KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2023 PRELIMINARY EXAMINATION

Secondary 4 Express

NAME			
CLASS		**REG. NO**	

CHEMISTRY

6092 / 01

Paper 1 Multiple Choice

25 August 2023

1 hour

Additional Materials: Multiple Choice Answer Sheet.
Setter: Ms. Lim Zi Min

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

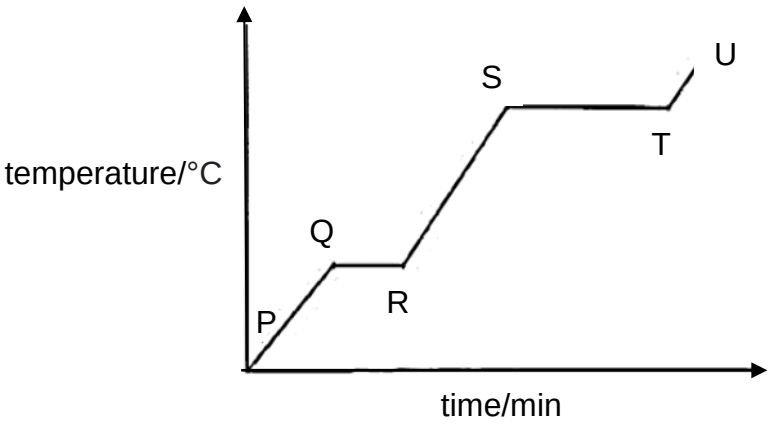
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 **16**.
The use of an approved scientific calculator is expected, where appropriate.

Section A (40 marks)

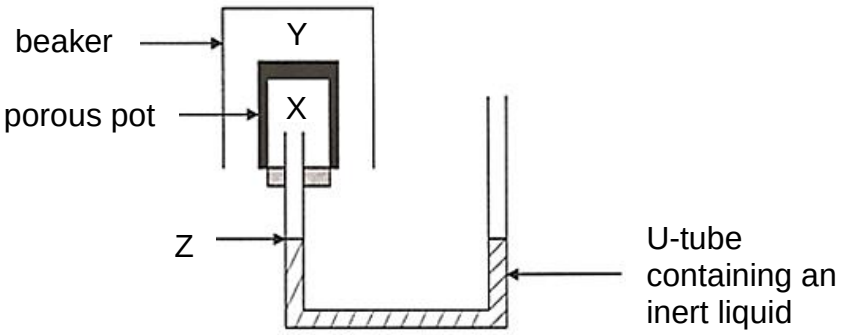
1 The following shows the heating curve of ice.



Which description in the table below best explains the respective section of the graph?

	section	description
A	P to Q	The particles are stationary and held in fixed positions
B	Q to R	Heat energy taken in is used to overcome forces of attraction between particles.
C	R to S	The volume of water is increasing as the particles expand and become larger.
D	T to U	Water is boiling to form steam.

2 The apparatus shown below consists of a porous pot containing gas X which is surrounded by gas Y in a beaker.



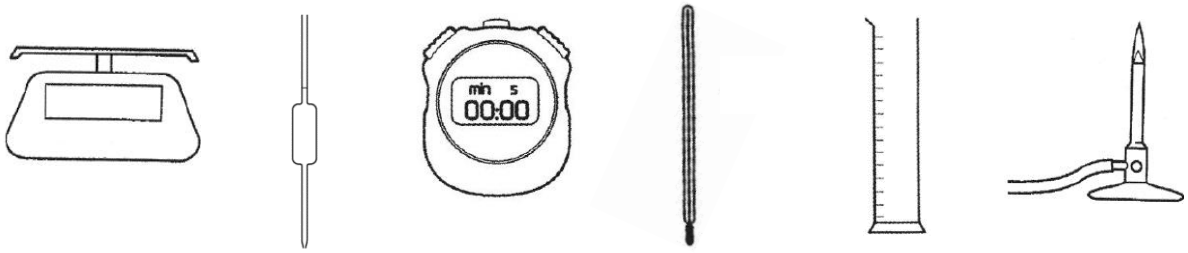
Which one of the following pairs of gases will cause an upward movement of the inert liquid at level Z?

	gas X	gas Y
A	H_2	O_2
B	CH_4	H_2
C	C_3H_8	H_2
D	CO_2	C_3H_8

3 A student is given 250 cm^3 of a saturated solution of sodium salt S and 500 cm^3 of a saturated solution of potassium salt P in respective beakers. Both salts do not decompose on heating.

