

Name: _____ () Class: _____

PRELIMINARY EXAMINATION
GENERAL CERTIFICATION OF EDUCATION ORDINARY LEVEL

CHEMISTRY

Paper 1 Multiple Choice

6092/01

28 August 2024

1 hour

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on the Answer Sheet using a soft pencil.

There are **40** questions in 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.

Amendments may be done using a soft eraser.

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 22.

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

For Examiner's Use	
Total (40)	

This document consists of **22** printed pages.



圣尼各拉女校

CHI J ST NICHOLAS GIRLS' SCHOOL

Girls of Grace • Women of Strength • Leaders with Heart

[Turn over

- 1 An ion X^{2-} has m nucleons and n electrons.

What does the nucleus of an atom of X contain?

	number of protons	number of neutrons
A	$n - 2$	$m - n$
B	$n - 2$	$m - (n - 2)$
C	$n + 2$	$m - (n - 2)$
D	$n + 2$	$m - (n + 2)$

- 2 Which of the following substances could be hydrogen chloride?

	melting point /°C	boiling point /°C	electrical conductivity	
			in molten state	in aqueous state
A	-100	-85	none	good
B	-114	78	none	none
C	190	290	none	insoluble
D	1081	1565	good	good

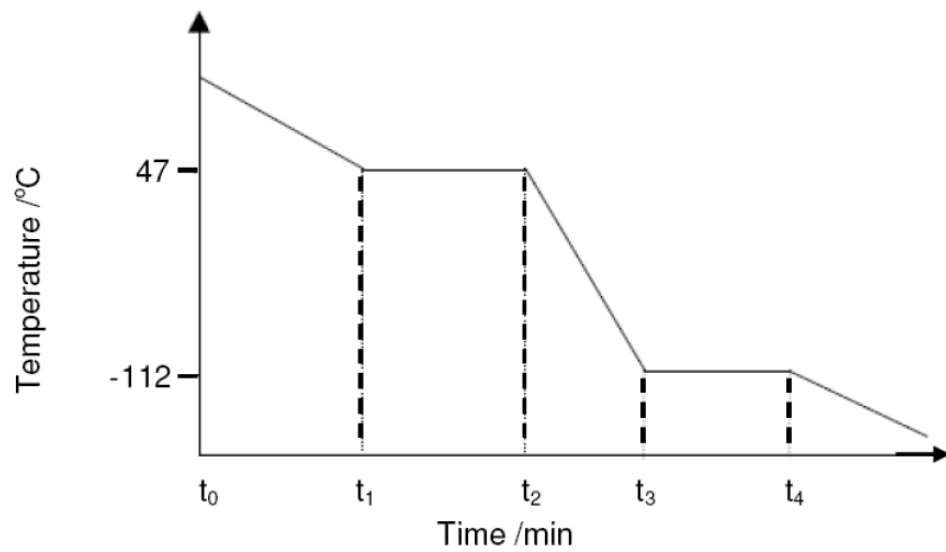
- 3 The table below shows some information about four substances labelled P to S.

substance	appearance	observations
P	colourless liquid	boils away, leaving a white residue
Q	colourless gas	burns in oxygen to form water and carbon dioxide only
R	yellow solid	splits up by electricity in molten state to form a metal and a gas
S	white solid	burns in air to form an oxide as the only product

Based on the observations, which of these substances P, Q, R and S are compounds?

- A P and Q only
 B Q and R only
 C R and S only
 D Q, R and S only

- 4 The graph below shows the cooling curve of carbon disulfide.

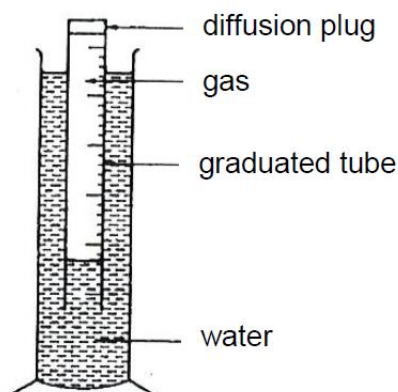


Which one of the following statements is true?

- A The boiling point of carbon disulfide is -112 °C.
- B From t_1 to t_2 , the spaces between particles are increasing.
- C From t_2 to t_3 , there is no solid present.
- D From t_3 to t_4 , all the particles of carbon disulfide are vibrating in fixed positions.

- 5 The diagram below shows an apparatus for measuring the rates of diffusion of gases. The time taken for 100 cm³ of some gases at room temperature and pressure to diffuse from this apparatus is shown in the table.

gas	time /s
CO	132
Cl ₂	211
CH ₄	100
O ₂	141



What will be the time taken for nitrogen gas to diffuse from this apparatus?

