ST JOSEPH'S INSTITUTION
PRELIMINARY EXAMINATION 2022
(YEAR 4)

CANDIDATE NAME			
CLASS		INDEX NUMBER	

CHEMISTRY **6092/01**

Paper 1 **31 August 2022**

Additional Materials: **1 hour**
Multiple Choice Answer Sheet **(08:00 – 09:00)**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class 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 Question paper.
A copy of the Periodic Table is printed on page 2 of this question paper.
The use of an approved scientific calculator is expected, where appropriate.

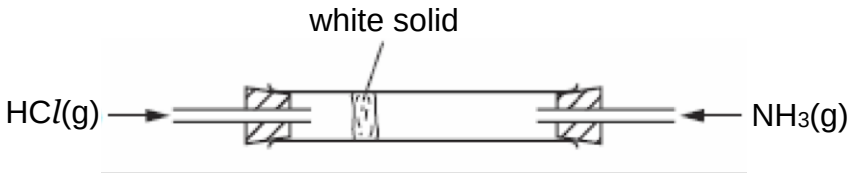
The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key proton (atomic) number atomic symbol name relative atomic mass									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 –		114 Fl flerovium –		116 Lv livermorium –		

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 dm^3 at room temperature and pressure (r.t.p.).

1 Two gases, ammonia and hydrogen chloride, are allowed to enter the apparatus as shown below.



After some time, a white solid is formed on the inside of the tube.

Which statements explain why a white solid is formed in the position shown?

1 Ammonia and hydrogen chloride react to form solid ammonium chloride.

2 Ammonia diffuses faster than hydrogen chloride.

3 Ammonia has a higher relative molecular mass than hydrogen chloride.

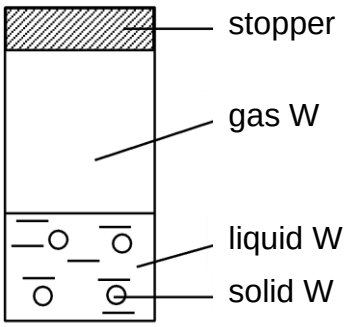
A 1 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

2 The gas jar contains compound W which is present in the solid, liquid and gaseous states.



Which of the following statements is correct?

A A gaseous W molecule has a lower mass than a liquid W molecule.

B Liquid W molecules move slower than solid W molecules.

C When W changes from gas to liquid, energy is absorbed.

D When W changes from liquid to solid, energy is released.

3 A student plans two experiments.

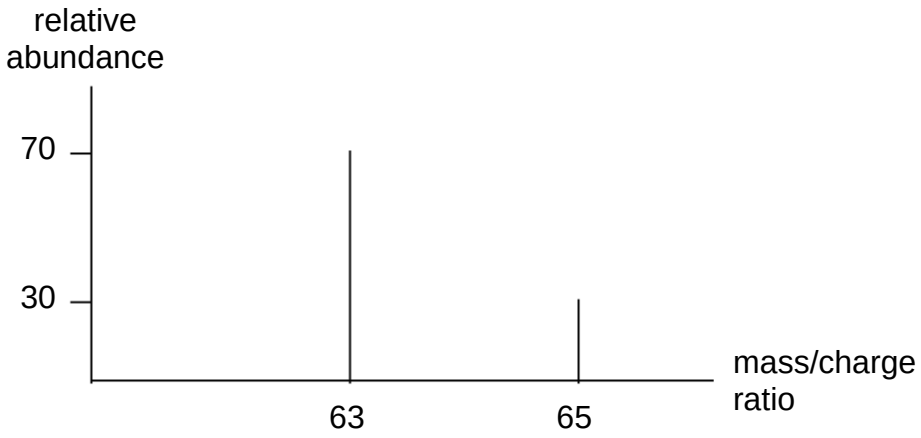
Experiment 1: To find the concentration of aqueous sodium hydroxide by titration with dilute hydrochloric acid