Which of the following apparatus must she use in order to determine which salt is more soluble in water?

1 2 3 4 5 6



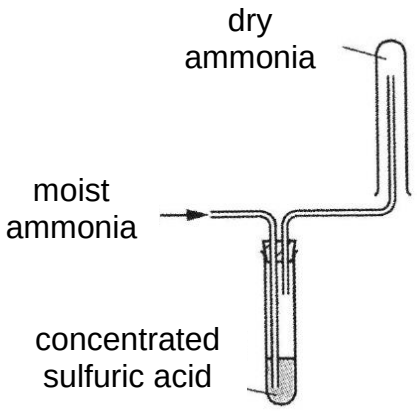
A 1, 2, 3 and 4
B 1, 4 and 6
C 1, 5 and 6
D 2, 4, 5 and 6

4 A student is provided with two drying agents, concentrated sulfuric acid and calcium oxide.

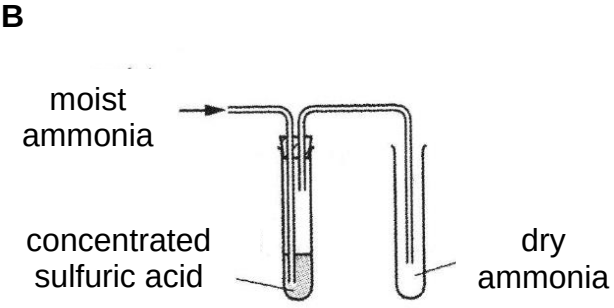
Which method should he use to collect a sample of dry ammonia?

[M_r: NH_3, 17]

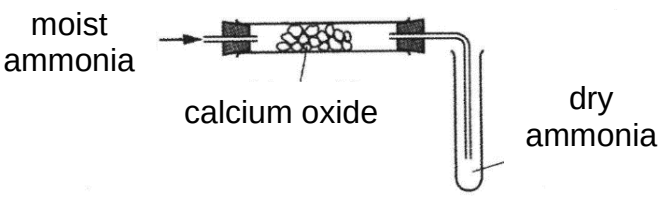
A



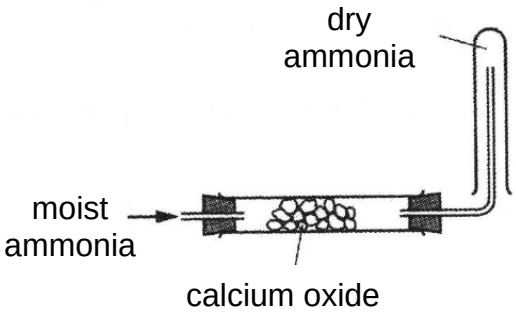
B



C



D



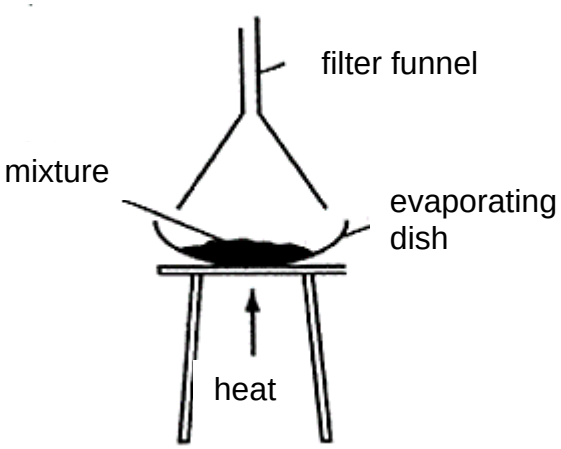
5 Propyl ethanoate and water are two liquids which are immiscible.