- A** 66 s
- B** 72 s
- C** 100 s
- D** 132 s
- 6 Which of the following is an example of oxidation?
- A** Bromine becomes colourless when added to aqueous sodium iodide.
- B** Nitrogen dioxide is removed during the reaction occurring in a motor car's catalytic convertor.
- C** Iron(II) hydroxide is precipitated from a solution of iron(II) ions.
- D** Silver anode becomes smaller during electrolysis.
- 7 A textbook writes 'Nitric acid, HNO₃, is a strong oxidising agent'. Which of the following cannot be a product of nitric acid in its reaction with a reducing agent?
- A** N₂
- B** NO
- C** NO₂
- D** N₂O₅

- 8 The atomic radius of some Group 1 elements of the Periodic Table is given.

element	atomic radius /pm
K	231
L	152
M	248
N	186

Which of the following shows the correct ascending order of melting point for the elements?

	lowest → highest			
A	L	K	M	N
B	L	N	K	M
C	M	K	L	N
D	M	K	N	L

- 9 Which of the following statements correctly describes a trend in the properties of the elements, going from left to right of Period 2 of the Periodic Table?
- A** The ability to form positive ions decreases.
 - B** The number of electron shells increases.
 - C** The ionic charge of the element increases.
 - D** The oxidizing ability of the element decreases.

- 10** Hydrated sodium carbonate has the formula $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$. On strong heating, hydrated sodium carbonate decomposes completely into water and anhydrous sodium carbonate, Na_2CO_3 . The formula of hydrated sodium carbonate was found by the following procedure.

A mass of hydrated sodium carbonate was heated strongly in a crucible until decomposition was complete. The following results were obtained.

Mass of empty crucible = 11.50 g

Mass of crucible + hydrated sodium carbonate = 17.22 g

Mass of crucible + anhydrous sodium carbonate = 13.62 g

These data suggests that the formula for hydrated sodium carbonate is

- A** $\text{Na}_2\text{CO}_3 \cdot 3\text{H}_2\text{O}$
 - B** $\text{Na}_2\text{CO}_3 \cdot 5\text{H}_2\text{O}$
 - C** $\text{Na}_2\text{CO}_3 \cdot 8\text{H}_2\text{O}$
 - D** $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
- 11** The mineral dolomite is a double carbonate of magnesium and calcium, with the formula $\text{CaMg}(\text{CO}_3)_2$. When 2.00 g of an impure sample of dolomite was completely dissolved in excess hydrochloric acid, 0.45 g of carbon dioxide was given off. What is the percentage purity of the sample?

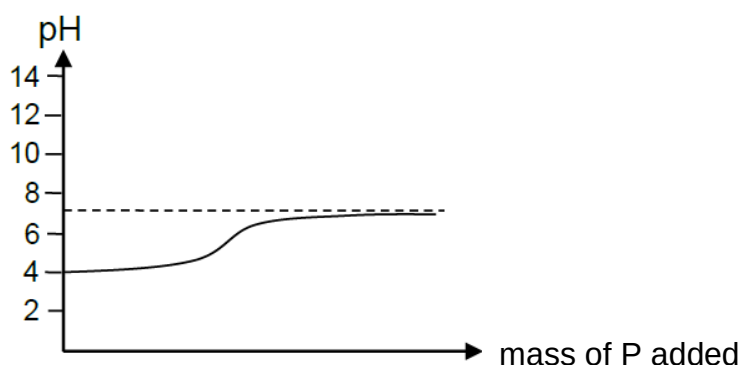


- A** 22.5%
- B** 47.0%
- C** 77.5%
- D** 94.1%

- 12** Dilute sulfuric acid, dilute nitric acid, and dilute ethanoic acid were separately titrated with 0.10 mol/dm^3 aqueous sodium hydroxide. The same volume and concentration of each acid was used.

In order to react completely,

- A** all three acids would require the same volume of aqueous sodium hydroxide.
- B** ethanoic acid and nitric acid would require the same volume of aqueous sodium hydroxide but sulfuric acid would require more.
- C** nitric acid would require more aqueous sodium hydroxide than ethanoic acid but less than sulfuric acid.
- D** sulfuric acid and nitric acid would require the same volume of aqueous sodium hydroxide but ethanoic acid would require less.
- 13** The graph shows the changes in pH when solid P was added to a beaker containing solution Q.



What could P and Q be?

