

Class:	Candidate Name:	Candidate Index Number:
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EDGEFIELD SECONDARY SCHOOL
2022 Preliminary Examination
Secondary 4 Express

O
Syllabus

CHEMISTRY

Paper 1 Multiple choice

6092/01

August 2022

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your class, name and class register number in the above boxes.

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 18.

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

FOR EXAMINER'S USE

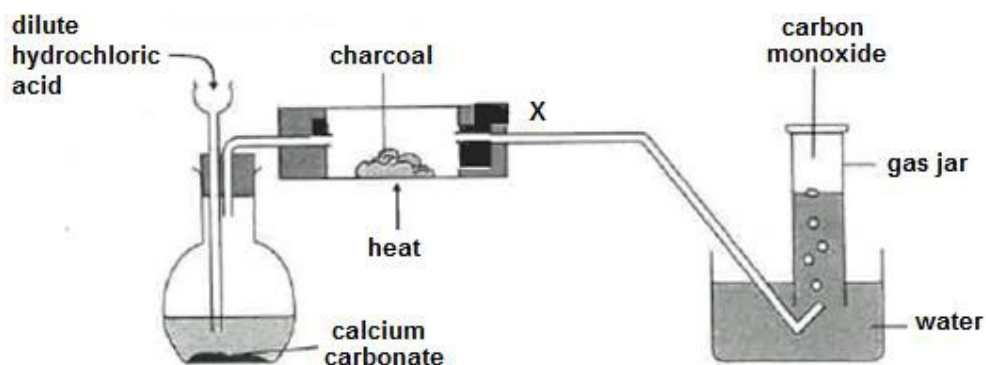
My target grade/mark: _____

TOTAL / 40

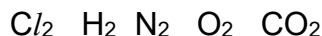
 Parent's signature

This document consists of 18 printed pages.

- 1 The following diagram shows an experimental setup used by a student to prepare carbon monoxide from charcoal. What should the student do to obtain a purer yield of carbon monoxide?

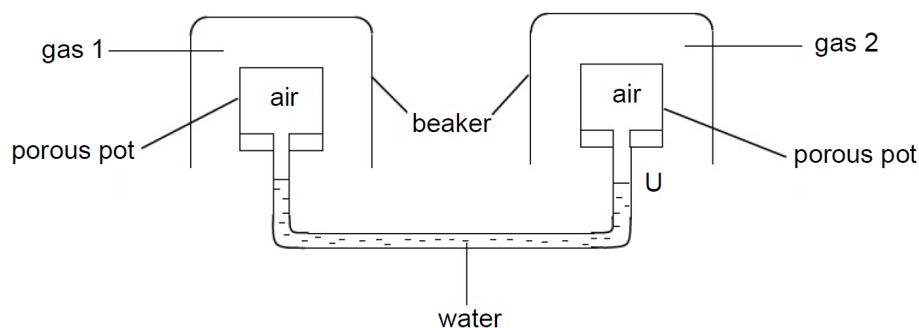


- A Use dilute sulfuric acid instead of dilute hydrochloric acid so that hydrogen chloride gas will not be formed.
 - B Bubble the stream of gas from X into a flask containing drying agent before collection.
 - C Pass the stream of gas from X through a filtering system to remove soot produced from charcoal.
 - D Pass the stream of gas from X into a flask containing aqueous sodium hydroxide before collection.
- 2 How many of the molecules shown contain only one single covalent bond?



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

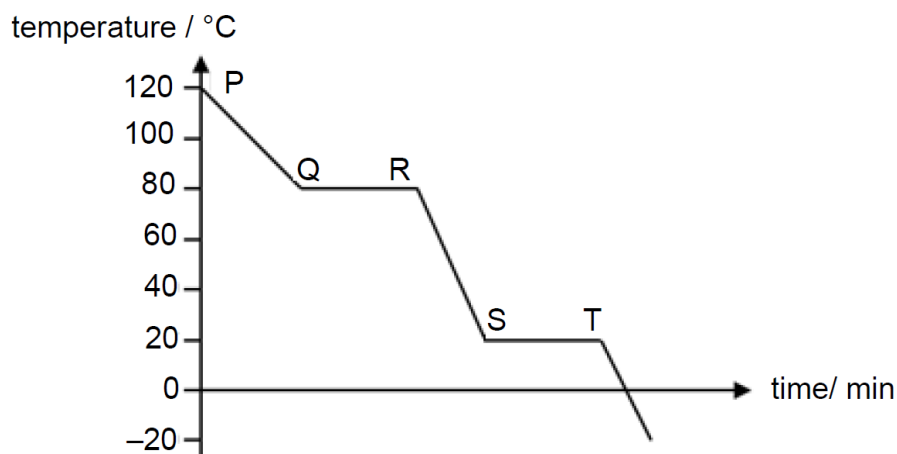
- 3 The apparatus is set up, using different gases in the two inverted beakers.