Which method could be used to separate a mixture of propyl ethanoate and water?

1 fractional distillation
2 evaporation
3 filtration
4 use of a separating funnel

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

6 A mixture is heated using the set-up shown.



Which of the following mixtures can be separated into its components using this set-up?

A ammonium chloride and iodine
B copper(II) sulfate and sodium chloride
C potassium iodide and copper(II) sulfate
D sodium chloride and ammonium chloride

7 Some properties of substances P, Q, R and S are given in the table below.

substance	percentage composition by mass	electrical conductivity when solid	effect of heat
P	constant	yes	solid burns in air to form an oxide
Q	varies	no	liquid burns to form carbon dioxide and water
R	constant	no	solid decomposes to form two products
S	varies	yes	solid melts

Which classification of the substances as an element, a mixture or a compound is correct?

	element	mixture	compound
A	P	Q, S	R
B	P	S	Q, R
C	R	Q, S	P
D	S	Q	P, R

8 Which row correctly shows the number of particles in $^{34}_{16}S^{2-}$?

	protons	neutrons	electrons
A	16	18	14
B	16	18	18
C	18	16	14
D	18	16	18

9 The element sodium has several isotopes, including ^{23}Na and ^{24}Na.

Which of the following statements is true about the isotopes?

A The densities of two metal coins consisting of ^{23}Na and ^{24}Na respectively are different.

B The formulas of the chlorides formed between ^{23}Na and ^{24}Na and chlorine are different.

C The isotopes ^{23}Na and ^{24}Na differ in their rate of reaction with water.

D The rate of thermal decomposition of the carbonates of ^{23}Na and ^{24}Na are different.

10 The elements X and Y form the compound X_2Y.

What is the correct electronic configuration in the atoms of X and Y?

	atom of X electronic configuration	atom of Y electronic configuration
A	2, 1	2, 7
B	2, 2	2, 7
C	2, 1	2, 6
D	2, 2	2, 6

11 Which of the following compounds does **not** have both covalent and ionic bonding?

A ammonium chloride
B copper(II) carbonate
C phosphorus pentachloride
D sodium nitrate

12 Which of the following substances contain delocalised electrons?

1 iron
2 steel
3 diamond
4 graphite

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

13 Which gas sample contains the most molecules?

A 4 g of hydrogen, H_2
B 14 g of nitrogen, N_2
C 24 dm^3 of carbon dioxide, CO_2
D 36 dm^3 of hydrogen chloride, HCl

14 Oxalic acid has the formula $C_2H_2O_4.2H_2O$.

What is the mass of oxalic acid crystals needed to prepare 100 cm^3 of 0.1 mol/dm^3 oxalic acid solution?

A 1.26 g
B 2.52 g
C 32.4 g
D 126 g

15 A 15 cm^3 sample of a gaseous hydrocarbon is completely burnt in oxygen. The total volume of the products is 75 cm^3.

Which equation correctly shows the complete combustion of this hydrocarbon?

A CH_4 (g) + $2O_2$ (g) → CO_2 (g) + $2H_2O$ (g)
B C_2H_4 (g) + $3O_2$ (g) → $2CO_2$ (g) + $2H_2O$ (g)
C C_3H_8 (g) + $5O_2$ (g) → $3CO_2$ (g) + $4H_2O$ (g)
D $2C_2H_6$ (g) + $7O_2$ (g) → $4CO_2$ (g) + $6H_2O$ (g)

16 Solutions P and Q were tested with a few drops of universal indicator.
Solution P turned the indicator red while solution Q turned the indicator yellow.

Which of the following can be deduced from the experiment?

