube.

What colour changes will the piece of moist blue litmus paper undergo?

- A** Moist blue litmus paper remains blue.
- B** Moist blue litmus paper turns red.
- C** Moist blue litmus paper turns red and is then bleached.
- D** Moist blue litmus paper turns red and then turns blue.
- 3 Which row correctly shows the effect of impurities on melting and boiling points?

	effect on melting point	effect on boiling point
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 4 Hydrochloric acid was reacted with calcium carbonate to produce a gas that was passed through a drying agent before being collected.

Which row shows an appropriate drying agent to use and an appropriate method of collection?

	drying agent	collection method
A	concentrated sulfuric acid	downward delivery
B	concentrated sulfuric acid	upward delivery
C	calcium oxide	downward delivery
D	calcium oxide	upward delivery

- 5 Ammonium chloride, copper(II) chloride, and silver chloride are mixed together in a mixture. Which techniques should be used in the given order to obtain hydrated copper(II) chloride from the mixture?

	1	2	3	4
A	dissolution	filtration	sublimation	crystallisation
B	dissolution	filtration	sublimation	evaporation to dryness
C	sublimation	dissolution	filtration	crystallisation
D	sublimation	dissolution	filtration	evaporation to dryness

- 6 Which statements are correct?

- 1 All elements exist as atoms.
- 2 All molecules are compounds.
- 3 All substances with ionic bonding are compounds.

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

- 7 Particle **X** can be represented as $^{197}_{79}\text{Au}$. Particle **Y** has 2 more protons, 1 more neutron, and 1 more electron than particle **X**.

Which particle represents **Y**?

- A** $^{198}_{81}\text{Tl}$
B $^{200}_{81}\text{Tl}$
C $^{198}_{81}\text{Tl}^+$
D $^{200}_{81}\text{Tl}^+$

- 8 The following table shows the number of protons for elements **P**, **Q**, **R** and **S**.

element	number of protons
P	1
Q	3
R	8
S	10

Which two elements will react to form a compound with a low melting point?

- A** **P** and **Q**
- B** **P** and **R**
- C** **Q** and **R**
- D** **R** and **S**

- 9 An element **Z** is found to exist in three isotopic forms, ^{20}Z , ^{21}Z and ^{22}Z .

- Relative abundance of ^{20}Z is **x**
- Relative abundance of ^{21}Z is half the abundance of ^{20}Z
- Relative abundance of ^{22}Z is **x – 0.2**

What is the relative atomic mass of **Z**?

- A** 20.6
- B** 20.7
- C** 20.8
- D** 20.9

- 10 How many electrons are not involved in covalent bonding in a hydrazine, N_2H_4 molecule?

- A** 0
- B** 4
- C** 8
- D** 12

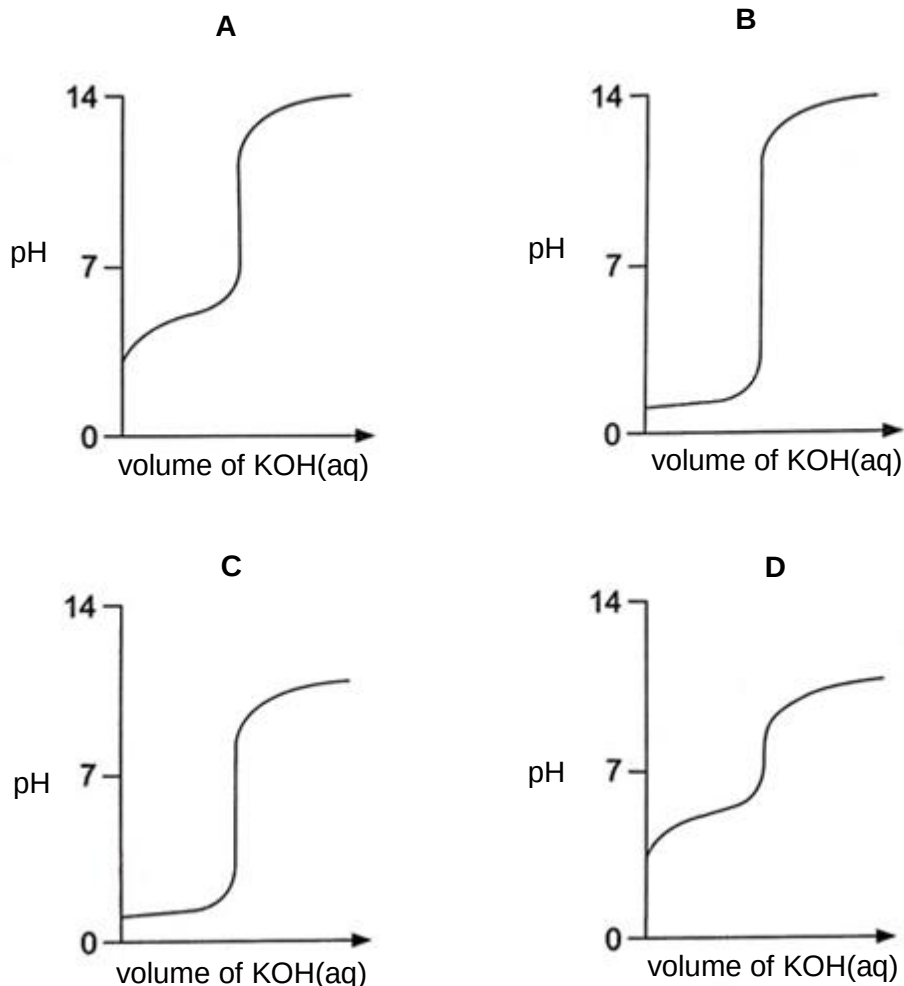
- 11 Sulfuric acid is a vital commodity chemical due to its multiple applications.

