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HKDSE / IB Diploma / GCE AS AL / AP / SAT / HSC
IGCSE / GCSE / IB MYP / KS3 / MO / F.1 - F.6 / Y9 - Y13

2015 HKDSE Chemistry Paper 1B

Suggested Solutions

Prepared by Andy Lai

HKDSE 5** Teacher

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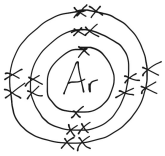
MATHS

Section B

1.

黎 Sir 提提你 :

(a)



(b) Van der waal's force between chlorine molecules.

(c)

Element	Natural source	Method of extraction
Argon	Air in atmosphere	Fractional distillation of liquefied air
Chlorine	Sea water, which is called brine solution	Electrolysis of brine solution which comes from sea water

2.

黎 Sir 提提你 :

(a) The limewater turns milky first, then become colourless again.

Turn milky equation: CO_2 (g) + $Ca(OH)_2$ (aq) → $CaCO_3$ (s) + H_2O (l)

Become colourless again: CO_2 (g) + $CaCO_3$ (s) + H_2O (l) → $Ca(HCO_3)_2$ (aq)

(b) The solution turns from orange to green.

$3\ SO_3^{2-}$ (aq) + $Cr_2O_7^{2-}$ (aq) + $8\ H^+$ (aq) → $3\ SO_4^{2-}$ (aq) + $2\ Cr^{3+}$ (aq) + $4\ H_2O$ (l)

3.

黎 Sir 提提你 :

(a) It is because iron is less reactive than aluminium and so the compound of iron, for example, iron (III) oxide is easier to be reduced back to iron by heating with carbon, but aluminium oxide used a harder method called electrolysis of its molten ore.

(b)

(i)

	Iron	**:**	**Oxygen**
Mass ratio	**1.67**	**:**	**2.31 - 1.67 = 0.64**
Mole ratio	$\frac{1.67}{55.8}$	**:**	$\frac{0.64}{16}$
	0.0299	**:**	**0.04**
=	**1**	**:**	$\frac{0.04}{0.0299}$
=	**1**	**:**	**1.338**
≈	**1**	**:**	$\frac{4}{3}$
=	**3**	**:**	**4**

∴ Empirical formula = Fe_3O_4

(ii) Fe_3O_4 (s) + 4 CO (g) → 4 CO_2 (g) + 3 Fe (s)

(iii) Carry out the experiment in fume cupboard to let the fan take out the carbon monoxide out of the room.

(c) Because the zinc is more reactive than iron once part of the zinc touches the iron surface, zinc will oxidize become zinc ions first but not iron rust.

(d) Water is broken down into hydrogen and oxygen during electrolysis. Water undergoes self dissociation into hydrogen ions and hydroxide ions, the hydroxide ions will oxidize into oxygen in anode, the oxygen formed will reacts with the aluminium to form aluminium oxide to thicken its oxide layer. The oxide layer is impermeable to oxygen and water, which prevent the corrosion of aluminium from occurring.

4.

黎 Sir 提提你 :

(a) Secondary cell means the cell can be recharged many times.

(b) The voltage supported by the lead-acid accumulator is constant and large enough.

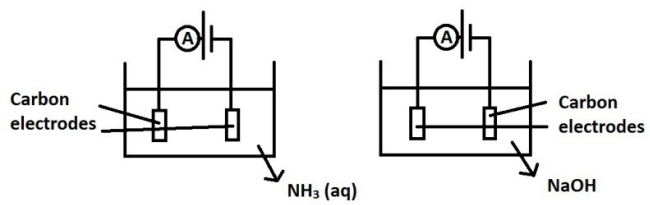
(c) Lead is toxic, if the food is contaminated with it, the animals may even die, or hurt human brain.

(d)

(i) Firstly, put the concentrated sulphuric acid into a halfly-full beaker with pure water, and at the same time, stirring the water with glass rods to make the heat produced distributed evenly. Wear a safety googles to carry out this experiment.

(ii) Mole of H_2SO_4 = $\frac{2.48}{98.1}$ = 0.02528 mol

Molarity of H_2SO_4 = $\frac{0.02528}{\frac{5}{1000}}$ = 5.056 = 5.06 M (3 sig. fig.)

