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**CRESCENT GIRLS' SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION 2023**

CHEMISTRY

**6092/01
30 August 2023
1 hour**

Paper 1 Multiple Choice

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluids.

Write your name, index number and class 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 OTAS 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.

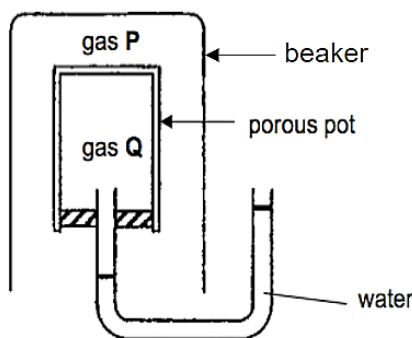
Any rough working should be done in this booklet

A copy of the Periodic Table is printed on **page 14**.

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

- 1 Which is the best method to collect a sample of ammonia gas?
- A bubble the gas into hydrochloric acid and collect with an inverted measuring cylinder
 B bubble the gas into water and collect with an inverted measuring cylinder
 C downward delivery
 D upward delivery
- 2 The apparatus can be used to show the diffusion of gases. A beaker containing gas P was placed over a porous pot containing gas Q.

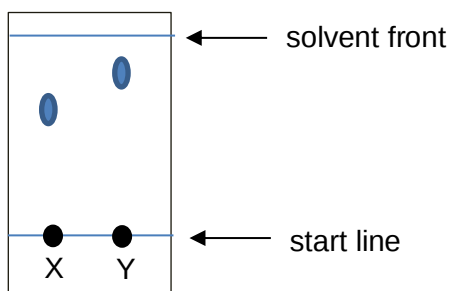
The resulting water levels in a U-tube are shown below.



Which statement is correct?

- A Gas P has a larger relative molecular mass than gas Q.
 B Gas P has a smaller relative molecular mass than gas Q.
 C Gas P has the same relative molecular mass as gas Q.
 D It is not possible to determine which gas has a larger relative molecular mass.
- 3 The results of a paper chromatography experiment are shown.

X is an aqueous solution of a salt of a coloured transition element. Y is an aqueous solution of a salt of a Group I element.

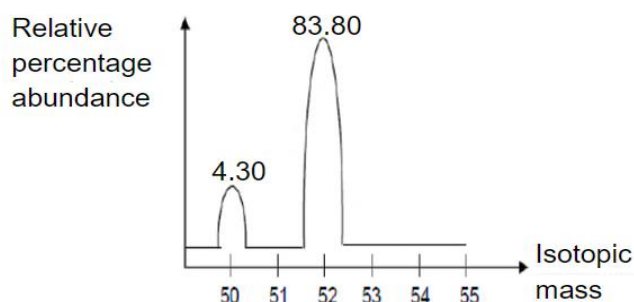


Which row about the spot produced by X and Y is correct?

	larger R_f value	requires use of locating agent
A	X	X
B	X	Y
C	Y	X
D	Y	Y

- 4 Which pair of reagents could be used in a test for sulfate ions in an aqueous solution?
- A aqueous barium nitrate and nitric acid
 B aqueous barium nitrate and sulfuric acid
 C aqueous silver nitrate and hydrochloric acid
 D aqueous silver nitrate and nitric acid
- 5 An element Z exists as three isotopes, two of which have isotopic masses of 50 and 52.

The diagram shows the mass spectrum of the element Z which shows the relative percentage abundance of two of its isotopes.



What is the isotopic mass of the third isotope if the relative atomic mass of element Z is 52.033?

- A 51
 B 53
 C 54
 D 55
- 6 Element Q has an electronic structure of 2.4.
 The formula of the compound formed between element Q and element R is QR_2 .

What is the electronic structure of element R?

- A 2.1
 B 2.5
 C 2.6
 D 2.7
- 7 The table shows some properties of four substances, A, B, C and D.

Which substance has a giant molecular structure that consists of atoms held together by strong covalent bonds?

	melting point/ $^{\circ}\text{C}$	boiling point/ $^{\circ}\text{C}$	soluble in water	conducts electricity	
				when solid	when molten
A	-120	-60	yes	no	no
B	546	974	no	yes	yes
C	875	1242	yes	no	yes
D	1623	2470	no	no	no

8 How many substances below contain(s) delocalised electrons?

- aqueous magnesium sulfate
- deionised water
- graphite
- molten sodium fluoride
- zinc metal

- A** 1
B 2
C 3
D 5

9 The statements below describe elements S and T.

1. An atom of S has more protons than an atom of T.
2. An atom of T has more valence electrons than an atom of S.
3. Particles of S and T combine to form an ionic compound.