Which pair of gases would cause an upward movement of the water level at U?

	gas 1	gas 2
A	helium	carbon monoxide
B	helium	hydrogen
C	nitrogen	carbon monoxide
D	nitrogen	hydrogen

- 4 The graph shows the change in temperature with time when a substance at 120°C is cooled to -20°C .



Which statement correctly describes the change taking place between the points?

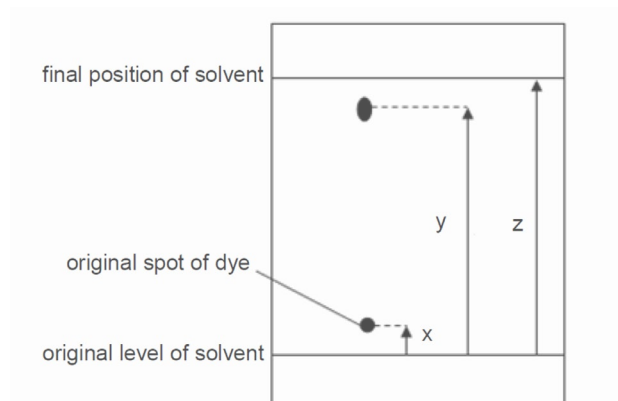
- A** The volume of vapour is decreasing from R to S.
- B** The particles release energy as they become closer together from Q to R.
- C** The particles absorb energy as they become more orderly from S to T.
- D** The energy of the particles remain constant from 20°C to -20°C .

- 5 The melting and boiling points of some gases in air are shown below.

gas	melting point/ °C	boiling point/ °C
oxygen	– 219	– 183
argon	– 189	– 186
nitrogen	– 210	– 196

What temperature should the sample of air be decreased to in order to obtain only liquid oxygen?

- A** – 180 °C
B – 182 °C
C – 185 °C
D – 219 °C
- 6 Which of the following physical processes could be used to separate a mixture of hexane and water?
- A** filtration
B fractional distillation
C sublimation
D use of separating funnel
- 7 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 $\frac{z}{z-x}$
D $\frac{y-x}{z-x}$

8 Which substance is likely to be a pure compound?

- A a colourless liquid which gives two fractions when distilled
- B a white powder that dissolves in water
- C a yellow liquid that boils at 115 °C
- D green crystals that start to melt at 72 °C and completely melt at 75 °C

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 An element, Z, has p protons and n neutrons in the nucleus of its atoms. Element Z reacts with oxygen to form a basic oxide.

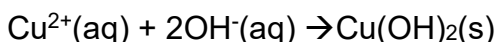
Which list gives the correct information about the ion of an isotope of Z?

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

11 A hydrated salt, $\text{MSO}_4 \cdot n\text{H}_2\text{O}$ is formed when 0.2 mol of MSO_4 reacts with 36.0 g of water. What is the value of n ?

- A 2
- B 4
- C 5
- D 10

- 12 When a few drops of aqueous ammonia are added to copper(II) sulfate solution, the reaction that takes place can be represented by the following ionic equation:



In excess aqueous ammonia, a soluble copper(II) complex ion is formed.

What would be observed when 20 cm³ of 0.5 mol/dm³ aqueous copper(II) sulfate was mixed with 30 cm³ of 1.0 mol/dm³ aqueous ammonia?

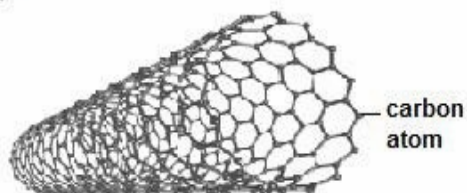
- A pale blue solution
B dark blue solution
C blue precipitate in colourless solution
D colourless solution
- 13 At the start of a reaction, a 2.00 dm³ solution contains 0.500 mol of ethanol. After 100 seconds, the concentration of the ethanol has decreased to 0.140 mol/dm³. What is the decrease in the concentration of ethanol?
- A 0.036 mol/dm³
B 0.140 mol/dm³
C 0.110 mol/dm³
D 0.250 mol/dm³
- 14 The shell of a quail egg makes up 2% of the mass of an average quail egg. An average quail egg has a mass of 15 g. Assuming the quail egg shell is made up of pure calcium carbonate, what is the volume of 1.0 mol/dm³ hydrochloric acid that 10 quail eggs can neutralise?
- A 0.0250 dm³
B 0.0300 dm³
C 0.0500 dm³
D 0.0600 dm³
- 15 Element Y exists as 3 stable isotopes and has a relative atomic mass of 65.0. Which of the following compositions of isotopes is correct?
- A 32.1% ⁶⁴Y, 56.4% ⁶⁶Y and 11.5% ⁶⁷Y
B 54.6% ⁶⁴Y, 6.6% ⁶⁶Y and 38.8% ⁶⁷Y
C 56.3% ⁶⁴Y, 31.1% ⁶⁶Y and 12.6% ⁶⁷Y
D 50.3% ⁶⁴Y, 25.5% ⁶⁶Y and 24.2% ⁶⁷Y
- 16 Chloroform, also known as trichloromethane, is a colourless, sweet-smelling liquid which was once used as an anaesthetic. How many valence electrons are not involved in bonding?
- A 0
B 2
C 18
D 21

