

ANDERSON SECONDARY SCHOOL
Preliminary Examination 2022
Secondary Four Express



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

CHEMISTRY

6092/01

Paper 1

22 August 2022

1 hour

0800 – 0900 h

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 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 in this booklet.

A copy of Periodic Table is printed on page 19.

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

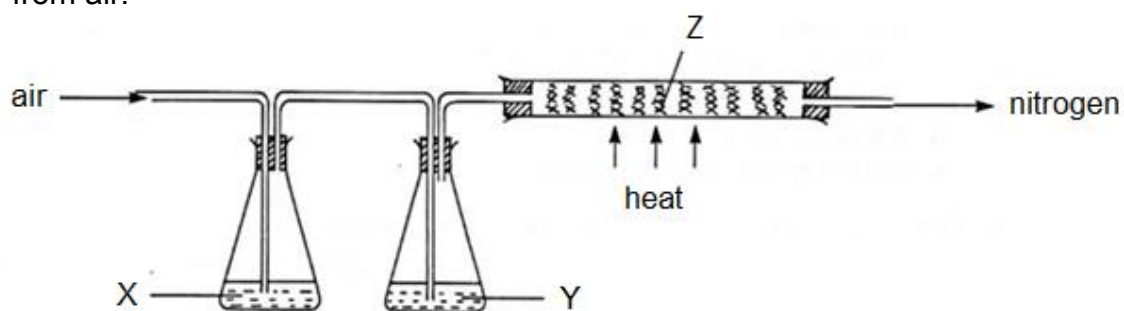
- 1 The R_f values for the dyes P, Q, R and S, in four different solvents are shown in the table.

	solvent			
	water	ethanol	propanone	tetrachloromethane
dye P	0.3	0.9	0.7	0.5
dye Q	0.0	0.8	0.6	0.2
dye R	0.5	0.7	0.6	0.1
dye S	0.0	0.6	0.4	0.2

Which solvent could be used to separate a mixture of all the four dyes?

- A** ethanol
B propanone
C tetrachloromethane
D water

- 2 The diagram below shows an apparatus that can be used to obtain a stream of nitrogen from air.



Using this apparatus, which set of substances labelled X, Y and Z gives the purest sample of nitrogen?

	X	Y	Z
A	aqueous calcium hydroxide	calcium chloride solution	sulfur
B	concentrated sulfuric acid	aqueous calcium hydroxide	carbon
C	sodium hydroxide solution	concentrated sulfuric acid	copper
D	concentrated sulfuric acid	sodium hydroxide solution	carbon

- 3 The information on two substances P and Q are given below.

substance	P	Q
arrangement of particles	close and not orderly	regularly arranged and very close
movement of particles	sliding around randomly	vibrating about their fixed positions

Four substances are given below.

substance	description
1	copper at 100 °C
2	ethanol at 25 °C
3	oxygen at 10 °C
4	water at 200 °C

Which row shows substances P and Q?

	P	Q
A	1	2
B	2	1
C	3	4
D	4	1

- 4 A student conducted an experiment to determine how much hydrochloric acid is exactly required to neutralise 25.0 cm³ of aqueous potassium hydroxide.

Without the use of an indicator, which piece of apparatus does he require to determine the end-point of the reaction?

- A** electronic balance
- B** gas syringe
- C** stopwatch
- D** thermometer

- 5 A student prepared an ester by heating ethanoic acid and ethanol for thirty minutes.

Which apparatus is most suitable for the student to separate the ester formed from the reaction mixture at the end of the reaction?

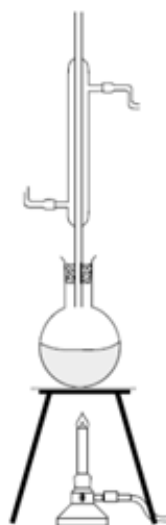
A



B



C



D



- 6 A newly discovered element, Preliminarium (Pm) has a proton number of 123 and a nucleon number of 248.

Which row shows the correct number of sub-atomic particles in a Preliminarium ion, Pm^{3+} ?