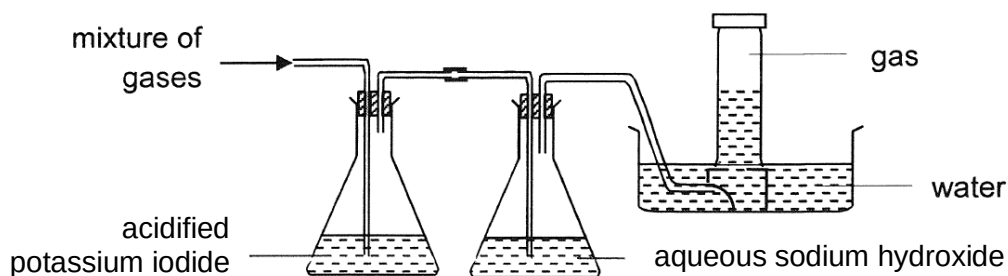
	P	Q
A	aluminium oxide	dilute hydrochloric acid
B	potassium oxide	dilute hydrochloric acid
C	sodium oxide	dilute ethanoic acid
D	zinc oxide	dilute ethanoic acid

- 14** A student mixed two aqueous solutions of ionic compounds at a time and made the following observations.

solution A	solution B	observations
$\text{Sr}(\text{ClO}_3)_2$	$\text{Mg}(\text{IO}_3)_2$	a precipitate formed
$\text{Mg}(\text{IO}_3)_2$	$\text{Ni}(\text{ClO}_3)_2$	a precipitate formed
MgCrO_4	$\text{Pb}(\text{ClO}_3)_2$	a precipitate formed
MgCrO_4	$\text{Ca}(\text{ClO}_3)_2$	no visible change

Which conclusion is correct based on these observations?

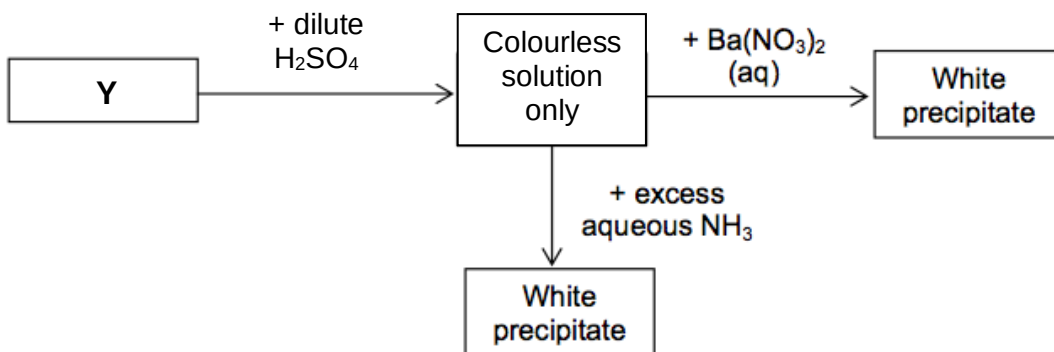
- A** Only $\text{Ni}(\text{IO}_3)_2$ and $\text{Mg}(\text{ClO}_3)_2$ are insoluble.
- B** Only $\text{Ni}(\text{IO}_3)_2$ and PbCrO_4 are insoluble.
- C** $\text{Sr}(\text{IO}_3)_2$, $\text{Ni}(\text{IO}_3)_2$ and PbCrO_4 are insoluble.
- D** $\text{Sr}(\text{IO}_3)_2$, $\text{Ni}(\text{IO}_3)_2$, PbCrO_4 and CaCrO_4 are insoluble.
- 15** Which is the best method to make lead (II) sulfate?
- A** Adding lead (II) chloride to barium sulfate.
- B** Adding lead (II) oxide to dilute sulfuric acid.
- C** Adding lead (II) oxide to excess dilute nitric acid followed by dilute sulfuric acid.
- D** Adding lead (II) oxide to dilute hydrochloric acid followed by ammonium sulfate.
- 16** A gaseous mixture of ammonia, hydrogen, sulfur dioxide and chlorine was passed through the apparatus shown below. Only one gas was collected in the gas jar.



What is the property of the gas collected in the gas jar?

- A** It bleaches moist red litmus paper.
- B** It extinguishes a lighted splint with a pop sound.
- C** It turns acidified potassium manganate(VII) colourless.
- D** It turns moist red litmus paper blue.

- 17 The scheme below shows some reactions of compound Y.

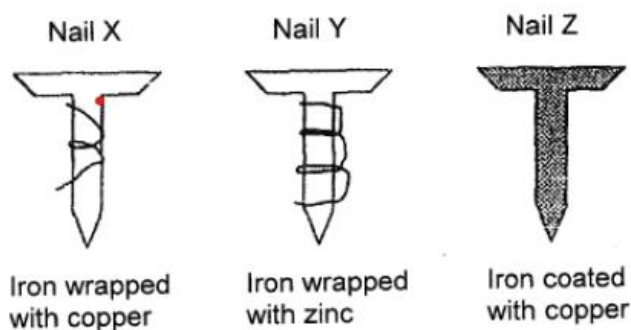


What is compound Y?