A Solution P has a higher concentration of hydrogen ions than solution Q.
B Solution P has a higher pH than solution Q.
C Solution Q is a strong acid while solution P is a weak acid.
D Solution Q is more concentrated than solution P.

17 An element burns in air to form a compound which does **not** react with both acids and alkalis.

Which element could it be?

A aluminium
B carbon
C iron
D phosphorus

18 Which reagent, when heated and mixed with ammonium sulfate, liberates ammonia?

A acidified potassium manganate(VII) solution
B aqueous copper(II) chloride
C dilute hydrochloric acid
D limewater

19 Which one of the following salts is prepared differently?

A ammonium nitrate
B beryllium chloride
C copper(II) sulfate
D zinc sulfate

20 Which is the best way to prepare barium sulfate, starting from barium carbonate?

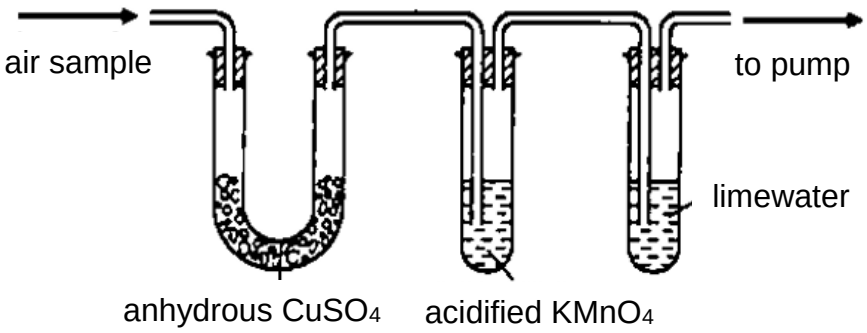
A Add dilute sulfuric acid to barium carbonate and then filter.
B Add excess aqueous sodium sulfate to barium carbonate and then filter.
C Add excess nitric acid to barium carbonate followed by dilute sulfuric acid and filter.
D Heat barium carbonate and then react the barium oxide with dilute sulfuric acid, then filter.

21 An aqueous solution containing a mixture of copper(II), iron(II) and lead(II) ions was treated with an excess of aqueous ammonia in a test-tube.

What precipitate is left in the test-tube at the end of the reaction?

A copper(II) hydroxide only
B iron(II) hydroxide only
C iron(II) hydroxide and lead(II) hydroxide
D iron(II) hydroxide and copper(II) hydroxide

22 A sample of air was passed through the following reagents in the set-up below.



The results are shown in the table below.

reagent	anhydrous $CuSO_4$	acidified $KMnO_4$	limewater
observation	turned from white to blue	remained purple	white precipitate was formed

Which gases were present in the sample of air?

	1	2	3
A	H_2O	SO_2	CO_2
B	H_2O	N_2	CO_2
C	N_2	H_2O	H_2
D	N_2	SO_2	H_2O

23 In which of the following does vanadium have the lowest oxidation state?

A NH_4VO_3
B V^{3+}
C VO^{2+}
D V_2O_5

24 The reactions of four metals, P, Q, R and S are as described below.

- Metals Q and S can be extracted by reacting their metal oxides with carbon, but metals P and R can only be extracted by electrolysis of its molten compounds.
- Metal Q can also be extracted by heating its metal oxide with metal S.
- The metal carbonate of P decomposes more readily than the metal carbonate of R.