Which statement can be deduced based on the statements above?

- A** An atom of S has the same number of electron shells as an atom of T.
B S forms positively charged ions.
C S and T are in the same group of the Periodic Table.
D An atom of S will form a covalent compound with oxygen.

10 How many pairs of electrons are shared in the molecule $\text{CH}_3\text{CH}_2\text{CH}_3$?

- A** 4
B 8
C 10
D 12

11 Which aqueous solution contains the greatest number of ions?

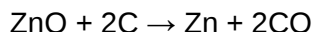
- A** 1 dm^3 of $0.1 \text{ mol/dm}^3 \text{ Al}(\text{NO}_3)_3$
B 1 dm^3 of $0.2 \text{ mol/dm}^3 \text{ H}_2\text{SO}_4$
C 1 dm^3 of $0.3 \text{ mol/dm}^3 \text{ MgCl}_2$
D 1 dm^3 of $0.4 \text{ mol/dm}^3 \text{ HCl}$

12 The compound called cynogen is used as a rocket propellant. Its empirical formula is CN and 1.3 g of cynogen occupied 600 cm^3 at room temperature and pressure.

What is its molecular formula?

- A** CN
B C_2N_2
C C_3N_2
D CN_4

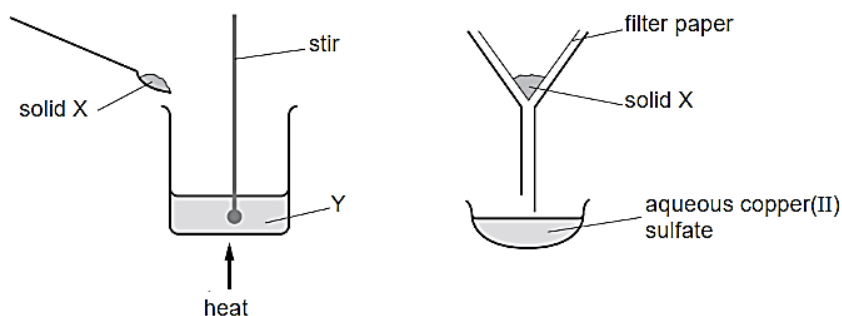
- 13 Zinc can be extracted from its ore, ZnO, by reducing it with coal in a blast furnace.



What is the percentage purity of the zinc ore if 1200 g of ZnO produces 250 g of zinc?

- A $\frac{65}{250} \times \frac{1200}{81} \times 100$
- B $\frac{65}{250} \times \frac{81}{1200} \times 100$
- C $\frac{250}{65} \times \frac{81}{1200} \times 100$
- D $\frac{250}{81} \times \frac{1200}{65} \times 100$
- 14 Both hydrochloric acid and ethanoic acid have the same concentration of 0.50 mol/dm^3 .
- Which of the following will show identical results for both acids?
- measuring the electrical conductivity of both solutions
 - testing both solutions with moist blue litmus paper
 - testing both solutions with Universal Indicator
 - titrating 25.0 cm^3 of each solution with 1.0 mol/dm^3 of aqueous sodium hydroxide, NaOH
- A 1 and 3
- B 2 and 3
- C 2 and 4
- D 2, 3 and 4

- 15 The set-up shown is used to prepare aqueous copper(II) sulfate.



What are the possible identities of X and Y?

	X	Y
A	copper	aqueous iron(II) sulfate
B	copper(II) carbonate	aqueous sulfuric acid
C	copper(II) nitrate	aqueous sulfuric acid
D	copper (II) oxide	aqueous iron(II) sulfate

- 16** When a mixture of two metal oxides, M and N is added to excess aqueous sodium hydroxide, only a colourless solution is observed.

Which row does not show the possible identities of oxides M and N?

	M	N
A	aluminium oxide	sodium oxide
B	calcium oxide	magnesium oxide
C	lead(II) oxide	aluminium oxide
D	zinc oxide	lead(II) oxide

- 17** Which statements about the Haber Process are correct?

1. Ammonia formed is removed by condensation.
2. The source of hydrogen is from liquid air.
3. The reaction chamber is pressurised to speed up the reaction.

