

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)



SINGAPORE CHINESE GIRLS' SCHOOL
Preliminary Examination 2014
Secondary Four

CHEMISTRY
PAPER 1 Multiple Choice

5073/01

Tuesday

12 AUGUST 2014

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and register number on the Answer Sheet in the spaces provided.

There are **forty** 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.

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 2.

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
																	1 H Hydrogen
																	2 He Helium
3 7 Li Lithium	4 8 Be Beryllium											5 11 B Boron	6 12 C Carbon	7 14 N Nitrogen	8 16 O Oxygen	9 18 F Fluorine	10 20 Ne Neon
11 23 Na Sodium	12 24 Mg Magnesium											13 27 Al Aluminium	14 28 Si Silicon	15 31 P Phosphorus	16 32 S Sulfur	17 35.5 Cl Chlorine	18 40 Ar Argon
19 39 K Potassium	20 40 Ca Calcium	21 45 Sc Scandium	22 48 Ti Titanium	23 51 V Vanadium	24 52 Cr Chromium	25 55 Mn Manganese	26 56 Fe Iron	27 58 Co Cobalt	28 59 Ni Nickel	29 64 Cu Copper	30 65 Zn Zinc	31 70 Ga Gallium	32 73 Ge Germanium	33 75 As Arsenic	34 78 Se Selenium	35 80 Br Bromine	36 84 Kr Krypton
37 85 Rb Rubidium	38 88 Sr Strontium	39 89 Y Yttrium	40 91 Zr Zirconium	41 93 Nb Niobium	42 98 Mo Molybdenum	43 101 Tc Technetium	44 101 Ru Ruthenium	45 103 Rh Rhodium	46 106 Pd Palladium	47 108 Ag Silver	48 112 Cd Cadmium	49 115 In Indium	50 118 Sn Tin	51 122 Sb Antimony	52 128 Te Tellurium	53 127 I Iodine	54 131 Xe Xenon
55 133 Cs Cesium	56 137 Ba Barium	57 138 La Lanthanum	58 178 Hf Hafnium	59 181 Ta Tantalum	60 184 W Tungsten	61 186 Re Rhenium	62 190 Os Osmium	63 192 Ir Iridium	64 195 Pt Platinum	65 197 Au Gold	66 201 Hg Mercury	67 204 Tl Thallium	68 207 Pb Lead	69 208 Bi Bismuth	70 209 Po Polonium	71 210 At Astatine	72 210 Rn Radon
87 Fr Francium	88 226 Ra Radium	89 227 Ac Actinium															

*58-71 Lanthanoid series
190-103 Actinoid series

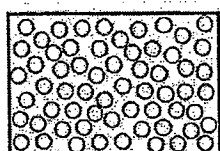
Key

a	a = relative atomic mass
X	X = atomic symbol
b	b = proton (atomic) number

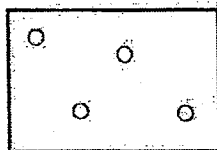
140 Ce Cerium	141 Pr Praseodymium	144 Nd Neodymium	150 Pm Promethium	152 Sm Samarium	157 Eu Europium	158 Gd Gadolinium	162 Tb Terbium	162 Dy Dysprosium	165 Ho Holmium	167 Er Erbium	168 Tm Thulium	173 Yb Ytterbium	175 Lu Lutetium
89 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	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 dm³ at room temperature and pressure (r.t.p.).

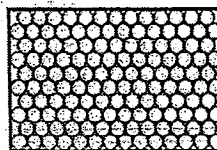
- 1 The diagrams show the arrangement of particles in three different physical states of substance X.



state 1



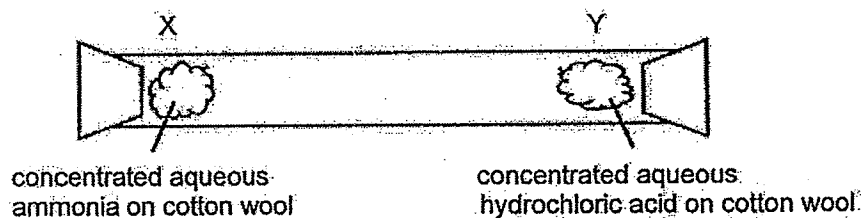
state 2



state 3

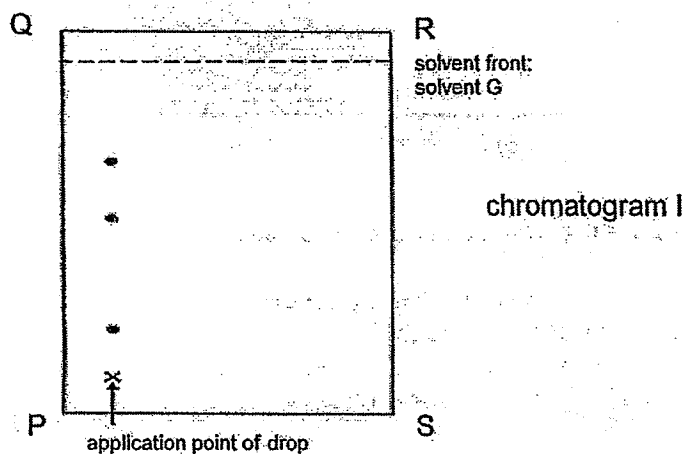
Which statement about the physical states of substance X is correct?

- A Particles in state 1 vibrate about fixed positions.
 - B State 1 changes to state 2 by diffusion.
 - C State 2 changes directly to state 3 by condensation.
 - D The substance in state 3 has a fixed volume.
- 2 The apparatus below was set up. Two cotton wool plugs were soaked in concentrated aqueous ammonia and concentrated aqueous hydrochloric acid respectively. These plugs were placed at opposite ends of a long glass tube as shown below. After some time, a white solid formed within the tube. The experiment was repeated at a higher temperature. Which of the following is true of the repeat experiment?



- A The white solid now forms even closer to X compared to the first experiment.
- B The white solid now forms even closer to Y compared to the first experiment.
- C The white solid forms at a much faster rate compared to the first experiment.
- D The white solid forms along the entire glass tube.

- 3 A drop of a substance that contains a mixture of four amino acids was applied to a plate. The plate was placed in solvent G and the following chromatogram was obtained.

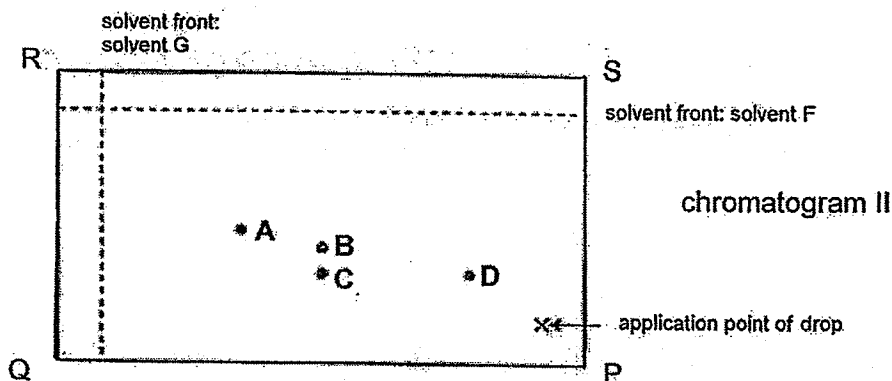


The R_f values for each of the amino acids in solvent G are provided in the table below.

amino acid	R_f (solvent G)
alanine	0.51
arginine	0.16
threonine	0.51
tyrosine	0.68

The plate was dried, rotated through 90° in an anticlockwise direction and then placed in solvent F. The R_f values for each of the amino acids in solvent F are provided in the table below. Chromatogram II was obtained.

amino acid	R_f (solvent F)
alanine	0.21
arginine	0.21
threonine	0.34
tyrosine	0.43



Which spot on chromatogram II represents alanine?

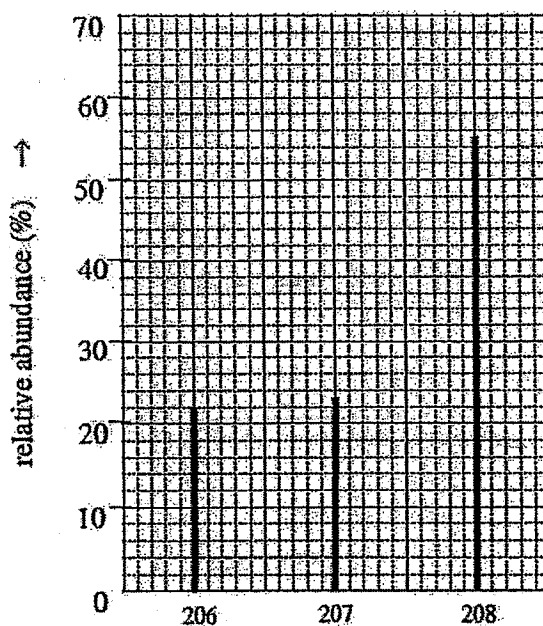
- 4 Which of the following correctly describes the sequence of procedures to collect separate samples of sand, salt and water from a mixture of sand and salt solution?

