Candidate Name	Form Class	Index Number

ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

CHEMISTRY **6092/01**

Paper 1 Multiple Choice **27 August 2024**

1 hour

Setter: Mr Vincent Voo

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, class and index number on the Question Paper and on the Answer Sheet in the spaces provided.

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 on this question paper.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** printed pages.

[Turn Over

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1 Which apparatus can be used to determine the end-point in a volumetric experiment involving the addition of dilute hydrochloric acid to 25.0 cm^3 of aqueous sodium hydroxide?

A electronic balance

B gas syringe

C stopwatch

D thermometer

2 Which of the following procedure describes the best method to obtain a pure sample of barium chloride from a mixture of barium chloride and barium sulfate salts?

	step 1	step 2	step 3	step 4
A	dissolution	crystallisation	filtration	evaporation
B	dissolution	filtration	evaporation	crystallisation
C	evaporation	crystallisation	dissolution	filtration
D	filtration	dissolution	evaporation	crystallisation

3 100 cm^3 of carbon dioxide gas diffuses through a porous pot in 50 s. 100 cm^3 of gas X takes more than 50 s to diffuse through the same porous pot under the same room conditions.

Which of the following is gas X?

A ammonia

B hydrogen

C methane

D sulfur dioxide

4 Which statement explains why sodium chloride has a lower melting point than magnesium oxide?

A Sodium metal is more reactive than magnesium metal.

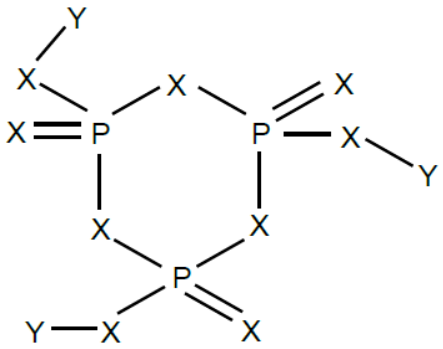
B The attraction between Na^+ and Cl^- is weaker than that between Mg^{2+} and O^{2-}.

C The boiling point of sodium chloride is lower than that of magnesium oxide.

D The bonding in sodium chloride is covalent while it is ionic in magnesium oxide.

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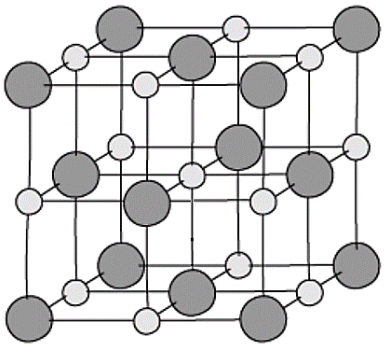
5 The diagram shows a molecule of a substance made up of three different elements, P, X and Y.



If P is the element phosphorus, what elements could X and Y be?

	X	Y
A	H	O
B	O	Cl
C	S	Na
D	Mg	Na

6 The structure of an ionic compound is as shown.



Which compound cannot have this arrangement of its ions?

A lithium oxide

B magnesium carbonate

C potassium chloride

D zinc sulfate

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7 The formula of sodium silicate, which is used in the manufacture of silica gel, is Na_2SiO_3.

What is the formula of magnesium silicate?

A $MgSiO_3$

B Mg_2SiO_3

C $Mg(SiO_3)_2$

D $Mg_3(SiO_3)_2$

8 The table shows the proton number and nucleon number of elements X and Y.

element	proton number	nucleon number
X	9	17
Y	13	28

What is the mass of one mole of the compound formed between elements X and Y?

A 22 g

B 45 g

C 79 g

D 101 g

9 The mass of mixture M containing barium carbonate and barium sulfate is 8.0 g. Excess nitric acid is added to the mixture and the resulting content is then filtered. The mass of the residue and filtrate is found to be 5.2 g and 13.4 g respectively.

What is the percentage purity of barium sulfate in mixture M?

A $\frac{2.8}{8.0} \times 100\%$

B $\frac{5.2}{8.0} \times 100\%$

C $\frac{5.2}{13.4} \times 100\%$

D $\frac{8.2}{13.4} \times 100\%$

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10 The complete combustion of ethane is represented by the following equation.

$$C_2H_4\ (g)\ +\ 3\ O_2\ (g)\ \rightarrow\ 2\ CO_2\ (g)\ +\ 2\ H_2O\ (l)$$

60 cm^3 of ethane reacts with 120 cm^3 of oxygen in a closed container.

What is the total volume of gas collected at room temperature at the end of the reaction?

A 60 cm^3

B 80 cm^3

C 100 cm^3

D 120 cm^3

11 The pH of a sample of dilute hydrochloric acid is 2.

What will be the pH of the acid after the addition of 10 g of sodium chloride salt?