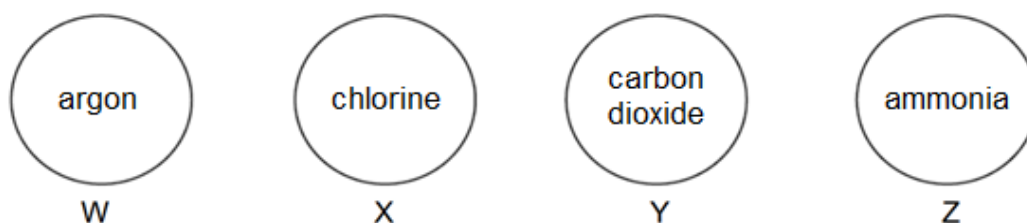
	number of electrons	number of neutrons	number of protons
A	120	120	123
B	120	123	120
C	120	125	123
D	123	125	120

- 7 Element M exists as 3 stable isotopes and has a relative atomic mass of 65.0.

Which row shows the correct compositions of isotopes?

	^{64}M	^{66}M	^{67}M
A	32.1%	56.4%	11.5%
B	54.6%	6.6%	38.8%
C	56.3%	31.1%	12.6%
D	53.3%	25.5%	21.2%

- 8 Four balloons W, X, Y and Z, were inflated to the same size with four different gases: argon, chlorine, carbon dioxide and ammonia.



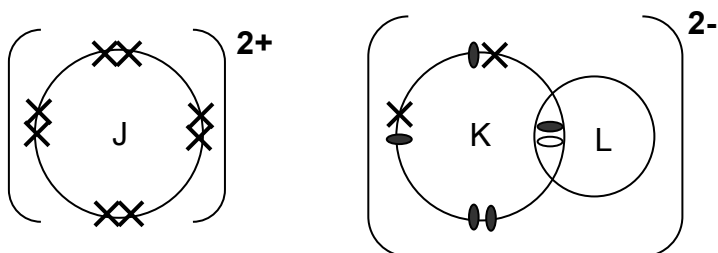
After several hours, all four balloons became smaller.

What is the correct order of balloon size?

	largest → smallest			
A	X	Y	W	Z
B	X	W	Y	Z
C	W	Z	Y	X
D	Z	W	Y	X

- 9 The formula of an ionic compound, containing elements J, K and L is shown below.

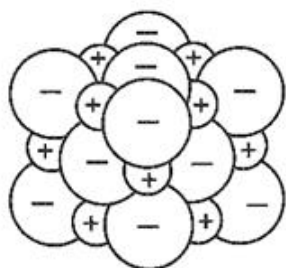
The letters J, K and L are **not** the chemical symbols of the elements.



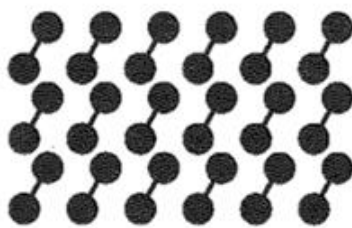
Which statements are correct?

- 1 Element K belongs to Group V of the Periodic Table.
 - 2 Element J could be magnesium.
 - 3 Element K and element L are bonded together by covalent bond.
 - 4 Element L is a metal.
- A** 1 and 2 only
- B** 1, 2 and 3 only
- C** 3 and 4 only
- D** 2, 3 and 4 only

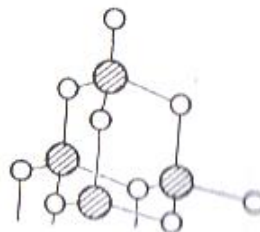
The structures of four substances P, Q, R and S at room conditions, are represented as follows. Use the structures to answer questions 10, 11 and 12.



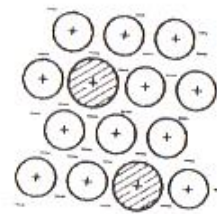
P



Q



R



S

10 Which statement about the four substances is **not** correct?

- A All the substances are pure.
- B All the substances are solids at room conditions.
- C One of the substances is an element.
- D Substance Q has a simple molecular structure.

11 Which property describes substance P correctly?

- A low melting point
- B hard
- C poor electrical conductivity in all states
- D soluble in organic solvent

12 Which row shows the correct identities for the four substances P, Q, R and S?

	P	Q	R	S
A	brass	dry ice	diamond	calcium oxide
B	calcium oxide	iodine	sand	brass
C	sand	poly(ethene)	sodium chloride	iodine
D	sodium chloride	oxygen	poly(ethene)	brass

- 13** Element R reacts with water producing a solution which turns red litmus paper to blue. The solution also reacts with dilute sulfuric acid to form a colourless liquid.

In which group or section of the Periodic Table is R found?

