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2008-2009

HKCEE

Mock Examination

Chemistry- Paper I

Marking Scheme

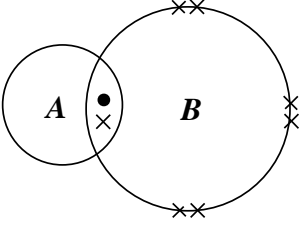
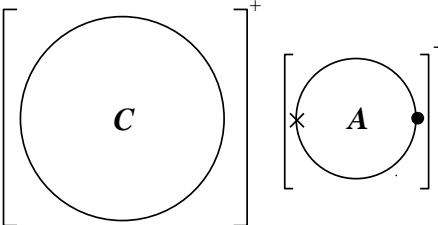
Dr. Kelvin Lau

Marking Schemes

These documents were prepared for markers' reference. They should not be regarded as sets of model answers. Candidates and teachers who were not involved in the marking process are advised to interpret their contents with care.

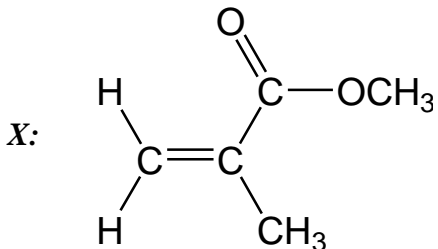
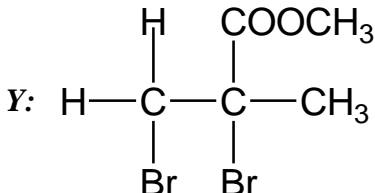
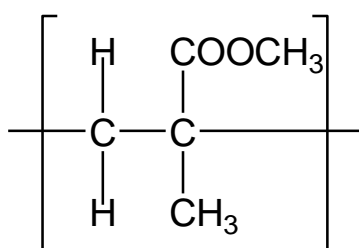
HKCEE-MOCK

Section A

- | | <u>Marks</u> |
|--|--------------|
| 1. (a) X : covalent compound | 1 |
| Y : ionic compound | 1 |
| (b) | |
|  <p style="text-align: center;">Compound X</p> | 1 |
|  <p style="text-align: center;">Compound Y</p> | 1 |
| (c) The melting point of Y is higher | 1 |
| X is a simple molecular substance. There are only weak van der Waals' forces between X molecules | 1 |
| Y is has a giant ionic structure, in which cations of C and and anions of A are held by strong ionic bonds. | 1 |
| (Award zero mark if wrong explanation is given) | |

	<u>Marks</u>
2. (a) $2 \text{ZnS} + 3 \text{O}_2 \rightarrow 2 \text{ZnO} + 2 \text{SO}_2$	1
$\text{SO}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S}_2\text{O}_7$	1
(b) $2 \text{SO}_2 + \text{O}_2 \rightleftharpoons 2 \text{SO}_3$	
Number of mole of $\text{SO}_3 = \frac{30000}{32.1 + 3(16)} = 374.5 \text{ mol}$	1
Number of mole of $\text{SO}_2 = \text{number of mole of } \text{SO}_3 = 374.5 \text{ mol}$	
Volume of $\text{SO}_2 = 374.5 \times 24 = 8988 \text{ dm}^3$	1
(c) Concentration of the concentrated sulfuric acid	
$= \frac{1.84 \times 0.98 \times 1000}{[2(1) + 32.1 + 4(16)]} = 18.38 \text{ M}$	1
Volume of the sulfuric acid required = $\frac{1.5 \times 200}{18.38} = 16.32 \text{ cm}^3$	1
3. (a) To complete the circuit by allowing the ions to pass through.	1
(b) To remove the oxide layers on the metal surfaces	1
(c) $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$	1
(d) The voltage will drop to zero.	1
Methanol does not contain mobile ions and thus cannot conduct electricity.	1