Experiment 2: To find the rate of the reaction between calcium carbonate and dilute hydrochloric acid by measuring the volume of gas given off every minute

What are the other apparatus needed in addition to a conical flask?

	experiment 1	experiment 2
A	burette, pipette	electronic balance, measuring cylinder, thermometer
B	burette, pipette	measuring cylinder, gas syringe, stopwatch
C	electronic balance, measuring cylinder, thermometer	measuring cylinder, gas syringe, stopwatch
D	measuring cylinder, gas syringe, stopwatch	burette, pipette

4 A sample of Y was analysed and found to contain only two isotopes, Y-63 and Y-65. The graph below shows the relative abundances of the two isotopes.



What is the relative atomic mass of Y?

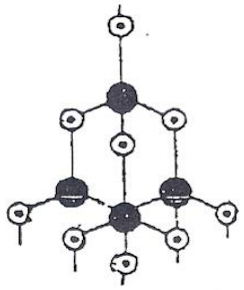
A 63.2

B 63.4

C 63.6

D 64.0

5 Silicon carbide has the following structure shown below.



Which statement is true for silicon carbide?

A It has a high boiling point because of the strong intermolecular forces of attraction.

B It has a high melting point because it has a giant ionic lattice structure.

C It is a hard solid because its atoms are bonded in a giant network.

D It is a soft solid because the layers of atoms can slide over one another.

6 The physical properties of substances X, Y and Z are shown below.

substance	X	Y	Z
melting point / °C	801	2852	3550
boiling point / °C	1413	3600	4827
electrical conductivity of solid	poor	poor	good

What could be the identities of X, Y and Z?

	X	Y	Z
A	MgO	NaC*l*	C (graphite)
B	MgO	NaC*l*	SiO_2
C	NaC*l*	MgO	C (graphite)
D	NaC*l*	MgO	SiO_2

7 Ethene is a colourless gas while polyethene is a solid at room temperature and pressure.

Which statement best explains this observation?

A The covalent bonds in ethene are stronger than the covalent bonds in polyethene.

B The covalent bonds in polyethene are stronger than the covalent bonds in ethene.

C The intermolecular forces of attraction in polyethene are stronger than the intermolecular forces of attraction in ethene.

D The intermolecular forces of attraction in polyethene are weaker than the intermolecular forces of attraction in ethene.

8 The elements X, Y and Z form the covalent compound with the structural formula shown below.

$$X - Y \equiv Z$$

Which of the following shows the possible electronic configurations of the atoms of X, Y and Z?

	X	Y	Z
A	1	2, 2	2, 5
B	1	2, 4	2, 3
C	2, 8, 7	2, 2	2, 3
D	2, 8, 7	2, 4	2, 5

9 Four oxides are added separately to aqueous sodium hydroxide.

1 aluminium oxide

2 carbon dioxide

3 copper(II) oxide

4 magnesium oxide

Which oxides react with aqueous sodium hydroxide?

A 2 only

B 1 and 2 only

C 3 and 4 only

D 1, 3 and 4 only

10 The pH of an aqueous solution of hydrochloric acid is 2.

What will be the pH of the acid after the addition of 10 g of sodium chloride?

A 1

B 2

C 7

D 9

11 Which pair of substances can be used to prepare a sample of lead(II) chloride when added to water and mixed?

A lead and hydrochloric acid

B lead(II) carbonate and hydrochloric acid

C lead(II) nitrate and potassium chloride

D lead(II) sulfate and potassium chloride

12 Which method is most suitable for the laboratory preparation of copper(II) chloride?

A react copper with chlorine gas

B react copper(II) carbonate with excess dilute hydrochloric acid

C react excess copper with concentrated hydrochloric acid

D react excess copper(II) oxide with dilute hydrochloric acid

13 Excess aqueous silver nitrate is added to aqueous barium chloride, and the precipitate formed is removed by filtration.