- A aluminium carbonate
 - B aluminium oxide
 - C lead(II) oxide
 - D zinc hydroxide
- 18 Metal X reacts rapidly with cold water while metal Y reacts only with steam. Which of the following statements is incorrect?
- A Extraction of metal X requires electricity while metal Y is extracted by chemical reduction.
 - B Metal X displaces Y from the solution containing ions of Y.
 - C The carbonate of X requires a lower temperature to decompose than that of Y.
 - D There is no reaction when oxide of X and metal Y are strongly heated.
- 19 Equal masses of magnesium carbonate and copper(II) carbonate are heated at the same temperature until no further change is observed. Which carbonate decomposes more quickly, and which one produces a greater volume of carbon dioxide gas?

	higher rate of decomposition	greater volume of carbon dioxide gas
A	copper(II) carbonate	magnesium carbonate
B	copper(II) carbonate	copper(II) carbonate
C	magnesium carbonate	magnesium carbonate
D	magnesium carbonate	copper(II) carbonate

- 20** The diagram below shows an experiment to investigate the rusting in iron nails.



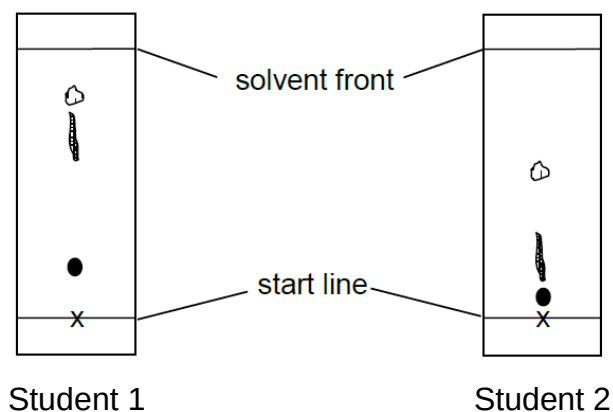
Which of the nail(s) above will rust faster than an untreated nail?

- A** X only
 - B** Z only
 - C** X and Z only
 - D** Y and Z only
- 21** A solid mixture of manganese(IV) oxide and sulfur may be separated by the procedure below:
- I) The mixture is added into excess carbon disulfide and stirred.
 - II) The resulting mixture is filtered.
 - III) The filtrate is distilled over to recover sulfur, which is left behind in the round bottomed flask.

Which one of the following cannot be deduced from the above procedure?

- A** Carbon disulfide has a low density.
- B** Manganese(IV) oxide does not react with carbon disulfide.
- C** Sulfur is soluble in carbon disulfide.
- D** Sulfur is stable to heating.

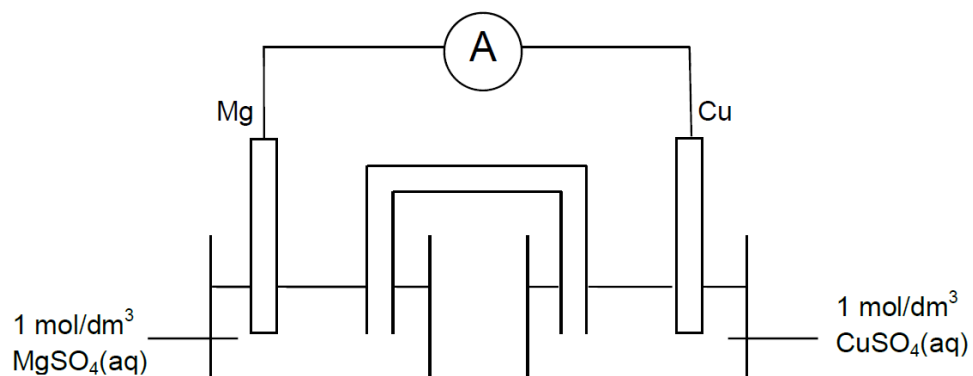
- 22** Student 1 and student 2 carried out a chromatography experiment to examine the dyes present in a sample of paint. Both students used a sample of the same paint. The chromatograms obtained by the two students are shown below.



Which statement best explains the difference in the results observed?

- A** Student 1 allowed the chromatography to proceed for a longer time.
- B** Student 1 and student 2 used different solvents.
- C** Student 2 used a more concentrated sample than student 1.
- D** The solvent moved up the paper at different speeds.

23 The following is a set up for a simple cell.



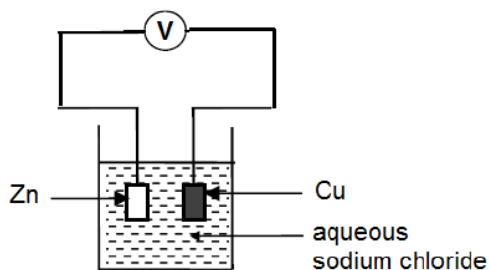
Which of the following statements are correct?

- I) Mass of copper remains the same.
- II) Mass of magnesium decreases.
- III) Electrons flow from magnesium to copper.
- IV) Copper is the anode.
- V) Chemical energy is converted into electrical energy.