17 Which statement about one mole of a metal is always true?

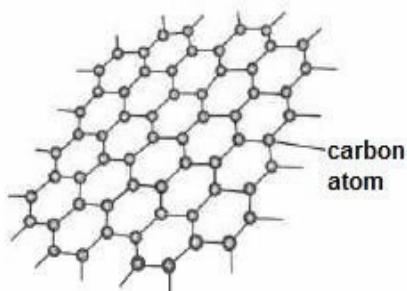
- A It contains the same number of particles as $1/12$ mole of ^{12}C .
- B It has the same mass as one mole of hydrogen atoms.
- C It contains the same number of particles as one mole of hydrogen atoms
- D It contains the same mass as one mole of ^{12}C .

18 Carbon can form different structures as shown in the diagram below. Which of these structure(s) is/are able to conduct electricity?

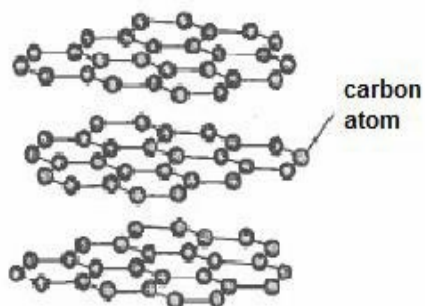
I



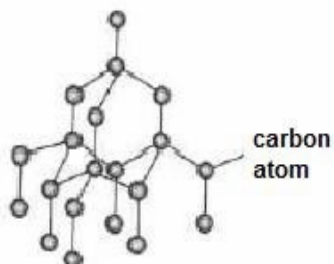
II



III



IV



- A I and IV only
- B II and III only
- C I, II and III only
- D III and IV only

- 19 Two separate tests were carried out on an unknown salt solution, **Z**. The results of the tests are shown in the table below.

	test	result
1	add aqueous ammonia	green precipitate formed which is insoluble in excess
2	add dilute nitric acid then aqueous silver nitrate	yellow precipitate formed

What is the identity of salt **Z**?

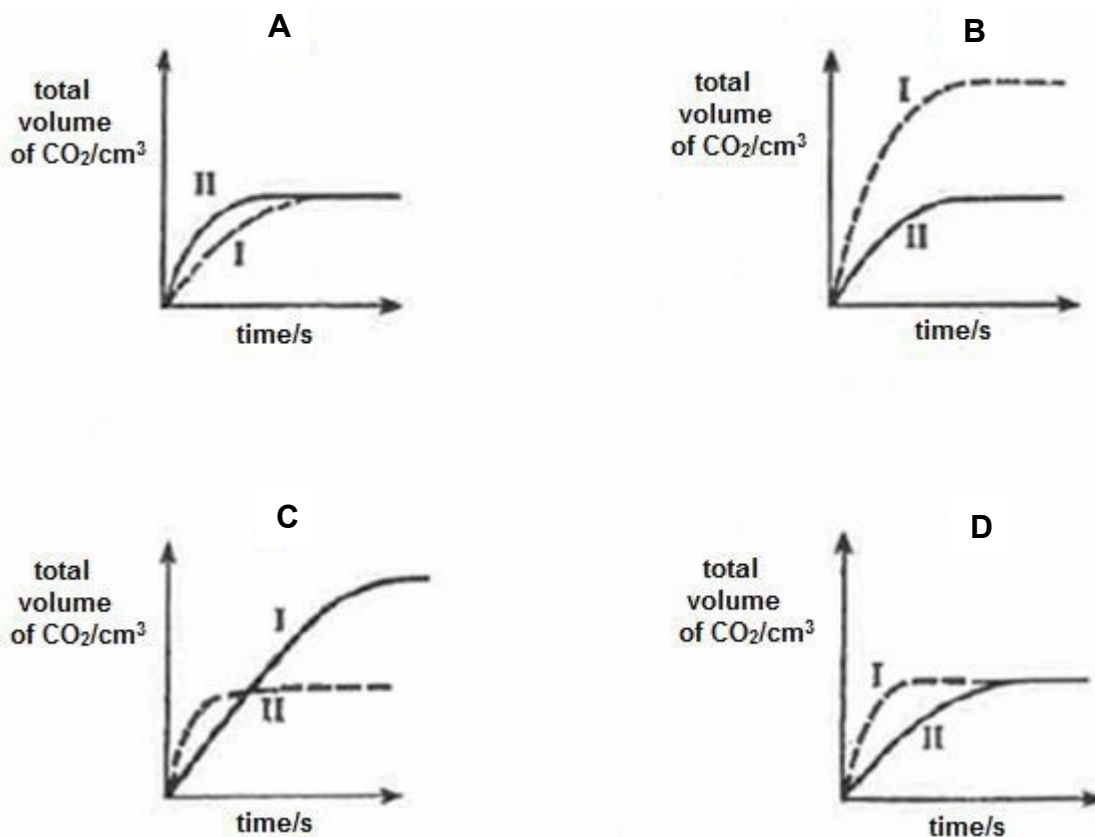
- A Copper(II) chloride
- B Iron(II) chloride
- C Iron(II) iodide
- D Iron(III) iodide

- 20 Ammonia is produced by the Haber process.