What are the possible ions present in the filtrate?

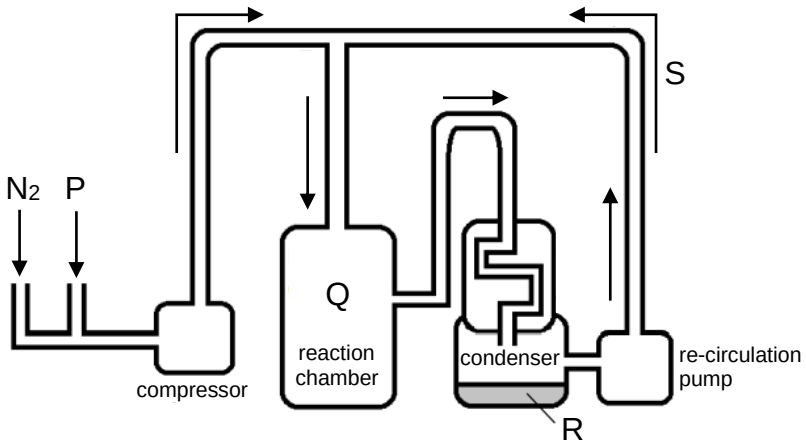
A Ag^+ and NO_3^-

B Ba^{2+} and NO_3^-

C Ag^+, Ba^{2+} and NO_3^-

D Ba^{2+}, Cl^- and NO_3^-

14 The diagram below shows a simplified diagram of the Haber Process. P, Q, R and S refer to the different substances present in different parts of the Haber Process.



Some statements about P, Q, R and S are shown.

1 P is obtained from the fractional distillation of liquid air.

2 Q is formed under reaction conditions of 450 °C and 250 atm.

3 R is an essential element used to make fertilisers.

4 S is a mixture of two compounds.

Which of the above statements are true?

A 2 only

B 2 and 3 only

C 1, 3 and 4 only

D 2, 3 and 4 only

15 The table below shows the concentration of polluting gases in four different industrial cities in parts of pollutant per billion parts of air (ppb).

city	concentration of ozone / ppb	concentration of sulfur dioxide / ppb	concentration of nitrogen dioxide / ppb
W	11	38	40
X	21	45	14
Y	23	17	46
Z	30	32	33

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

A W **B** X **C** Y **D** Z

16 Which of the following changes does not take place in a catalytic converter?

A carbon monoxide → carbon dioxide

B oxides of nitrogen → nitrogen

C oxides of nitrogen → nitrogen monoxide

D unburnt hydrocarbons → carbon dioxide and water

17 Tobacco is a harmful substance which is found in cigarettes. The active component in tobacco is nicotine, which is dangerous and highly addictive.

Analysis of a sample of nicotine showed that it contains 74.0 % carbon, 8.7 % hydrogen and 17.3 % nitrogen.

Determine the molecular formula of nicotine if its relative molecular mass is 162.

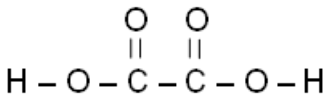
A C_5H_7N

B C_6H_9N

C $C_{10}H_{14}N_2$

D $C_{12}H_{18}N_2$

18 The structure of oxalic acid is shown below.



25.0 cm^3 of oxalic acid reacts completely with 15.0 cm^3 of 2.50 mol/dm^3 aqueous sodium hydroxide.

Determine the concentration of oxalic acid.

A 0.667 mol/dm^3

B 0.750 mol/dm^3

C 1.33 mol/dm^3

D 1.50 mol/dm^3

19 Bones contain a complex mixture of calcium salts, proteins and other materials. When a bone is strongly heated in a current of air, the only residue is calcium oxide.

A 50.0 g sample of bone was heated strongly and 14.0 g of calcium oxide was obtained. What was the percentage by mass of calcium in the bone?