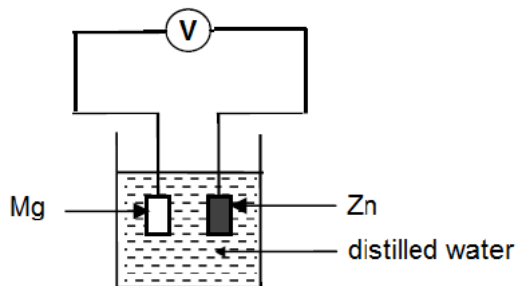
- A** I, II and III
- B** I, II and IV
- C** III, IV and V
- D** II, III and V

24 Which simple cell set-up would produce the greatest reading on the voltmeter?

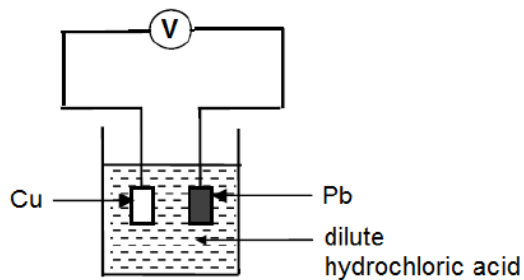
A



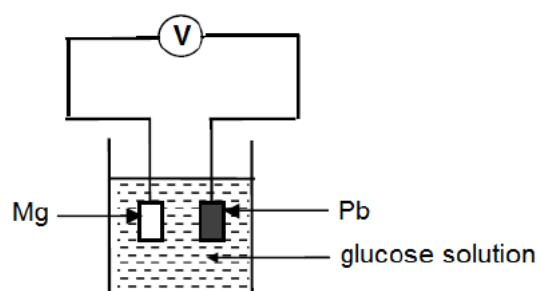
B



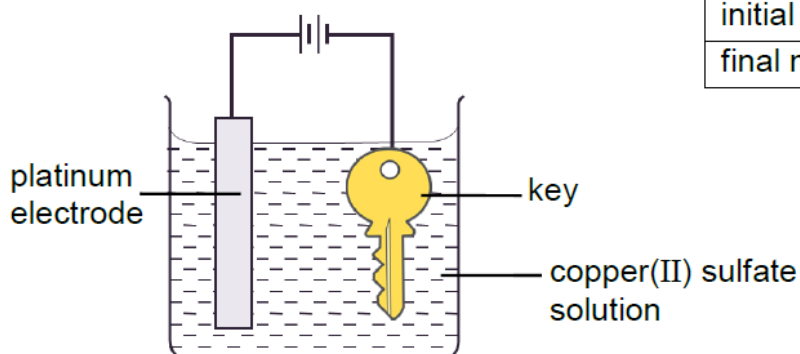
C



D



25 The diagram shows the process of electroplating a metal key. The initial and final mass of the key is shown in the table.



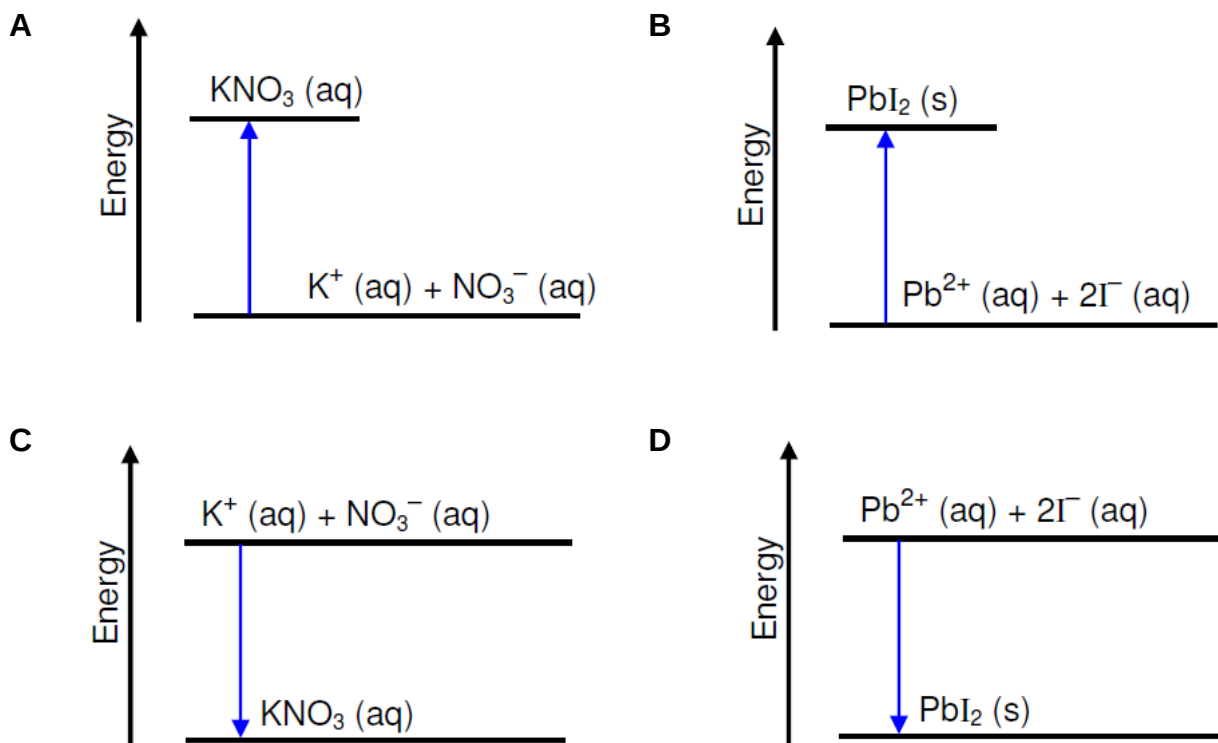
initial mass of key / g	23.6
final mass of key / g	24.4