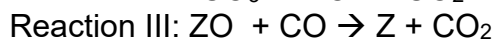
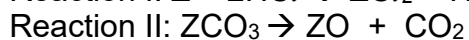
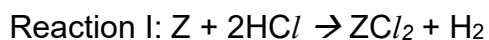
Which statement is **not** correct?

- A An iron catalyst is used.
- B Each hydrogen molecule reacts with three nitrogen molecules to form two molecules of ammonia.
- C Hydrogen for the Haber process can be obtained by the cracking of crude oil.
- D The reaction is reversible.

- 21 In two separate experiments, the reaction of calcium carbonate with an excess of dilute hydrochloric acid was investigated. The calcium carbonate used in Experiment I was more finely divided than that used in Experiment II. Assuming all other conditions were identical in both experiments, which of the following graphs best illustrates the results?



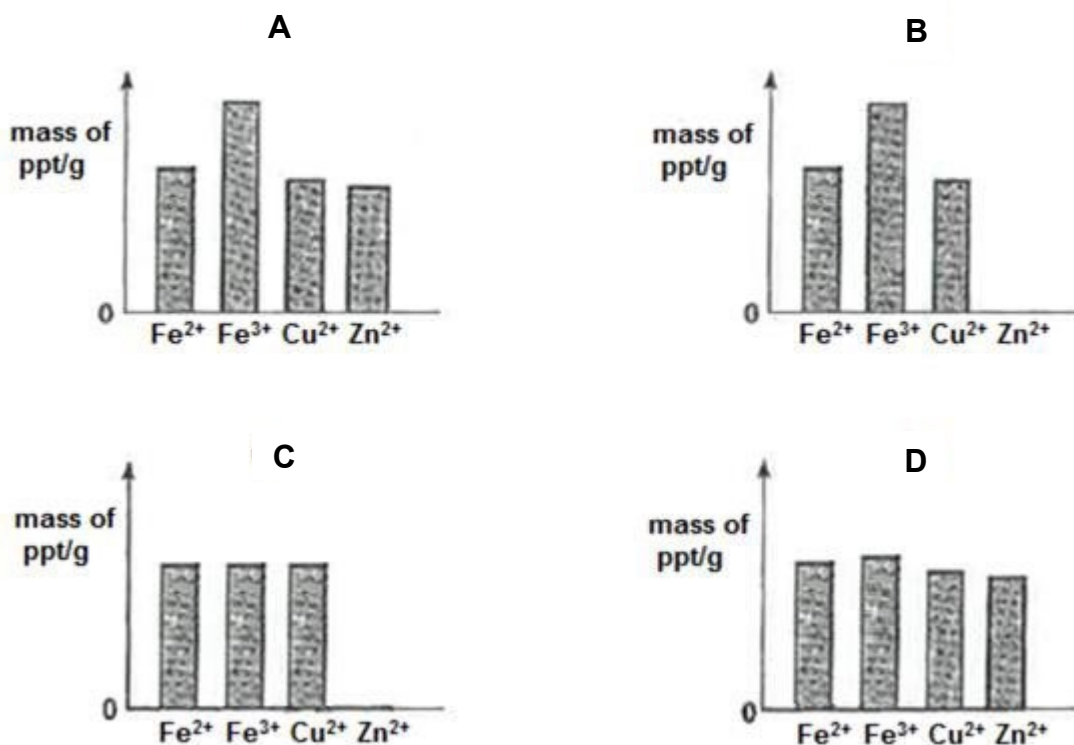
- 22 Metal Z and its compounds undergo the following reactions.



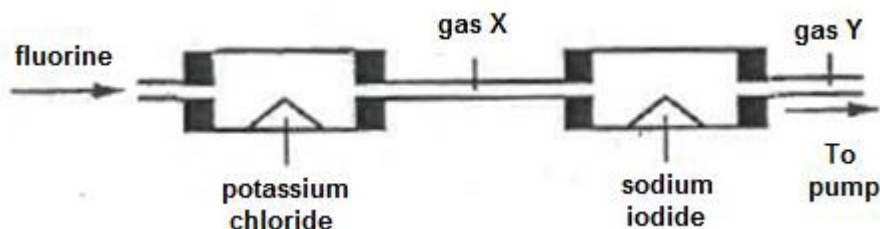
What could metal Z be?