	<u>Marks</u>
4. (a) $\text{Ca(OH)}_2(\text{s}) + 2 \text{NH}_4^+ \rightarrow \text{Ca}^{2+}(\text{aq}) + 2 \text{NH}_3(\text{g}) + 2 \text{H}_2\text{O}(\text{l})$	2
(b) The color of the solution changes from red to blue. Ammonia is an alkaline gas. It can partially ionize in water to generate hydroxide ions.	1 1
(c) No. The reducing power of NH_3 is not strong enough to reduce concentrated nitric acid to nitrogen dioxide. Neutralization will take place in stead of redox reaction. (Award 0 mark for wrong explanation) $\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3$	1 1 1
5. (a) Some ions can also form precipitate with silver ions such as CO_3^{2-} and SO_3^{2-} . Addition of acid can remove these ions to prevent the interference of the analysis.	1
(b) $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$	
Number of mole of silver chloride = $\frac{8.24}{107.9 + 35.5} = 0.05746 \text{ mol}$	1
Number of mole of carnallite = $\frac{1}{3} \times$ number of mole of silver chloride = 0.01915 mol	1
Mass of carnallite = $0.01915[39.1 + 24.3 + 3(35.5) + 6(18)] = 5.32 \text{ g}$	
Percentage by mass of carnallite = $\frac{5.32}{8.24} \times 100\% = 64.6\%$	1
(c) The impurities do not contain bromide and iodide, which can form precipitates with silver ion.	1
(d) Electrolysis	1

			<u>Marks</u>
6.	(a)	(i) Concentrated sulfuric acid (Not accept concentrated H ₂ SO ₄)	1
		(ii)	
		X: 	1
	(b)	(i) The color of the solution changes from orange to colorless (Not accept from brown to colorless)	1
		(ii)	
		Y: 	1
		Methyl 2,3-dibromo-2-methylpropanoate	1
	(c)	(i) 	1
		(ii) contact lenses/ aircraft windows (Accept other correct answers)	1

			<u>Marks</u>	
7.	(a)	(i)	Anode: $\text{Zn} \rightarrow \text{Zn}^{2+} + 2 \text{e}^-$	1
			Cathode: $2 \text{NH}_4^+ + 2 \text{MnO}_2 + 2 \text{e}^- \rightarrow 2 \text{NH}_3 + \text{Mn}_2\text{O}_3 + \text{H}_2\text{O}$	1
		(ii)	The redox reaction in the cell is not reversible	1
	(b)	(i)	Anode: $\text{H}_2 \rightarrow 2 \text{H}^+ + 2 \text{e}^-$	1
			Cathode: $\text{O}_2 + 4 \text{H}^+ + 4 \text{e}^- \rightarrow 2 \text{H}_2\text{O}$	1
		(ii)	$2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$	1
		(iii)	High efficiency	1
			Or Only water is produced, fuel cell is environmental friendly	(1)
8.	Chemical knowledge (6 marks)			
	-	Chlorine is denser than air, it is collected by downward delivery		1
	-	In the preparation of sulfur dioxide, hydrochloric acid is slowly added to an aqueous solution of sodium sulphite using a dropping funnel.		1
	-	Sulfur dioxide is denser than air, it is collected by downward delivery		1
		<u>Similarities:</u>		
	-	Bleaching properties: both chlorine and sulfur dioxide can decolorize litmus solution.		1
		<u>Differences</u>		
	-	Chlorine is an oxidizing agent; it can oxidize bromide to bromine.		1
	-	Sulfur dioxide is a reducing agent, it can reduce dichromate ion to chromium(III) ion.		1
		(Accept other correct examples)		
		Effective communications (3 marks)		3

Marks

	Chlorine	Oxygen	Carbon	Hydrogen
Mass ratio	55.0	24.8	18.6	1.6
Mole ratio	$\frac{55.0}{35.5} = 1.55$	$\frac{24.8}{16.0} = 1.55$	$\frac{18.6}{12.0} = 1.55$	$\frac{1.6}{1.0} = 1.60$
	1	1	1	1