A pH 1

B pH 2

C pH 7

D pH 9

12 Which of the following set of reactants is most appropriate to prepare a pure sample of copper(II) chloride crystals?

A copper and hydrochloric acid

B copper(II) carbonate and hydrochloric acid

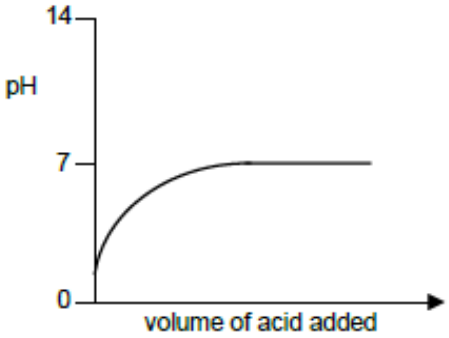
C copper(II) hydroxide and ammonium chloride

D copper(II) nitrate and potassium chloride

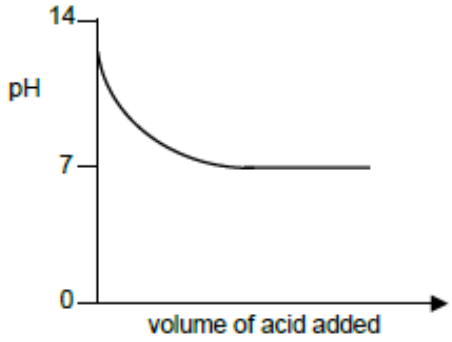
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13 Which graph shows the changes in pH as excess dilute hydrochloric acid is added to aqueous sodium hydroxide?

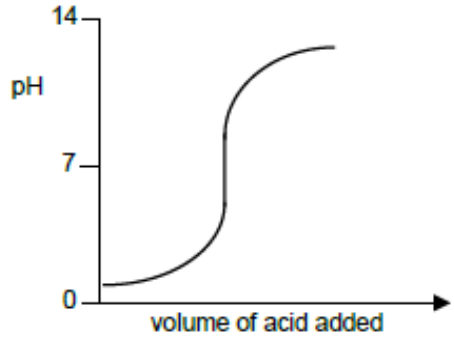
A



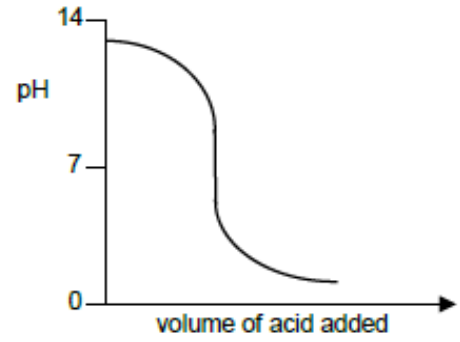
B



C



D



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14 Which of the following will react with aqueous ammonium sulfate to produce an alkaline gas?

A calcium hydroxide

B copper(II) oxide

C nitric acid

D sodium chloride

15 In the Haber process, nitrogen and hydrogen react to form ammonia.

What is the source of hydrogen?

A cracking of oil fractions

B electrolysis of water

C fractional distillation of liquid air

D reaction between acid and metal

16 Which of the following can increase the yield of ammonia in the Haber process?

A increase the pressure to 450 atm

B increase the temperature to 1000 ^{o}C

C use equal volume of nitrogen and hydrogen

D use platinum as a catalyst

17 Which of the following pairs of solutions will show no visible change when mixed?

A barium nitrate and hydrochloric acid

B lead(II) nitrate and sodium sulfate

C sodium carbonate and magnesium nitrate

D zinc and copper(II) sulfate

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18 A salt has the chemical formula $(NH_4)_2Fe(SO_4)_2.12H_2O$.

In an experiment, excess sodium hydroxide was added slowly, with shaking, to an aqueous solution of the salt until there is no further changes. The boiling tube was then left to stand.

Which of the following observations would not be made?

A A green precipitate was produced.

B A pungent gas which turned damp red litmus paper blue was produced.

C On standing, a brown precipitate was produced.

D The precipitate dissolved in excess aqueous sodium hydroxide.

19 Both aqueous sodium carbonate and sodium hydroxide solution turn red litmus paper blue.

Which one of the following substances can be used to differentiate the two solutions?