- A Magnesium
- B Copper
- C Iron
- D Calcium

- 23 Four separate solutions are prepared such that each solution contains 1 g of one of the ions Fe^{2+} , Fe^{3+} , Cu^{2+} , Zn^{2+} . Excess aqueous sodium hydroxide is added to each solution and the mass of any resulting precipitate is recorded. Which of the following diagrams, **A**, **B**, **C**, **D** illustrates the results?

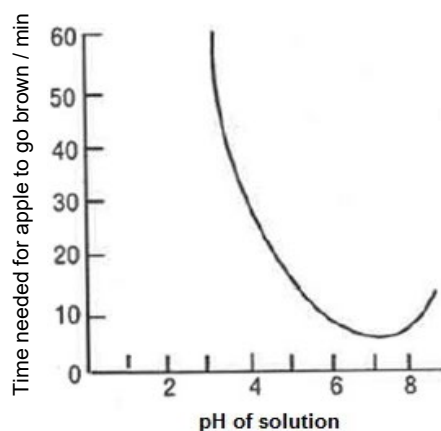


- 24 The reaction shown below was carried out. Which of the following gives the correct colour of gas X, sodium iodide and gas Y?



	gas X	sodium iodide	gas Y
A	Pale yellow	Brown	Violet
B	Greenish yellow	White	Violet
C	Pale yellow	Yellow	Brown
D	Greenish yellow	Brown	Brown

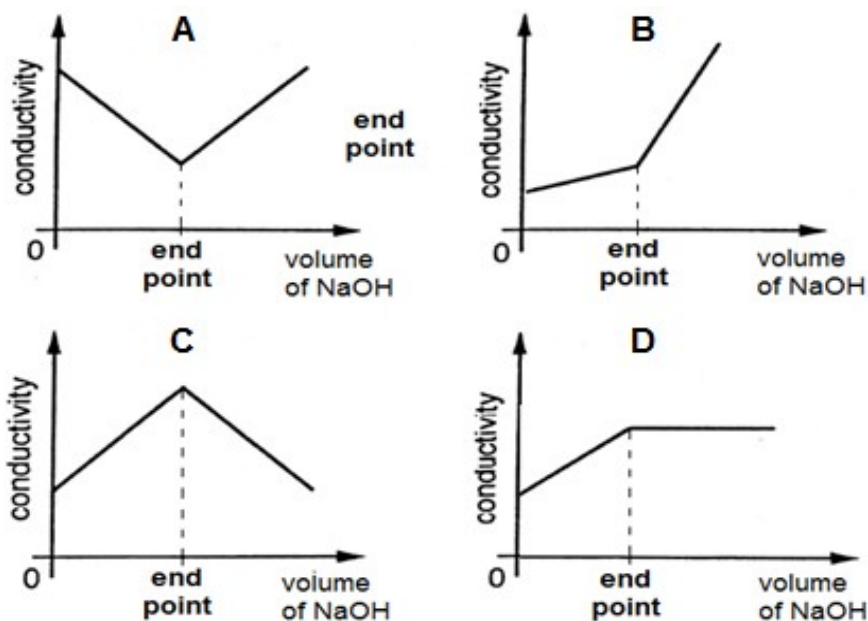
- 25 Pieces of apples usually go brown when they are left in air for a few minutes. To stop browning, cut apples are placed in special solutions. The graph below indicates how browning is affected by the pH of a solution.



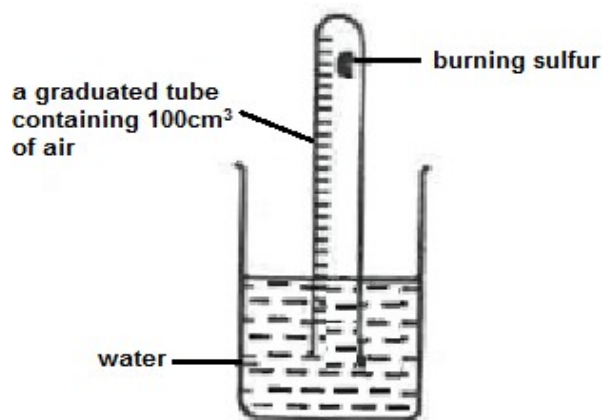
Which one of these solutions stops browning?

- A sodium carbonate (pH 9)
 - B sodium chloride (pH 7)
 - C ethanoic acid (pH 4)
 - D sodium hydrogen sulfate (pH 2.5)
- 26 Aqueous sodium hydroxide is a strong alkali while dilute ethanoic acid is a weak acid. The reaction between the alkali and the acid causes a change in the electrical conductivity of the mixture.

Which of the following graph correctly shows the change in electrical conductivity when aqueous sodium hydroxide is added slowly to the dilute ethanoic acid until it is in excess?

