



East Spring Secondary School

Towards Excellence and Success

Name: ()

Class:

Preliminary Examination 2022 Secondary 4 Express

CHEMISTRY

6092/01

Paper 1 Multiple Choice

Tuesday
13 September 2022

1 hour
0800 – 0900

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, index number 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 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.

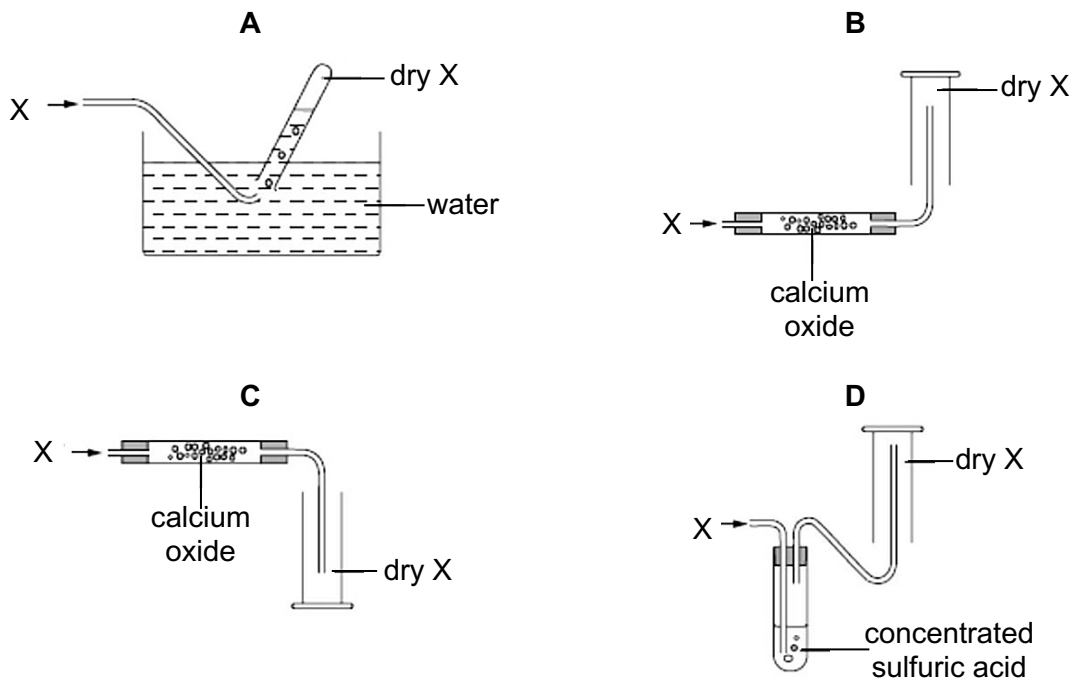
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

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

- 1 Gas X is very soluble in water, less dense than air, and turns moist red litmus paper blue.

Which method would be **most** suitable to collect a dry sample of the gas?



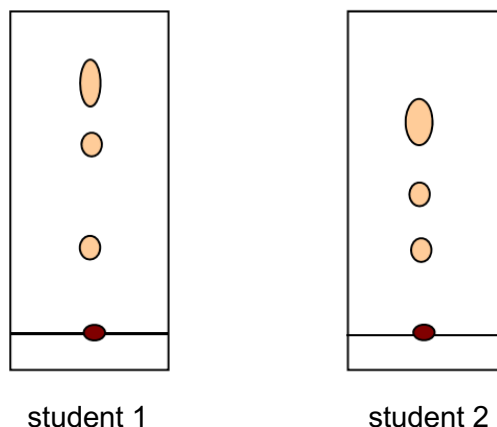
- 2 A gas, T, has the following properties:

- 1 a choking smell
- 2 turns damp blue litmus paper red, then bleaches it
- 3 does not decolourise acidified potassium manganate(VII)

What is T?

- | | |
|-------------------------|-------------------------|
| A ammonia | B chlorine |
| C carbon dioxide | D sulfur dioxide |

- 3 Two students investigated the substances that produce the colour in a type of sweet. The solution obtained from the sweet was separated by paper chromatography. The chromatograms obtained by the two students are shown below.