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

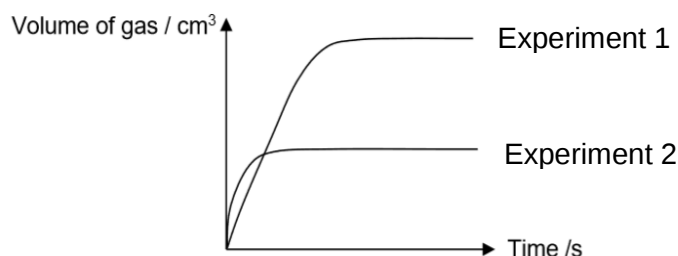
- 18** Which underlined reagent is an oxidising agent?

- A** $\text{CuCl}_2 + \underline{\text{Mg}} \rightarrow \text{MgCl}_2 + \text{Cu}$
B $\underline{\text{NH}_3} + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$
C $\text{Mg} + 2\underline{\text{HNO}_3} \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2$
D $\underline{\text{Zn}} + \text{H}_2\text{O} \rightarrow \text{Zn}(\text{OH})_2 + 2\text{H}_2$

- 19** In which reaction is substance X reduced?

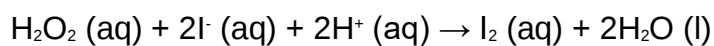
- A** Purple acidified aqueous potassium manganate(VII) decolourises when a solution of X is added.
B Colourless aqueous potassium iodide turns brown when a solution of X is added.
C Yellow solution of Fe^{3+} turns green when a solution of X is added.
D Blue solution of CuSO_4 turns colourless and a reddish brown solid forms when solid X is added.

- 20 In Experiment 1, 1.0 g of zinc strip was added to excess nitric acid at room temperature. The volume of gas produced was measured over a period of time. The results for Experiment 1 are plotted on a graph. The experiment is repeated with one change. The results for Experiment 2 are plotted on the same graph.



Which change is made in Experiment 2?

- A Acid of twice the concentration and 0.5 g of zinc was used.
 - B Acid of half the concentration and 2.0 g of zinc was used.
 - C The temperature of the acid was increased to 35°C.
 - D Zinc powder was used instead of zinc strips.
- 21 In the iodine clock reaction, hydrogen peroxide reacts with potassium iodide in the presence of dilute acid to produce iodine molecules as shown in the equation below.

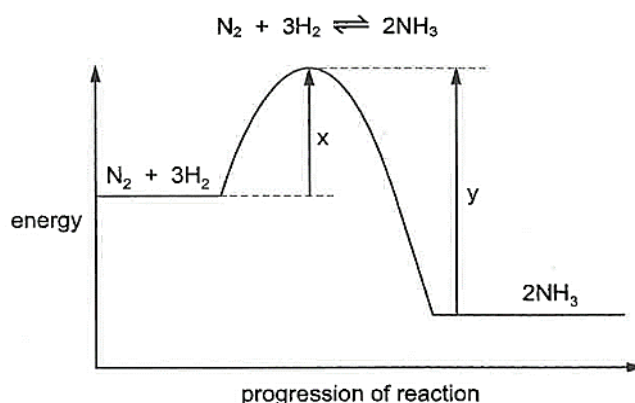


Which factor would **not** affect the rate of this reaction?

- A concentration of hydrogen peroxide
 - B concentration of potassium iodide
 - C pressure of the reacting vessel
 - D temperature of the reacting vessel
- 22 In which process is heat energy absorbed?

- | | |
|------------------|---------------|
| A condensation | C freezing |
| B photosynthesis | D respiration |

- 23 The equation and the energy profile diagram for the reversible reaction in the Haber Process are shown.



Which statement about the reaction is correct?

- A The activation energy for the forward reaction is y .
 - B The activation energy for the reverse reaction is x .
 - C The enthalpy change for the forward reaction is $y - x$.
 - D The enthalpy change for the reverse reaction is $x - y$.
- 24 Details of some reactions of chromium are shown in the table below.

	product
reaction with dilute hydrochloric acid	hydrogen
reaction with aqueous lead(II) nitrate	lead
reaction with cold water	none

Which shows the correct order of increasing reactivity of calcium, lead and chromium?

- A calcium, chromium, lead
 - B chromium, calcium, lead
 - C lead, chromium, calcium
 - D lead, calcium, chromium
- 25 A student sets up four test-tubes to investigate the process of rusting in iron nails.

In which test-tube will the iron nail be expected to rust?