5.		**黎 Sir 提提你 :** **Weak alkali is any substance dissolve in water will ionize hydroxide ions partly.** **For example, ammonia solution. Equation: $NH_3 + H_2O <-> NH_4^+ + OH^-$.** **Since the reaction above is reversible, that is not all NH_3 molecules can be ionized in water to gives $NH_4^+ + OH^-$, so NH_3 (aq) is in water regarded as weak alkali.** **We can connect a battery with two inert electrodes and put the two inert electrodes inside ammonia solution, and build up the same apparatus with sodium hydroxide.** **Make sure that the concentration, volume, temperature, humidity, battery voltage of the two experimental sets are equal.** **Insert an ammeter in series in both circuit and showing the current.** **You will find out two sets of readings are not the same, the experimental set with lower ammeter readings is ammonia solutions, because it is party ionized in water, the concentration of mobile ions to conduct electricity is less than that in sodium hydroxide, provided that the concentrations are the same.** **Therefore, the current is smaller in ammonia solutions. Label the diagram below for reference:** 

6.		黎 Sir 提提你 : **(a) Substitution reaction.** **(b) Experiment should be carried out under diffuse ultra violet light.** **(c) The colour of the bromine solution changes from brown to colourless.** **(d) The species is called bromine radical which have a single unpaired electron. Therefore, the singe unpaired electron will tends to form bonds with others to become paired electron and stable.** **(e)** **(i) Tetrabromomethane.** **(ii) If excess methane is reacted with limiting bromine under diffuse UV light, more CH_3Br will be formed.**

7.

黎 Sir 提提你 :

(a) Because the oily dirts cannot conduct electricity and so the Cu^{2+} ions cannot gain electrons from the object surface.

(b) A compound which conducts electricity only in aqueous state or in molten state.

(c) Copper (II) ions, Cu^{2+}, sulphate ions, SO_4^{2-}, hydrogen ions, H^+, hydroxide ions, OH^-

(d) It is because copper is in the lower position than hydrogen in electrochemical series. Therefore, copper (II) ions are more readily to gain 2 electrons than hydrogen ions. So, copper (II) ions are preferentially discharged.

(e) $Cu\ (s) \rightarrow Cu^{2+}\ (aq) + 2\ e^-$

(f) No change.

(g) No. of moles of e^- = $\frac{2.28\times10^{22}}{6.02\times10^{23}}$ = 0.03787 mol

By cathode, equation: $Cu^{2+} + 2\ e^- \rightarrow Cu$

No. of moles of copper formed = $\frac{0.03787}{2}$ = 0.018936877 mol

Mass of copper = 0.018936877 x 63.5 = 1.20249 = 1.20 g (3 sig. fig.)

8.

黎 Sir 提提你 :

(a) C_nH_{2n+2}

(b)

(i)

Covalent bond(s) broken	C-H, C-H, C-H, C-H, O=O, O=O
Covalent bond(s) formed	C=O, C=O, H-O, H-O, H-O, H-O

(iii) The total energy absorbed in breaking of covalent bonds is smaller than the total energy released in forming of covalent bonds.

Overall, the energy is released and so it is exothermic reaction.

(iv) $CH_4\ (g) + 2\ O_2\ (g) \rightarrow CO_2\ (g) + 2\ H_2O\ (l)$

$C\ (s) + 2\ H_2\ (g) \rightarrow CH_4\ (g) \quad \triangle H = -74.8\ kJ\ mol^{-1}$

$C\ (s) + 2\ O_2\ (g) \rightarrow CO_2\ (g) \quad \triangle H = -393.5\ kJ\ mol^{-1}$

$H_2\ (g) + \frac{1}{2} O_2\ (g) \rightarrow H_2O\ (g) \quad \triangle H = -285.9\ kJ\ mol^{-1}$

$2\ H_2\ (g) + O_2\ (g) \rightarrow 2\ H_2O\ (g) \quad \triangle H = -571.8\ kJ\ mol^{-1}$

The standard enthalpy change of combustion of methane

$= +74.8 - 393.5 - 285.9 \times 2 = -890.5\ kJ\ mol^{-1}$

(c) Firstly, the hydrocarbon chain of natural gas should be shorter than coal. Upon burning, natural gas produces less sooty flames and less air pollution compared to burning of coal.