Which statement is not an application of sulfuric acid?

- A** as a bleaching agent for paper, wool and silk
- B** as an electrolyte in car batteries
- C** manufacture of detergents
- D** manufacture of fertilisers

- 12** Formic acid is a weak acid that is as a preservative and antibacterial agent in livestock feed.

Which graph best represents the change in pH that occurs when a sample of formic acid is titrated with aqueous potassium hydroxide.



- 13** Most of the Earth's crust consists of solid oxides, the result of elements reacting with the oxygen in air or in water. The chemical formulae of some oxides are shown below.

NO PbO CaO Al_2O_3 CO_2 SO_3

Which row in the table gives the correct number of each type of oxide?

	number of each type of oxide			
	acidic	basic	neutral	amphoteric
A	1	1	2	2
B	2	1	1	2
C	2	2	1	1
D	3	1	2	1

14 In which reaction is the metal oxide or metal hydroxide not behaving as a base or an alkali?

- A** $2\text{KOH} + (\text{NH}_4)_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{NH}_3 + \text{H}_2\text{O}$
B $\text{Ca}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightarrow \text{CaCl}_2 + 2\text{NH}_3 + 2\text{H}_2\text{O}$
C $\text{ZnO} + 2\text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{H}_2\text{O}$
D $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$

15 Which is the most suitable method to prepare a high yield of calcium sulfate salt?

- A** Adding excess calcium carbonate to dilute sulfuric acid.
B Adding excess calcium metal to dilute sulfuric acid.
C Adding excess calcium hydroxide to dilute nitric acid, filter, followed by adding dilute sulfuric acid to filtrate.
D Adding excess dilute sulfuric acid to calcium oxide.

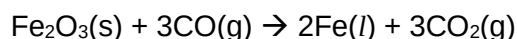
16 The table below shows the pH of the solution and the colour of the solution after bromophenol blue has been added as an indicator.

pH	colour
≤ 3.0	yellow
3.0 to 4.6	greenish blue
≥ 4.6	blue

Which statement is true?

- A** The indicator would be suitable for an acid-base titration where the end point is around pH 9.
B The indicator cannot be used to differentiate between water and sodium hydroxide solution.
C In solution of pH 1, the indicator has a blue colour.
D The indicator is not able to distinguish between a solution of hydrochloric acid which has a pH of 1 and a solution of ethanoic acid which has a pH of 5.

17 The reaction of iron(III) oxide with carbon monoxide in the blast furnace is represented by the following equation:

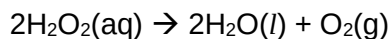


When 5.00 kg of iron(III) oxide reacted with excess carbon monoxide, only 2.83 kg of iron was formed.

What is the percentage yield of iron?

- A** 56.6%
B 61.8%
C 76.1%
D 80.9%

- 18** Hydrogen peroxide decomposes to form water and oxygen as shown in the following equation:



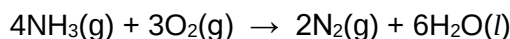
When 9.62 g of hydrogen peroxide decomposes, the volume of oxygen gas collected under room temperature and pressure is 1650 cm³.

What is the percentage purity of hydrogen peroxide?

- A** 24.3%
B 25.7%
C 48.6%
D 97.2%
- 19** Butane is a portable gas fuel often dispensed as canisters in Korean BBQ or Thai Mookata restaurants. Its empirical formula is C₂H₅. At room temperature and pressure, 3.48 g of the hydrocarbon has a volume of 1440 cm³.

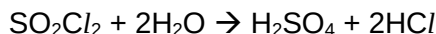
What is the molecular formula of butane?

- A** C₂H₅
B C₄H₁₀
C C₆H₁₅
D C₈H₂₀
- 20** Ammonia burns in oxygen as shown the following equation:



If 160 cm³ of ammonia is added to 140 cm³ of oxygen, what is the total volume of the resultant gas mixture?

- A** 20 cm³
B 80 cm³
C 100 cm³
D 300 cm³
- 21** The compound SO₂Cl₂ reacts with water according to the following equation:



0.35 g of SO₂Cl₂ was dissolved in distilled water to obtain a solution with a volume of 25.0 cm³. The solution was titrated with 0.267 mol dm⁻³ potassium hydroxide solution.

