

CHEMISTRY Paper 1 6092/01

1 hour

15 September 2022

Additional Materials: OMR Form

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, class and index number on the answer sheet in the spaces provided unless this has already been done for you.

There are **forty** questions in 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 very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

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 provided on page 19.

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

This document consists of 19 printed pages and 1 blank page.

- A argon
- B fluorine
- C methane
- D oxygen
- The diagram shows the fractional distillation of two liquids, R and S.
 R has a boiling point of 80 °C and S has a boiling point of 110 °C.



Which statement is correct when the thermometer shows 80 °C?

- 1 The liquid left in the flask contains more **S** than **R**.
- 2 The vapour at point Y only contains **R**.
- 3 The temperature at X is higher than the temperature at Y.
- **A** 1, 2 and 3
- B 1 and 2 only
- C 1 only
- D 2 and 3 only

3 The diagram shows the chromatogram obtained by the analysis of a dye mixture. The distances travelled by three spots are shown in the diagram.



What is the Rf of the most soluble dye?

Α	0.20	В	0.80	С	1.00	D	1.25
Α	0.20	в	0.80	C	1.00	D	1.

4 The equation shows the reaction between calcium hydroxide and dilute nitric acid.

 $Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$

An experiment is conducted to determine the solubility of calcium hydroxide in water at room temperature. 25.0 cm³ of a saturated solution of freshly prepared calcium hydroxide is titrated against dilute nitric acid.

Besides the conical flask, what other apparatus is needed for the titration?

- **A** beaker and pipette
- **B** burette and measuring cylinder
- **C** burette and pipette
- **D** burette and stirrer

5 The apparatus below is used to obtain a small sample of dry nitrogen gas from a sample of gas contaminated with hydrogen chloride.



Which row correctly describes the reagents in flask P and in flask Q?

	flask P	flask Q
Α	ethanoic acid	concentrated sulfuric acid
в	water	aqueous sodium hydroxide
С	aqueous sodium hydroxide	concentrated sulfuric acid
D	concentrated sulfuric acid	aqueous sodium hydroxide

- 6 Propane and butane are usually stored as liquids. They are produced by compressing the gases in separate vessels with the same volume. Assuming that the same mole equivalent of propane and butane is used, which of the following statements is true?
 - 1 Energy will be released to the surroundings during compression.
 - 2 Liquid propane will be heavier after all the gaseous propane have been compressed.
 - 3 Liquid butane has a higher density than liquid propane.
 - 4 The molecules in liquid propane and butane are randomly arranged in the vessel.
 - A 1, 2 and 3 only
 - **B** 1, 2 and 4 only
 - **C** 1, 3 and 4 only
 - **D** 2, 3 and 4 only

7 The following graphs are obtained by cooling four liquids, A, B, C and D.Which of the graphs shows the cooling curve of a pure liquid?



8 An element consists of four isotopes. The graph shows the relative abundances of the four isotopes. The relative abundance is a measure of the percentage by mass of the isotope of a particular relative atomic mass.



What is the relative atomic mass of the element?

A 22.8 **B** 23.0 **C** 91.3 **D** 92.0

9 The following molecules all contain covalent bonds.

- 1 ammonia
- 2 carbon dioxide
- 3 oxygen

Which of the molecules contains only single covalent bonds?

- **A** 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 and 3 only
- **10** The diagrams show three separate experiments involving ammonium compounds.



In which experiment is ammonia gas produced?

- **A** 1, 2 and 3 **B** 1 only **C** 2 only **D** 3 only
- **11** Copper is a metal. The structure of copper is described as a lattice of positive ions in a sea of electrons.

Which statement about copper is correct?

- 1 Copper conducts electricity because the electrons are free to move.
- 2 Copper conducts heat because the positive ions are free to move.
- 3 Copper has a high melting point due to strong covalent bonds.
- 4 Copper ions are held together because of their attraction for each other.
- **A** 1, 2 and 3 only **B** 1 only **C** 2, 3 and 4 only **D** 2 and 3 only

12 ${}^{36}S^{2-}$ and ${}^{37}Cl^{-}$ are ions of sulfur and chlorine isotopes.

What do the ions have in common?