A filtration, evaporation
 B filtration, distillation
 C crystallization, filtration
 D sublimation, filtration, distillation

- 5 In which set does each of the three particles have the same total number of electrons?

A Li^+ Na^+ K^+
 B K^+ Ca^{2+} Br^-
 C F^- Ne Na^+
 D Cl^- Br^- I^-

- 6 Element X has three isotopes, ^{206}X , ^{207}X and ^{208}X . The graph below shows the relative abundances of the isotopes.



What is the relative atomic mass of X?

A 206.8
 B 207.0
 C 207.3
 D 207.5

- 7 Three substances, R, S and T, have physical properties as shown.

substance	melting point/ $^{\circ}\text{C}$	boiling point/ $^{\circ}\text{C}$	electrical conductivity	
			of solid	of liquid
R	801	1413	poor	good
S	2852	3600	poor	good
T	3550	4827	good	-

What could the identities of R, S and T be?

	R	S	T
A	sodium fluoride	potassium chloride	copper
B	sodium bromide	barium oxide	silicon dioxide
C	sodium chloride	magnesium oxide	graphite
D	bromine	calcium oxide	diamond

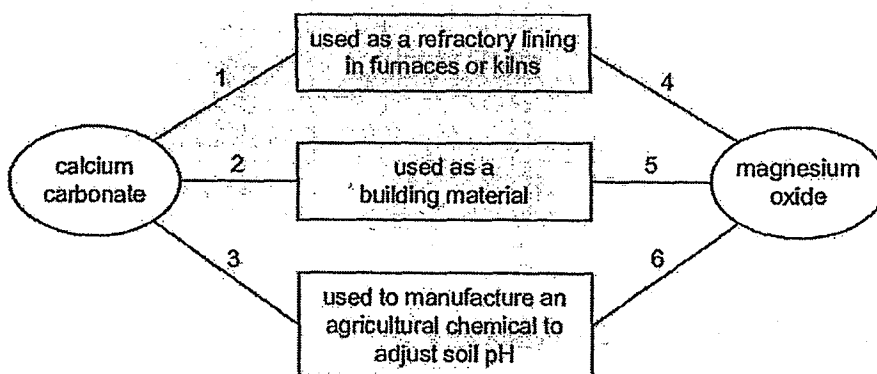
- 8 Silicon carbide has a structure similar to diamond. Boron nitride has a structure similar to graphite. Bronze is an alloy.

Which statements about silicon carbide, boron nitride and bronze are correct?

- 1 All are bonded covalently.
- 2 All except silicon carbide conduct electricity when solid.
- 3 All have high melting points.
- 4 All are insoluble in water.

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

- 9 The diagram shows some applications of compounds of Group II elements.



Which numbered links are correct?

	calcium carbonate	magnesium oxide
A	1,2 and 3	4,5
B	1,2 and 3	5,6
C	2 and 3 only	4 only
D	2 and 3 only	6 only

- 10 Which two statements are true for all elements between proton numbers 21 and 30?

The elements

- 1 conduct electricity.
- 2 do not react with water.
- 3 form ions with charges +2 and +3 only.
- 4 form coloured sulfates.

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

- 11 A part of the Periodic Table is shown below.

	Group							
	I	II	III	IV	V	VI	VII	0
First Period								X
Second Period	v	y		w				
Third Period						u		

Which of the following statements is correct?

- A x exists as discrete diatomic molecules.
B v gains electrons more readily than u.
C w forms an ionic compound with y.
D v is a solid at room temperature and pressure.

- 12 Which of the following formulae for compounds of germanium, Ge, is unlikely to be correct?

- A GeF_3
B GeS_2
C GeO_2
D GeH_4

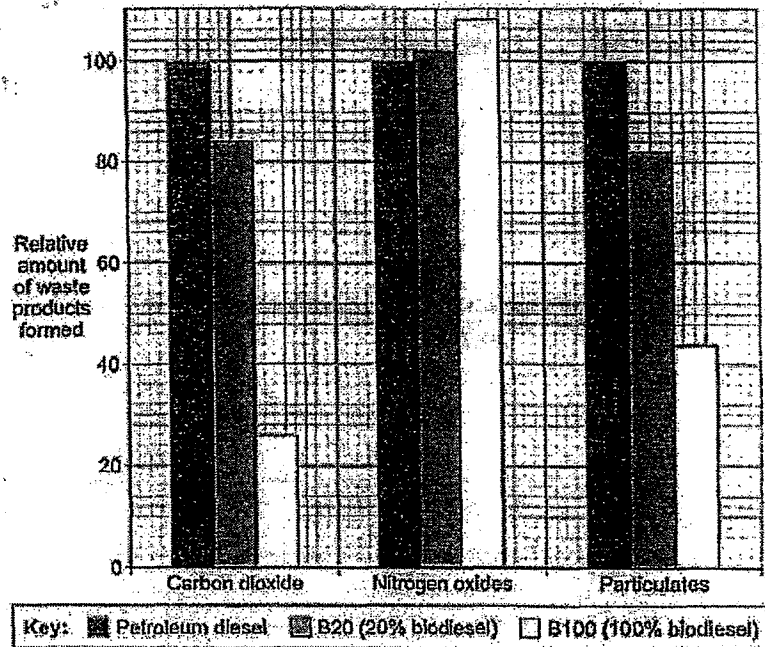
- 13 Alloy X is strong and has a low density.
Alloy Y is heavy and is resistant to corrosion.

Which could be uses of X and Y?

	Bridge supports	Aircraft	Overhead cables
A	X	X	Y
B	X	Y	Y
C	Y	X	X
D	Y	Y	X

For questions 14 and 15 refer to the information below.

Biodiesel can be mixed with petroleum diesel to make a fuel for cars. The bar chart compares the relative amounts of waste products made when three different types of diesel fuel burn in a car engine.



- 14 From the graph, it can be seen that biodiesel releases carbon dioxide but some scientists claim that biodiesel is a carbon neutral fuel.

What is the basis for this argument?

- A Biodiesel produces less carbon dioxide when it burns.
 - B Plants take up carbon dioxide as they grow.
 - C Biodiesel is not a carbon compound.
 - D Plants release carbon dioxide in respiration.
- 15 One possible disadvantage of using fuel with a high percentage of biodiesel is that
- A It is non-biodegradable.
 - B It could increase the amount of acid rain.
 - C It is non-renewable.
 - D It could increase global warming.

16 The following facts are known about four metals, P, Q, R and S.

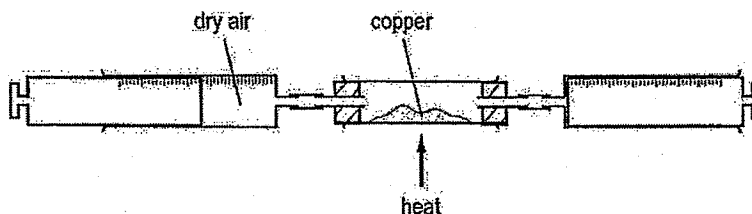
- (i) R displaces P and S from solutions of their ions.
- (ii) Q reacts with water, R does not.
- (iii) If plates of P and S are dipped into an electrolyte and joined by wires through a meter, electrons flow from P to S through the meter.

The order of reactivity, the most reactive being placed first, is

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

17 A sample of clean, dry air is passed over hot copper until all the oxygen in the air reacts with copper.

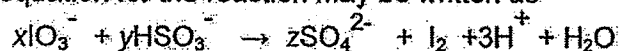
The volume of gas at the end of the reaction is 120cm^3 .
What is the starting volume of dry air?



- A 132 cm^3
- B 152 cm^3
- C 180 cm^3
- D 571 cm^3

18 A commercial production of iodine involves the reduction of a solution of iodate(V) ions, IO_3^- , with hydrogen sulfite ions HSO_3^- .

The equation for the reaction may be written as



What are the numbers x, y and z?

- A 2,5,5
- B 2,5,2
- C 5,2,2
- D 5,5,2

19 A student was asked to prepare a sample of magnesium sulfate by choosing a solid substance to add to dilute sulfuric acid. The experiment failed. Which of the following solid substances was chosen?

- A Magnesium
- B Magnesium oxide
- C Magnesium carbonate
- D Magnesium nitrate

- 20 Two indicators, bromophenol blue and congo red, show the following colors in acidic and alkaline solutions.

indicator	acid	alkali
bromophenol blue	yellow	blue
congo red	violet	red

A few drops of each indicator are added to separate samples of a solution of pH 2. What are the colors of the indicators in this solution?

	in a solution of pH 2	
	bromophenol blue	congo red
A	blue	red
B	blue	violet
C	yellow	red
D	yellow	violet

- 21 A black powder is suspected to be carbon or a mixture of carbon and copper(II) oxide. Which of the following methods can be used to identify the black powder?