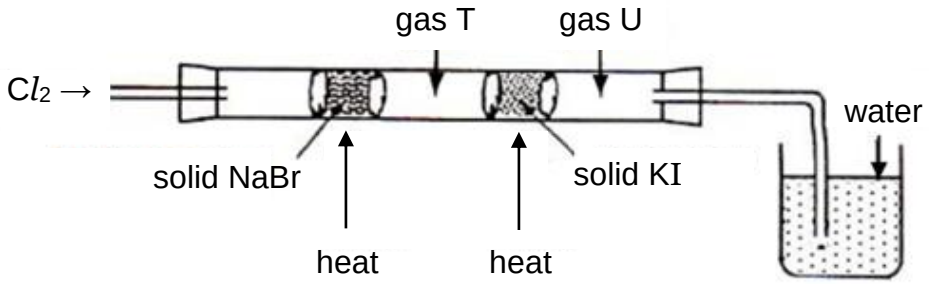
A 20.0 %

B 28.0 %

C 35.7 %

D 80.0 %

20 The diagram below shows a set-up used to investigate the reactivity of halogens.



A small amount of chlorine gas was pumped into the glass tube. What will be the colours observed for gas T, gas U and in the water?

	gas T	gas U	water
A	brown	reddish brown	colourless
B	greenish yellow	violet	yellow
C	reddish brown	brown	brown
D	reddish brown	violet	brown

21 Magnesium and chlorine are found in Period 3 of the Periodic Table.

Which of the following statements best explains why magnesium has more metallic character than chlorine?

A Magnesium has fewer electrons than chlorine.

B Magnesium has fewer number of electron shells than chlorine.

C Magnesium has fewer protons than chlorine.

D Magnesium has fewer valence electrons than chlorine.

22 The table below shows some information about the chlorides of some elements in Period 3 of the Periodic Table.

element	formula of main chloride	bonding present in chloride	pH of resulting solution when dissolved in water
sodium	NaC*l*	metallic	7
magnesium	MgCl_2	metallic	7
aluminium	A*l*Cl_3	covalent	3
phosphorus	PCl_3	covalent	2
sulfur	$S_2C l_2$	covalent	2

What is the bonding present in the chloride of silicon and the pH value of the resulting solution when the chloride is dissolved in water?

	bonding present in chloride	pH of resulting solution when dissolved in water
A	covalent	2
B	covalent	7
C	metallic	2
D	metallic	7

23 Which reactions are not redox reactions?

1 chlorine gas reacting with aqueous potassium iodide

2 dilute hydrochloric acid reacting with magnesium carbonate

3 dilute sulfuric acid reacting with aqueous sodium hydroxide

A 1 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

24 The oxide of titanium, TiO_2, is used as a 'whitener' in toothpaste. It is obtained from the ore iron(II) titanate, $FeTiO_3$.

What is the change in the oxidation number of titanium from $FeTiO_3$ to TiO_2?

A +3 to +2

B +3 to +4

C +6 to +4

D no change

25 A metal reacts vigorously with cold water.

Which statements about the metal are correct?

1 It is above hydrogen in the reactivity series.

2 It is below calcium in the reactivity series.

3 It reacts with aqueous zinc nitrate.

4 Its oxide can be reduced with carbon.

A 1 and 3 only

B 2 and 4 only

C 1, 2 and 3 only

D 1, 3 and 4 only

26 Which of the following statements are correct?

1 Aluminium alloys are used to manufacture aircraft bodies as they are strong.

2 Copper is used for cooking utensils as it is a good conductor of electricity.

3 Mild steel is used to make car bodies because it is ductile.

4 Stainless steel is used to make cutlery as it is resistant to corrosion.

A 4 only

B 1 and 4 only

C 1, 2 and 4 only

D 1, 3 and 4 only

27 Which statement about the blast furnace is not correct?

A Haematite is the ore which contains iron(III) oxide.

B Most carbon monoxide is formed from the incomplete combustion of coke.

C Nitrogen from hot air is released as a waste gas.