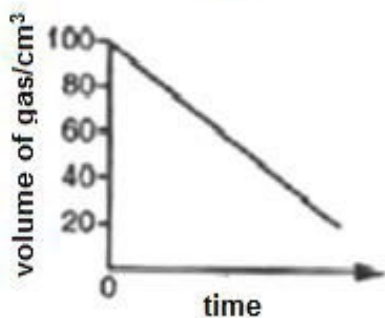


- 27 Sulfur burns in air to form a water-soluble solid oxide. A small lump of sulfur was burnt in the tube shown in the diagram below. The initial volume of air in the tube is 100 cm^3 .

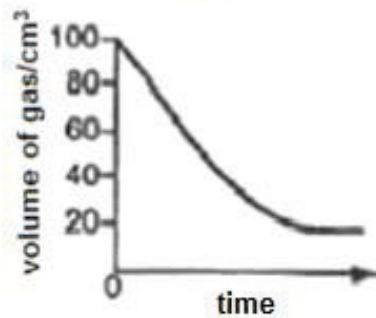


Which graph shows how the volume of gas remaining in the apparatus changes?

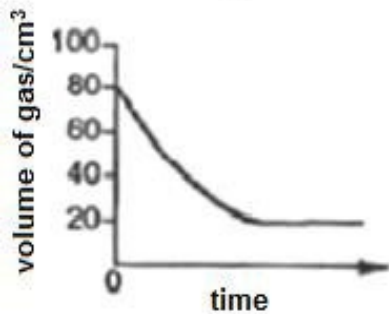
A



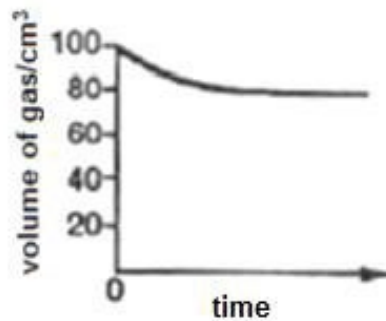
B



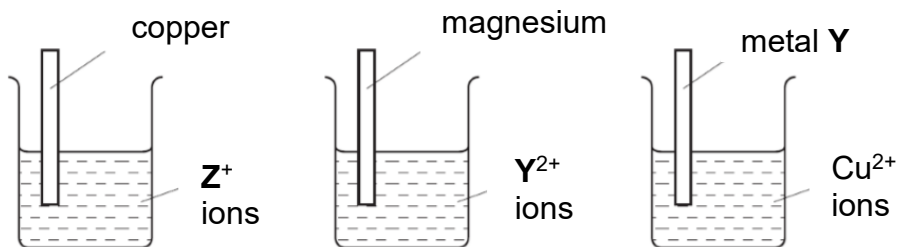
C



D



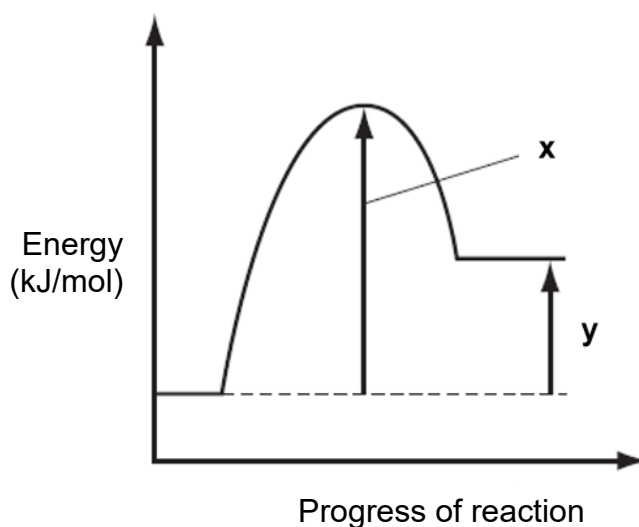
- 28 A student conducted three experiments to compare the reactivities of four different metals; copper, magnesium, metal Y and metal Z.



A deposit was observed on the metal strip for each experiment. How many metals that were investigated will be able to react with aqueous hydrochloric acid?

- A 1
B 2
C 3
D 4
- 29 Which electrolytic set-up results in no change in the concentration of the solution during electrolysis?
- A aqueous sodium chloride solution between carbon electrodes
B copper(II) sulfate solution between copper electrodes
C copper(II) sulfate solution between platinum electrodes
D dilute sodium chloride solution between platinum electrodes
- 30 In an electrolysis, the same amount of charge deposited 54.0 g of silver and 14.9 g of tin. If the charge on silver ion is 1+, what was the most likely charge of the tin ion?
- A 1+
B 2+
C 3+
D 4+
- 31 Which statement describes what happens when hydrogen and oxygen are used in a fuel cell?
- A Electricity is generated due to flow of electrons from cathode to anode.
B Hydrogen is burned to form steam.
C Hydrogen is oxidised by losing electrons at the anode.
D Oxygen is oxidised by gaining electrons from hydrogen.

