



YUAN CHING SECONDARY SCHOOL

Secondary Four Express Course

Preliminary Examination 2023

CANDIDATE
NAME

CLASS

INDEX
NUMBER

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CHEMISTRY

6092/01

Paper 1 Multiple Choice

28 Aug 2023

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, class and index 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.

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

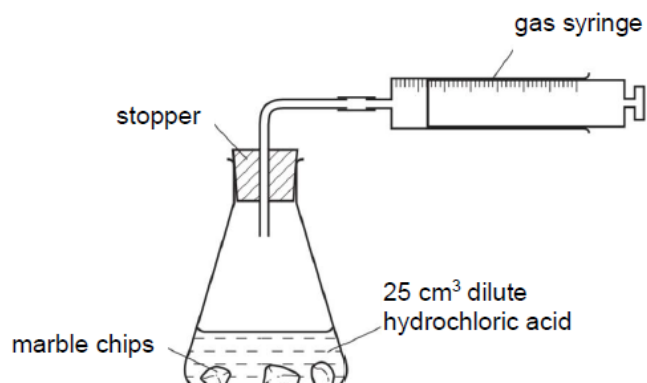
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on Page 18.

The total number of marks for this paper is 40.

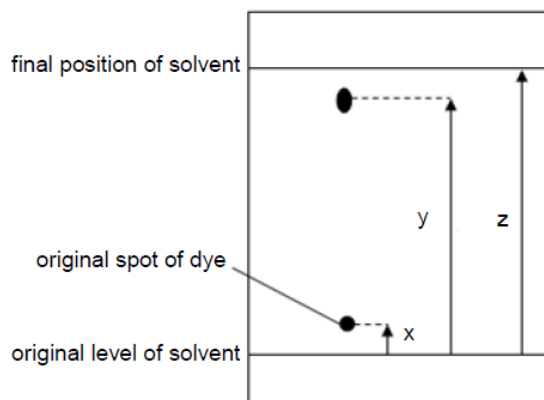
This paper consists of **18** printed pages.

- 1 A student uses the apparatus below to measure the volume of carbon dioxide gas produced when different masses of marble chips are added to 25 cm³ of dilute hydrochloric acid.



Which other apparatus do the student need?

- A** electronic balance and filter funnel
B electronic balance and measuring cylinder
C stopwatch and filter funnel
D stopwatch and measuring cylinder
- 2 A student carried out a chromatography experiment. The diagram below shows the chromatogram obtained.



Which one of the following gives the R_f value of the dye?

- A** $\frac{y}{z}$
B $\frac{y-x}{z}$
C $\frac{y}{z-x}$
D $\frac{y-x}{z-x}$

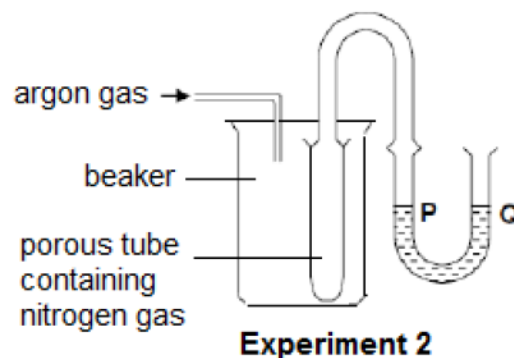
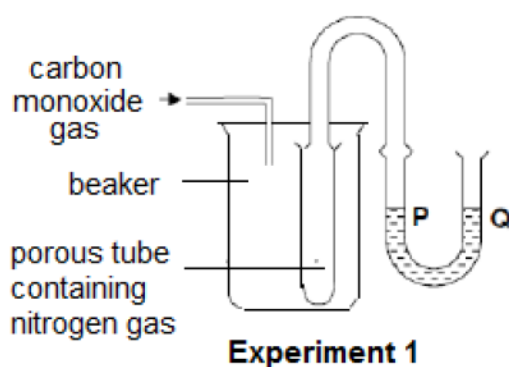
- 3 The sun-lit side of the planet Mercury has a temperature of 430°C . The dark side of the planet has a temperature of -180°C .