D The decomposition of limestone forms a product to remove silicon dioxide.

28 The formation of nitrogen dioxide from nitric oxide (NO) and oxygen is an exothermic reaction.

$$2NO + O_2 \rightarrow 2NO_2$$

What can be deduced from this information?

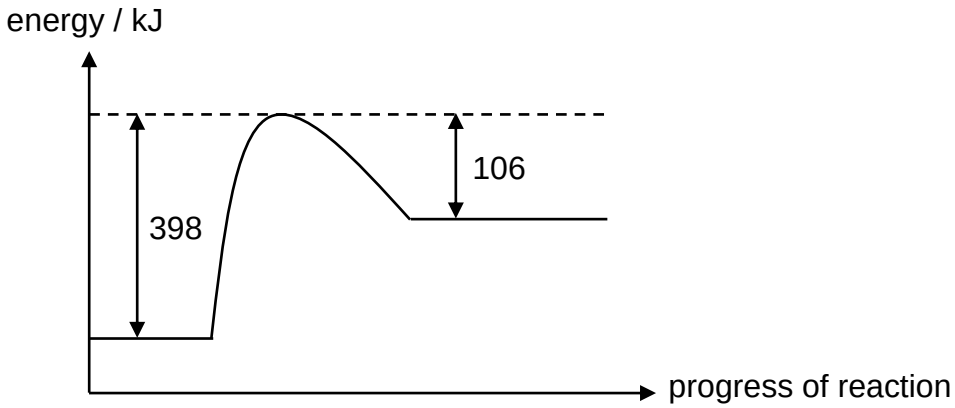
A The breaking of O=O bonds absorbs a lot of energy.

B The number of bonds broken is less than the number of bonds formed.

C The product possesses less energy than the reactants.

D The total energy change in bond breaking is greater than that in bond forming.

29 The diagram below shows the energy profile for a reaction.



Which statement about the reaction is correct?

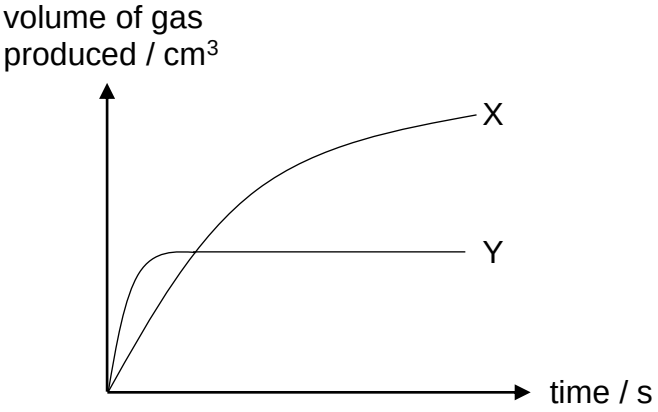
A The reaction is endothermic and the enthalpy change of reaction is +398 kJ.

B The reaction is endothermic and the enthalpy change of reaction is +292 kJ.

C The reaction is exothermic and the enthalpy change of reaction is -106 kJ.

D The reaction is exothermic and the enthalpy change of reaction is -292 kJ.

30 In the graph below, curve X represents the results of the reaction between 1.0 g of granulated zinc and excess sulfuric acid at 30 °C.



Which change will produce curve Y?

A Using 0.5 g of granulated zinc at 20 °C

B Using 0.5 g of powdered zinc at 30 °C

C Using 1.0 g of granulated zinc at 40 °C

D Using 1.0 g of powdered zinc at 40 °C

31 Powdered manganese(IV) oxide acts as a catalyst in the decomposition of aqueous hydrogen peroxide.

Which of the following statements explains why the rate of production of oxygen decreases during the reaction?