Why are the two chromatograms obtained different?

- A** The two students used different solvents.
 - B** One of the students did not use enough solvent.
 - C** The solvent for student 2 did not reach the top of the paper.
 - D** The solvent moved up the paper at different speeds.
- 4 A student was provided with a solid mixture, M. The table below shows some information about the three substances found in mixture M.

substance	boiling point / °C	solubility in water
W	140	soluble
X	90	insoluble
Y	95	soluble

The student was told he could carry out some of the following steps to separate the three substances in mixture M.

- 1 filtration
- 2 fractional distillation
- 3 evaporation
- 4 addition of water

In which order should the student carry out the steps?

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

- 5 Deuterium, D, is an isotope of hydrogen.

Which statement about deuterium is **not** correct?

- A An atom of deuterium contains one proton.
- B It forms the ion D^+ .
- C It has the same density as hydrogen.
- D It reacts with ethene to form the compound CH_2DCH_2D .

- 6 An ion, X^{2-} , has p nucleons and q electrons.

What does the nucleus of an atom of X contain?

	number of protons	number of neutrons
A	$q - 2$	$p - q$
B	$q - 2$	$p - (q - 2)$
C	$q + 2$	$p - (q - 2)$
D	$q + 2$	$p - (q + 2)$

- 7 Boron is a non-metallic element which is placed above aluminium in Group III of the Periodic Table.

It forms a compound with nitrogen known as boron nitride which has a structure similar to graphite.

A student made the following conclusions about boron nitride.

- 1 Boron nitride has a layered structure with weak attraction forces between the layers.
- 2 The empirical formula of boron nitride is BN.
- 3 The boron and nitrogen atoms are likely to be arranged alternately in a hexagonal pattern.

Which of the conclusions about boron nitride are correct?

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

8 In which molecule are all the outer electrons of the atoms involved in bonding?



9 When a covalent liquid boils, its molecules are spaced further apart.

Which property of the molecules affects the energy required to boil a covalent liquid the most?

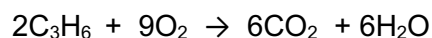
A the reactivity of the molecules

B the shape of the molecules

C the strength of the covalent bonds between the atoms

D the strength of the forces of attraction between the molecules

10 20 cm^3 of propene gas reacts with 500 cm^3 of oxygen according to the equation shown below.



What is the **total** volume of gas remaining at the end of the reaction?
(all volumes are measured at room temperature and pressure.)

A 120 cm^3

B 410 cm^3

C 470 cm^3

D 530 cm^3

11 An excess of dilute hydrochloric acid was added separately to the following.

1 2.4 g of magnesium

2 4.2 g of magnesium carbonate

3 2.0 g of magnesium oxide, then warmed

Which statement is correct?

A The number of moles of magnesium chloride formed would be the greatest in reaction 1.

B The number of moles of magnesium chloride formed would be the greatest in reaction 2.

C The number of moles of magnesium chloride formed would be the greatest in reaction 3.

D The number of moles of magnesium chloride formed would be the same for all three reactions.

12 When 20 g of a sample of impure calcium carbonate is heated, 6.6 g of carbon dioxide is obtained.

What is the percentage purity of the sample of calcium carbonate?

A 15%

B 33%

C 50%

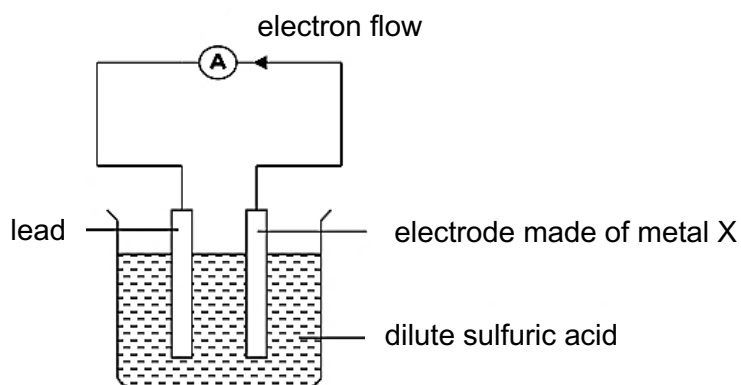
D 75%

- 13** Aqueous copper(II) sulfate is electrolysed using a positive copper electrode and a negative graphite electrode.