Which substance may be found on one side of planet Mercury as a liquid and the other side as a solid?

	substance	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$
A	ethane	-183	-87
B	lead	328	1744
C	nitrogen	-210	-196
D	phosphorous	44	280

- 4 Two experimental set-ups used to demonstrate diffusion of gases are shown in the diagrams below. The gas in each porous tube is nitrogen.

In **Experiment 1**, the gas introduced into the beaker is carbon monoxide while in **Experiment 2**, the gas is argon.



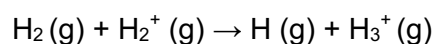
What changes, if any, to the water levels at P and Q would you expect to see in both experiments?

	Experiment 1	Experiment 2
A	P and Q remain at the same level.	P is at a higher level than Q.
B	P and Q remain at the same level.	Q is at a higher level than P.
C	P is at a higher level than Q.	P is at a higher level than Q.
D	P is at a higher level than Q.	Q is at a higher level than P.

- 5 An element, Z, has p protons and n neutrons in its nucleus.
Which row gives the possible correct number of protons, neutrons and electrons in a negative ion of an isotope of Z?

	protons	neutrons	electrons
A	p	$n + 1$	$p + 1$
B	p	$n + 1$	$p - 1$
C	$p + 1$	n	$p + 1$
D	$p + 1$	n	$p - 1$

- 6 A reaction in gas clouds of the Universe is as shown.



How many protons, neutrons and electrons does an H_3^+ ion contain?

	protons	neutrons	electrons
A	2	1	1
B	2	1	2
C	3	0	1
D	3	0	2

- 7 Substance Z has the following properties.

- ☐ Melting point higher than 500°C
- ☐ Insoluble in water
- ☐ Insoluble in organic solvent
- ☐ Conducts electricity only when molten

What could substance Z be?

- | | |
|-----------------------|--------------------------|
| A copper | B iron(III) oxide |
| C poly(ethene) | D sodium chloride |

- 8 Which substance does **not** contain atoms bonded to other atoms by four covalent bonds?

- A** diamond
- B** poly(ethene)
- C** silicon dioxide
- D** water

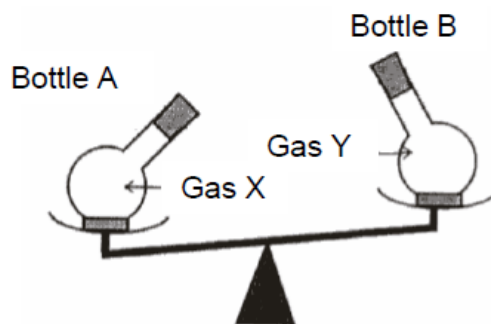
- 9 The descriptions of three substances are given as follows:

substance	description
x	It is made up of identical molecules which burns in excess air to form carbon dioxide and water.
y	It is a gas which burns in excess air to form water only.
z	Its solution can be separated into three dyes by paper chromatography.

Which of the following correctly classifies substances x, y and z?

	x	y	z
A	element	element	compound
B	compound	compound	mixture
C	compound	element	mixture
D	element	mixture	element

- 10 At room conditions, two identical flasks which have been filled with gas X and Y were put on a balance. The result is shown below.



Which of the following statements shows a fair conclusion?

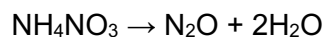
- A** The number of gas particles in Bottle A is less than the number of gas particles in Bottle B.
- B** The number of moles of gas particles in Bottle A is greater than the number of moles of gas particles in Bottle B.
- C** The number of molecules of gas is the same in each bottle but each molecule of Gas X contains more atoms than each molecule of Gas Y.
- D** The mass of 48 dm³ of gas particles in Bottle A is greater than the mass of 48 dm³ of gas particles in Bottle B.

- 11 The formula of an oxide of element Y is Y_2O .
8.7 g of Y_2O contains 7.1 g of Y.

How many moles of Y does 7.1 g of the element contain?