- A** Group I
- B** Group VII
- C** Group 0
- D** transition metals

- 14** A student is given five reagents as shown below to make salts.

dilute hydrochloric acid

dilute sulfuric acid

dilute nitric acid

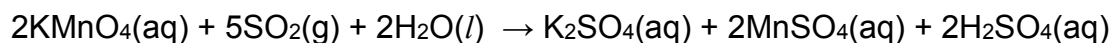
solid lead(II) oxide

solid copper(II) oxide

How many soluble salts can be prepared?

- A** 3
- B** 4
- C** 5
- D** 6

- 15** Study the reaction shown below.



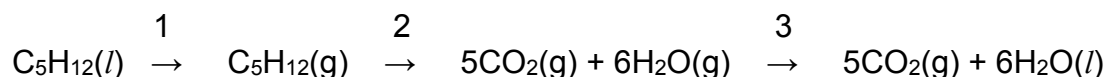
Which pair of oxidising and reducing agents is correct?

	oxidising agent	reducing agent
A	H_2SO_4	MnSO_4
B	KMnO_4	H_2O
C	KMnO_4	SO_2
D	SO_2	KMnO_4

16 Which row correctly shows the salts that are prepared by each method?

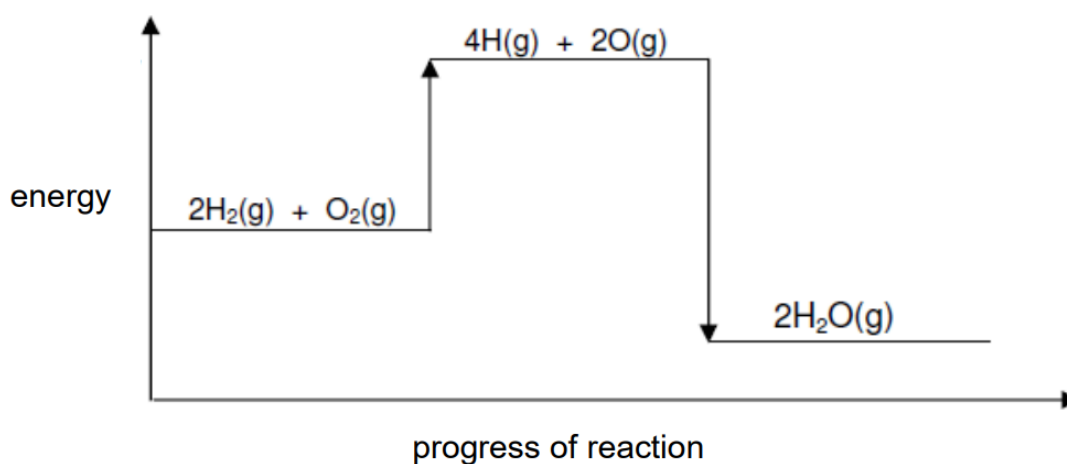
	titration	precipitation	adding excess solid reactants
A	ammonium nitrate	lead(II) sulfate	sodium chloride
B	calcium carbonate	calcium sulfate	calcium chloride
C	copper(II) sulfate	ammonium chloride	lead(II) nitrate
D	potassium sulfate	silver chloride	zinc sulfate

17 Pentane can be converted into carbon dioxide and water in the following stages:



Which stages are exothermic?

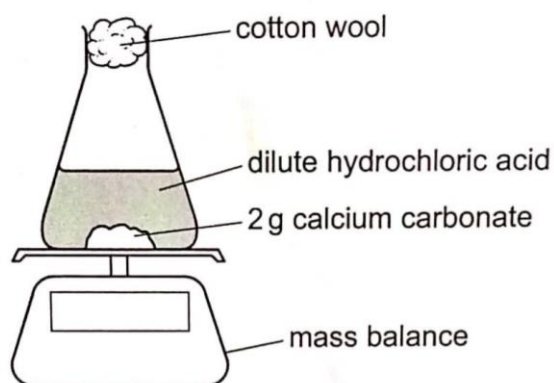
- A** 1 and 2
B 1 and 3
C 2 and 3
D 1, 2 and 3
- 18 The energy level diagram for burning hydrogen gas in oxygen to form steam is shown in the diagram.



Which statement about the reaction is correct?

- A** The enthalpy change of the reaction has a negative value.
B The reaction is endothermic.
C The temperature of the reaction mixtures decreases.
D The volume of the reactants is equal to the volume of the products.