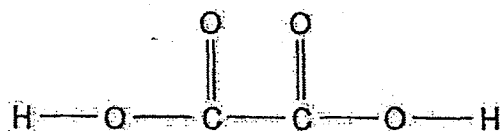
- 1 adding dilute sulfuric acid to the powder
- 2 adding sodium hydroxide to the powder
- 3 heating the powder strongly

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

- 22 A sample of insecticide DDT, $C_{14}H_9Cl_5$, was found to contain 0.120g of carbon. What mass of chlorine was present in the sample?

- A 0.127g
 B 0.254g
 C 0.994g
 D 1.01g

- 23 The structure of oxalic acid is shown below.



A 25.0 cm³ of oxalic acid reacts completely with 15.0 cm³ of 2.50 mol/dm³ of sodium hydroxide.

The concentration of oxalic acid solution is

- A 0.667 mol/dm³
B 0.750 mol/dm³
C 1.33 mol/dm³
D 1.50 mol/dm³
- 24 Three electrolysis cells are set up. Each cell has inert electrodes.

The electrolytes are listed below.

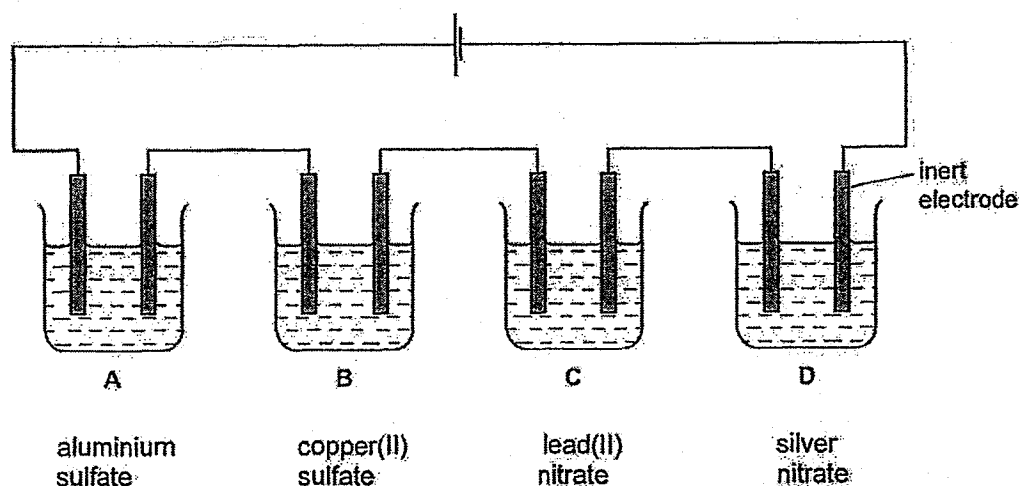
cell 1 : aqueous sodium chloride

cell 2 : concentrated hydrochloric acid

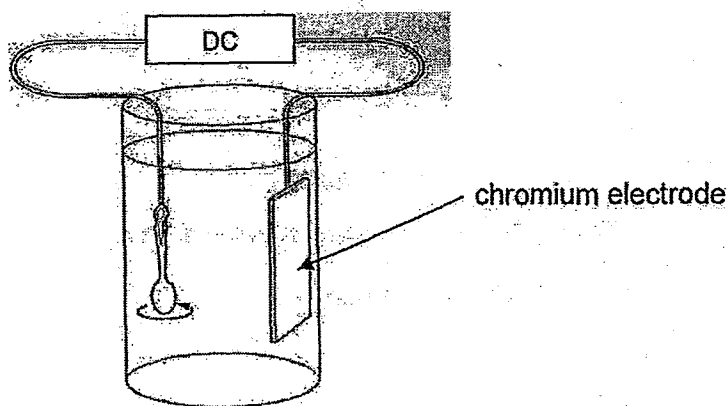
cell 3 : molten lead(II) bromide

In which cell is a gas formed at both electrodes?

- A 1 and 2 B 1 and 3 C 2 only D 3 only
- 25 When electrolyzed using inert electrodes, which dilute solution would produce the greatest increase in mass of the cathode?
[A_r: Al, 27; Cu, 64; Pb, 207; Ag, 108]



- 26 The apparatus shown below is used to plate a spoon with chromium.



Which statement is **not** correct?

- A Chromium would stick to the spoon because it is preferentially discharged.
 - B The electrolyte would be a chromium salt dissolved in water.
 - C The ionic equation at the chromium electrode is $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$.
 - D The spoon would be connected to the negative terminal of the power supply.
- 27 In which of the following reactions does the metal atom show the greatest change in oxidation number?

- A MnO_4^- to Mn^{2+}
- B MnO_2 to $\text{Mn}(\text{OH})_3$
- C PbO_2 to PbSO_4
- D VO_2^+ to VO^{2+}

- 28 The table shows the heat of combustion for four compounds.

Compound	M_r	Heat of combustion (kJ mol^{-1})
CO	28	233
CH_4	16	890
C_2H_2	26	1300
C_2H_6	30	1560

Which of these compounds produces the most energy when 1.00 g of the compound is completely burned?

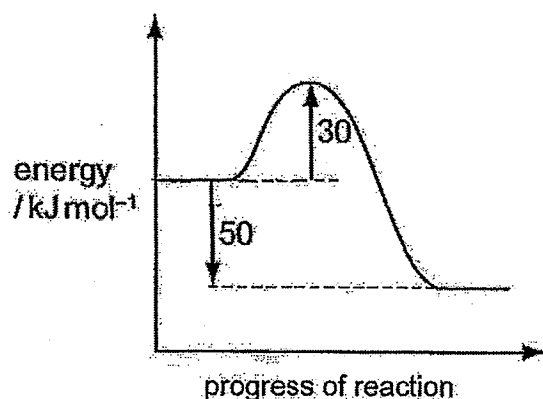
- A CO
- B CH_4
- C C_2H_2
- D C_2H_6

29 Which of the following reactions is endothermic?

- A $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$
 B $\text{CaCO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{H}_2\text{O(l)} + \text{CO}_2(\text{g})$
 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 $\text{C}_9\text{H}_{20}(\text{l}) \rightarrow \text{C}_2\text{H}_6(\text{g}) + \text{C}_3\text{H}_6(\text{g}) + \text{C}_4\text{H}_8(\text{g})$

30 The reaction pathway for a reversible reaction is shown below.

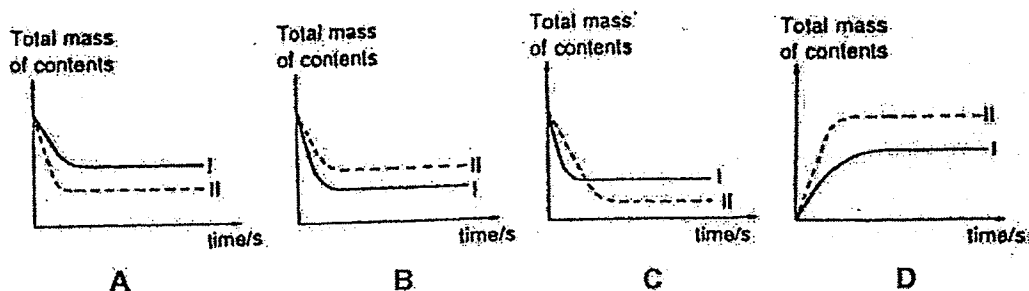
Which statement is correct?



- A The activation energy of the reverse reaction is $+80\text{ kJ mol}^{-1}$
 B The activation energy of the forward reaction is -30 kJ mol^{-1}
 C The enthalpy change for the forward reaction is $+50\text{ kJ mol}^{-1}$
 D The enthalpy change for the reverse reaction is $+30\text{ kJ mol}^{-1}$
- 31 Two experiments I and II were carried out to find the rate of production of carbon dioxide from excess powdered limestone and dilute hydrochloric acid. The total mass of contents in each of the conical flasks was measured as the reaction progresses.

Experiment	Solution used
I	100 cm ³ of 0.2 mol/dm ³ of hydrochloric acid
II	50 cm ³ of 1.0 mol/dm ³ of hydrochloric acid

All other conditions were identical in both experiments. Which one of the following shows the correct experimental results?



- 32 A sample of an alloy of two metals was added to excess dilute sulfuric acid. A pink solid, G, and a colourless solution, H were obtained. Addition of aqueous ammonia to this colourless solution gave a white precipitate, I, which was soluble in excess aqueous ammonia.

The identities of G, H and I are

	G	H	I
A	iron	calcium sulfate	calcium hydroxide
B	iron	aluminum sulfate	aluminium hydroxide
C	copper	lead(II) sulfate	lead(II) hydroxide
D	copper	zinc sulfate	zinc hydroxide

- 33 An aqueous sample of T shows these observations with the following reagents.