Which row is correct?

	at the positive electrode	at the negative electrode
A	electrode dissolves	copper deposited
B	hydrogen gas given off	oxygen gas given off
C	oxygen gas given off	copper deposited
D	electrode dissolves	hydrogen gas given off

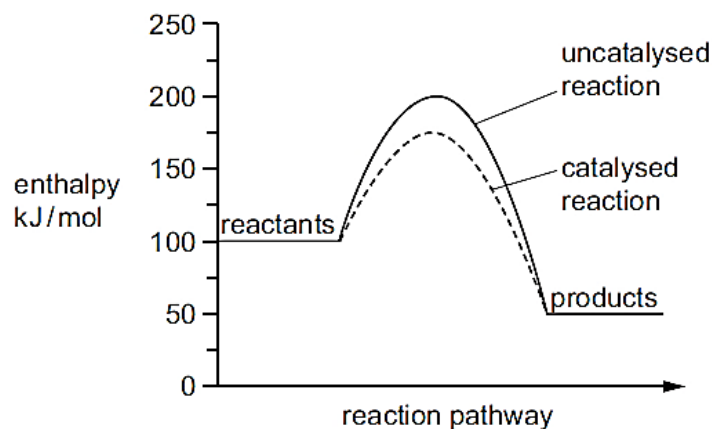
- 14** In the set-up below, a lead electrode, an electrode made of metal X and dilute sulfuric acid are used to produce electrical energy.



With reference to the set-up, which of the following statements is correct?

- A** The lead electrode is the negative electrode.
B Metal X is below lead in the reactivity series.
C The mass of the lead electrode decreases.
D The mass of the metal X electrode decreases.
- 15** Which of the following statements best describes the mechanism of a hydrogen-oxygen fuel cell?
- A** Hydrogen and oxygen undergo redox reactions to generate electricity.
B Hydrogen ions react with hydroxide ions to generate electricity.
C Electricity is used to provide heat energy.
D Electricity is used to generate hydrogen and oxygen.

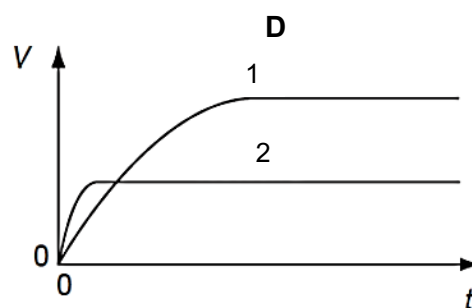
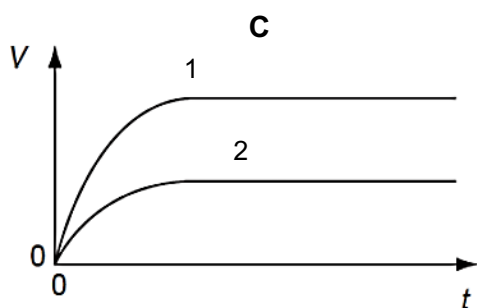
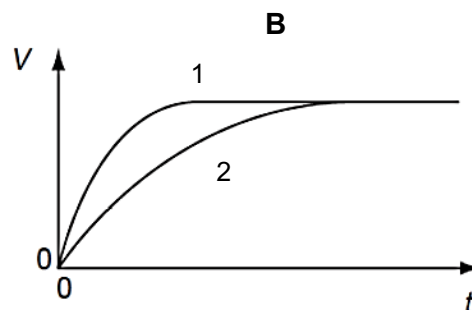
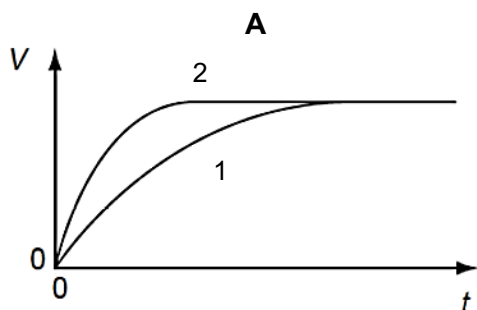
- 16 The energy diagram below represents a chemical reaction carried out with a catalyst and without a catalyst.