- 32 The energy profile diagram for a chemical reaction is shown below.



Which statement about the energy profile diagram is correct?

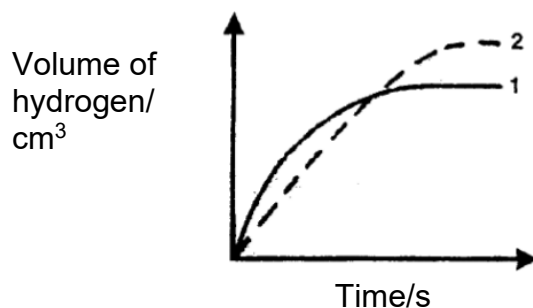
- A** The overall enthalpy change is equal to $x + y$.
B The reaction is exothermic.
C The value of x would decrease in the presence of catalyst.
D The value of y would increase in the presence of catalyst.
- 33 The scheme shows four stages, 1 to 4, in the conversion of solid candle wax, $C_{30}H_{62}$, into carbon dioxide and water

1	$C_{30}H_{62}(s) \rightarrow C_{30}H_{62}(l)$
2	$C_{30}H_{62}(l) \rightarrow C_{30}H_{62}(g)$
3	$C_{30}H_{62}(g) + 45.5O_2(g) \rightarrow 30CO_2(g) + 31H_2O(g)$
4	$30CO_2(g) + 31H_2O(g) \rightarrow 30CO_2(g) + 31H_2O(l)$

Which stages are exothermic?

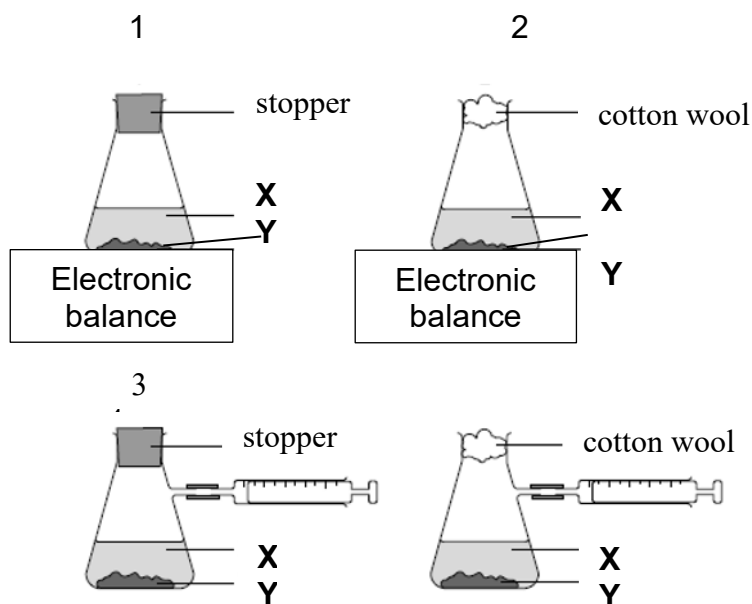
- A** 1 and 2
B 1 and 4
C 2 and 3
D 3 and 4

- 34 In the graph below, curve 1 was obtained by the reaction between 50.0 cm³ of 1.00 mol/dm³ sulfuric acid and excess zinc granules.



Which changes would produce curve 2?

- A increase the temperature by 10°C
 - B add the same mass of zinc powder instead of zinc granules
 - C use 100.0 cm³ of 1.00 mol/dm³ sulfuric acid instead of 50.0 cm³ of 1.00 mol/dm³ sulfuric acid
 - D use 100.0 cm³ of 0.75 mol/dm³ sulfuric acid instead of 50.0 cm³ of 1.00 mol/dm³ sulfuric acid
- 35 A liquid X reacts with solid Y to form a gas.



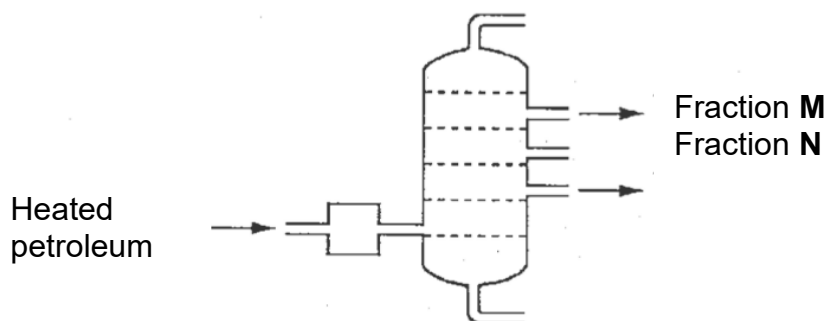
Which two diagrams show suitable methods for investigating the speed of the reaction?