- A $\frac{1.6}{16} \times 2$
 B $\frac{1.6}{16} \times \frac{1}{2}$
 C $\frac{8.7}{16} \times 2$
 D $\frac{8.7}{16} \times \frac{1}{2}$

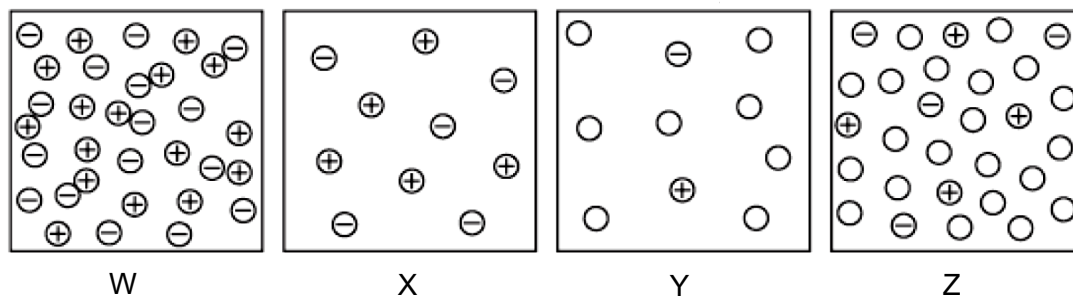
- 12 On heating, ammonium nitrate, NH_4NO_3 , decomposes to form dinitrogen oxide and water.



When 90 g of an impure sample of ammonium nitrate is heated, 28 g of water is formed.
What is the percentage purity of ammonium nitrate in the impure sample?

- A $\frac{28}{18} \times \frac{80}{90} \times 100$
 B $\frac{28}{36} \times \frac{80}{90} \times 100$
 C $\frac{28}{18} \times \frac{90}{80} \times 100$
 D $\frac{28}{36} \times \frac{90}{80} \times 100$

- 13 The diagrams below show some of the particles present in different acids, W, X, Y and Z. Water molecules are not shown.



$\oplus$: hydrogen ions

$\ominus$: negative ions

$\circ$: molecules of acid which are not ionised

Which of the diagrams correctly shows the arrangement of particles in each of the three acids?

	dilute ethanoic acid	concentrated ethanoic acid	dilute hydrochloric acid
A	X	W	Z
B	X	Y	W
C	Y	Z	X
D	Z	W	X

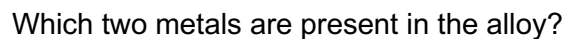
- 14 A bottle of copper(II) oxide has been contaminated with some solid sodium chloride.

How can the sodium chloride be removed from the copper(II) oxide?

- A** add dilute acid to the mixture and filter
- B** add water to the mixture and filter
- C** heat the mixture and allow it to cool
- D** place the mixture in a separating funnel

What is salt L?

- 16** A sample of an alloy containing two metals was subjected to several tests as shown below.



- A** iron and aluminium
B iron and lead
C iron and zinc
D lead and zinc

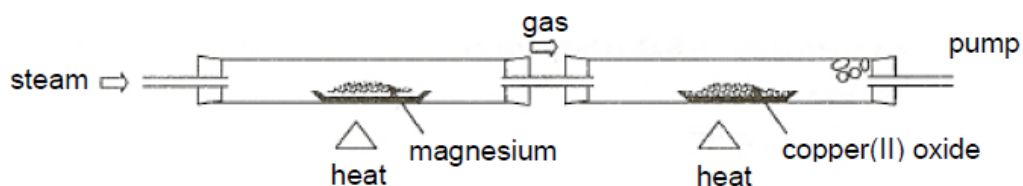
17 Substance X liberates iodine from aqueous potassium iodide and decolourises acidified potassium manganate (VII). How is the behaviour of X described?

- A As a reducing agent only.
- B As an oxidising agent and a reducing agent.
- C As an oxidising agent only.
- D Neither an oxidising agent nor a reducing agent.

18 Which of the following is a redox reaction?

- A dissolving zinc chloride salt in water
- B electrolysis of dilute potassium sulfate using inert electrodes
- C reacting aqueous sodium hydroxide and aqueous copper(II) nitrate
- D reacting iron(II) oxide with dilute hydrochloric acid

19 An experiment is set up as shown.



Which of the following is **not** a product formed in this experiment?