A aqueous calcium nitrate

B aqueous potassium chloride

C carbon dioxide

D dilute hydrochloric acid

20 In which reaction is the underlined substance behaving as an oxidising agent?

A $\underline{Cl_2} + 2\,NaBr \rightarrow Br_2 + 2\,NaCl$

B $\underline{HCl} + NaOH \rightarrow NaCl + H_2O$

C $2\,\underline{FeCl_2} + Cl_2 \rightarrow 2\,FeCl_3$

D $2\,\underline{NaOH} + FeCl_2 \rightarrow Fe(OH)_2 + 2\,NaCl$

21 In which reaction does the oxidation state of iron remain unchanged?

A $Fe + 2\,FeCl_3 \rightarrow 3\,FeCl_2$

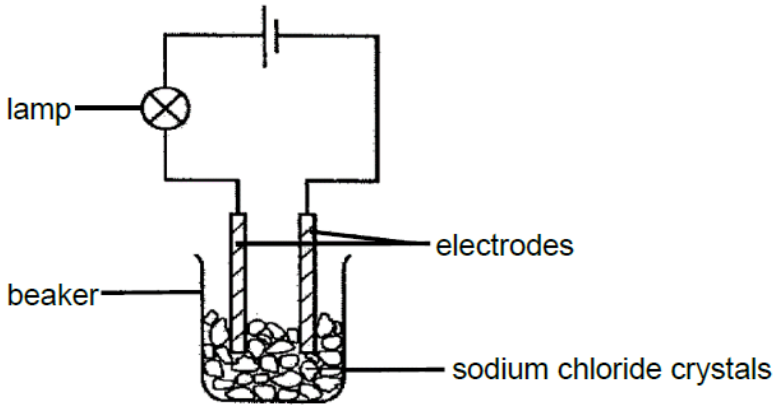
B $Fe_2O_3 + 6\,HCl \rightarrow 2\,FeCl_3 + 3\,H_2O$

C $2\,Fe + 3\,Cl_2 \rightarrow 2\,FeCl_3$

D $2\,FeCl_2 + Cl_2 \rightarrow 2\,FeCl_3$

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22 In the set-up shown, the lamp did not light up. Distilled water was then added to the beaker and the lamp lighted up.



Which statement explains these observations?

A Electrons are free to move in the solution when sodium chloride dissolves.

B Metal ions are free to move when sodium reacts with water.

C Non-metal ions are free to move when sodium chloride dissolves.

D Oppositely charged ions are free to move when sodium chloride dissolves.

23 In an electrolysis experiment, the same amount of charge deposits 19.5 g of zinc and 11 g of manganese.

Which is the charge of the manganese ion? [Ar: Mn, 55; Zn, 65]

A +2

B +3

C +4

D +7

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

What property could **not** be predicted from the position of the element in the Periodic Table?

A the number of isotopes the element has

B the formula of the oxides of the element

C the acidic and basic nature of the oxides of the element

D the metallic and non-metallic properties of the element

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25 A student compares the properties of two Group 1 elements, lithium and potassium.

Which of the following is correct?

	higher melting point	more vigorous reaction with water
A	lithium	lithium
B	lithium	potassium
C	potassium	lithium
D	potassium	potassium

26 Elements X and Y are in Group 17 of the Periodic Table. X is a liquid and Y is a solid at room temperature.

What statement is/are correct?

1 Atoms of Y have more electrons than atoms of X.

2 A molecule of Y has more atoms than a molecule of X.

3 X displaces Y from an aqueous solution of Y^- ions.

A 1 only

B 2 only

C 1 and 3 only

D 1, 2 and 3

27 Metal X and its compound undergo the following reactions.

1 $XO + H_2 \rightarrow X + H_2O$
2 $X + 2\,HCl \rightarrow XCl_2 + H_2$

What could metal X be?

A calcium

B iron

C magnesium

D potassium

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28 Which of the following aqueous solutions, when added to aqueous iron(II) chloride, takes part in a redox reaction?

A ammonia

B silver nitrate

C potassium hydroxide

D potassium manganate(VII)

29 Metals P, Q, R and S are placed in salt solutions as shown in the table.

metal	salt of P	salt of Q	salt of R	salt of S
P	no reaction	no reaction	no reaction	S displaced
Q	P displaced	no reaction	no reaction	S displaced
R	P displaced	Q displaced	no reaction	S displaced
S	no reaction	no reaction	no reaction	no reaction

What is the order of reactivity of the metals in increasing order?

A Q, P, S, R

B R, Q, P, S

C S, P, Q, R

D S, Q, P, R

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30 Ethyne (H–C≡C–H) undergoes addition of hydrogen to form ethane as shown.

$$C_2H_2 + 2\ H_2 \rightarrow C_2H_6$$

The average bond energies of the following bonds are shown in the table.

bond	C–H	C–C	C=C	C≡C	H–H
bond energy / kJ/mol	413	347	614	839	432

What is the enthalpy change for the reaction?

A −296 kJ/mol

B −176 kJ/mol

C +176 kJ/mol

D +296 kJ/mol

31 Which of the following reactions will pressure least likely to affect the speed of reaction?

A $C\ (s) + CO_2\ (g) \rightarrow 2\ CO\ (g)$

B $C_2H_4\ (g) + Br_2\ (l) \rightarrow C_2H_4Br_2\ (l)$

C $2\ Na\ (s) + 2H_2O\ (l) \rightarrow 2\ NaOH\ (aq) + H_2\ (g)$

D $2\ SO_2\ (g) + O_2\ (g) \rightarrow 2\ SO_3\ (g)$

32 When excess magnesium ribbon is added to dilute hydrochloric acid, the reaction soon becomes slower and finally stops.