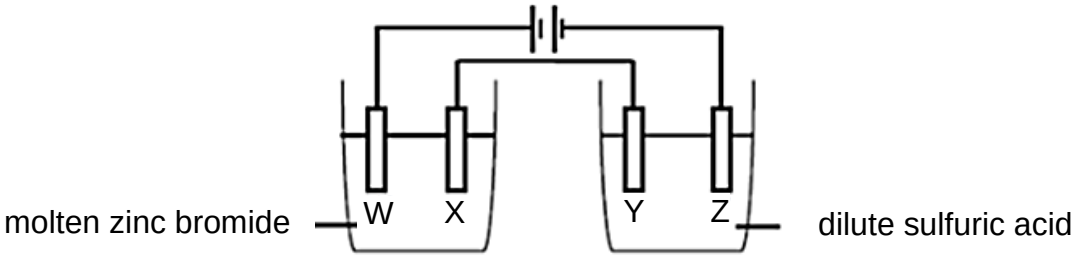
What is the correct order, in decreasing reactivity, for the four metals?

A P, R, Q, S
B P, R, S, Q
C R, P, Q, S
D R, P, S, Q

25 Which statement about the production of iron from haematite is correct?

A Coke is used to oxidise slag.
B Limestone is used to remove basic impurities.
C Molten iron floats on slag at the base of the furnace.
D The haematite is reduced by carbon monoxide.

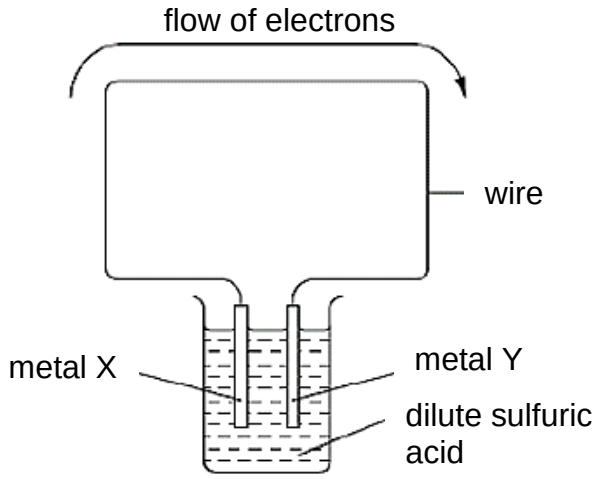
26 Refer to the following electrolytic set-up. All electrodes used are graphite.



What will be observed after a few minutes?

A A colourless and odourless gas is formed at electrode Z.
B A colourless gas with a pungent smell gas is formed at electrode Y.
C A reddish-brown liquid is formed around electrode X.
D A silvery solid is formed on electrode W.

27 The diagram shows a simple cell.



For which pair of metals would the electrons flow as shown in the diagram?

	metal X	metal Y
A	iron	calcium
B	iron	zinc
C	zinc	magnesium
D	zinc	copper

28 Element Z is in the same group in the Periodic Table as bromine but has a lower boiling point.

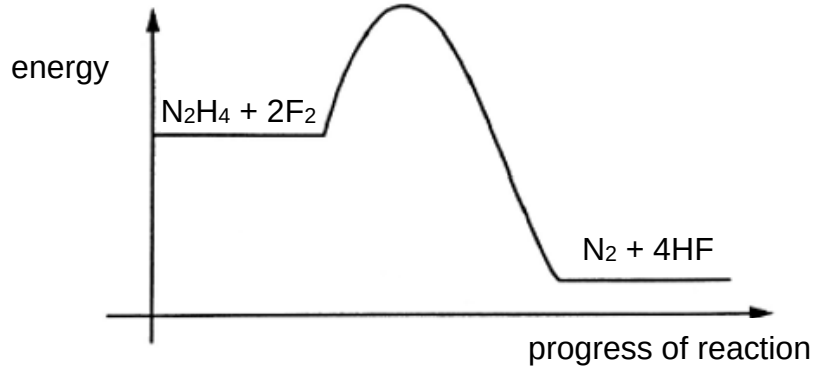
Which statement about Z is correct?

A It can displace bromine from aqueous potassium bromide.
B It has an atomic number greater than 35.
C It is a solid at room temperature.
D It loses an electron when it reacts with a metal.