1

Empirical formula = ClOCH

1

(b) Number of mole of 10.75 g X = $\frac{2}{24} = 0.0833$ mol

Molar mass of X = $\frac{10.75}{0.0833} = 129$ g

1

Let the molecular formula of X = (ClOCH)_n

$n(35.5 + 16 + 12 + 1) = 129$

$n = 2$

Molecular formula of X = Cl₂O₂C₂H₂

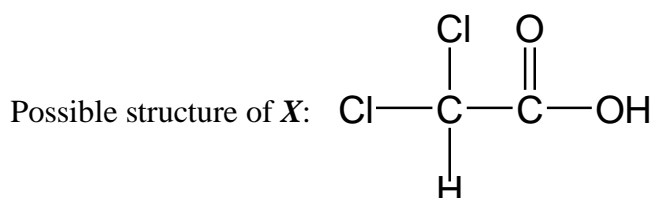
1

(c) (i) X can react with sodium hydrogen carbonate to produce colorless gas. X is a carboxylic acid

1

X cannot decolorize bromine in the absence of sunlight. X does not contain C=C double bond.

1



1

(ii) 2,2-dichloroethanoic acid

1

	<u>Marks</u>
10. (a) Conduct the experiment in fume cupboard.	1
Nitrogen dioxide released is a toxic gas	1
(b) Number of mole of KOH	
$= (0.2)\left(\frac{21}{1000}\right) = 0.0042 \text{ mol}$	1
Number of mole of HCl in 10 cm ³ filtrate	
= Number of mole of KOH = 0.0042 mol	
Number of mole of HCl in 100 cm ³ filtrate = 0.042 mol	
Total number of mole of HCl = $7\left(\frac{100}{1000}\right) = 0.7 \text{ mol}$	
Number of mole of HCl reacted with Mg = $0.7 - 0.042 = 0.658 \text{ mol}$	1
Number of mole of Mg = $0.5 \times \text{number of mole of HCl} = 0.329 \text{ mol}$	
Mass of Mg = $0.329 \times 24.3 = 8 \text{ g}$	
Percentage by mass of Mg = $\frac{8}{15} \times 100\% = 53.3\%$	1
(c) $\text{Ag} + 2 \text{H}^+ + \text{NO}_3^- \rightarrow \text{Ag}^+ + \text{NO}_2 + \text{H}_2\text{O}$	1
Yes. The oxidation number of Ag increases from 0 in Ag to +1 in Ag ⁺ .	1
Or The oxidation number of N decreases from +5 in NO ₃ ⁻ to +4 in NO ₂	(1)
(d) Number of mole NO ₂ = $\frac{1}{24} = 0.0417 \text{ mol}$	1
Number of mole of Ag = number of mole of NO ₂ = 0.0417 mol	
Mass of Ag = $0.0417 \times 107.9 = 4.5 \text{ g}$	
Percentage by mass of Ag = $\frac{4.5}{15} \times 100\% = 30\%$	1
(e) The impurities in the sample does not react with hydrochloric acid	1
Or	
The impurities in the sample does not form gaseous product with nitric acid	(1)

	<u>Marks</u>
11. (a) Electrode A: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$	1
Electrode B: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$	1
Electrode C: $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	1
Electrode D: $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	1
(b) Oxidation occurs in Electrode C. Electrode C is anode. (Award 0 mark for wrong explanation)	1
(c) The volume of the gaseous product obtained in Electrode C will be smaller. It is because chlorine is relatively more soluble in water than hydrogen. (Award zero mark for wrong explanation)	1
(d) Electrode A: colorless gas evolves	1
Electrode C: zinc electrode gradually dissolves.	1

Marks

12. Chemical knowledge (6 marks)

Polymerization:

- Ethene undergoes addition polymerization to form low density polyethene. The process does not involve the elimination of small molecules. 1
- Condensation polymerization between hexanedioic acid and hexa-1,6-diamine gives nylon-6.6. Water is eliminated in the process. 1
- Urea and methanal also undergoes condensation polymerization to form urea-methanal. 1

Structures of polymers:

- Low density polyethene: The polymer chains contain branched chains. Only weak van der Waals' forces exist between branched chains. 1
- Nylon 6.6: The polymer chain does not contain branched chain and cross-link. Only weak van der Waals' forces exist between branched chains. 1
- Urea-methanal: There are cross-links between branched chains. It cannot soften upon heating. 1

Effective communications (3 marks) 3