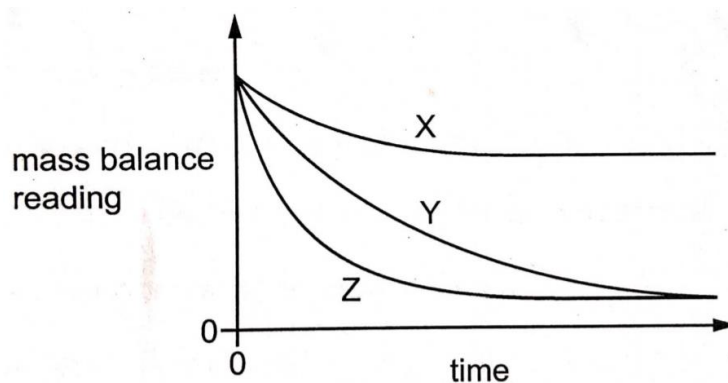
- 19** The rate of reaction between calcium carbonate and hydrochloric acid is measured in three separate experiments.



The conditions at which each experiment is performed are as follows:

experiment	particle size of calcium carbonate	moles of hydrochloric acid provided for reaction
1	powdered	in excess
2	lumps	in excess
3	lumps	insufficient

The results of these experiments are shown.



Which statement is correct?

- A** Experiment 1 is shown by curve X.
- B** Experiment 1 is shown by curve Y.
- C** Experiment 2 is shown by curve Y.
- D** Experiment 3 is shown by curve Z.

- 20 An aqueous solution contains the same amount of Al^{3+} and Cu^{2+} ions. Aqueous sodium hydroxide is added until in excess. After shaking, the mixture is filtered.

What would be left on the filter paper?

- A a blue solid
- B a blue solid and a white solid
- C a white solid
- D no solid residue

- 21 A student carried out the following reactions on a sample of ammonium nitrate.

reaction 1	warming with aqueous sodium hydroxide
reaction 2	warming with aluminium and aqueous sodium hydroxide
reaction 3	warming with dilute hydrochloric acid

Which reactions produces a gas that turns damp red litmus paper blue?

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

- 22 Chlorine is bubbled into aqueous iron(II) chloride. Subsequently, aqueous sodium hydroxide is added to the resultant solution and a reddish brown precipitate is observed.

Which statement is **not** correct?

- A Chlorine causes iron(II) chloride to undergo oxidation.
- B Iron(III) hydroxide is formed.
- C The aqueous sodium hydroxide is the reducing agent.
- D The oxidation state of chlorine has decreased.

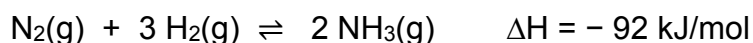
- 23** Methane reacts very slowly with air at room temperature. When metal T is added to the methane-air mixture, methane ignites quickly.

Which statements about the addition of metal T are correct?

- 1 T provides an alternative pathway with a lower activation energy.
- 2 T increases the enthalpy change of the reaction.
- 3 T increases the rate of reaction.
- 4 T increases the yield of the reaction.

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

- 24** Ammonia is manufactured by the Haber Process. The equation for the Haber process is given below.



Which statement about the Haber Process is true?

- A** Hydrogen used is obtained from the hydrogenation of alkenes.
- B** Nitrogen used is obtained from the fractional distillation of crude oil.
- C** The reaction is exothermic as energy is absorbed to break the strong $\text{N}\equiv\text{N}$ bonds.
- D** The yield of the reaction is always lower than 100% as the reaction is reversible.

- 25** Cynogen is a compound 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 the molecular formula of cynogen?

- A** CN
- B** C_2N_2
- C** C_3N_3
- D** C_4N_4

- 26** Nickel makes up 25.0% of the total mass of a coin. The coin has a mass of 8.0 g.

How many nickel atoms are there in the coin?

- A** 2.03×10^{22}
- B** 4.15×10^{22}
- C** 8.12×10^{22}
- D** 1.20×10^{24}

- 27** 110 g of manganese reacts completely with 72 dm³ of fluorine gas to form a fluoride of manganese.

Which equation correctly represents the reaction?

- A** $\text{Mn} + \text{F}_2 \rightarrow \text{MnF}_2$
- B** $\text{Mn} + 2\text{F}_2 \rightarrow \text{MnF}_4$
- C** $2\text{Mn} + 3\text{F}_2 \rightarrow 2\text{MnF}_3$
- D** $4\text{Mn} + 3\text{F}_2 \rightarrow 2\text{Mn}_2\text{F}_3$

- 28** Methanethiol, CH₃SH, burns as shown in the equation below.