29 Hydrazine, N_2H_4, is often used in rocket fuel and it reacts with fluorine to produce nitrogen and hydrogen fluoride.

$$N_2H_4 + 2F_2 \rightarrow N_2 + 4HF$$

The energy profile diagram for the reaction is shown below.



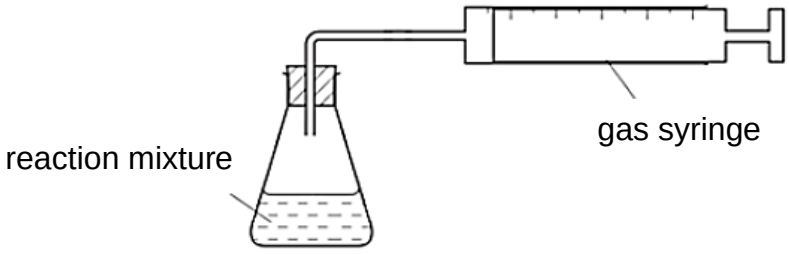
Which statement about the reaction is correct?

A Heat is absorbed from the surroundings during the reaction.
B The enthalpy change for the reaction is positive.
C The products have more energy than the reactants.
D The total energy given out during bond formation is more than the total energy taken in during bond breaking.

30 What are the effects of temperature of the reactants and use of a catalyst on the activation energy and enthalpy change of a reaction?

	effect of temperature		effect of catalyst	
	activation energy	enthalpy change	activation energy	enthalpy change
A	decreases	no change	lower	no change
B	decreases	decreases	no change	decreases
C	no change	no change	lower	no change
D	no change	no change	lower	decreases

31 The apparatus shown below can be used to measure the rate of some chemical reactions.



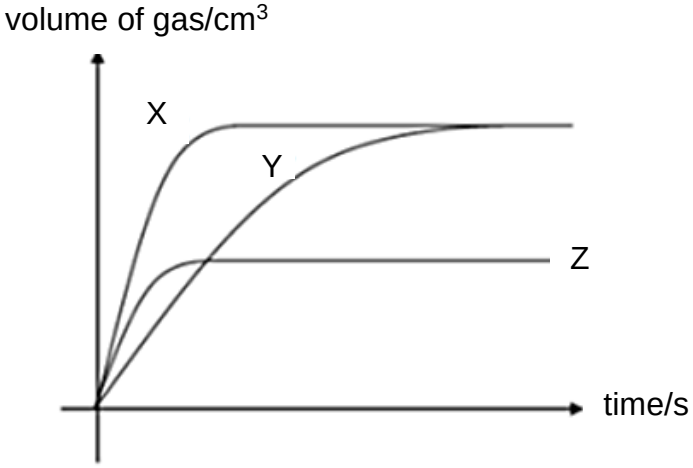
Which of the following reactions would this apparatus be suitable for?

A $AgNO_3 + HCl \rightarrow AgCl + HNO_3$
B $2H_2O_2 \rightarrow 2\ H_2O + O_2$
C $MgO + 2HCl \rightarrow MgCl_2 + H_2O$
D $Zn + CuO \rightarrow ZnO + Cu$

32 A student performed three experiments to produce carbon dioxide gas using excess magnesium carbonate and dilute nitric acid at 30°C.

experiment	magnesium carbonate	dilute nitric acid	
	particle size	volume/cm^3	concentration /mol dm^{-3}
1	powdered	20	1.00
2	lumps	10	1.00
3	lumps	40	0.50

The volume of gas collected over time for each experiment was recorded and plotted into a graph.