Reagent	Observation
Aqueous ammonia	Reddish brown precipitate
Lead(II) nitrate	White precipitate
Barium nitrate	White precipitate

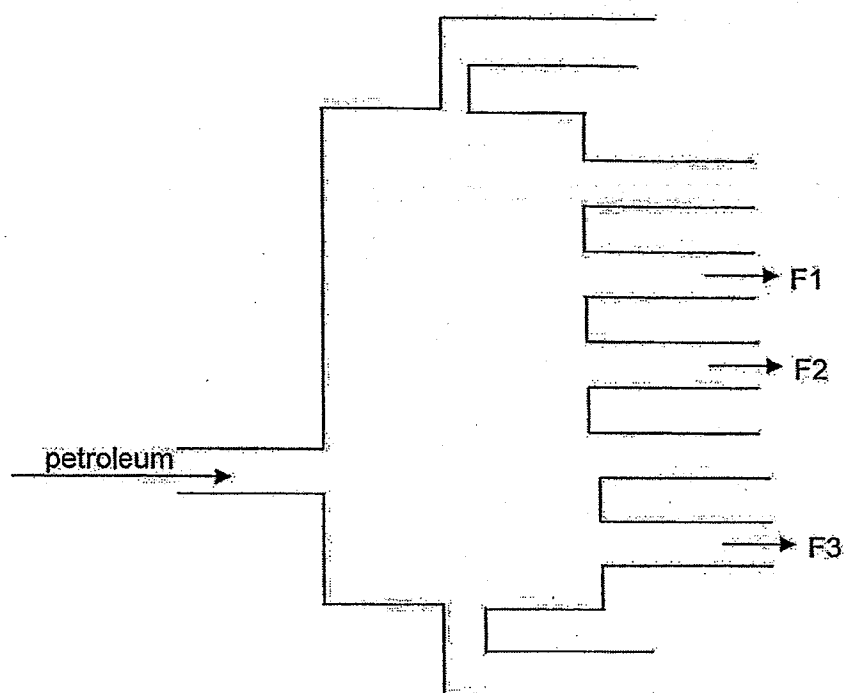
What is compound T?

- A iron(III) sulfate
 B iron(II) sulfate
 C iron(III) chloride
 D potassium iodide
- 34 An organic compound has the following percentage composition by mass : 54.5% C, 9.1% H and 36.4% O. Which of the following could this compound be?
- A methanoic acid
 B propanoic acid
 C butanoic acid
 D pentanoic acid
- 35 2.30g of ethanol were mixed with an excess of aqueous acidified potassium permanganate. The reaction mixture was then boiled under reflux for one hour. The desired organic product was then collected by distillation. The yield of the product was 60.0%.

What mass of product was collected?

- A 1.32g B 1.38g C 1.80g D 3.20g

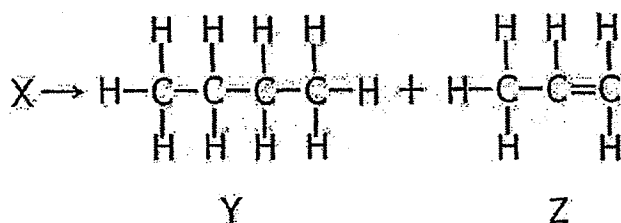
- 36 The diagram below represents the fractionating column of an oil refinery.



What are the uses of fractions F1, F2 and F3?

	F1	F2	F3
A	Fuel for car engines	For making feedstock	Making roads
B	Fuel for car engines	Fuel for aircraft engines	Fuel for diesel engines
C	For making feedstock	Fuel for aircraft engines	For making waxes
D	Fuel for aircraft engines	For making feedstock	For making waxes

- 37 A chemist carried out a cracking reaction on a hydrocarbon, X, and obtained two products, Y and Z.



The chemist then wrote the following statements in his notebook.

- 1 A molecule of X has 7 carbon atoms.
- 2 Y is unsaturated.
- 3 Z will decolourise bromine water
- 4 One molecule of Z will react with excess oxygen to produce 2 molecules of water and 3 molecules of carbon dioxide

Which statements are correct?

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

- 38 The table shows the boiling points of four fractions, P, Q, R and S, obtained when crude oil is distilled.

Fraction	P	Q	R	S
Boiling point range/°C	35 – 75	80 – 145	150 – 250	Greater than 250

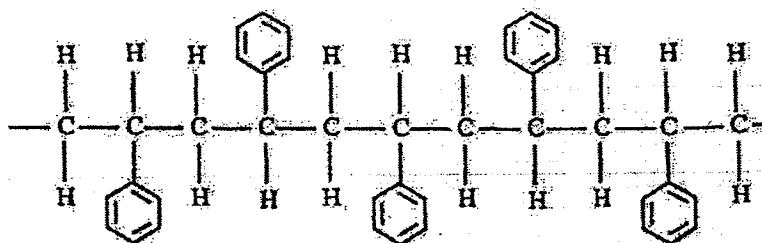
How is fraction P different from fraction S?

- A** Fraction P is more viscous than fraction S.
B Fraction P is in less demand than fraction S.
C Fraction P is more flammable than fraction S.
D Fraction P contains molecules of larger molecular masses than fraction S.

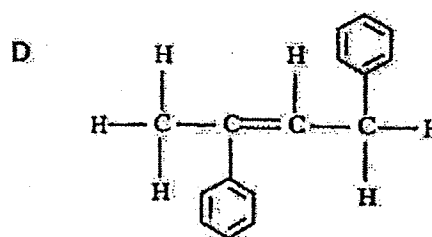
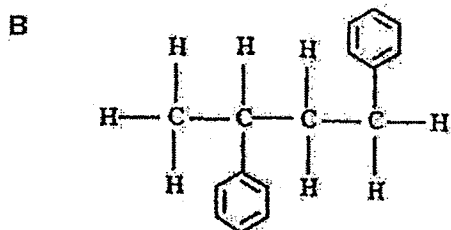
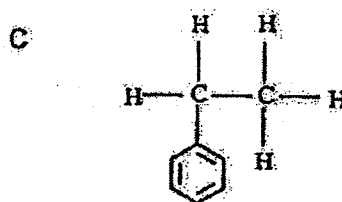
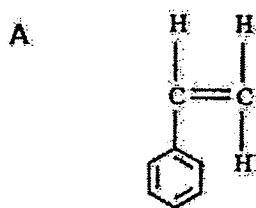
- 39 The number of structural isomers of C_4H_9Cl is

- | | |
|---|---|
| A | 2 |
| B | 3 |
| C | 4 |
| D | 5 |

40 A section of a polymer chain is given below.



The monomer for this polymer would be



Answers for MCQ Prelim 2014

1-5	D	C	C	B	C
6-10	C	C	D	C	B
11-15	D	A	C	B	B
16-20	A	B	A	D	D
21-25	C	A	B	A	D
26-30	C	A	B	D	A
31-35	A	D	A	C	C
36-40	C	A	C	C	A

NAME & REGISTER NO.	CLASS	CENTRE NO:	INDEX NO:
---------------------	-------	------------	-----------



SINGAPORE CHINESE GIRLS' SCHOOL
Preliminary Examination 2014

CHEMISTRY
PAPER 2

5073 / 02

Friday

1 August 2014

1 hour 45 minutes

Additional Materials: Writing Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
 Write in dark blue or black pen on both sides of the paper.
 You may use a soft pencil for any diagrams, graphs or rough working.
 Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A

Answer all questions in the spaces provided.

Section B

Answer all three questions, the last question is in the form either / or.
 Write your answers on the separate answer paper provided.

At the end of the examination, fasten all your work securely together.
 The number of marks is given in brackets [] at the end of each question or part question.
 A copy of the Periodic Table is printed on page 2.