- A copper
- B magnesium oxide
- C oxygen
- D water vapour

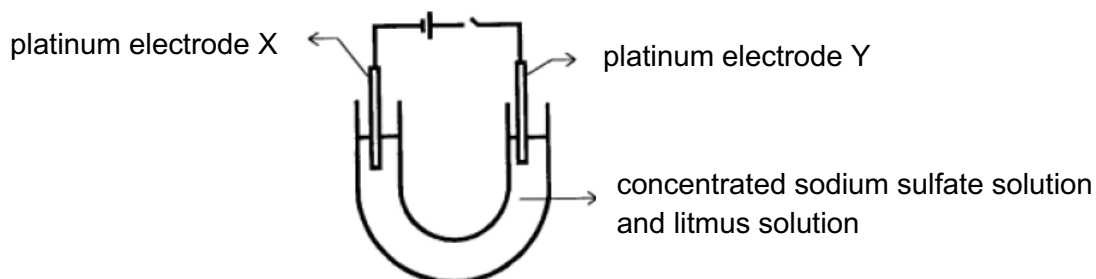
20 A block of magnesium and a block of copper were attached to underground steel tanks, X and Y, as shown.



Which pair of equations represent the reactions that would occur at tanks X and Y?

	steel tank X	steel tank Y
A	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
B	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$
C	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
D	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$

- 21 The diagram below shows an electrolytic set-up using concentrated sodium sulfate solution as the electrolyte.



Which of the following changes would occur when a current is passed through the solution for some time?

- A Oxygen is given off at X and hydrogen is given off at Y.
 - B Sodium is formed at X and oxygen gas is given off at Y.
 - C The colour of the solution becomes blue around both X and Y.
 - D The colour of the solution becomes blue around X and red around Y.
- 22 The shield of a space rocket is gold plated. Which electrodes and electrolyte could be used to gold plate the shield?

	cathode	anode	electrolyte
A	carbon	shield	gold compound
B	gold	shield	gold compound
C	shield	carbon	gold compound
D	shield	gold	gold compound

- 23 Which of the following statements best explains why chlorine is more reactive than iodine?
- A Iodine has a larger atomic radius than chlorine.
 - B The intermolecular forces of attraction are weaker in chlorine compared to iodine.
 - C The nuclear attraction on valence electrons is stronger in chlorine compared to iodine.
 - D The nuclear attraction on valence electrons is weaker in chlorine compared to iodine.

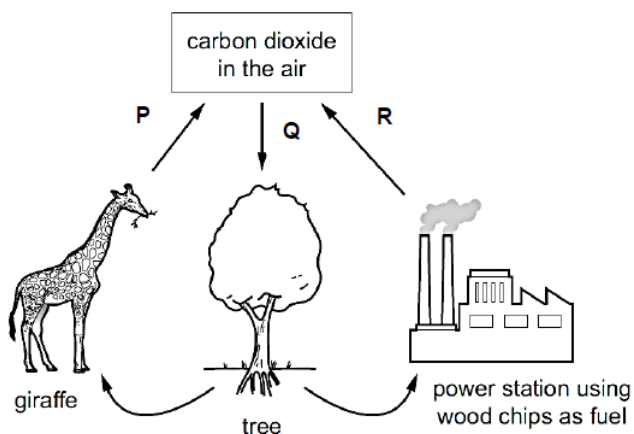
- 24 In each of three experiments, a halogen was added to separate solutions of halides. The table shows the results.

experiment	halogen added	solution of halide		
		U^-	V^-	W^-
1	U_2		no reaction	reaction occurs
2	V_2	reaction occurs		reaction occurs
3	W_2	no reaction	no reaction	

What were the halogens U, V and W?

	U	V	W
A	Br_2	Cl_2	I_2
B	Br_2	I_2	Cl_2
C	Cl_2	Br_2	I_2
D	Cl_2	I_2	Br_2

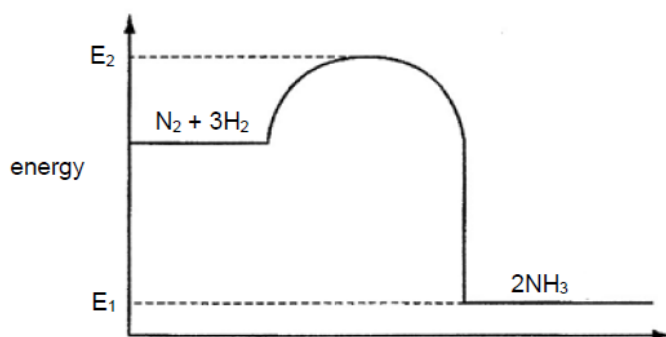
- 25 The diagram below shows part of the carbon cycle.