- **A** Both ions contain the same number of nucleons in their nuclei.
- **B** Both ions have electronic configuration 2, 8, 6.
- **C** Both ions have more electrons than neutrons.
- **D** Both ions have 20 neutrons in their nuclei.
- **13** Which statement best explains why 1 mole of hydrogen atoms has approximately the same mass as 1 mole of protons?
 - **A** A hydrogen atom is made up of one proton only.
 - **B** An electron has zero mass.
 - **C** One mole of any substance has the same mass.
 - **D** The mass of a proton is much greater than the mass of an electron.
- **14** Bromobutane, C₄H₉Br, can be made from butanol using the reaction shown.

 $C_4H_9OH + HBr \rightarrow C_4H_9Br + H_2O$

In an experiment, 10 g of butanol produced 12 g of bromobutane.

What is the percentage yield of bromobutane? [M_r: C₄H₉OH, 74; C₄H₉Br, 137]

- **A** 45% **B** 54% **C** 65% **D** 83%
- 15 The combustion reaction between hydrogen gas and oxygen gas is shown.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

A mixture of 24 dm³ of hydrogen gas and 100 dm³ of oxygen gas was ignited. The reaction mixture was cooled to room temperature and pressure. What would be the total volume of gases remaining at the end of the reaction?

A 24 dm³ **B** 66 dm³ **C** 88 dm³ **D** 124 dm³

$$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$$

How many moles of lithium hydroxide will neutralize the solution produced by 0.25 mol of SO_2Cl_2 and 1.0 mol of water?

A 0.75 mol **B** 1.00 mol **C** 1.50 mol **D** 2.00 mol

- 17 Which of the following processes does **not** cause the surrounding temperature to rise?
 - A dissolving ammonium chloride in water
 - **B** mixing potassium hydroxide with nitric acid
 - **C** reacting hydrogen with nitrogen to form ammonia
 - **D** rusting of iron
- **18** The decreasing order of reactivity of four metals is as follows: **T** is most reactive, followed by **W**, **V** and **U**.

These four metals are extracted from their ores in three different ways:

- One of the metals is extracted from their ores by electrolysis.
- Metal V and one other metal are extracted by heating their ores with carbon.
- One of the metals occurs uncombined.

Which method of extraction is correct?

	extraction by electrolysis	extraction by heating with carbon
Α	metal T	metal W
в	metal T	metal U
С	metal U	metal W
D	metal U	metal T

- **19** Which of the following involves the largest number of electrons for complete discharge of ions during electrolysis?
 - **A** 4 mol of Al^{3+} ions
 - B 6 mol of Cu²⁺ ions
 - C 7 mol of O²⁻ions
 - **D** 12 mol of Cl^{-} ions
- 20 An ion is discharged at the cathode during electrolysis of a molten salt containing the ion.

Which could describe this ion?

	proton number	electronic configuration
Α	12	2, 8
в	16	2, 8, 8
С	17	2, 8, 8
D	18	2, 8, 8

21 The diagram shows part of an experimental set up to electroplate an object.



What must be true for the object to be electroplated with silver?

- **A** The electrode is the cathode.
- **B** The electrolyte must be a molten silver salt and not an aqueous solution of silver ions.
- **C** The object is connected to the negative terminal of the battery.
- **D** The object is made of a less reactive metal than silver.

22 The set up below was used to carry out a small-scale experiment on electrolysis.



Which row describes the observations at graphite rod **1** and **2** after a current was passed through the circuit for some time?

	graphite rod 1	graphite rod 2
Α	bubbling	solution around the rod turns red
В	bubbling	solution around the rod turns blue
С	potassium globules formed	solution around the rod turns red
D	potassium globules formed	solution around the rod turns blue

- **23** In terms of particle theory, why do the speed of gaseous reactions increase at higher pressure?
 - **A** The bonds inside the gas molecules are weaker.
 - **B** The gas molecules break up more easily.
 - **C** The gas molecules collide more frequently.
 - **D** The gas molecules travel at a greater speed.

24 Manganese (IV) oxide catalyses the decomposition of aqueous hydrogen peroxide into water and oxygen.

$$2H_2O_2 \rightarrow O_2 + 2H_2O$$

The volume of oxygen gas formed is measured.