Secondly, the sulphur impurities of coal is normally more than that in natural gas, so burning natural gas will not burn the sulphur impurities too much. However, burning coal with sulphur impurities will produce lots of sulphur dioxide and when it further oxidizes to sulphur trioxide.

9.

黎 Sir 提提你 :

(a) Rate of reaction would be faster and so the results can be achieved faster.

(b) After some hydrogen is reacted, the water level inside the inverted measuring cylinder will rise, if the tubing was placed at the uppermost position of the inverted measuring cylinder, the water will not get inside the tubing as it rise, only hydrogen which is insoluble in water and will rise and float above the water surface.

(c) The water level inside the inverted measuring cylinder will rise at first and then stop once all the methyl oleate reacted.

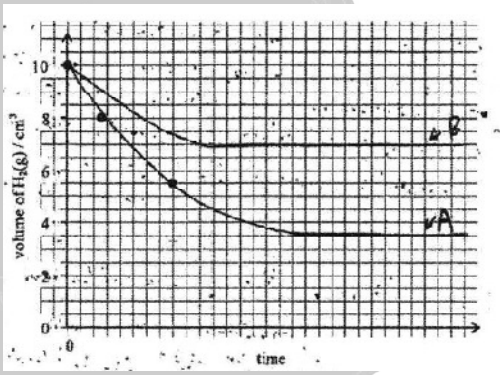
(d) No. of mole of methyl oleate = $\frac{0.080}{296.0}$ = 2.70270 x 10^{-4}

No. of mole of H_2 (g) freezed = 2.70270 x 10^{-4}

Volume of H_2 (g) needed = 2.70270 x 10^{-4} x 24 = 6.486486 x 10^{-3} dm^3

= 0.006486486 dm^3 = 0.0065 dm^3

(e) (i) (ii)

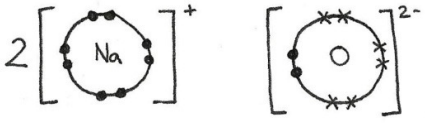


10.

黎 Sir 提提你 :

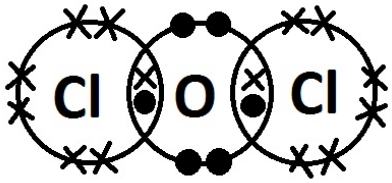
(a)

(i)



Sodium oxide reacts with water to form sodium hydroxide which is alkaline solutions.

(ii)



Cl_2O reacts with water to form hypochlorous acid (HOCl (aq)) which is very weak acid solution. and it will ionizes slightly in water to form hydrogen ions and hypochlorite ions (OCl^-).

(b) Firstly, the oxidation state of transition metals are varying, not fixed.
Like Fe^{2+}, Fe^{3+}, the oxidation state of iron can be +2 or +3.

Secondly, the ions of transition metals usually have colours,
like Fe^{2+} (aq) is green, Fe^{3+} (aq) is yellow.

11.

黎 Sir 提提你 :

(a)

(i) $pH = -\log [H^+ (aq)]$

$7 = -\log [H^+ (aq)]$

$[H^+ (aq)] = 1 \times 10^{-7}$ M

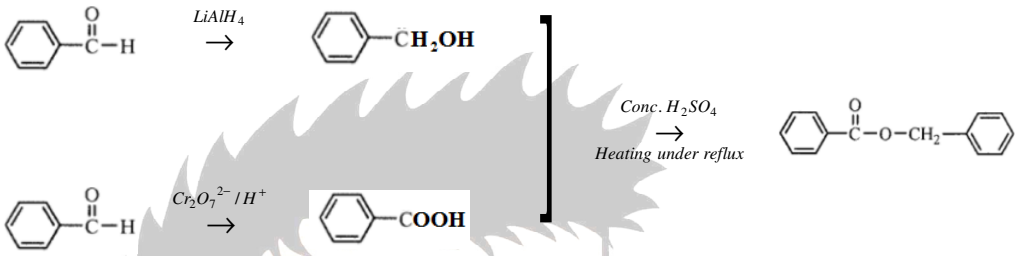
(ii) As $[H^+ (aq)] = [OH^- (aq)]$

$[H^+ (aq)] [OH^- (aq)] = [1 \times 10^{-7}] [1 \times 10^{-7}] = 1 \times 10^{-14}$ mol^2 dm^{-6}

(c) It is because H_2O (l) can only very slightly ionize to become H^+ (aq) and OH^- (aq), so we can consider the [H_2O (l)] as a constant.