Which row correctly identifies P, Q and R as exothermic or endothermic reactions?

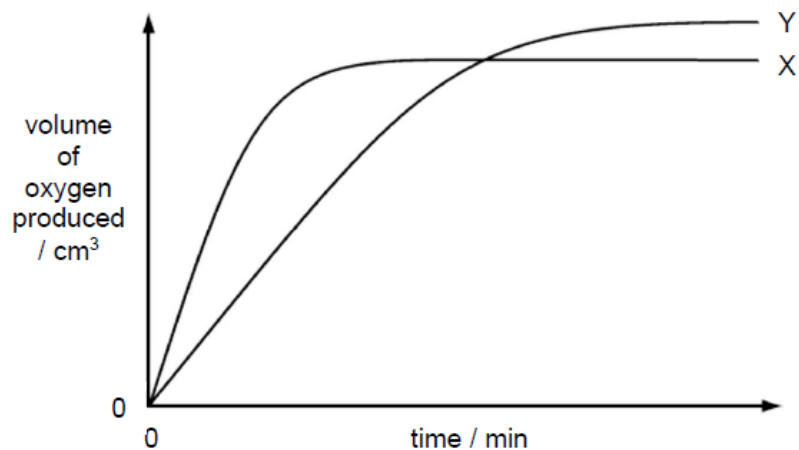
	P	Q	R
A	endothermic	exothermic	exothermic
B	exothermic	exothermic	exothermic
C	exothermic	endothermic	exothermic
D	exothermic	endothermic	endothermic

- 26 The diagram below shows the energy profile diagram of a reversible reaction.



What does the energy change $E_2 - E_1$ represent?

- A activation energy of the forward reaction
 - B activation energy of the reverse reaction
 - C enthalpy change of the forward reaction
 - D enthalpy change of the reverse reaction
- 27 In the diagram, curve X was obtained by observing the decomposition of 100 cm^3 of 1.0 mol/dm^3 hydrogen peroxide, catalysed by manganese(IV) oxide.



What change in the original experimental conditions would produce curve Y?

- A adding some 0.1 mol/dm^3 hydrogen peroxide
- B adding water
- C lowering the temperature
- D using less manganese(IV) oxide

- 31** Which atmospheric pollutants, emitted by internal combustion engines, are reacted together to convert them into less harmful products?
- A** nitrogen dioxide and carbon dioxide
 - B** nitrogen dioxide and carbon monoxide
 - C** unburned hydrocarbons and carbon dioxide
 - D** unburned hydrocarbons and carbon monoxide

- 32** The table below shows the boiling points of four fractions, W, X, Y and Z, obtained when crude oil is distilled.

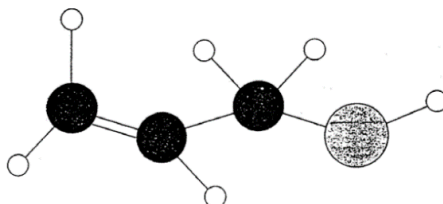
fraction	W	X	Y	Z
boiling range / °C	35 – 75	80 – 145	150 – 250	greater than 250

How is fraction W different from fraction Z?

- A** Fraction W contains molecules of larger relative molecular masses than Z.
 - B** Fraction W is in less demand than fraction Z.
 - C** Fraction W is more flammable than fraction Z.
 - D** Fraction W is more viscous than fraction Z.
- 33** When dodecane, $C_{12}H_{26}$, is cracked, only three hydrocarbons are formed. The hydrocarbons are ethene, propane and propene. What is the ratio of the hydrocarbons formed?

	ethene	propane	propene
A	1	1	1
B	1	1	3
C	1	3	1
D	3	1	1

- 34 The molecular structure of an organic compound containing only carbon, hydrogen and oxygen atoms is shown below.



Which reaction will this compound **not** undergo?

- A Bromination
 - B Hydration
 - C Neutralisation
 - D Polymerisation
- 35 Which reactions in the list below show water is either a reactant or a product?