What is the volume of gas liberated at the anode?

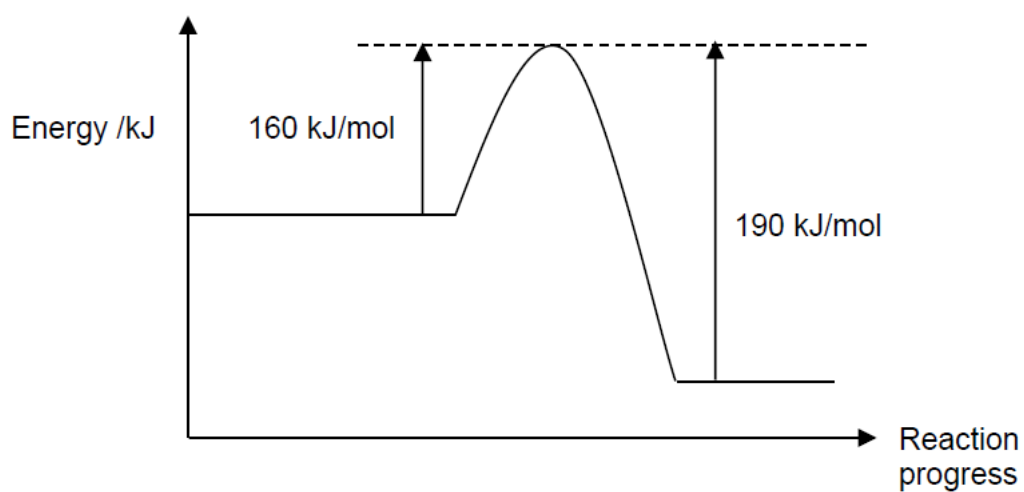
- A 75 cm³
- B 150 cm³
- C 300 cm³
- D 600 cm³

- 26** A current is passed through an electrolyte using platinum electrodes.
Which electrolyte will produce an alkaline solution at the end of the electrolysis?
- A** aqueous copper(II) nitrate
B aqueous sodium sulfate
C concentrated potassium chloride
D dilute sulfuric acid
- 27** Two molten bromides XBr and YBr_2 are separately electrolysed using the same amount of current for the same period of time.
Which statement about this experiment is correct?
- A** An equal number of moles of X and Y is deposited.
B Equal masses of X and Y are deposited.
C The number of moles of Y deposited is half the number of moles of X deposited.
D YBr_2 gives off twice the volume of bromine gas as compared to XBr .
- 28** The reaction between aqueous lead(II) nitrate and aqueous potassium iodide results in an increase in the temperature of the reaction mixture.

The energy level diagram of this reaction can be represented by



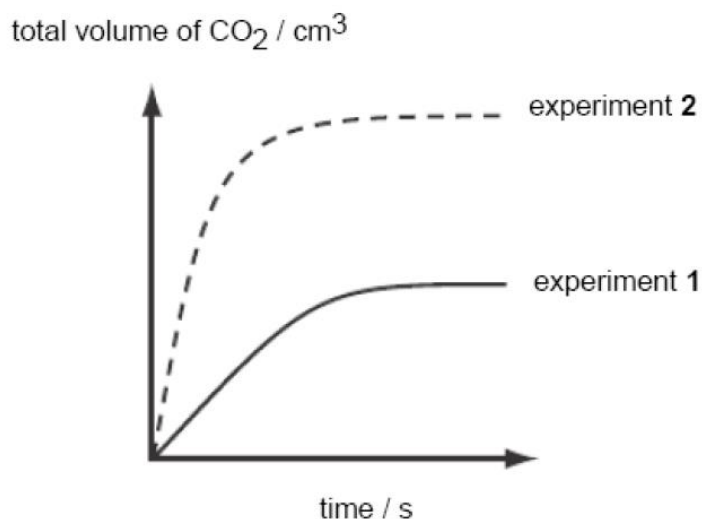
- 29** An energy profile diagram for a reversible reaction is given below. When a catalyst is used, the activation energy of the reaction changes by 125 kJ/mol .