What is the enthalpy change for catalysed reaction?

- A** -150 kJ/mol **B** -50 kJ/mol **C** $+50 \text{ kJ/mol}$ **D** $+100 \text{ kJ/mol}$
- 17 A student performs two experiments at room temperature.
- In experiment 1, 10 g of magnesium ribbon was reacted with excess 2.0 mol/dm^3 of dilute hydrochloric acid.
- In experiment 2, 5 g of magnesium powder was reacted with excess 2.0 mol/dm^3 of dilute hydrochloric acid.
- In both experiments, the volume of hydrogen, V , was plotted against time, t .

Which set of graphs is correct?



18 Which factor decreases the activation energy of a reaction?

- A addition of a catalyst
- B decrease in temperature
- C increase in pressure
- D increase in concentration of the reactants

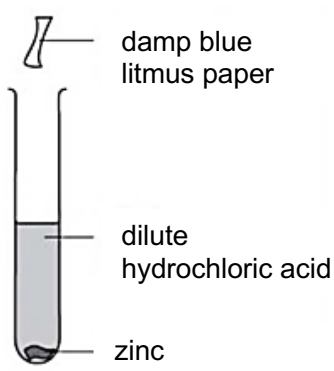
19 Chemical Z is a powerful reducing agent.

Which statement about Z is correct?

- A Z reacts with aqueous potassium iodide producing a brown solution and gains electrons in the process.
- B Z reacts with aqueous potassium iodide producing a brown solution and loses electrons in the process.
- C Z decolourises acidified potassium manganate(VII) and gains electrons in the process.
- D Z decolourises acidified potassium manganate(VII) and loses electrons in the process.

20 The diagrams below show mixtures of chemicals that react to produce gases. In which reaction will the litmus paper change colour?

A

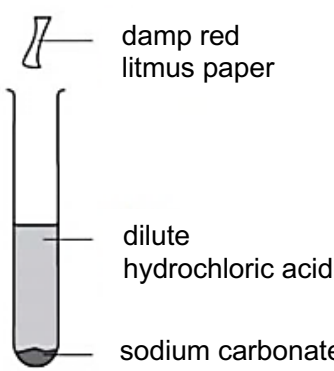


damp blue litmus paper

dilute hydrochloric acid

zinc

B

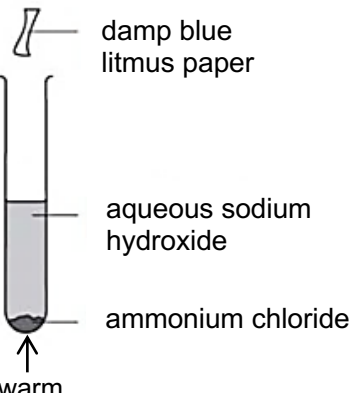


damp red litmus paper

dilute hydrochloric acid

sodium carbonate

C



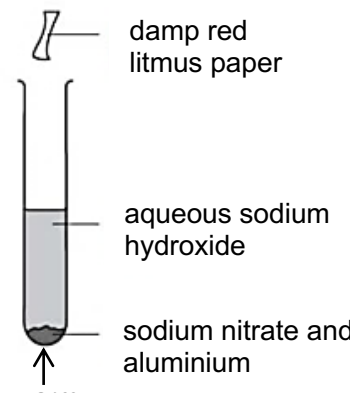
damp blue litmus paper

aqueous sodium hydroxide

ammonium chloride

warm

D



damp red litmus paper

aqueous sodium hydroxide

sodium nitrate and aluminium

warm

- 21** As part of the procedure to prepare a pure salt, a student carried out crystallisation.

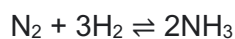
Which of the following could the salt be?

