

Name: Index no: Class:



Bukit Batok Secondary School

'O' LEVEL PRELIMINARY EXAMINATIONS 2023

SECONDARY 4 EXPRESS

CHEMISTRY

Paper 1 Multiple Choice

6092/01

23 AUG 2023

1105 – 1205

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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

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 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 **15**.

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

- 1** A student studied the rate of reaction when 0.05 g of magnesium was reacted with excess acid at room temperature and pressure.

Which apparatus would be suitable to measure the volume of gas produced at different times during the experiment?

- 1 a 50 cm³ gas syringe
- 2 an inverted 100 cm³ measuring cylinder filled with water
- 3 an inverted gas jar filled with water

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

- 2** Under the same conditions, which of the following gases would diffuse at the same rate as ethene, C₂H₄?

- 1 carbon monoxide
- 2 carbon dioxide
- 3 ethane
- 4 nitrogen

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

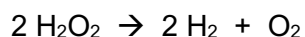
- 3** The boiling points of four substances found in air are given in the table.

Air is cooled to –190 °C such that some substances condense into liquid.

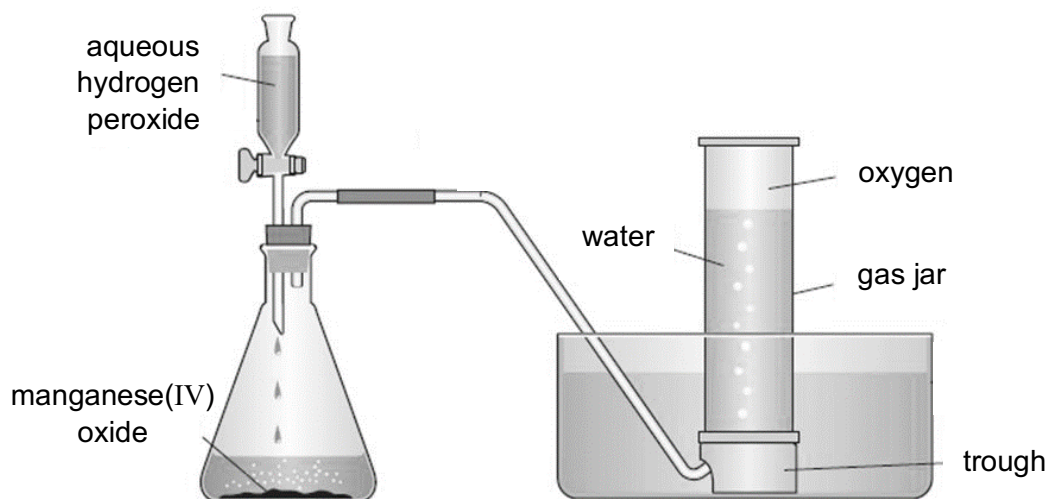
When the temperature is then raised, which liquid would turn into a gas first?

	substance	boiling point /°C
A	argon	–186
B	carbon dioxide	–78 (sublimes)
C	nitrogen	–196
D	oxygen	–183

- 4 Oxygen was prepared by the decomposition of hydrogen peroxide in the presence of manganese(IV) oxide according to the equation:



The oxygen was collected using the set-up shown in the diagram.



Which substance contaminated the first few jars of oxygen collected?

- A hydrogen
 - B hydrogen peroxide
 - C manganese(IV) oxide
 - D nitrogen
- 5 Solid P conducts electricity and has a high melting point.

When solid P is warmed with excess dilute hydrochloric acid, it partially dissolves leaving behind a residue.

What is P?

- A brass
- B copper(II) oxide
- C graphite
- D iron

6 Which of the following method(s) can be used to determine if a colourless liquid is pure?

- 1 Heat the liquid to saturation then allow to cool
- 2 Measure the boiling point of the liquid and compare with the reference value
- 3 Test the substance using paper chromatography

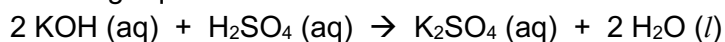
A 1 and 2 only **B** 2 and 3 only **C** 2 only **D** 3 only

7 When aqueous sodium hydroxide is added to an aqueous solution of Y, a red-brown precipitate is observed. When nitric acid and aqueous silver nitrate is added to an aqueous solution of Y, a yellow precipitate is observed.

What is Y?