For Examiner's Use	
Section A	
B8	
B9	
B10	
Total	

The Periodic Table of the Elements

Group																																													
I	II											III	IV	V	VI	VII	0																												
												1 H hydrogen 1						4 He helium 2																											
Key relative atomic mass atomic symbol name atomic number												11 B boron 5		12 C carbon 6		14 N nitrogen 7		16 O oxygen 8		19 F fluorine 9		20 Ne neon 10																							
7 Li lithium 3	9 Be beryllium 4											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulphur 16	35.5 Cl chlorine 17	40 Ar argon 18																												
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36																												
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	— Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54																												
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	— Po polonium 84	— At astatine 85	— Rn radon 86																												
— Fr francium 87	— Ra radium 88	— Ac actinium 89																																											
*58-71 Lanthanoid series			<table><tr><td>140 Ce cerium 58</td><td>141 Pr praseodymium 59</td><td>144 Nd neodymium 60</td><td>— Pm promethium 61</td><td>150 Sm samarium 62</td><td>152 Eu europium 63</td><td>157 Gd gadolinium 64</td><td>159 Tb terbium 65</td><td>162 Dy dysprosium 66</td><td>165 Ho holmium 67</td><td>167 Er erbium 68</td><td>169 Tm thulium 69</td><td>173 Yb ytterbium 70</td><td>175 Lu lutetium 71</td></tr><tr><td>232 Th thorium 90</td><td>— Pa protactinium 91</td><td>238 U uranium 92</td><td>— Np neptunium 93</td><td>— Pu plutonium 94</td><td>— Am americium 95</td><td>— Cm curium 96</td><td>— Bk berkelium 97</td><td>— Cf californium 98</td><td>— Es einsteinium 99</td><td>— Fm fermium 100</td><td>— Md mendelevium 101</td><td>— No nobelium 102</td><td>— Lr lawrencium 103</td></tr></table>															140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	— Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71	232 Th thorium 90	— Pa protactinium 91	238 U uranium 92	— Np neptunium 93	— Pu plutonium 94	— Am americium 95	— Cm curium 96	— Bk berkelium 97	— Cf californium 98	— Es einsteinium 99	— Fm fermium 100	— Md mendelevium 101	— No nobelium 102	— Lr lawrencium 103
140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	— Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71																																
232 Th thorium 90	— Pa protactinium 91	238 U uranium 92	— Np neptunium 93	— Pu plutonium 94	— Am americium 95	— Cm curium 96	— Bk berkelium 97	— Cf californium 98	— Es einsteinium 99	— Fm fermium 100	— Md mendelevium 101	— No nobelium 102	— Lr lawrencium 103																																
†90-103 Actinoid series																																													

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

Section A (50 marks)

Answer all questions in this section in the spaces provided.

A1 The following are names of different types of reactions.

addition	combustion	displacement	oxidation
substitution	polymerization	reduction	neutralization

Choose one of these reactions to represent each of the following equations.
Each answer can be used once, more than once or not at all.

- (a) $\text{CH}_3\text{CH}_2\text{CH}_3 + \text{Br}_2 \rightarrow \text{CH}_3\text{CH}_2\text{CHBr}_2 + 2\text{HBr}$
- (b) $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$
- (c) $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- (d) $\text{Cl}_2 + 2\text{I}^- \rightarrow 2\text{Cl}^- + \text{I}_2$
- (e) $n\text{CH}_2 = \text{CH}_2 \rightarrow -(\text{CH}_2 - \text{CH}_2)_n$

[Total:5 marks]

A2(a) This question is based on Group VII elements.

The following report appeared in a newspaper.

Vehicle Crashed on Driveway

"Drums of purple liquid bromine broke open after a vehicle crash on the motorway. Traffic was diverted as the accident resulted in irritation to the drivers' eyes. Firemen sprayed water over the scene of the accident, dissolving the bromine and washing it away."

(i) Identify an error in the report. Explain your answer. [1]

.....

(ii) Explain how the liquid bromine comes into contact with the driver's eyes. [2]

.....

.....

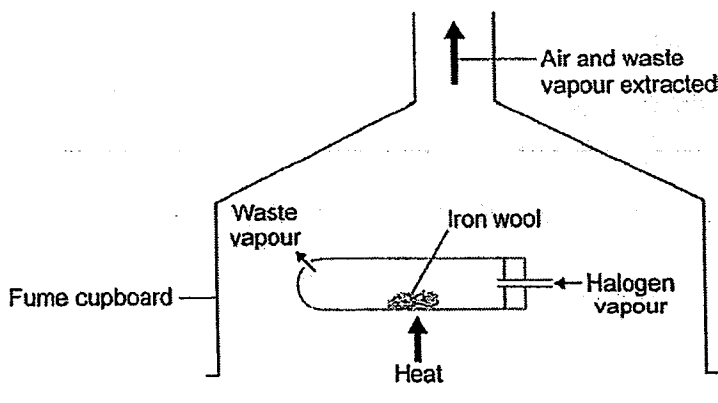
(iii) Comment on the method used by the firemen to get rid of bromine. Include in your answer the negative impact on the environment. [2]

.....

.....

.....

- (b) A teacher demonstrated an experiment involving passing bromine vapour through heated iron wool in a fume cupboard. A red-brown solid was produced.



- (i) Write an equation for the reaction above. [1]

- (ii) State and explain the type of reaction that occurs when bromine reacts with heated iron wool. [3]

- (c) The disinfecting action of chlorine in swimming pools is due to the presence of chloric(I) acid, HClO , formed by the reaction of chlorine with water. In many swimming pools, chemicals other than chlorine are used to form chloric(I) acid. These chemicals include potassium chlorate(I), calcium chlorate(I) and chlorine dioxide.

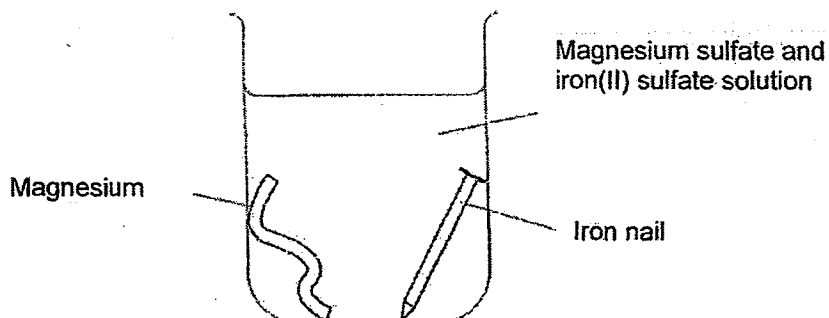
Complete the following table.

[1]

Name of Compound	Formula
Chloric(I) acid	HClO
Potassium chlorate(I)	KClO
Calcium chlorate(I)	
Chlorine dioxide	

[Total:10 marks]

- A3** A student set up a laboratory experiment with a beaker containing a strip of magnesium, an iron nail, and a solution of iron(II) sulfate and magnesium sulfate. This was left for several days.



- (a)** Describe, using relevant ionic equations, what would happen to the

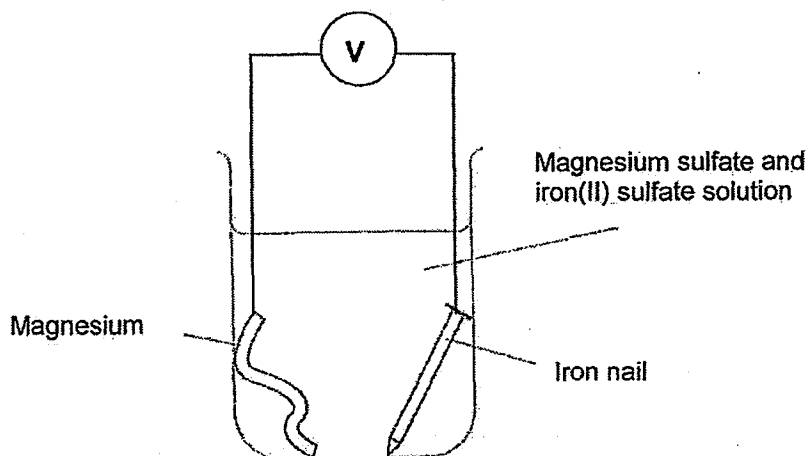
(i) magnesium strip

[2]

(ii) iron nail

[2]

- (b)** An electric current was generated by connecting the magnesium strip to the iron nail by using wires as shown.



(i) Explain why bubbles were seen at the iron nail.

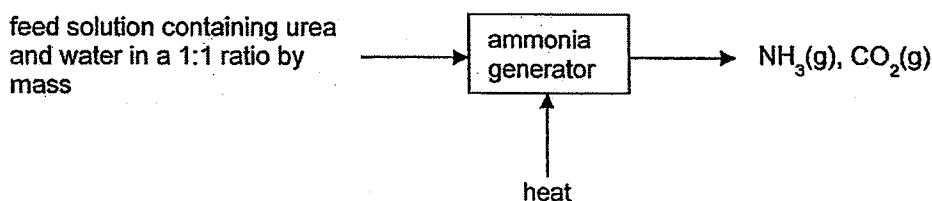
[3]

(ii) Describe how the voltage of this cell can be increased?

[1]

[Total:8 marks]

- A4** There are two ways of producing ammonia in an industrial plant. One way is to use the Haber Process, and another way is using small scale ammonia generators. A simplified diagram of a plant that uses small scale ammonia generators is shown below.