A

C

B

D

26 During the extraction of iron, what is the main reducing agent in the blast furnace?

- A carbon dioxide
- B carbon monoxide
- C coke
- D nitrogen

27 Elements D, E and F are all in the same period of the Periodic Table.

- D forms an acidic oxide.
- E is found as a single atom.
- F has a high density.

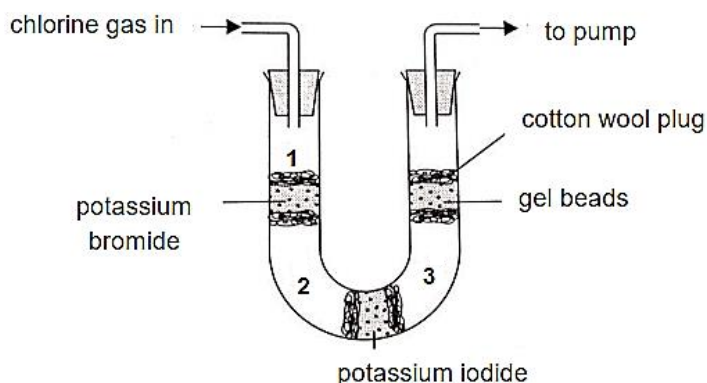
In which order do the elements appear in the Periodic Table?

- A D → E → F
- B E → D → F
- C F → D → E
- D F → E → D

28 The table compares the properties of Group I metals and Group VII halogens. Which row in the table is correct?

	Group I metals	Group VII halogens
A	forms ionic compounds with non-metals	forms covalent compounds with metals
B	forms cations	forms anions
C	high melting point	low melting point
D	low density	high density

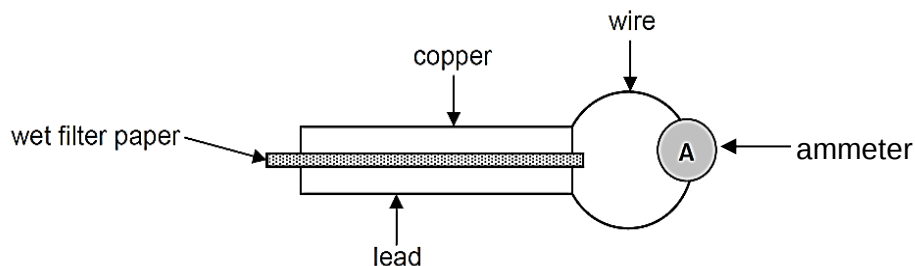
29 Chlorine gas was passed through the apparatus below. The apparatus was continuously heated at regions 2 and 3 and the observations were recorded below.



Which observations would be made at regions 1, 2 and 3?

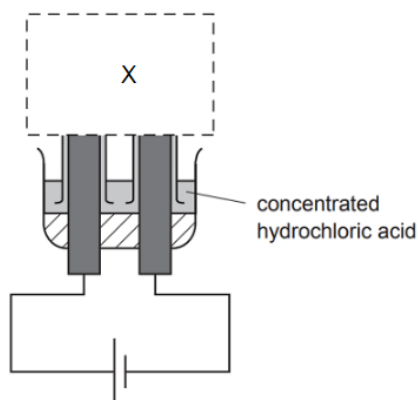
	region 1	region 2	region 3
A	yellow-green gas	violet gas	black solid
B	yellow-green gas	red-brown gas	violet gas
C	red-brown gas	violet gas	violet gas
D	red-brown gas	black solid	black solid

- 30** In the following set-up, lead and copper strips are pressed against a piece of wet filter paper soaked in dilute sulfuric acid and the amount of electric current flowing through can be detected by an ammeter, a device used to measure current.



Which statement is correct?

- A** Copper strip decreases in size.
 - B** Electrons flow from copper to lead through the wire.
 - C** Lead strip is coated with a pink substance.
 - D** Oxidation occurs on the lead strip.
- 31** The set-up for the electrolysis of concentrated hydrochloric acid shown is not complete.



What should be shown at X when the electrolysis is complete?

- A**

C

B

D

32 In the electroplating of silver onto a plastic spoon, which statement is incorrect?

- A The plastic spoon should be coated with graphite before electroplating.
- B The plastic spoon is placed at the cathode.
- C The electrolyte used should be aqueous silver nitrate.
- D The silver metal at the cathode gets smaller during electroplating.