A FeBr₂ **B** FeCl₃ **C** FeCO₃ **D** FeI₃

8 The reaction between potassium hydroxide solution and dilute sulfuric acid may be represented by the following equation:



A student found that 20 cm³ of 0.2 mol/dm³ potassium hydroxide exactly neutralised 25 cm³ of dilute sulfuric acid. What was the concentration of dilute sulfuric acid?

- A** $\frac{20 \times 0.2}{25} \text{ mol/dm}^3$
- B** $\frac{20 \times 0.2}{2 \times 25} \text{ mol/dm}^3$
- C** $\frac{25 \times 0.2}{2 \times 20} \text{ mol/dm}^3$
- D** $\frac{2 \times 20 \times 0.2}{25} \text{ mol/dm}^3$

9 Potassium ferrocyanide, K₄[Fe(CN)₆].3H₂O, is an inorganic compound commonly used as an anti-caking agent for table salt.

What is the percentage by mass of potassium in potassium ferrocyanide?

A 9.2% **B** 37.0% **C** 37.3% **D** 43.1%

- 10 The equations for the action of heat on four metal carbonates are shown below.



A 5.0 g sample of each metal carbonate was heated until constant mass.

Which metal carbonate would produce the greatest volume of carbon dioxide?

- A** FeCO_3 **B** MgCO_3 **C** PbCO_3 **D** ZnCO_3

- 11 The nucleus of the ion Q^{2-} (not its real chemical symbol) contains a total of 33 particles, of which 16 possess a charge.

Which statement about this ion is correct?

- A** It contains 16 neutrons and 16 electrons.
B It contains 16 protons and 16 electrons.
C It contains 17 neutrons and 18 electrons.
D It contains 17 protons and 18 electrons.

- 12 Metal nitrides are formed when metal atoms transfer electrons to nitrogen atoms.

In the formation of one mole of which metal nitride do the metal atoms **not** transfer exactly three moles of electrons?

- A** aluminium nitride
B chromium(III) nitride
C lithium nitride
D zinc nitride

- 13 Which pair of substances have similar three-dimensional arrangements of their atoms?

- A** diamond and graphite
B diamond and silicon dioxide
C lead and graphite
D lead(IV) oxide and silicon dioxide

- 14** In a molecule of hydrogen cyanide, HCN, what is the total number of electrons present and how many of them are involved in bonding?

	total number of electrons	number of electrons involved in bonding
A	14	4
B	14	8
C	26	4
D	26	8

- 15** Electrical conductivity of substances is determined by the presence of mobile charged particles.

These include:

- 1 anions
- 2 cations
- 3 electrons

Which charged particles are responsible for the electrical conductivity of copper?

- A** 1 and 2 **B** 2 and 3 **C** 3 only **D** 1, 2 and 3
- 16** When heated with potassium hydroxide, a solution of salt X produces a gas Y that turns damp red litmus blue.

After no more gas is produced, aluminium powder is added. Upon heating, gas Y is produced again.

What is the formula of salt X?

- A** Na_2CO_3 **B** NaNO_3 **C** $(\text{NH}_4)_2\text{CO}_3$ **D** NH_4NO_3
- 17** A dilute aqueous solution of a strong acid, HA, contains molecules of water and the ions H^+ and A^- .

Which statement(s) is/are correct?

- 1 The concentration of H^+ ions is equal to the concentration of A^- ions.
- 2 The pH of the solution is greater than 7.
- 3 The solution contains a high concentration of HA molecules.
- 4 The solution also contains OH^- ions.

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

- 18 Arsenic trioxide, As_2O_3 , is an amphoteric white solid.

Which reagents could be used to distinguish arsenic trioxide from solid magnesium hydroxide?

- 1 HNO_3
- 2 H_2SO_4
- 3 NaOH
- 4 KOH

- A** 1 or 2 **B** 1 or 3 **C** 2 or 4 **D** 3 or 4

- 19 Which pair of elements would react to form the most violent reaction?

- A** lithium and chlorine
- B** potassium and bromine
- C** rubidium and fluorine
- D** sodium and iodine

- 20 The nuclide notation of an atom of element R is written as ${}^5_2\text{R}$.

Which group of the Periodic Table does R belong to?

- A** Group 0 **B** Group II **C** Group V **D** Group VII

- 21 Copper(I) oxide reacts with sulfuric acid according to the equation



What is the oxidising and reducing agent in this reaction?

	oxidising agent	reducing agent
A	Cu_2O	Cu_2O
B	Cu_2O	H_2SO_4
C	H_2SO_4	Cu_2O
D	H_2SO_4	H_2SO_4

- 22 Which compound in aqueous solution, when added to aqueous iron(III) chloride, takes part in a redox reaction?