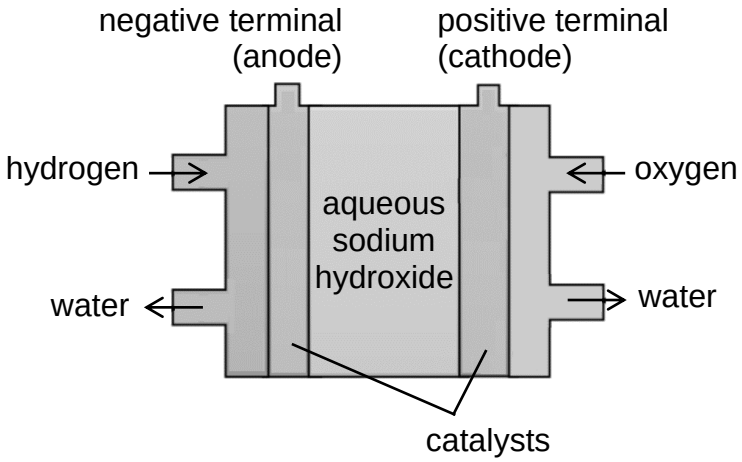
A The concentration of aqueous hydrogen peroxide decreases.

B The mass of manganese(IV) oxide decreases.

C The surface area of manganese(IV) oxide decreases.

D The temperature of aqueous hydrogen peroxide decreases.

32 The diagram below shows a hydrogen-oxygen fuel cell used to generate electricity.



Which half-equation represents the reaction that takes place at the positive terminal of the fuel cell?

A $H_2(g) + 2OH^-(aq) \rightarrow 2H_2O(l) + 2e$

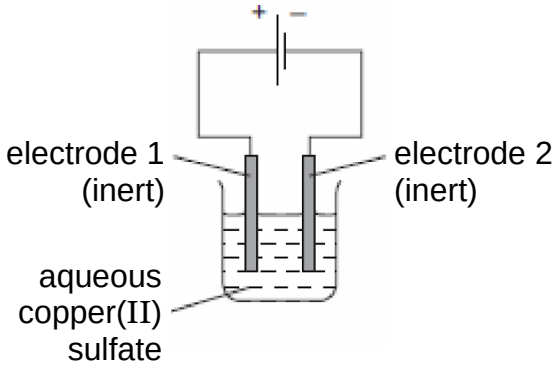
B $O_2(g) + 2H_2O(l) + 4e \rightarrow 4OH^-(aq)$

C $2H_2O(l) + 2e \rightarrow H_2(g) + 2OH^-(aq)$

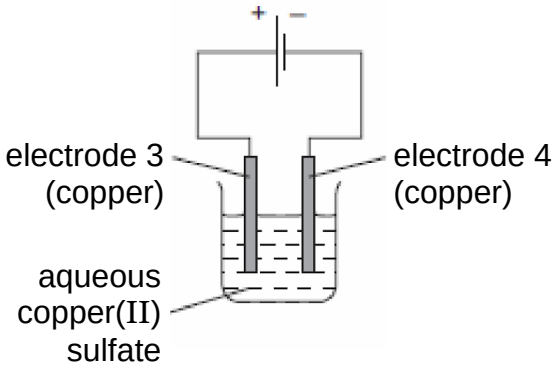
D $4OH^-(aq) \rightarrow O_2(g) + 2H_2O(l) + 4e$

33 The diagrams below show two different experiments for the electrolysis of aqueous copper(II) sulfate.

In experiment 1, both electrodes are inert. In experiment 2, both electrodes are made of copper.



Experiment 1



Experiment 2

At which electrodes can effervescence be observed?