What is the enthalpy change of the catalysed reverse reaction?

- A** -315 kJ/mol
- B** -30 kJ/mol
- C** $+30 \text{ kJ/mol}$
- D** $+125 \text{ kJ/mol}$

- 30** In two separate experiments, the reaction of iron(II) carbonate with dilute hydrochloric acid is investigated. In experiment 1, 100 cm³ of 0.10 mol/dm³ of hydrochloric acid and 0.56 g of iron(II) carbonate chips were used.



What conditions will produce the curve for experiment 2?

- A** 100 cm³ of 0.20 mol/dm³ of dilute hydrochloric acid and 0.56 g of iron(II) carbonate chips
- B** 200 cm³ of 0.10 mol/dm³ of dilute hydrochloric acid and 0.56 g of iron(II) carbonate chips
- C** 200 cm³ of 0.20 mol/dm³ of dilute hydrochloric acid and 1.12 g of iron(II) carbonate chips
- D** 100 cm³ of 0.10 mol/dm³ of dilute hydrochloric acid and 1.12 g of iron(II) carbonate chips

- 31** Manganese(IV) oxide (MnO_2) acts as a catalyst in the following reaction.



Several experiments were carried out using the same mass of manganese(IV) oxide and the same volume of hydrogen peroxide (H_2O_2) solution.

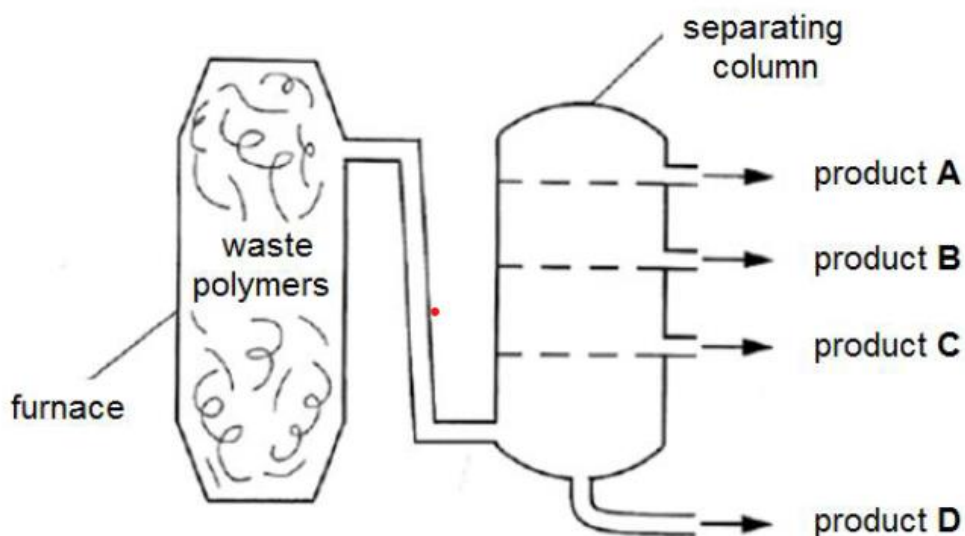
experiment	concentration of H_2O_2 /mol/dm ³	temperature /°C	particle size of MnO_2
1	0.5	20	powder
2	1.0	30	lump
3	1.5	30	lump
4	1.5	30	powder
5	0.5	20	lump
6	2.0	20	powder

Which two experiments should be used to study the effect of particle size on the speed of reaction?

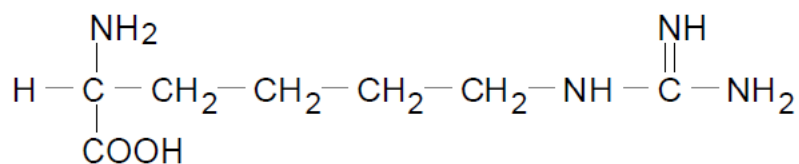
- A** Experiments 1 and 3
B Experiments 1 and 5
C Experiments 2 and 4
D Experiments 3 and 6
- 32** In which reaction is the pressure least likely to affect the rate of reaction?
- A** $\text{C (s)} + \text{CO}_2 \text{ (g)} \rightarrow 2\text{CO (g)}$
B $\text{C}_2\text{H}_4 \text{ (g)} + \text{H}_2\text{O (g)} \rightarrow \text{C}_2\text{H}_5\text{OH (aq)}$
C $2\text{C}_4\text{H}_{10} \text{ (g)} + 13\text{O}_2 \text{ (g)} \rightarrow 8\text{CO}_2 \text{ (g)} + 10\text{H}_2\text{O (l)}$
D $\text{Zn (s)} + 2\text{HCl (aq)} \rightarrow \text{ZnCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$