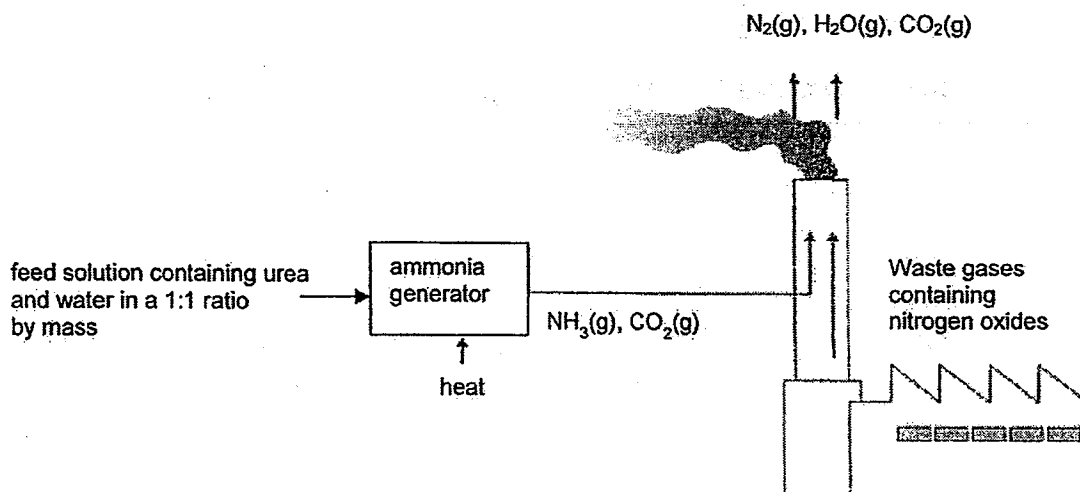
- (a) The chemical reaction occurring in the ammonia generator is
 $(\text{NH}_2)_2\text{CO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons 2 \text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$

In a particular generator a 1:1 mass ratio (equal mass) of urea and water is used.

State the excess reactant? Explain your answer.

[2]

- (b) The ammonia generated in small scale ammonia generators is used to treat waste gases containing nitrogen oxides. This treatment converts the oxides of nitrogen to nitrogen and water.



- (i) Write a chemical equation for the reaction of nitrogen monoxide with ammonia. [1]

- (ii) State the effect on the composition of the gases released into the atmosphere when an insufficient amount of ammonia was added to nitrogen monoxide. Explain how this affects the environment. [2]

- (iii) Give one advantage, other than cost, of producing ammonia on-site (at the same location) by this method rather than having ammonia delivered from a plant at another location. [1]

- (c) Ammonia is manufactured on a large scale by the reaction between nitrogen gas and hydrogen gas in the Haber Process.

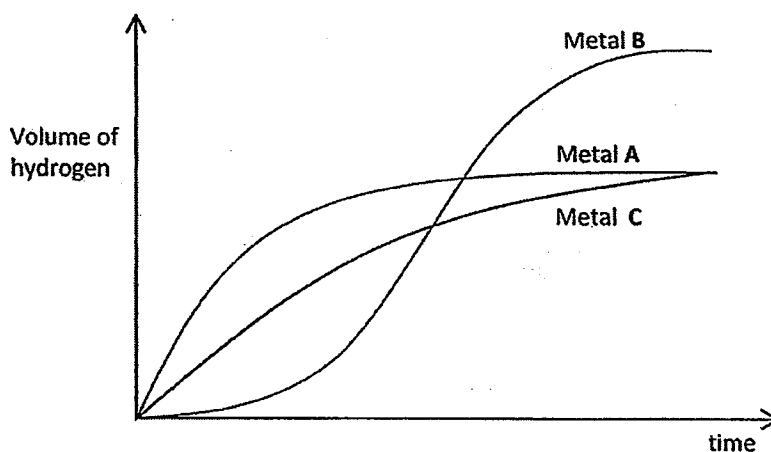
State the essential conditions required for the production of ammonia. [2]

[Total: 8 marks]

- A5** Excess hydrochloric acid was added to powdered zinc. The hydrogen evolved was collected and its volume measured every 20 seconds.

The experiment was repeated at the same temperature using the same number of moles of powdered magnesium and aluminium.

The graph below shows the volume of hydrogen produced from each metal against time.



- (a) Identify metal **B** and explain the shape of the graph for metal **B**. [3]

- (b) Identify metals **A** and **C**. [1]

- (c) Using the concept of moles, explain why metals **A** and **C** form the same volume of hydrogen but metal **B** forms a larger volume. [2]

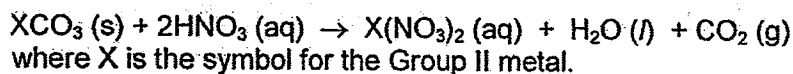
[Total: 6 marks]

- A6** A student was tasked to identify an unknown carbonate of a Group II metal. She set up an experiment to measure the volume of carbon dioxide given off when a weighed sample of this carbonate was reacted with nitric acid.

Her results are shown in the table.

mass of Group II carbonate	0.888 g
volume of gas collected	144 cm ³

The equation for the reaction is



- (a) Based on her results, she did some calculations and concluded that the unknown carbonate was strontium carbonate. Explain, showing your working clearly, how she arrived at this conclusion. [3]

- (b) She decided to do a cation test to confirm the identity of the metal carbonate. She made a solution by reacting the metal carbonate with hydrochloric acid. She then added aqueous sodium hydroxide until in excess. She observed that a white precipitate insoluble in excess aqueous sodium hydroxide was obtained and concluded that it was indeed strontium carbonate.
Give a reason why this conclusion may be incorrect. [1]

- (c) The student was told by Professor Choo that the metal was not strontium but calcium. The student calculated that if metal X were calcium, 0.888g of calcium carbonate would produce 213cm³ of carbon dioxide. Assuming that she had measured the mass of the metal carbonate and the volume of the gas correctly, suggest a reason why the volume of gas collected was only 144cm³. [1]

[Total: 5 marks]

- A7** Zinc is a reactive metal that will react with oxygen at high temperatures. Its two main ores are zinc sulfide and zinc carbonate. The relative abundance of each ore is about the same throughout the world.
There are 3 stages in the production of zinc from its ores.

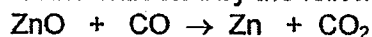
Stage 1: The ores, zinc sulfide and zinc carbonate, were first heated separately to produce zinc oxide.
Zinc sulfide when heated in air produces sulfur dioxide as the other product.

- (a) Write the equations for the two reactions that took place when the ores are heated in Stage 1.

[2]

Stage 2: The zinc oxide is then mixed with carbon (coke) and heated in a furnace. In the furnace, carbon monoxide is produced.

Stage 3: Zinc is extracted by the following reaction:



- (b) Describe the 2 reactions occurring in the furnace that led to the production of carbon monoxide in Stage 2.

[2]

- (c) The atmosphere inside the furnace is kept rich in carbon monoxide. Explain why. [1]

- (d) Zinc ores also contain lead compounds. Lead is produced with zinc in the furnace. The temperature inside the furnace is about 1500°C.

	Boiling point/°C	Density in g/cm ³	Reactivity
Lead	1749	11.3	Low
Zinc	907	7.1	High

Suggest how the two metals are separated in the furnace.

[1]

- (e) Lead and iron are also manufactured by the reduction of the oxides with carbon monoxide.

Which of the three metal oxides, lead(II) oxide, iron(III) oxide and zinc oxide, is the most easily reduced? Explain your answer. [2]

[Total: 8 marks]

Section B (30 marks)

Answer all **three** questions from this section on the writing paper provided.

The last question is in the form either/or and only **one** of the alternatives should be attempted.

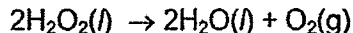
- B8** A molecule that is made up of more than two atoms usually has a central atom that all other atoms are bonded to. The table below shows information about some of these molecules with central atoms (except carbon monoxide) formed by elements in Periods 2 and 3 of the Periodic Table. Study the information carefully and answer the questions that follow.

Central atom	Period that Central atom belongs to	Formula of molecule	Dot-and-cross diagram of molecule
C	2	CO	:C::O:
		CO ₂	
N	2	NH ₃	$\begin{array}{c} \text{H}:\ddot{\text{N}}:\text{H} \\ \\ \text{H} \end{array}$
O	2	I ₂ O	$\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} \\ \text{I}\text{---}\text{I} \end{array}$
P	3	PCl ₃	$\begin{array}{c} \text{Cl} \\ \text{Cl}:\text{P}:\text{Cl} \\ \text{Cl} \end{array}$
		PCl ₅	$\begin{array}{c} \text{Cl} \\ \text{Cl}:\text{P}:\text{Cl} \\ \text{Cl} \end{array}$
S	3	SF ₄	$\begin{array}{c} \text{F} \\ \text{F}:\text{S}:\text{F} \\ \text{F} \end{array}$
		SF ₆	$\begin{array}{c} \text{F} \\ \text{F}:\text{S}:\text{F} \\ \text{F} \end{array}$

* Only valence electrons are shown

- (a) Draw a dot-and-cross diagram of the carbon dioxide molecule, similar to the diagrams in the table. [1]
- (b) Comment on the unusual bonding seen in the dot-and-cross diagram in carbon monoxide and phosphorus pentachloride (PCl_5). [2]
- (c) Based on the information given in the table, draw the dot-and-cross diagram of BrF_5 . [1]
- (d) Interhalogen compounds are formed between atoms of different Group VII elements and these are very strong oxidizing agents.
- (i) Explain the term *oxidizing agent*. [1]
- (ii) Chlorine and fluorine react exothermically to form ClF_3 . When gaseous ClF_3 is added to water, a vigorous reaction occurs, giving three gases. One of the gases produced turns moist blue litmus red and then bleaches it. Another relights a glowing splint, and the third is hydrogen fluoride gas. Construct a balanced chemical equation, with state symbols, for the reaction. [2]
- (iii) Another interhalogen compound is BrF_3 which is a straw-coloured liquid with a pungent odour. The liquid is able to conduct electricity.
- $$\text{BrF}_3 \rightarrow \text{BrF}_2^+ + \underline{\hspace{2cm}}$$
- Copy and complete the equation above. Explain why BrF_3 is a good conductor of electricity while bromine and fluorine are non-conductors of electricity. [3]

- B9** Hydrogen peroxide is often used to bleach or lighten hair colour.
Hydrogen peroxide slowly decomposes to produce water and oxygen.