- A** acidified potassium manganate(VII)
- B** copper(II) sulfate
- C** potassium iodide
- D** silver nitrate

- 23 20 cm³ of methane was burnt in 30 cm³ of oxygen.

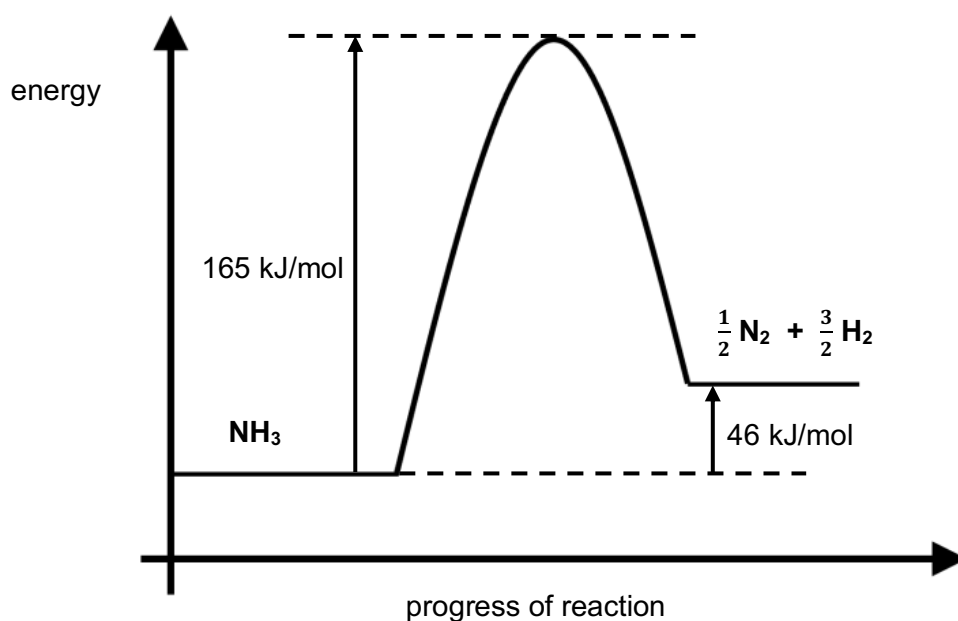
When cooled to room temperature, what could the resulting mixture of gases contain?

- A CO, CO₂, H₂O
- B CO, CO₂, CH₄
- C CO₂, CH₄, O₂
- D CO₂, H₂, O₂

- 24 Which of the following statements regarding ammonia is correct?

- A It is formed by warming aqueous ammonium salts with dilute hydrochloric acid.
- B It is manufactured industrially using a by-product from the production of ethene.
- C It is soluble in water and forms a solution with pH less than 7.
- D Its aqueous solution can be used to distinguish sodium ions and calcium ions.

- 25 The energy profile diagram for the decomposition of ammonia is shown.



What is the activation energy for the formation of ammonia?

- A 46 kJ / mol
- B 119 kJ / mol
- C 165 kJ / mol
- D 211 kJ / mol

- 26** Copper(II) oxide reacts with dilute sulfuric acid at a constant temperature of 25 °C.

Which statement best describes the rate of this reaction?

- A** The rate of reaction decreases over time.
- B** The rate of reaction decreases at first, then increases over time.
- C** The rate of reaction increases over time.
- D** The rate of reaction remains constant.