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

36 Which pair of pollutants can cause the most damage to limestone buildings?

- A carbon monoxide and oxygen
- B chlorofluorocarbons and ozone
- C methane and sulfur dioxide
- D nitrogen dioxide and sulfur dioxide

37 The diagram shows the fractional distillation of petroleum.



Which row about fraction **M** and **N** are correct?

	M burns more easily than N	M has a higher boiling point than N	M is more viscous than N
A	True	False	False
B	True	True	False
C	False	True	True
D	False	False	True

38 In the polymerisation of ethene to form poly(ethene), which does **not** change?

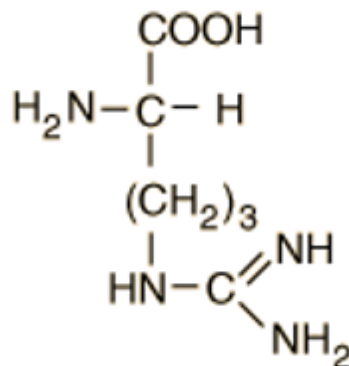
- A boiling point
- B density
- C empirical formula
- D molecular mass

39 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 the ester contain?

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

- 40 The full structural formula of the amino acid, Arginine, is shown below.



The following statements were made about the amino acid.

- 1 It undergoes addition polymerisation.
- 2 It forms a polymer with the same linkage as nylon.
- 3 It reacts with magnesium to form hydrogen gas.
- 4 It decolorises acidified potassium manganate(VII) solution readily.

Which statements are correct?

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

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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 Ts tennessine -	117 Uu unseptennium -	118 Og oganeson -	119 Uue unbinilium -	120 Uuh untrium -	121 Uub unbibium -	122 Uut unbium -	123 Uuq unquadium -	124 Uuq unquadium -	125 Uup unpentium -	126 Uuq unquadium -	127 Uuh unheptium -	128 Uub unbibium -	129 Uut unbium -	130 Uuq unquadium -	131 Uuh unheptium -	132 Uub unbibium -	133 Uut unbium -	134 Uuq unquadium -	135 Uuh unheptium -	136 Uub unbibium -	137 Uut unbium -	138 Uuq unquadium -	139 Uuh unheptium -	140 Uub unbibium -	141 Uut unbium -	142 Uuq unquadium -	143 Uuh unheptium -	144 Uub unbibium -	145 Uut unbium -	146 Uuq unquadium -	147 Uuh unheptium -	148 Uub unbibium -	149 Uut unbium -	150 Uuq unquadium -	151 Uuh unheptium -	152 Uub unbibium -	153 Uut unbium -	154 Uuq unquadium -	155 Uuh unheptium -	156 Uub unbibium -	157 Uut unbium -	158 Uuq unquadium -	159 Uuh unheptium -	160 Uub unbibium -	161 Uut unbium -	162 Uuq unquadium -	163 Uuh unheptium -	164 Uub unbibium -	165 Uut unbium -	166 Uuq unquadium -	167 Uuh unheptium -	168 Uub unbibium -	169 Uut unbium -	170 Uuq unquadium -	171 Uuh unheptium -	172 Uub unbibium -	173 Uut unbium -	174 Uuq unquadium -	175 Uuh unheptium -	176 Uub unbibium -	177 Uut unbium -	178 Uuq unquadium -	179 Uuh unheptium -	180 Uub unbibium -	181 Uut unbium -	182 Uuq unquadium -	183 Uuh unheptium -	184 Uub unbibium -	185 Uut unbium -	186 Uuq unquadium -	187 Uuh unheptium -	188 Uub unbibium -	189 Uut unbium -	190 Uuq unquadium -	191 Uuh unheptium -	192 Uub unbibium -	193 Uut unbium -	194 Uuq unquadium -	195 Uuh unheptium -	196 Uub unbibium -	197 Uut unbium -	198 Uuq unquadium -	199 Uuh unheptium -	200 Uub unbibium -	201 Uut unbium -	202 Uuq unquadium -	203 Uuh unheptium -	204 Uub unbibium -	205 Uut unbium -	206 Uuq unquadium -	207 Uuh unheptium -	208 Uub unbibium -	209 Uut unbium -	210 Uuq unquadium -	211 Uuh unheptium -	212 Uub unbibium -	213 Uut unbium -	214 Uuq unquadium -	215 Uuh unheptium -	216 Uub unbibium -	217 Uut unbium -	218 Uuq unquadium -	219 Uuh unheptium -	220 Uub unbibium -	221 Uut unbium -	222 Uuq unquadium -	223 Uuh unheptium -	224 Uub unbibium -	225 Uut unbium -	226 Uuq unquadium -	227 Uuh unheptium -	228 Uub unbibium -	229 Uut unbium -	230 Uuq unquadium -	231 Uuh unheptium -	232 Uub unbibium -	233 Uut unbium -	234 Uuq unquadium -	235 Uuh unheptium -	236 Uub unbibium -	237 Uut unbium -	238 Uuq unquadium -	239 U

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	euporium	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	—	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.).