In all four experiments, the same volume of hydrogen peroxide is used. The concentration, or temperature, or both concentration and temperature of hydrogen peroxide, are changed.



Which statement is correct?

- 1 Experiment 4 is faster than Experiment 3.
- 2 The concentration of hydrogen peroxide used in Experiment 2 is of a lower concentration than in Experiment 1.
- 3 The temperature of hydrogen peroxide used is higher in Experiment 1 than in Experiment 2.

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

25 The following sequence shows the steps in the conversion of calcium phosphate, $Ca_3(PO_4)_2$, to phosphorous acid, H_3PO_3 .

 $Ca_3(PO_4)_2 \ \rightarrow \ P_4 \ \rightarrow \ P_4O_6 \ \rightarrow \ H_3PO_3$

Which row shows the correct oxidation numbers of phosphorus in this sequence?

	Ca ₃ (PO ₄) ₂	P4	P4O6	H₃PO₃
Α	+5	0	+3	+3
в	+3	0	+5	+5
С	+1	+4	+3	+1
D	+2	+4	+4	+1

- 26 Aqueous hydrogen peroxide may behave as an oxidising or reducing agent. In which reaction does hydrogen peroxide behave as an oxidising agent?
 - **A** It turns acidified potassium manganate(VII) colourless.
 - **B** It turns aqueous iodine colourless.
 - **C** It turns aqueous iron(III) nitrate pale green.
 - **D** It turns aqueous potassium iodide brown.
- **27** The following equations represent reactions of dilute sulfuric acid.

Which reaction does not show the characteristic chemical property of a dilute acid?

- A 2KOH (aq) + H₂SO₄ (aq) \rightarrow K₂SO₄ (aq) + 2H₂O (l)
- **B** CuO (s) + H₂SO₄ (aq) \rightarrow CuSO₄ (aq) + H₂O (l)
- **C** $Pb(NO_3)_2$ (aq) + H_2SO_4 (aq) $\rightarrow PbSO_4$ (s) + 2HNO₃ (aq)
- **D** ZnCO₃ (s) + H₂SO₄ (aq) \rightarrow ZnSO₄ (aq) + CO₂ (g) + H₂O (l)

28 A solution contained nitric acid and silver nitrate solution.

Which of the following results could be obtained if the solution was tested with universal indicator and potassium chloride solution?

	universal indicator	potassium chloride solution
Α	pH 2	white precipitate
В	pH 2	no observable change
С	pH 7	white precipitate
D	pH 11	no observable change

- **29** The Haber Process produces large-scale ammonia under controlled conditions. Since the percentage of nitrogen in the air is 78%, why is it not industrially advisable to use air in the Haber Process?
 - A Iron catalyst will be reduced by air.
 - **B** It is difficult to separate air from ammonia.
 - **C** Nitrogen has a lower boiling point than air.
 - **D** The reactants and catalyst will be oxidised by oxygen in air under high temperature.
- **30** Element **X** has the following properties.
 - forms **X**Cl₃ when heated with chlorine
 - forms XSO₄ when reacted with dilute sulfuric acid

To which part of the Periodic Table does X belong?

A Group II B Group III C Group IV D transition metal

31 A compound **Y** was mixed with zinc powder and calcium carbonate. When dilute hydrochloric acid was added to the mixture, hydrogen, carbon dioxide and hydrogen sulfide were given off.

Which of the following deductions can be made about compound **Y** from the information?

- **A Y** contains carbon, hydrogen and at least one other element.
- **B Y** contains carbon, hydrogen and sulfur.
- **C Y** contains carbon, hydrogen, oxygen and sulfur.
- **D Y** contains sulfur and at least one other element.
- **32** In an experiment, excess copper powder is heated. At room temperature, the system initially contains 80 cm³ of nitrogen, 60 cm³ of oxygen and 20 cm³ of argon.



The plungers of the gas syringes are moved back and forth until there is no further change in the system. The system is then allowed to cool to room temperature.

Which of the following statements concerning the experiment are correct?

- 1 Black solids would be formed in the glass tube.
- 2 The same change in total volume of gases would be observed if excess copper is replaced with excess zinc powder.
- 3 The total volume of the gases in the system would decrease by 60 cm³.