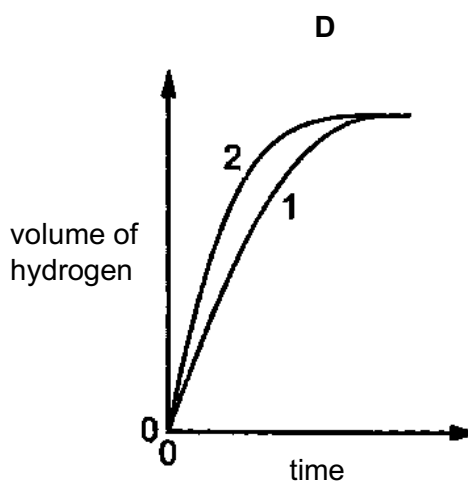
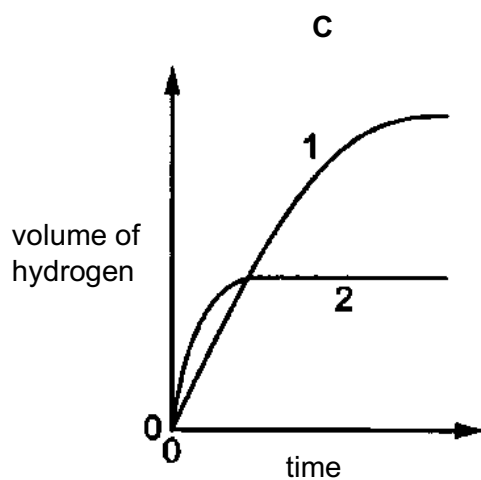
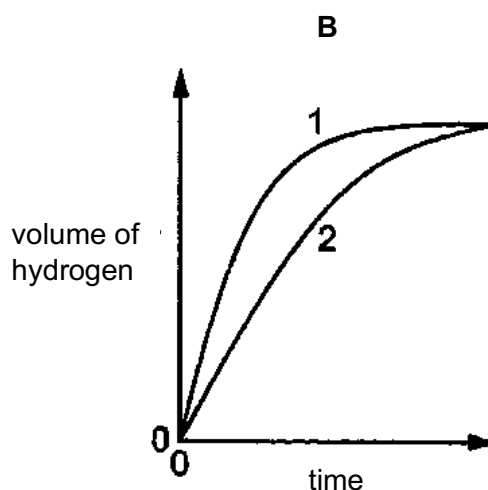
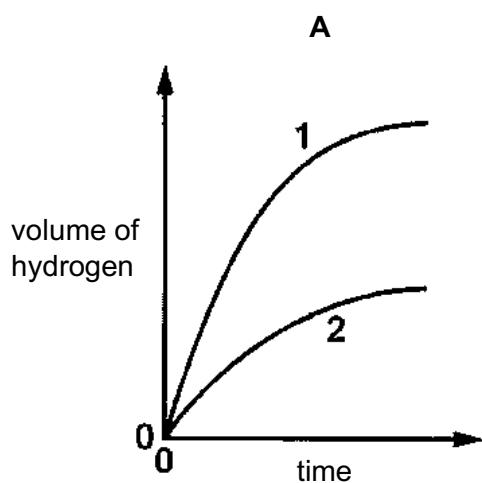
- 27** Dilute hydrochloric acid was reacted with 1.2 g of magnesium ribbon at room temperature in two experiments.

In experiment 1, 200 cm³ of 1 mol / dm³ hydrochloric acid was used.

In experiment 2, 50 cm³ of 2 mol / dm³ hydrochloric acid was used.

The volume of hydrogen gas given off was plotted against time.

Which graph is correct?



- 28** Metal M can be obtained by heating its oxide with carbon or by electrolysis of its aqueous chloride.

Which metal is M?

- A** calcium
 - B** copper
 - C** lead
 - D** silver
- 29** In the extraction of iron from its ore, which substance is oxidised in the blast furnace?
- A** carbon dioxide
 - B** calcium carbonate
 - C** coke
 - D** haematite
- 30** Mercury, Hg, is a silvery metal that is liquid at room temperature.

It forms two oxides with formulae HgO and Hg₂O respectively.

It mixes with other metals such as sodium to form an alloy.

Which property of mercury best explains why it is classified as a transition metal?

- A** Mercury is a good electrical conductor.
- B** Mercury is a silvery metal.
- C** Mercury has variable oxidation states
- D** Mercury forms alloys with other metals.

- 31** Pieces of magnesium, iron, lead and an unknown metal, Z, were placed separately in test tubes containing aqueous solutions of their ions.

	metal ions			
	Mg ²⁺	Fe ²⁺	Pb ²⁺	Z ²⁺
Mg		✓	✓	✓
Fe	X		✓	✓
Pb	X	X		X
Z	X	X	✓	

Legend: ✓ – reaction occurred
 X – no reaction occurred

Which statement about Z is most likely to be true?

- A** Z is found uncombined in the ground.
B Z is found in group II.
C Z reacts slowly with cold water.
D Z will react with copper(II) sulfate.
- 32** Four different conditions under which potassium bromide is electrolysed using inert electrodes are listed.