33 Petroleum can be separated into fractions using fractional distillation.

Which row shows the correct use of the named fraction?

	name of fraction	use
A	bitumen	fuel for jets
B	kerosene	fuel for cars
C	naptha	making chemicals
D	petroleum gas	lubricants

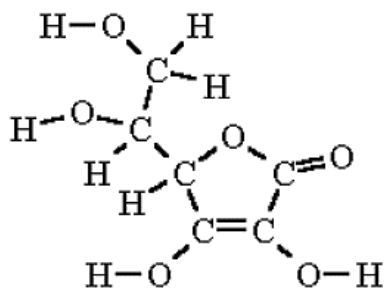
34 Two statements about substances X, Y and Z are given.

1. A hydrocarbon X is cracked to make Y and hydrogen gas.
2. Compound Z is formed by the addition polymerisation of Y.

Based on the two statements above, which statement is true?

- A X is an unsaturated compound.
- B Y is a saturated compound.
- C Y can react with steam to form an alcohol.
- D Z has a lower melting point than Y.

35 The structure of Vitamin C is shown below.



Based on the structure, which statement is **not** true?

- A It turns acidified aqueous potassium manganate(VII) from purple to colourless.
- B It turns aqueous bromine from brown to colourless.
- C It can self-polymerise via addition polymerisation.
- D It can give effervescence with magnesium metal.

36 The names of some esters are listed below.

1. ethyl propanoate
2. ethyl ethanoate
3. methyl ethanoate
4. propyl methanoate

Which esters are isomers with the 4th member of the carboxylic acid homologous series?

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

37 0.1 mole of a polyunsaturated hydrocarbon reacts with 4.8 dm³ of hydrogen gas.

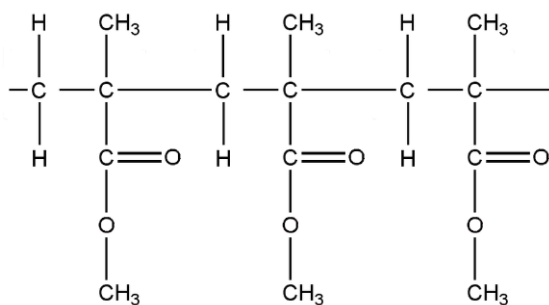
If the compound has 21 carbon atoms in its structure, what is the molecular formula of the hydrocarbon?

- | | |
|----------|----------------|
| A | $C_{21}H_{36}$ |
| B | $C_{21}H_{40}$ |
| C | $C_{21}H_{42}$ |
| D | $C_{21}H_{44}$ |

38 Which pair of organic compounds can be reacted to form a condensation polymer?

- A** $\text{HOOC-CH}_2\text{-COOH}$ and $\text{CH}_3\text{-CH}_2\text{-NH}_2$
B $\text{HOOC-CH}_2\text{-COOH}$ and $\text{H}_2\text{N-CH}_2\text{-NH}_2$
C $\text{CH}_3\text{-CH}_2\text{-OH}$ and $\text{CH}_3\text{-CH}_2\text{-NH}_2$
D $\text{HO-CH}_2\text{-OH}$ and $\text{H}_2\text{N-CH}_2\text{-NH}_2$

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



Which statement(s) about poly(methyl methacrylate) is correct?

1. It is an addition polymer.
2. Its monomer is $\text{CH}_2=\text{C}(\text{CH}_3)\text{CO}_2\text{CH}_3$.
3. It is an ester.

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

40 Which property does **not** increase when an alkene undergoes addition polymerisation?

- A** boiling point
- B** density
- C** mass
- D** relative molecular mass

Group																	
I	II	Key															
		1 H hydrogen 1															
		proton (atomic) number atomic symbol name relative atomic mass															
3 Li lithium 7	4 Be beryllium 9	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
11 Na sodium 23	12 Mg magnesium 24	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 xeron 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	114 Fl flerovium	115 Lv livermorium	116 Ts tennessine	117 Nh nihonium	118 Og oganeson	119 Uue unbinilium

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La lanthanum 139	Ce cerium 140	Pr praseodymium 141	Nd neodymium 144	Pm promethium —	Sm samarium 150	Eu europium 152	Gd gadolinium 157	Tb terbium 159	Dy dysprosium 163	Ho holmium 165	Er erbium 167	Tm thulium 169	Yb ytterbium 173	Lu lutetium 175
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac actinium	Th thorium 232	Pa protactinium 231	U uranium 238	Np neptunium	Pu plutonium	Am americium	Cm curium	Bk berkelium	Cf californium	Es einsteinium	Fm fermium	Md mendelevium	No nobelium	Lr lawrencium

actinoids

14