Α	1, 2 and 3	В	1 and 2 only	С	1 and 3 only	D	2 and 3 only
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- **33** Which of the following is **not** a trend from left to right across the elements of the third period of the Periodic Table?
 - A The oxides of the elements change from ionic to covalent.
 - **B** The melting points of the elements decrease steadily.
 - **C** The number of protons of the elements increase.
 - **D** The oxides of the elements change from basic to acidic.
- 34 Which of the following statements correctly shows why iron is more reactive than silver?
 - 1 Iron has a higher melting point than silver.
 - 2 Silver has fewer common oxidation states than iron.
 - 3 Silver nitrate decomposes at a lower temperature than iron(II) nitrate.
 - 4 Iron(II) carbonate decomposes to form iron(II) oxide and carbon dioxide, but silver carbonate decomposes to form silver, oxygen and carbon dioxide.
 - **A** 1, 2, 3 and 4
 - B 1 and 4 only
 - **C** 1 and 3 only
 - **D** 3 and 4 only
- **35** Which of the following gases **cannot** be removed from the petrol engine of a car by its catalytic converter?
 - A carbon dioxide
 - **B** carbon monoxide
 - **C** hydrocarbons
 - **D** nitrogen dioxide

36 A chlorofluorocarbon or CFC is obtained when some or all of the hydrogen atoms in an alkane molecule is replaced by chlorine or fluorine atoms. The structure of one CFC molecule is shown.



Which of the elements in this compound can cause depletion of the ozone layer?

- 1 carbon
- 2 chlorine
- 3 fluorine
- 4 hydrogen

Α	1, 2, 3 and 4	В	1, 2 and 3 only	С	2 only	D 3 only
	, ,		,, ,	-	- ,	

37 The table shows the boiling points of three alkanes.

alkane 1 H H H H H H C C C C C C H H H H H H	H alkane 2 H-C-H H H H H H-C-C-C-H H H H H H H H H	Н alkane 3 H-С-Н H H H-С-С-С-Н H H H-С-Н H H
36°C	28°C	10°C

What is responsible for the difference in boiling points?

- A different molecular mass
- **B** different number of carbon-carbon bonds
- C stronger intermolecular forces between straight chain molecules
- D weaker covalent bonds between atoms

38 The diagram below shows the process of fractional distillation of crude oil.

What fraction can be used as fuel for aircraft engines?



39 An organic compound Z which contains four carbon atoms undergoes three chemical tests as shown in the table. All tests show negative results.

No.	Test
1	Z is treated with acidified potassium manganate (VII) solution
2	Z is treated with aqueous bromine solution
3	Z is treated with aqueous sodium carbonate solution

Which of the following could be Z?

- A CH₃CH₂CO₂CH₃
- B CH₃CH₂CH₂CO₂H
- $\textbf{C} \quad CH_3CH_2CH_2CH_2OH$
- D CH₃CH₂CH=CH₂

40 Which of the following is **not** an isomer of ethyl ethanoate?

The full structural formula of ethyl ethanoate is shown below.



END OF PAPER ONE

Group																	
Ι	II							•					IV	V	VI	VII	0
L L L L L L L L L L L L L L L L L L L											2 He helium 4						
3 Li ^{lithium} 7	4 Be beryllium 9		proton (atomic) number atomic symbol name relative atomic mass							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											13 A <i>I</i> aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 C/ 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 119	51 Sb antimony 122	52 Te tellurium 128	53 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 T/ 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 -		114 F/ flerovium –		116 Lv livermorium		
lanthanoids		57 La Ianthanum 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	;	AC actinium	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium -	94 Pu plutonium	95 Am americium	Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium -	fermium	101 Md mendelevium	NO nobelium	103 Lr Iawrencium	

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

CEDAR GIRLS' SEC SCHOOL 2022 Sec 4 Chemistry Prelims Paper 1

1	2	3	4	5	6	7	8	9	10
С	С	В	С	С	С	А	С	С	D
11	12	13	14	15	16	17	18	19	20
В	D	D	С	С	В	А	А	С	А
21	22	23	24	25	26	27	28	29	30
С	В	С	D	А	D	С	А	D	D
31	32	33	34	35	36	37	38	39	40
D	A	В	D	А		С	В	A	С