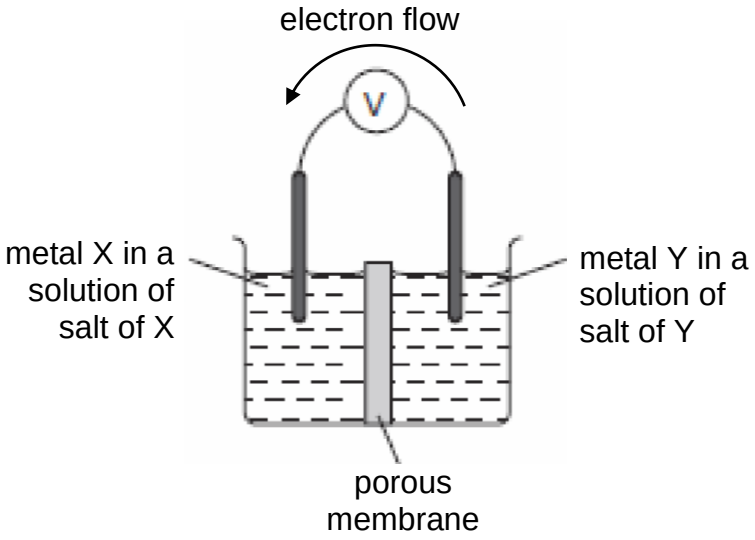
A 1 only

B 1 and 2 only

C 2 and 4 only

D 1, 2 and 4 only

34 Which pair of metals X and Y will produce the highest voltage when used as electrodes in a simple cell?

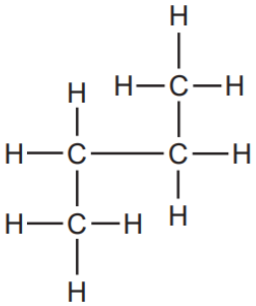


	metal X	metal Y
A	copper	magnesium
B	copper	zinc
C	magnesium	silver
D	magnesium	zinc

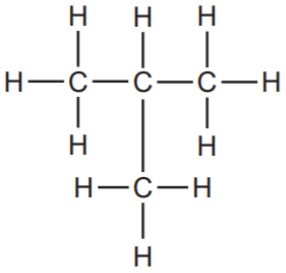
35 Which petroleum fraction is correctly matched to its use?

	fraction	use
A	bitumen	making waxes and polishes
B	gasoline	fuel for lorries
C	naphtha	lubricant for machinery
D	paraffin	fuel for aircraft

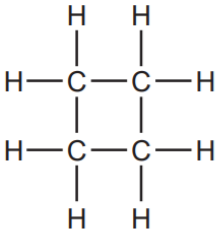
36 Four hydrocarbon structures are shown below.



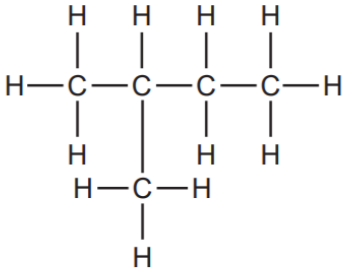
1



2



3



4

Which hydrocarbons are isomers of each other?

A 1 and 2 only

B 3 and 4 only

C 1, 2 and 3 only

D 1, 2 and 4 only

37 Some statements about propane and butane are shown below.

- Both are unsaturated hydrocarbons.
- Both reacts with chlorine in the presence of ultraviolet light.
- Butane has a lower boiling point than propane.
- Propane burns with a smokier flame than butane.

How many statements are correct?

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

38 Ethanol can be produced by using the two methods shown below.

Method 1: catalytic addition of steam to ethene
Method 2: fermentation

Which statements about the production of ethanol are correct?

1 Both methods give a high yield of ethanol.

2 Method 1 requires high temperature and pressure.

3 Method 2 occurs in the presence of oxygen at room temperature.

4 Method 2 requires yeast and glucose.

A 1 and 2 only

B 2 and 4 only

C 3 and 4 only

D 1, 2 and 4 only

39 Which straight chain hydrocarbon can form a polymer by addition polymerisation?

A C_6H_{14}

B C_7H_{14}

C C_8H_{18}

D C_9H_{20}

40 The diagrams below show four monomers.

How many of these monomers will react with the molecule below to form a polymer?

A 1

B 2

C 3

D 4

- End of Paper -