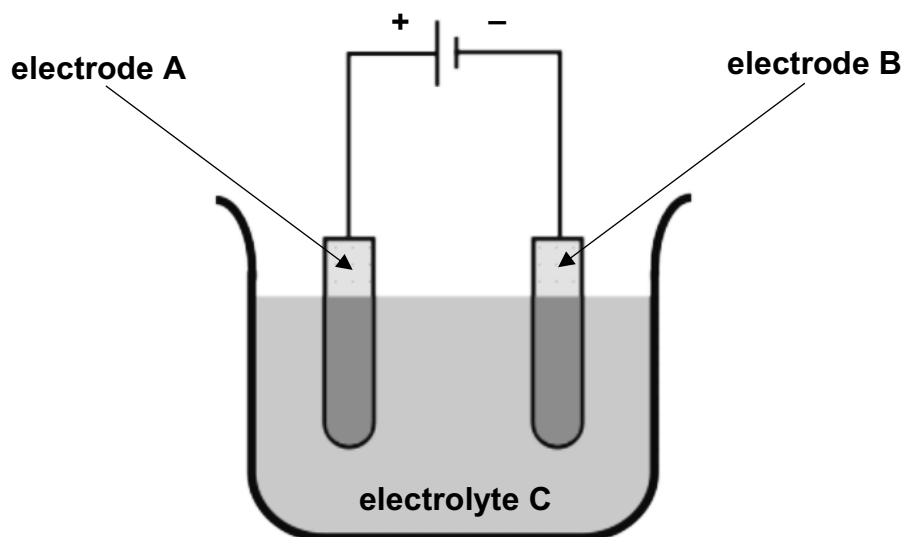
- 1 concentrated potassium bromide
- 2 dilute potassium bromide
- 3 molten potassium bromide
- 4 solid potassium bromide

Under which conditions would the electrolyte turn orange?

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

- 33** Galvanising steel is the process of coating steel with a layer of zinc. The zinc layer can be applied to the steel using electrolysis.

In the diagram, what are the electrodes A, B and electrolyte C used?



	electrode A	electrode B	electrolyte C
A	steel	zinc	iron(III) nitrate
B	steel	zinc	zinc nitrate
C	zinc	steel	iron(III) nitrate
D	zinc	steel	zinc nitrate

- 34** Which two petroleum fractions are commonly used as fuels for engines?

- A** bitumen and naphtha
- B** bitumen and paraffin
- C** diesel and naphtha
- D** diesel and paraffin

- 35** Which property shows an increase in the following series of hydrocarbons?

pentene → butene → propene → ethene

- A** boiling point
- B** flammability
- C** melting point
- D** viscosity

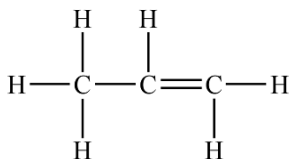
36 How many different alkanes have the molecular formula C_5H_{12} ?

- A** 2 **B** 3 **C** 4 **D** 5

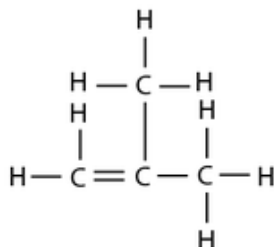
37 When reacted with steam and phosphoric acid at $300\text{ }^{\circ}\text{C}$ and 65 atm pressure, an unknown alkene only forms one type of alcohol.

What is the unknown alkene?

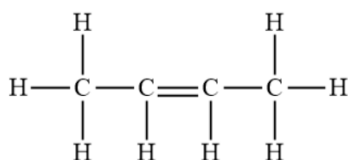
A



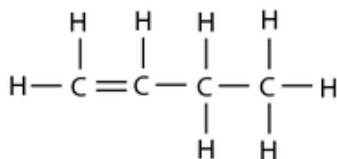
B



C



D



38 Which compound is obtained when acidified potassium manganate(VII) is warmed with 1-propanol?

- A** $\text{CH}_3\text{COOCH}_3$
B $\text{C}_2\text{H}_5\text{COOH}$
C $\text{C}_3\text{H}_7\text{COOH}$
D HCOOC_2H_5

- 39 The reaction between a carboxylic acid, C_xH_yCOOH and an alcohol $C_nH_{2n+1}OH$ produces an ester.

How many hydrogen atoms does one molecule of the ester contain?

- A $y + 2n$
 - B $y + 2n + 1$
 - C $y + 2n + 2$
 - D $y + 2n + 3$
- 40 Which of the following compounds would, without adding any other reagent, polymerise to form a polymer similar to terylene?

- A C_2H_4
- B $HOCH_2CH_2NH_2$
- C $H_2NCH_2CH_2COOH$
- D $HOCH_2CH_2COOH$

– End of paper –

The Periodic Table of Elements

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	–

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