Which graph best represents each of the three experiments?

	experiment 1	experiment 2	experiment 3
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	X	Y

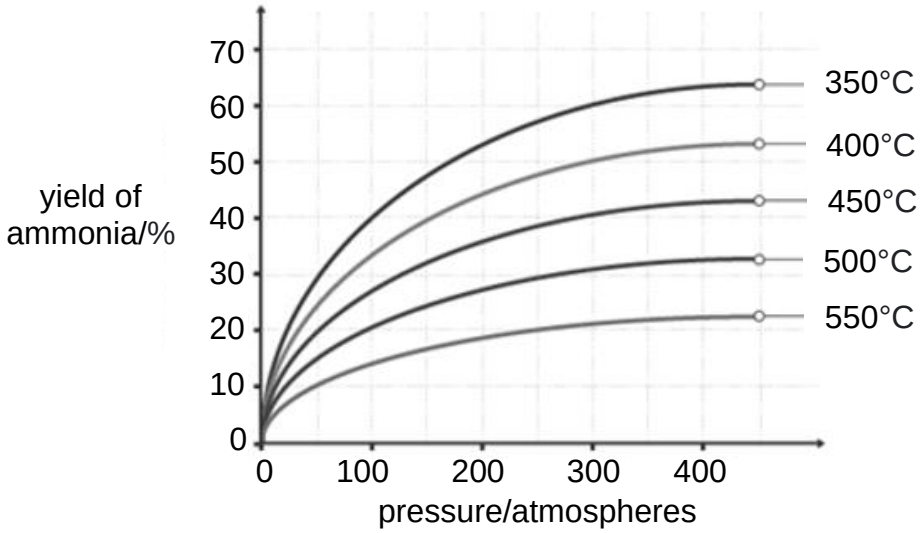
33 The following are statements about air pollutants.

1 Carbon monoxide is responsible for the formation of acid rain.
2 Oxides of nitrogen can be produced during volcanic eruptions.
3 Sulfur dioxide can be produced by combustion of fossil fuels.
4 Methane contributes to global warming.

Which of the statements are correct?

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

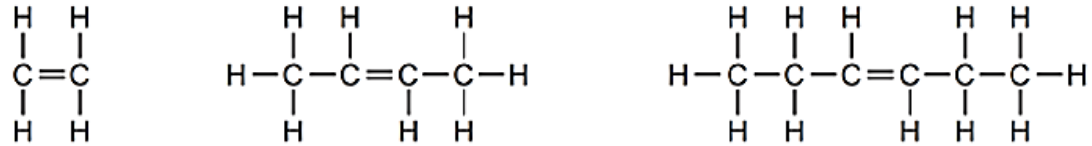
34 The graph below shows the yield of ammonia from Haber process at different temperatures.



Which of the following statements can be inferred from the graph?

A A higher percentage yield of ammonia can be obtained at higher pressure.
B As temperature increases, the yield of ammonia increases.
C At the right temperature and pressure, all of the hydrogen and nitrogen can be converted to ammonia.
D The speed of reaction is dependent on only the temperature.

35 The structures of three compounds are shown.



Why do these compounds all belong to the same homologous series?

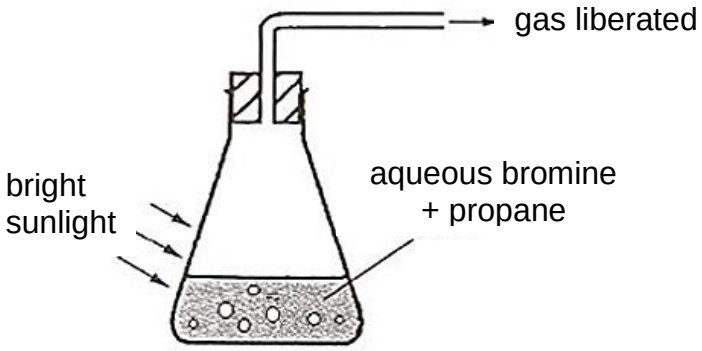
A They all contain an even number of carbon atoms.
B They all contain the same functional group.
C They are all hydrocarbons.
D They are all saturated.

36 A molecule of $C_{17}H_{36}$ undergoes catalytic cracking. The products of the reaction are one butane molecule, one propene molecule and some ethene molecules.

How many ethene molecules are being produced in the reaction?