Which of the following statements best explains this observation?

A The concentration of the acid is decreasing until it finally becomes zero.

B The magnesium ribbon becomes smaller and finally ‘dissolves’ completely.

C The magnesium ribbon is become covered with an insoluble layer of precipitate.

D The temperature of the reaction mixture decreases during the reaction.

33 Which of the following statements is true of petroleum?

A Bioethanol can be obtained from petroleum.

B Burning petroleum mainly produces carbon dioxide and water.

C Each fraction of petroleum has a fixed boiling point.

D Petroleum is a compound made up of carbon and hydrogen atoms.

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34 Why are biofuels produced from plants considered to be carbon neutral?

A Biofuels do not produce carbon dioxide when burnt.

B Biofuels produce carbon monoxide, which is neutral, when burnt.

C Plants give out carbon dioxide during respiration.

D Plants take in carbon dioxide during photosynthesis.

35 Which of the following cannot be used to distinguish between propanol and propanoic acid?

A acidified potassium manganate(VII)

B red litmus paper

C calcium carbonate

D zinc

36 A hydrocarbon is heated strongly in the presence of a catalyst. The resulting mixture consists of butane, ethene and propene in the molar ratio of 2 : 1 : 2.

What is the molecular formula of the hydrocarbon?

A C_9H_{18}

B C_9H_{20}

C $C_{16}H_{32}$

D $C_{16}H_{36}$

37 1 mole of a compound X reacts completely with 2 moles of hydrogen gas in the presence of a catalyst to form 1 mole of alkane.

What compound could X be?

A $CH_2{=}CH{-}CH_2{-}CH_3$

B $CH_2{=}CH{-}CH{=}CH_2$

C $CH_2{=}CH{-}CH{=}CH{-}O{-}H$

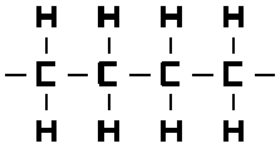
D $CH_2{=}CH{-}CH{=}CH{-}CH{=}CH_2$

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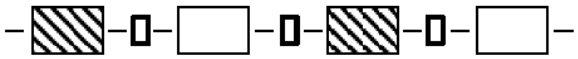
38 Polymer X has a similar linkage as nylon.

Which of the following is likely to be the monomer of polymer X.

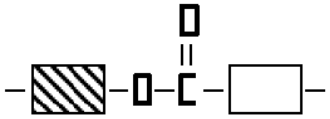
A



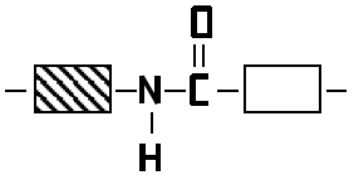
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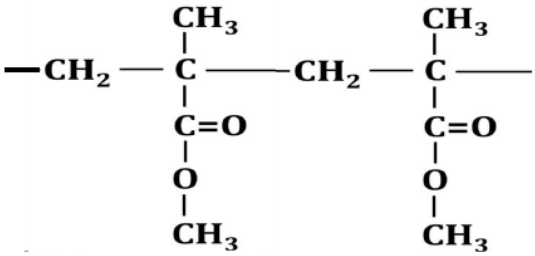
C



D



39 Poly(methyl methacrylate) is used to make hard contact lenses. Part of its polymer chain is shown below.



Which statements about poly(methyl methacrylate) are correct?

1 Its monomer is $CH_2=CCH_3CO_2CH_3$.
2 It can be classified as an acid.
3 It can be classified as an ester.
4 It is a condensation polymer.

A 1 and 2 only

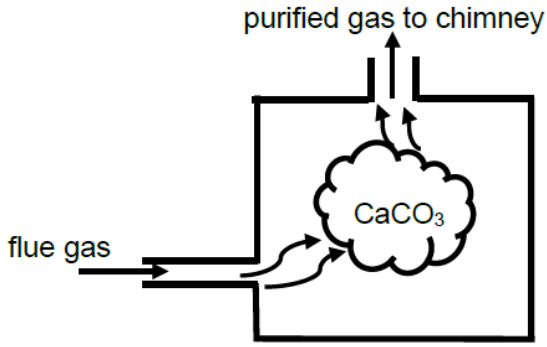
B 1 and 3 only

C 3 and 4 only

D 2, 3 and 4 only

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40 The diagram shows a simplified process to remove flue gas.



Which gas cannot be removed using the method shown?

A carbon monoxide

B nitrogen dioxide

C phosphorus trioxide

D sulfur dioxide

END OF PAPER

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The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	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.).
The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$.

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