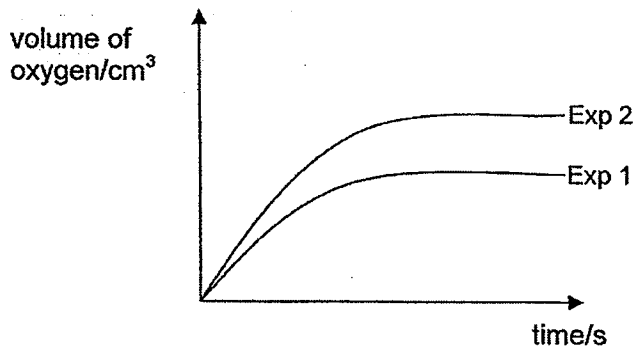


- (a) The decomposition of hydrogen peroxide involves a change from a liquid reactant to a gaseous product. Describe the differences in movement and arrangement of particles between a liquid and a gas. [2]
- (b) Explain, in terms of the collision theory, why the rate of decomposition of hydrogen peroxide increases with (i) an increase in temperature and (ii) the addition of a catalyst. [3]
- (c) Two experiments were performed to investigate the effect of a change in concentration on the rate of decomposition of hydrogen peroxide at room temperature. 1g of a catalyst in the form of small pellets was added.

Experiment 1: mixture of 4 cm³ of hydrogen peroxide and 46 cm³ of water

Experiment 2: mixture of 6 cm³ of hydrogen peroxide and 44 cm³ of water

The results of the two experiments were plotted and shown below.



Two further experiments were carried out.

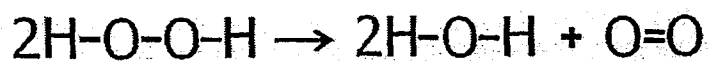
In experiment 3, a mixture of 2 cm³ of hydrogen peroxide and 48 cm³ of water was used. 1g of the same catalyst was added.

In experiment 4, a mixture of 6 cm³ of hydrogen peroxide and 44 cm³ of water was used. 1g of the same catalyst was added in powdered form.

Copy the graphs above and sketch on the same axes, two curves to show the progress of the reaction in both experiments 3 and 4.

[2]

- (d) The equation for the decomposition of hydrogen peroxide can be represented by using structural formulae as shown:

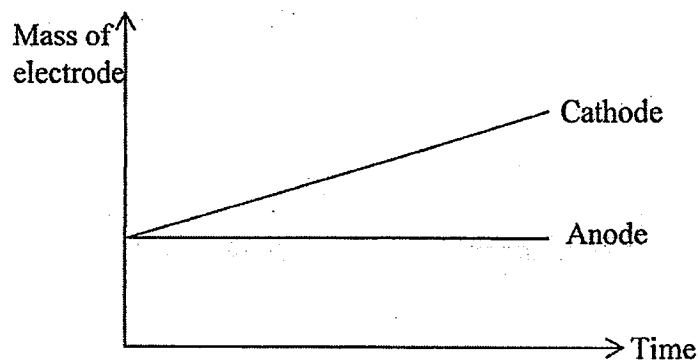


Using the bond energies in the table below, calculate the energy change for this reaction. [3]

Bond	Bond energy in kJ per mole
H – O	464
O – O	146
O = O	498

B10 Either

A student was given two different types of electrodes (carbon and copper electrodes), a fixed volume of 1.0 mol/dm^3 of copper(II) sulfate solution, some electrical wires and batteries. He carried out the electrolysis of the copper(II) sulfate solution using the different electrodes. First, he carried out the experiment with the carbon electrodes. At regular intervals, the cathode and anode were removed, dried and weighed. The results were plotted on the graph below.



- (a) (i) Give the formulae of the ions present in the electrolyte. [2]
- (ii) Explain why the cathode shows an increase in mass initially. [1]
- (iii) Describe what is observed at the anode with an appropriate equation. [2]

He carried out the same experiment with copper electrodes. Similarly, at regular intervals, the cathode and the anode were removed, dried and weighed.

- (b) (i) Predict and draw on a separate graph how the mass of the anode and cathode will change as electrolysis takes place. [2]
- (ii) Explain how the graph for the anode is derived with a relevant equation. [2]
- (iii) The student noticed that the colour of the electrolyte remained the same as electrolysis took place. Explain why. [1]

B10 Or

- (a) Ethanol is manufactured in two ways – fermentation of sugars and addition of steam to ethene.

(i) State the conditions needed for each reaction. [2]

Countries A to D are ethanol-producing countries. Study the table below and use the information to answer the questions given.

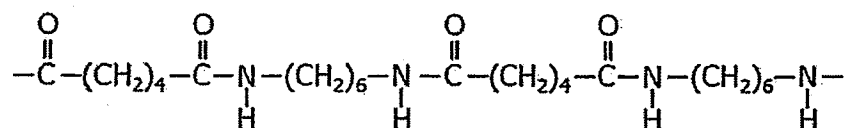
Country	Land Area/ km ²	Population	Climate	Other information
A	8 500 000	Sparingly populated	Mostly tropical	It is a poor country with no oil reserves.
B	710	Densely populated	Mostly tropical	It is a relatively rich country with no oil reserves.
C	9 800 000	Densely populated	Seasonal	It is a relatively rich country that has its own oil reserves.
D	330 000	Moderately populated	Mostly tropical	It is a relatively rich country that has its own oil reserves.

(ii) State the country which is likely to produce ethanol by fermentation of sugars. Explain your answer. [1]

(iii) State the country which is likely to produce ethanol by addition of steam to ethene. Explain your answer. [1]

(iv) Give one advantage of manufacturing ethanol using fermentation of sugars rather than addition of steam to ethene. [1]

- (b) The diagram below shows a section of the polymer chain of nylon.



Nylon is a polyamide and is formed by condensation polymerization.

(i) Explain the term 'condensation polymerisation'. [1]

(ii) With reference to the diagram above, deduce the structural formulae of the two monomers of nylon. [2]

(iii) Given that the relative molecular mass of the polymer is 5650. Calculate the number of repeating units in this polymer. [2]

~End of Paper~

Answers to 2014 Preliminary Paper 2 Section A

A1	(a) Substitution (b) Reduction (c) Combustion (d) Displacement (e) Polymerization Total[5]
A2(a)	(i) Bromine is reddish brown liquid. (ii) Liquid bromine (low boiling point) evaporates (easily) to form bromine gas. The gaseous bromine moving freely and randomly diffuses. (ii) The method used to dispose of bromine is wrong. Bromine will dissolve in water to produce (hydrobromic) acid. The acid when washed away will cause soil to be acidic, affecting plant growth or cause lakes/rives to be acid leading to death of fishes etc.
(b)	(i) $2\text{Fe} + 3\text{Br}_2 \rightarrow 2\text{FeBr}_3$ (ii) Redox. The oxidation number of bromine decreases from 0 to -1. Hence bromine is reduced. The oxidation number of iron increases from 0 to +3. Hence iron is oxidized. Or Each Iron atom loses 3 electrons to form iron(III) ion. Hence, iron is oxidised. Each bromine atom gain 1 electron to form bromide ion. Hence, bromine is reduced.
(c)	$\text{Ca}(\text{ClO})_2$, ClO_2 Total: [10]
A3(a)	(i) Magnesium strip will decrease in size/Grey solid deposited on magnesium strip. Magnesium being more reactive than iron will displace iron(II) ions from the iron(II) sulfate solution to form grey iron metal and magnesium sulphate solution. $\text{Mg} + \text{Fe}^{2+} \rightarrow \text{Mg}^{2+} + \text{Fe}$ The iron nail will rust/corrode and a reddish-brown coating formed on iron nail. $\text{Fe} - 3\text{e} \rightarrow \text{Fe}^{3+}$
(b)	(i) Magnesium, being more reactive than iron, will lose electrons to iron. Iron nail becomes negatively charged (and hydrogen ions, magnesium ions and iron(II) ions are attracted to the iron nail) Hydrogen ions are preferentially discharged (less stable than the other ions) to form hydrogen gas. (ii) Voltage is increased by replacing the iron nail with copper/lead/silver Total[8]