A sample of 20 cm³ of methanethiol was exploded with 30 cm³ of oxygen.

What would be the final volume of the resultant mixture of gases when cooled to room temperature and pressure?

- A** 20 cm³
- B** 30 cm³
- C** 40 cm³
- D** 50 cm³

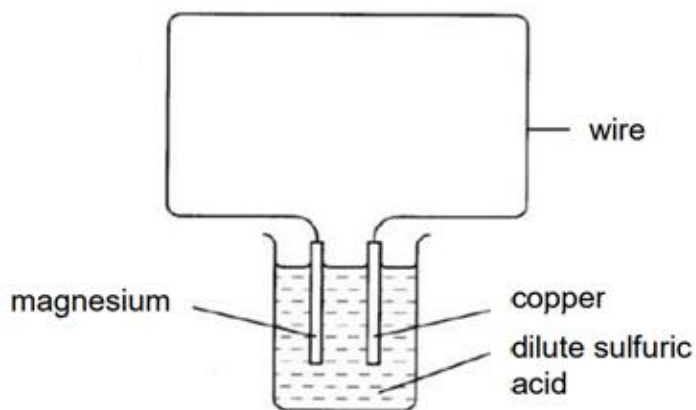
- 29** Elements X, Y and Z are in the same period of the Periodic Table. The properties of the oxides formed by these elements are shown below.

oxide X	dissolves in dilute hydrochloric acid only
oxide Y	dissolves in aqueous sodium hydroxide only
oxide Z	dissolves in both dilute hydrochloric acid and aqueous sodium hydroxide

What is the order of the elements X, Y and Z in increasing atomic number?

- A** X, Y, Z
B X, Z, Y
C Y, X, Z
D Y, Z, X

- 30** The diagram shows a simple cell.



Which statements about the simple cell are correct?

- 1 Bubbles are formed around copper.
- 2 Electrons move from magnesium to copper across the wire.
- 3 Mass of magnesium remains the same.
- 4 Copper is the negative electrode.

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

31 Which reaction is a step in the production of iron from haematite in the blast furnace?

- A** coke burning in air to produce carbon monoxide
- B** coke reacting with carbon monoxide to form carbon dioxide
- C** iron(III) oxide reacting with carbon monoxide to form iron
- D** iron reacting with limestone to produce slag

32 Four unknown metals, Q, R, S and T, are reacted with water, steam and dilute hydrochloric acid. The results are shown in the table.

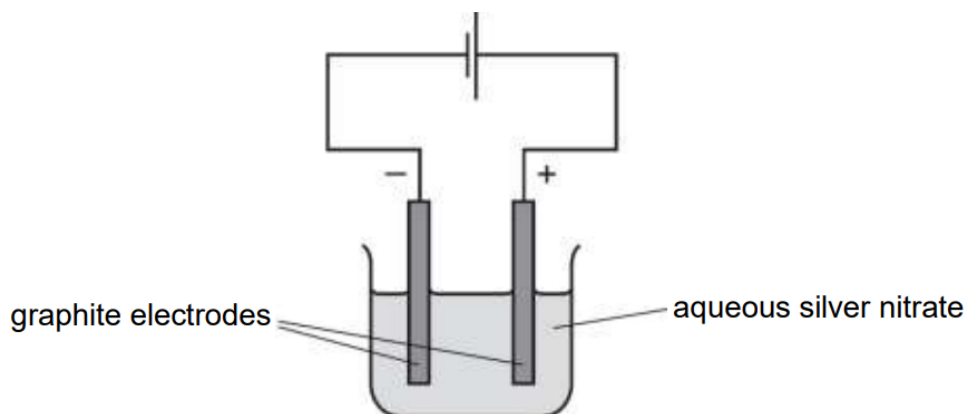
	reaction with water	reaction with steam	reaction with dilute hydrochloric acid
Q	slow reaction	fast reaction	fast reaction
R	no reaction	no reaction	no reaction
S	no reaction	very slow reaction	slow reaction
T	fast reaction	extremely fast reaction	extremely fast reaction

Which statements are correct?

- 1 R could be silver.
- 2 T could be Group I metal.
- 3 S is more reactive than Q and R.
- 4 Metals react faster with steam than they do with water.

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

- 33** The diagram shows the electrolysis of aqueous silver nitrate.



Which statement is correct?