What is the volume of potassium hydroxide solution used in the titration?

- A** 9.70 cm³
B 19.40 cm³
C 29.10 cm³
D 38.80 cm³

22 Which substance contains the least atoms?

- A 50.0 cm³ of CO₂ measured at room temperature and pressure
- B 0.00750 mol of NO
- C 0.45 g of SCl₂
- D 2.35×10^{20} molecules of CH₄

23 Which pair of reactants would not result in any visible change?

- A dilute hydrochloric acid and calcium carbonate
- B iron(III) hydroxide and dilute nitric acid
- C sodium sulfate solution and barium nitrate solution
- D dilute sulfuric acid and potassium hydroxide

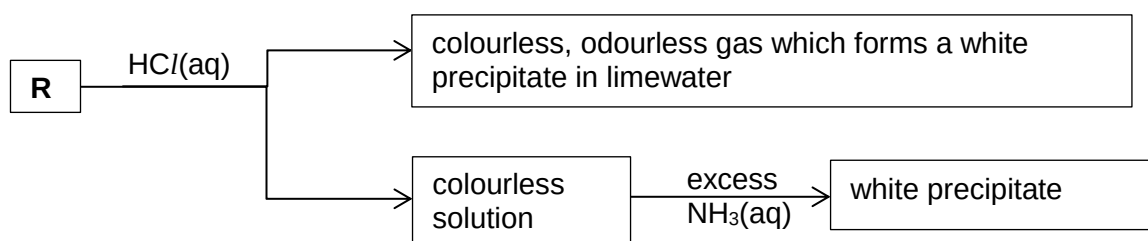
24 When a mixture of excess aqueous sodium hydroxide and substance **M** is warmed, there were no visible changes.

When a piece of aluminium foil was added to the mixture, a colourless and pungent gas was evolved upon warming the mixture. The gas turned moist red litmus blue.

Which substance could be **M**?

- A ammonium nitrate
- B ammonium sulfate
- C zinc nitrate
- D zinc sulfate

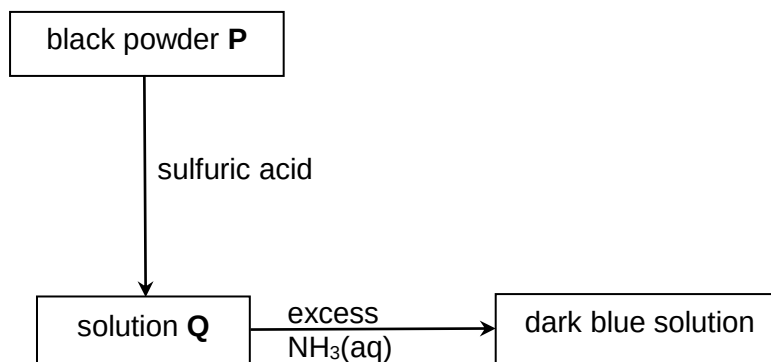
25 The flowchart below shows the reactions of compound **R**.



What can **R** possibly be?

- A aluminium carbonate
- B aluminium sulfate
- C lead(II) carbonate
- D zinc carbonate

26 Refer to the following flowchart.



Which statement is **false**?

- A **P** is a base.
- B **Q** contains Cu^{2+} ions.
- C **Q** can react with an alkali to form **P**.
- D **Q** forms a blue precipitate in excess aqueous sodium hydroxide.

27 Which statement about the properties of noble gases is not correct?

- A Helium is less dense than air.
- B Neon is used in light bulbs.
- C Noble gases exist as atoms.
- D Noble gases are colourless.

28 Many properties of an element and its compounds can be predicted from the position of the element in the Periodic Table.

Which property cannot be predicted in this way?

- A acidic and basic nature of oxide formed
- B charge of ion formed
- C metallic or non-metallic properties of element
- D number of isotopes the element has

- 29 The properties of four halogens, **P**, **Q**, **R** and **S** are given below.

property 1:	S has a lower boiling point than R .
property 2:	S is darker in colour than Q .
property 3:	R displaces P from its halide solution.

In which order do the halogens appear in Group 17?

	top → bottom			
A	Q	S	P	R
B	Q	S	R	P
C	Q	R	S	P
D	S	Q	R	P

- 30 Which ionic equation correctly shows a displacement reaction?

- A** $\text{F}_2(\text{g}) + 2\text{KBr}(\text{aq}) \rightarrow 2\text{KF}(\text{aq}) + \text{Br}_2(\text{aq})$
B $\text{F}_2(\text{g}) + \text{Br}^-(\text{aq}) \rightarrow \text{F}^-(\text{aq}) + \text{Br}_2(\text{aq})$
C $\text{F}_2(\text{g}) + 2\text{Br}^-(\text{aq}) \rightarrow 2\text{F}^-(\text{aq}) + \text{Br}_2(\text{aq})$
D $\text{F}(\text{g}) + \text{Br}^-(\text{aq}) \rightarrow \text{F}^-(\text{aq}) + \text{Br}(\text{aq})$

End of paper

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