- | | |
|---------------------------|---------------------------|
| A ammonium nitrate | B barium carbonate |
| C silver iodide | D calcium sulfate |

- 22** Which oxide is insoluble in aqueous ammonia?

- | | | | |
|--------------------------|---|--------------|--------------|
| A NO ₂ | B P ₄ O ₁₀ | C ZnO | D FeO |
|--------------------------|---|--------------|--------------|

- 23** Ammonia is manufactured industrially from nitrogen and hydrogen by the Haber process. The reaction can be represented by the following equation.



Which of the following statements are correct about the Haber process?

- 1 Nitrogen is oxidised to form ammonia.
- 2 Hydrogen is obtained from the cracking of crude oil.
- 3 Ammonia formed is condensed and obtained as a liquid.
- 4 An iron catalyst is used to increase the yield of ammonia.

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

- 24** Which of the following properties of the elements increases across the Periodic Table?

- 1 non-metallic character
- 2 number of electron shells
- 3 tendency to attract electrons

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

25 Caesium is a Group I metal.

Which reaction involving this element will **not** produce hydrogen gas?

- A adding caesium to dilute nitric acid
- B adding caesium to cold water
- C electrolysing aqueous caesium chloride
- D electrolysing molten caesium chloride

26 Two statements about noble gases are given:

- 1 Noble gases are reactive, monatomic gases.
- 2 All atoms of noble gases all have fully filled outer electron shells.

Which of the following is correct?

- A Both statements are correct and statement 2 explains statement 1.
- B Both statements are correct but statement 2 does not explain statement 1.
- C Statement 1 is correct but statement 2 is incorrect.
- D Statement 2 is correct but statement 1 is incorrect.

27 Which statement about alloys is correct?

- A They can all be represented by a chemical formula.
- B Their structures contain a 'sea' of electrons.
- C They are good conductors of electricity as they have mobile ions.
- D They are formed by chemically combining two metals.

28 Which of the following metals, when added to aqueous silver nitrate, will result in **all** the following observations made during the reaction?

- colourless, odourless gas produced
- a silvery metal formed
- colourless solution remains colourless

- A calcium B copper C gold D iron

29 A metal is positioned between zinc and lead in the reactivity series.

Which method is most suitable for the extraction of the metal?

- A** electrolysis of its molten compound
- B** electrolysis of its salt solution
- C** reduction of its oxide using carbon
- D** reduction of its oxide using lead

30 An iron object is galvanised with zinc coating.

Which of the following statements describes what happens to the object and the zinc coating when the surface of the object is scratched?

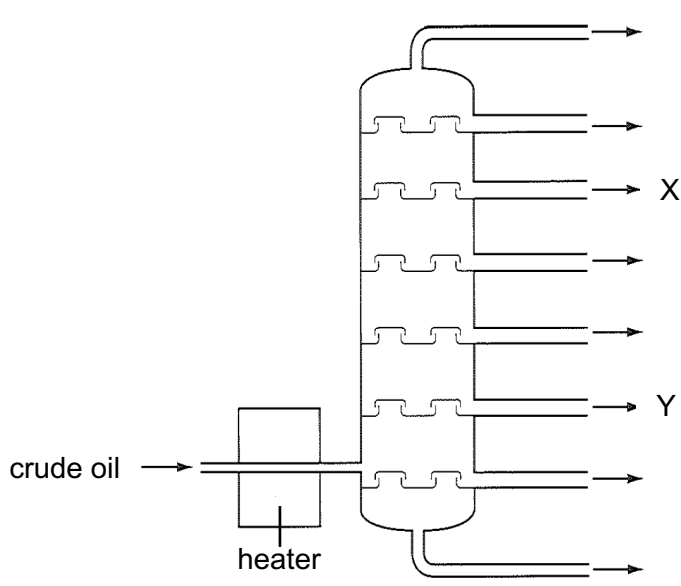
	iron object	zinc coating
A	starts to rust	remains unchanged
B	starts to rust	continues to corrode
C	remains unchanged	continues to corrode
D	remains unchanged	remains unchanged