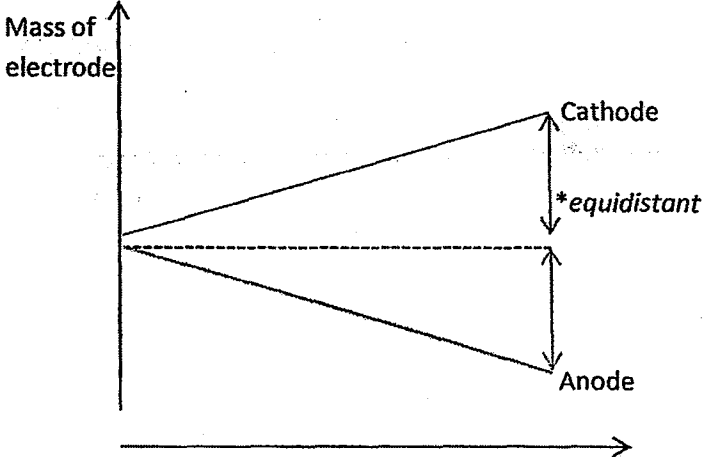
A4(a)	Mr (NH₂)₂CO = 60 , Mr(H₂O) =18 (not necessary) The relative molecular mass of urea is higher than that of water. Hence, no. of moles of water is higher than that of urea. Since the mole ratio of urea to water is 1:1, water is in excess.
(b)	(i) $6\text{NO} + 4\text{NH}_3 \rightarrow 5\text{N}_2 + 6\text{H}_2\text{O}$ (ii) There will be unreacted nitrogen monoxide released into the atmosphere together with less nitrogen and water produced. Nitrogen monoxide will react with air to form nitrogen dioxide. Nitrogen dioxide will react with moisture and air to form nitric acid that dissolves in water to form acid rain. (iii) Producing ammonia on site is easier as minimum storage and transportation of ammonia is required. Not producing ammonia on site means ammonia being a gas has to be stored in thick pressurized containers which are heavy and difficult to transport.
(c)	Temperature of 400- 450°C, pressure of 200-250 atmospheres and finely divided iron as catalyst.
Total[8]	
A5(a)	Metal B is aluminum. Reaction is slower at the start/less steep because of the oxide layer reacting with acid. Reaction is faster/ steeper when the oxide layer is removed exposing the aluminium which then reacts with the acid.
(b)	Metal A is magnesium. Metal C is zinc.
(c)	$2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ For both magnesium and zinc, 1 mole of metal produces 1 mole of H₂, therefore same volume of gas produced. For aluminium, 1 mole of metal produces 1.5 moles of H₂, therefore higher volume of gas produced.
Total[6]	
A6(a)	(i) No. of moles of CO₂ = $\frac{144}{24000}$ = 0.006 No. of moles of XCO₃ = 0.006 [1] $0.006 = \frac{0.888}{x+12+16 \times 3}$ [1] X = 148-12-48 X = 88 [1] X is Strontium. The carbonate is strontium carbonate.

(b)	Calcium ions would also form a white precipitate insoluble in excess aqueous sodium hydroxide. Or Calcium compounds/calcium chloride/calcium ions would also give the same results with excess aq sodium hydroxide.
(c)	Impure calcium carbonate was used. So volume of carbon dioxide is less than 213 cm³. (carbon dioxide is slightly soluble in water/ gas was lost between adding acid and replacing bung/ temperature was lower than room temperature - reject because difference in volume of gas is too great.) Total[5]
A7(a)	$2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + \text{SO}_2$ $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$
(b)	Carbon (Coke) reacts with oxygen in the air to form carbon dioxide. Carbon dioxide reacts with more coke to form carbon monoxide.
(c)	The atmosphere rich in carbon monoxide prevents the hot molten zinc from reacting with oxygen in the air to form zinc oxide again.
(d)	At 1500°C, zinc would be a gas that can be tapped off while lead will still be in liquid (or solid) state at the bottom of the furnace.
(e)	Lead(II) oxide is the most easily reduced <u>Lead is the least reactive of the three metals and therefore would form the least stable compound.</u> Total[8]

Answers to 2014 Preliminary Paper 2 Section B

B8(a)		
(b)	The carbon atom and the oxygen atom in carbon monoxide do not share equal number of electrons to attain the stable electronic configuration. Oxygen atom shared 4 electrons while carbon atom shared only 2 electrons. OR For carbon monoxide, one pair of electrons for sharing comes from the oxygen atom instead of one electron from each of carbon and oxygen. The P atom has a total of 10 valence electrons on the outermost shell instead of the usual configuration of 8 valence electrons.	
(c)		
(d)(i)	Oxidizing agent - Oxidises another substance and is itself reduced - Gives oxygen or takes hydrogen from another substance - Increases the oxidation number of another substance while it itself shows a decrease in oxidation number - Takes electrons from another substance (one of the above)	
(d)(ii)	$4\text{ClF}_3 (\text{g}) + 6\text{H}_2\text{O} (\text{l}) \rightarrow 2\text{Cl}_2 (\text{g}) + 3\text{O}_2 (\text{g}) + 12\text{HF} (\text{g})$	
(d)(iii)	$\text{BrF}_3 \rightarrow \text{BrF}_2^+ + \text{F}^-$ BrF_3 is made up of ions. In the liquid state, the <u>ions are mobile</u> and hence can conduct electricity. However, bromine and fluorine exists as molecules (absence of mobile charged particles) and hence cannot conduct electricity.	

B9(a)	Movement : The particles in the liquid states <u>roll and slide over each other/translate</u> while the particles in the gaseous state <u>moves freely and randomly</u>. Arrangement: The particles in the liquid state are <u>closely packed but not in an orderly arrangement</u> while the particles in the gaseous state are <u>very far apart</u>.	
(b)	As the temperature increases, the <u>particles gain kinetic energy and thus the particles move faster</u>. Hence the <u>frequency of collision</u> increases which leads to an increase in the <u>frequency of effective collision</u>. Hence the rate of reaction increases. Catalyst provides an alternative pathway with lower <u>activation energy for the reaction</u> hence more particles are able to attain the activation energy and thus there will be more effective collisions per unit time, thus the rate of reaction is faster.	
(c)	volume of oxygen/cm³ time/s	
(d)	$4(\text{O-H}) + 2(\text{O-O}) - 4(\text{O-H}) - (\text{O=O})$ Energy change $= 4(464) + 2(146) - 4(464) - 498$ $= -206 \text{ kJ}$ Or Energy absorbed to break bonds $= 4(464) + 2(146) = 2148 \text{ kJ}$ Energy released to form bonds $= 4(464) + 498 = 2354 \text{ kJ}$ Energy change $= 2148 - 2354 = -206 \text{ kJ}$	

either B10(a)	(i) Cu^{2+}, SO_4^{2-}, H^+, OH^- 1 mark for each set (ii) The <u>Copper(II) ion, being less stable, will be preferentially discharged instead of hydrogen ion</u> at the cathode resulting in the formation of copper that will coat round the cathode and resulted in the increase in mass. (iii) Effervescence of a colourless gas is observed at the anode. $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	
(b)(i)		
(ii)	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ The copper electrode is an active electrode and will ionized to produce copper(II) ion which goes into solution.	
(iii)	The rate at which copper(II) ions are discharged at the cathode is the same rate at which copper is ionized at the anode to form copper(II) ions. Hence, the electrolyte remains the same.	

or 10 (a)	(i) Fermentation: Temp: 35-38 °C, absence of oxygen, yeast Hydration condition : Temp: 300 °C , catalyst : phosphoric acid, pressure 70 atmospheres.	
	(ii)(a) Country A because it is a country with <u>tropical climate</u> , <u>large land</u> area for the <u>plantation of sugar</u> and also it has <u>no oil reserves</u> that can fermented to produce ethanol. (b) Country C because it is a country with it's <u>own oil reserve</u> that can be hydrated to produce ethanol. Furthermore, it is densely populated and has <u>limited land area</u> for crop plantation.	
	(iii) Ethanol made from ethene is said to be non-renewable because the <u>raw material ethene is a finite resource</u> from the fossil fuel. Ethanol made from sugars is renewable because the plant is a <u>renewable source of raw material</u> .	
(b)	(i) Condensation polymerization is a process whereby a polymer is formed by the <u>joining of many monomers</u> with the <u>elimination of small molecules/water</u> .	
	(ii) $\text{H}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-(\text{CH}_2)_4-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{H}$ $\begin{array}{c} \text{H}-\text{N}-(\text{CH}_2)_6-\text{N}-\text{H} \\ \qquad \qquad \\ \text{H} \qquad \qquad \text{H} \end{array}$	
	(iii) Mr of one repeated unit = 226 $5650 \div 226 = 25$ (Ans)	