- A** A brown gas is produced at the positive electrode.
 - B** A grey solid is coated on the negative electrode.
 - C** The anode dissolves and becomes smaller.
 - D** The electrons move from the negative terminal to positive terminal through the solution.
- 34** Four steel paper clips are treated before being placed in a beaker of water.
- Which paper clip rusts most quickly?
- A** attached to a piece of silver
 - B** coated with grease
 - C** dipped in paint and allowed to dry
 - D** electroplated with zinc
- 35** A Group I metal with the highest reactivity is reacted with a Group VII element with the highest colour intensity.

Which compound is formed?

- A** francium fluoride
- B** francium astatide
- C** lithium fluoride
- D** lithium astatide

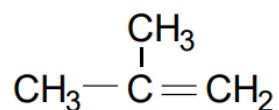
- 36 In which parts of a motor car do the reactions, shown in the equations, take place?

	$\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$	$2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$
A	engine	engine
B	engine	exhaust
C	exhaust	engine
D	exhaust	exhaust

- 37 In which reaction does the named product formed have a lower relative molecular mass than the reactant?

- A** conversion of ethanoic acid into ethyl ethanoate
B fermentation of glucose into ethanol
C formation of poly(ethene) from ethene
D oxidation of ethanol into ethanoic acid

- 38 The structural formula of a hydrocarbon is shown below.



Which statements about the hydrocarbon are correct?

- 1 It can undergo polymerisation.
- 2 It exhibits isomerism.
- 3 It forms an alcohol by reacting with water.
- 4 It reacts with chlorine only if ultra-violet light is present.

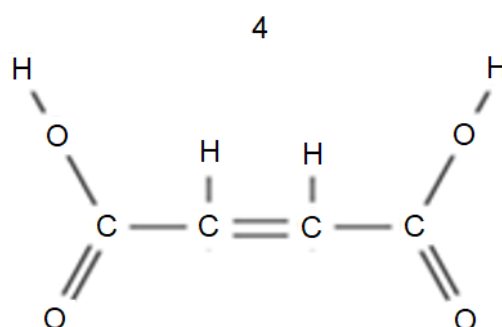
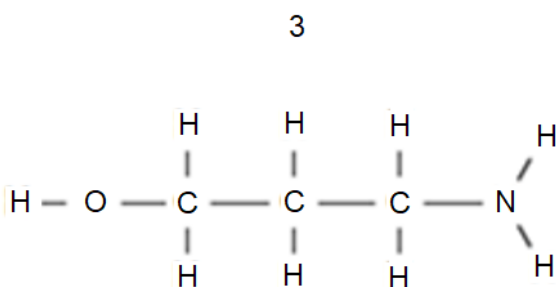
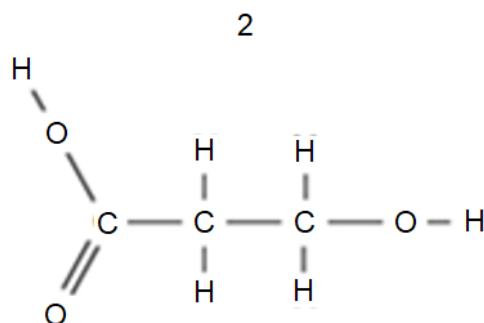
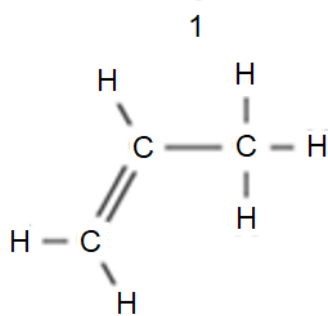
- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 2 and 4 only

- 39 A carboxylic acid has the molecular formula $C_{18}H_{28}O_2$.

How many $C = C$ bonds are there in one molecule of the acid?

- A** 1
B 2
C 3
D 4

- 40 Which monomers would undergo polymerisation on their own?



- A** 1, 2 and 3
B 1, 2 and 4
C 2 and 3
D All of the above

Group												
I	II	Key					III	IV	V	VI	VII	0
		proton (atomic) number atomic symbol name relative atomic mass										
		1 H hydrogen 1										
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	2 He helium 4
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	10 Ne neon 20
19 K potassium 39	20 Ca calcium 40						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						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						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 -						112 Cn copernicium -	114 Fl flerovium -	116 Lv livermorium -	118 Og oganeson -	119 Ts tennessine -	120 Nh nihonium -

actinoids

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	europlum	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
89	Ac	actinium	227	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	mendeleevium	—	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.).