31 Which pollutants can be removed from the car exhaust by a catalytic converter?

- 1 carbon monoxide
- 2 oxides of nitrogen
- 3 unburnt hydrocarbons
- 4 sulfur dioxide

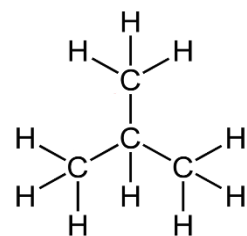
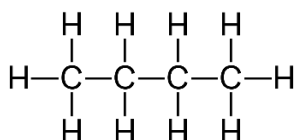
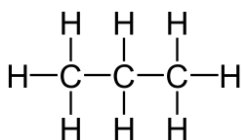
- A** 1 and 2
- B** 2 and 4
- C** 1, 2 and 3
- D** 1, 2, 3 and 4

- 32 Fractional distillation of crude oil occurs in a fractionating column. The positions at which fractions X and Y are collected are shown.



Which statement is correct?

- A X has a higher boiling point than Y.
 - B X has longer chain molecules than Y.
 - C X condenses at a lower temperature than Y.
 - D The temperature is highest at the top of the column.
- 33 The diagrams show the structures of three hydrocarbons.



Which statement is correct for all three compounds?

- A They are isomers of each other.
- B They have the same general formula.
- C They have the same physical properties.
- D They react with aqueous bromine.

- 34** When decane, $C_{10}H_{22}$, is cracked, only three compounds are formed.

The compounds are ethene, ethane and propene.

What is the ratio of the compounds formed?

	ethene	ethane	propene
A	1	1	1
B	1	1	2
C	1	2	1
D	2	1	1

- 35** One mole of polyunsaturated oil is converted completely to margarine. When the reaction is completed, the mass of the margarine is 8.0 g more than the mass of the vegetable oil.

How many carbon-carbon double bonds does the polyunsaturated vegetable oil contain?

- A** 1 **B** 2 **C** 4 **D** 8

- 36** Two gases, Q and R, have the following properties.

- Q dissolves in sodium hydroxide but R is insoluble
- R burns in excess oxygen to give Q and water only.
- R decolourises aqueous bromine.

What are the identities of Q and R?

	Q	R
A	carbon monoxide	ethene
B	carbon monoxide	ethane
C	carbon dioxide	ethene
D	carbon dioxide	ethane

37 Compound X has the following properties.

- 1 X can be made by a fermentation process.
- 2 X forms Y when added to acidified potassium manganate(VII).
- 3 X can react with Y to form Z and water.

Which homologous series do X, Y and Z belong to?

	X	Y	Z
A	alcohol	carboxylic acid	ester
B	alcohol	ester	carboxylic acid
C	carboxylic acid	alcohol	ester
D	carboxylic acid	ester	alcohol

38 Ethanol can be manufactured from either ethene or glucose. The table gives statements about the processes involved.

	process using ethene	process using glucose
1	reaction is faster at 300°C than at 200°C	reaction is faster at 100°C than at 30°C
2	produces pure ethanol	produces a dilute aqueous solution of ethanol
3	uses a catalyst	uses a catalyst
4	uses steam	produces carbon dioxide

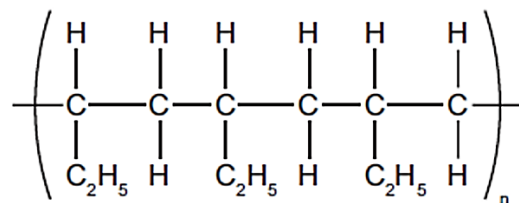
In which rows are both statements correct?

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

39 Which alcohol would combine with propanoic acid to give the ester $\text{C}_2\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$?

- A methanol
 B ethanol
 C propanol
 D butanol

40 A section of a polymer chain is shown below.



Which row correctly describes the molecule used to make this polymer, and the type of polymerisation involved?

	molecule	type of polymerisation
A	$\text{CH}_3\text{-CH=CH-CH}_3$	condensation
B	$\text{CH}_3\text{-CH}_2\text{-CH=CH}_2$	addition
C	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=CH}_2$	condensation
D	$\text{CH}_3\text{-CH=CH-CH}_3$	addition

End of Paper 1

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.)