- 33** Which of the following are true of the Haber process?
- I) Ammonia formed is condensed and obtained as a liquid.
 - II) Hydrogen gas used is obtained from cracking of petroleum.
 - III) Iron catalyst is used to increase the yield of ammonia.
 - IV) Nitrogen gas is oxidised to form ammonia.
- A** I and II
B I and III
C II and III
D III and IV
- 34** Vegetable oil is a polyunsaturated fat. 5.0 g of a vegetable oil ($M_r = 800$) was found to react completely with 0.9 dm^3 of hydrogen gas, measured at room temperature and pressure, to form margarine which is a saturated fat.
- How many C=C bonds are there in one molecule of the oil?
- A** 3
B 4
C 5
D 6
- 35** In which reaction does the relative molecular mass of the organic compound decrease?
- A** conversion of ethanoic acid into ethyl ethanoate
B conversion of ethene into ethanol
C fermentation of glucose into ethanol
D oxidation of ethanol into ethanoic acid

- 36** Waste polymers can be recycled by heating it in a furnace. The waste decomposes into a mixture of hydrocarbons which can be separated in a separating column. Which product has the largest number of carbon atoms per molecule?



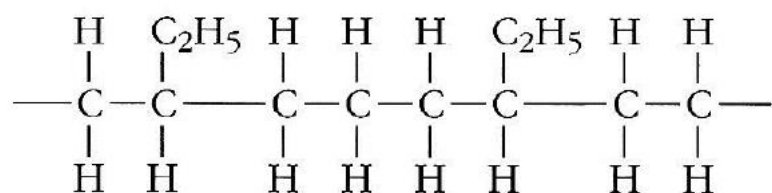
- 37** The diagram shows the structure of the amino acid, arginine.



Which statement about arginine is true?

- A** It forms a polymer with the same linkage as nylon.
- B** It forms an addition polymer with other amino acids.
- C** It readily decolourises acidified potassium manganate (VII) solution.
- D** It burns in air to produce carbon dioxide and water only.

38 Part of a polymer is shown below.



Which pair of alkenes was used as monomers to form the polymer above?

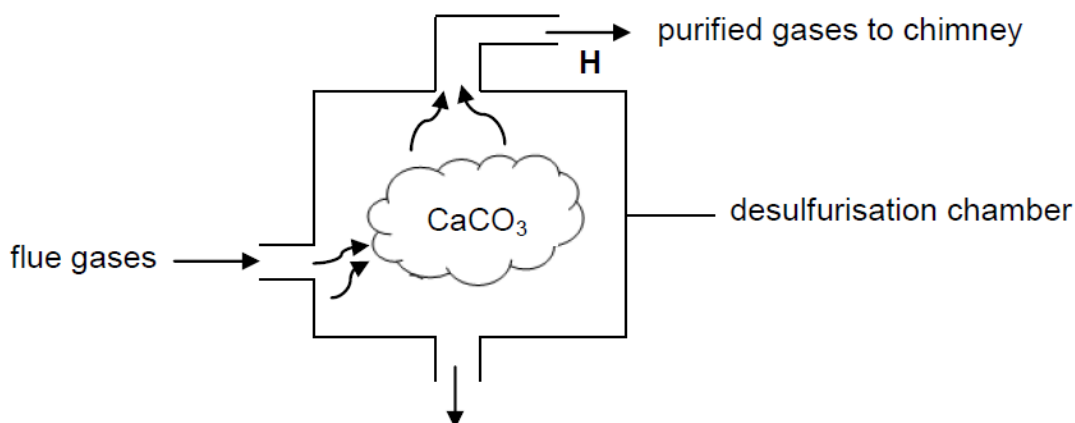
- A** ethene and but-1-ene
- B** ethene and propene
- C** propene and but-1-ene
- D** propene and but-2-ene

39 The data gives the concentration, in parts of pollutant per billion parts of air (ppb), of polluting gases in four different industrial cities.

In which city are limestone buildings under the greatest threat from pollution?

	ozone	sulfur dioxide	nitrogen dioxide
A	11	38	40
B	21	45	14
C	23	17	46
D	30	32	33

40 The following diagram shows a simplified process of desulfurisation.



Which of the following observation best describes the nature of the gases leaving at outlet H?

- A** The gases form a white precipitate in aqueous calcium hydroxide.
- B** The gases reignite a glowing splint.
- C** The gases turned acidified aqueous potassium manganate (VII) colourless.
- D** The gases turned aqueous potassium iodide brown.

- End of Paper -

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.). The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.