Reaction 1: addition of magnesium oxide to ethanoic acid

Reaction 2: conversion of ethene to ethanol

Reaction 3: conversion of vegetable oil to margarine

Reaction 4: fermentation of glucose

- A 1 and 2 only
 - B 1 and 3 only
 - C 1, 2 and 3 only
 - D 1, 2 and 4 only
- 36 The following statements describe an organic compound, M.

1	It does not react with aqueous sodium hydroxide.
2	It does not decolorise bromine solution.
3	If a mixture of ethanoic acid and compound M is warmed with concentrated sulfuric acid, no sweet smelling substance is formed.

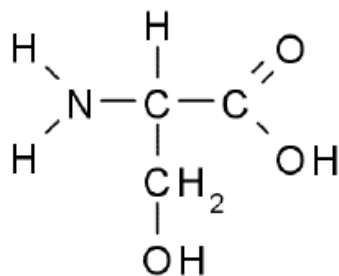
What could be the molecular formula of compound M?

- A $\text{CH}=\text{CHCOOH}$
- B $\text{CH}_2=\text{CHCOOCH}_3$
- C $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- D $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\text{I}$

- 37 The reaction between a carboxylic acid, $C_xH_yCO_2H$ and an alcohol, $C_nH_{2n+1}OH$, produces an ester. How many hydrogen atoms does one molecule of ester contain?

A $y + 2n$
 B $y + 2n + 1$
 C $y + 2n + 2$
 D $y + 2n + 3$

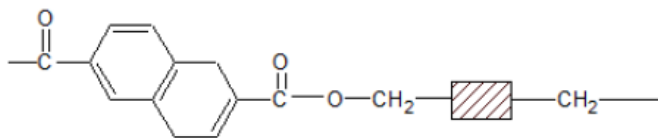
- 38 The structure of an amino acid, serine, is shown.



Which statement about serine is true?

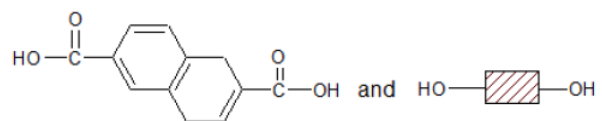
- A It burns in air to produce carbon dioxide and water only.
 B It can undergo addition polymerisation with other amino acids.
 C It does not decolourise acidified potassium manganate(VII).
 D It produces carbon dioxide when reacted with sodium carbonate.
- 39 Which two monomers can react together to form a polymer with only amide linkages?
- A $H_2NCH_2CH_2CH_2CO_2H$ and $HOC(CH_3)_2CH_2CO_2H$
 B $H_2NCH_2CH_2CH_2CO_2H$ and $HO_2CCH(CH_3)CH_2NH_2$
 C $HO_2CCH_2CH_2CH_2NH_2$ and $HO_2CCH(CH_3)CH_2CO_2H$
 D $HO_2CCH_2CH_2CO_2H$ and $CH_3CH(CH_3)CH_2NH_2$

40 The picture below shows a polymer.

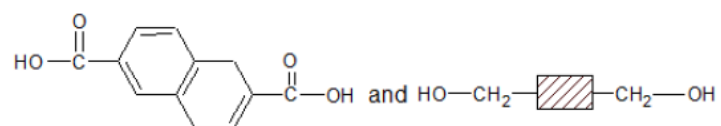


Which of the following correctly show the monomers that can be used to form this polymer?

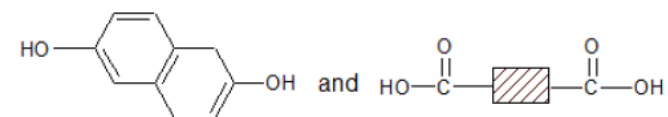
A



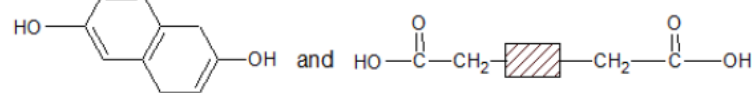
B



C



D



END OF PAPER

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
1 H hydrogen 1 proton (atomic) number atomic symbol name relative atomic mass																	
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											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 Lv livermorium -	116 Lv livermorium -	117 Ts tennessine -	118 Og oganesson -
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 dm³ at room temperature and pressure (r.t.p.).