A 1
B 2
C 5
D 10

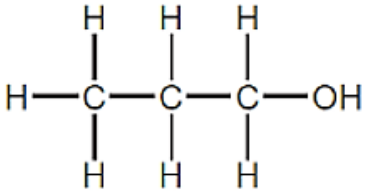
37 A mixture of bromine and excess propane was exposed to bright sunlight. The mixture in the flask began to bubble, giving off a colourless gas that turns moist blue litmus paper red.



Which row shows the correct type of reaction and gas liberated in the reaction?

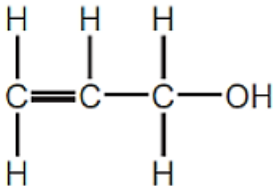
	type of reaction	gas liberated
A	addition	hydrogen
B	catalytic cracking	hydrogen
C	combustion	carbon dioxide
D	substitution	hydrogen bromide

38 The diagram below shows the structure of propanol.

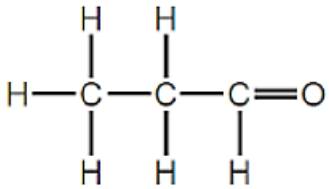


Which of the following is an isomer of this compound?

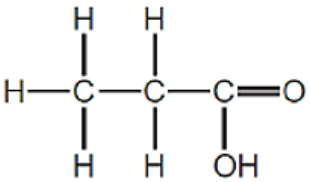
A



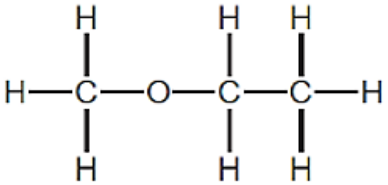
B



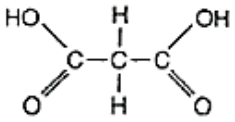
C



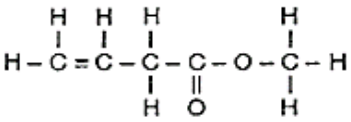
D



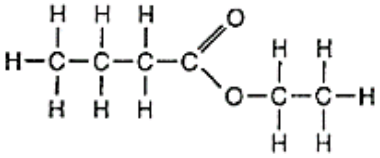
39 Which of the following tests can be carried out together to distinguish the following compounds, I, II and III separately from each other?



I



II

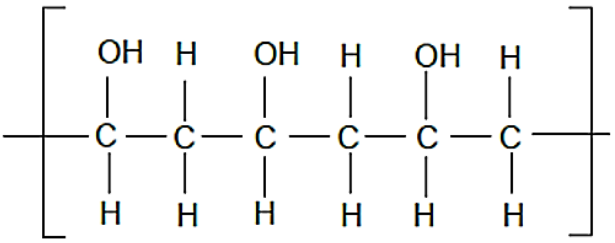


III

Test 1	Adding aqueous bromine
Test 2	Adding powdered magnesium
Test 3	Warming with acidified potassium manganate(VII)

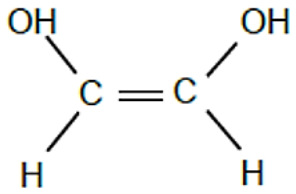
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

40 A section of a polymer is shown below.

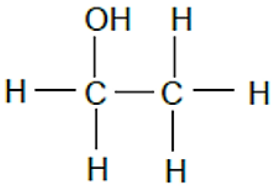


Which of the following shows the monomer involved in the formation of the above polymer?

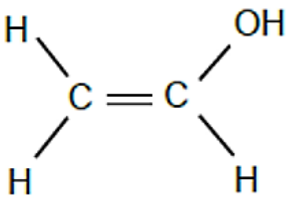
A



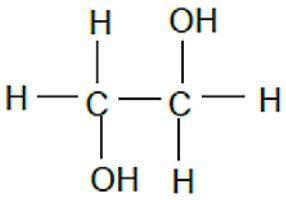
B



C



D



- **End of Section -**

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** 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 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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).