(d) The pH of water at 328 K would be less than 7.0.

It is because the forward reaction is endothermic.
Increase in temperature will shift the equilibrium position to the right.
Therefore, the concentration of H^+ (aq) will increase.

12.		**黎 Sir 提提你 :** 
13.		**黎 Sir 提提你 :** • **Chiral Center** • **Non-superimposable mirror image** • **Rotation polarization** • **Effective communication**

The end.

黎 Sir 簡介 Andy Lai BEng CUHK, MIEEE

Mathematics
Economics
Physics

- ✧ 畢業於香港中文大學電子工程學系，黎 Sir 教室創辦人之一.
- ✧ 超過 15 年教授中學文憑 / IB Diploma / GCE / HSC / SAT / AP / GCSE / IGCSE / IB MYP 課程經驗.
- ✧ 與學生面對新中學文憑試, 黎 Sir 親身上陣, 以實力於數學科, 物理科和經濟科奪取 5**,證明寶刀未老.
- ✧ 熟悉出題趨勢，教授考試取分技巧；鼓勵同學獨立思考，增強同學理解能力.
- ✧ 善用生活化例子講解，教法生動，增加學習趣味；深入淺出，明白學生學習上的困難和需要.
- ✧ 精心編制筆記，適合中文和英文中學學生就讀；精心編制練習和試題，協助同學盡快掌握答題技巧.
- ✧ 黎 Sir 在中學和大學時代已是一名傑出學生，曾獲取的多項學業上和運動上的獎學金及獎項.
- ✧ 曾代表香港參加國際性運動比賽，取得優異成績，又讀得又玩得，絕不是死讀書的書呆子.
- ✧ 任教科目：所有數學科，物理科，化學科，生物科，經濟科，商業科.

黎 Sir 教室學生佳績: Excellent Results

- ✧ 首屆香港中學文憑 (HKDSE)，多位學生取得 5/5*/5**級以上佳績. 更有學生考獲 5 科 5**級 2 科 5*級 1 科 5 級優異成績，在全港 72620 考生中，排名 28，入讀港大醫學院.
- ✧ 英國高考 (GCE AS/AL)，多位學生取得 A*/A 最高級別，更有學生考獲 5 科 A*.
- ✧ 國際文憑 (IB Diploma)，多位學生取得 6 / 7 級別，更有學生取得 44/45 總分.
- ✧ 英國會考 (IGCSE / GCSE)，多位學生取得 A / A*成績，更有學生取得 8 科 A*。
- ✧ 加拿大大學預科 (CESI) 數學課程 MCV4U，取得 98 / 100, 99 / 100 成績。
- ✧ 學生成功拔尖 (EAS)，提早入讀港大理學院和中大法律學院.
- ✧ 香港中學會考 (HKCEE)，多位學生取得 20 分以上佳績.
- ✧ 保加利亞國際數學競賽 (BIMC 2013) 隊際賽金牌.
- ✧ 奧數華夏杯/港澳杯/華杯，多位學生取得特等獎/金獎/一等獎/全港第二名.
- ✧ 還有更多，恕不能盡錄，詳情請瀏覽以下網址: www.andylai.hk/result.htm

黎 Sir 教室課程特色:

- ✧ 小組教學 (1 – 6 人)，導師親身教學；照顧每位學生需要，事半功倍.
- ✧ 精心編制筆記，練習以近 30 年本地和外國公開試題為藍本.
- ✧ 概念理解，取分技巧並重；協助同學盡快掌握答題技巧.
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黎 Sir 簡介 *Andy Lai* BEng CUHK, MIEEE

5 Mathematics 5
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Physics 5

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- ✧ 現於黎 Sir 教室任教補習班，學生就讀於英文中學，中文中學，國際學校及英國留學生.
- ✧ 熟悉近年出題趨勢，教授考試取分技巧；鼓勵同學獨立思考，增強同學理解能力.
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- ✧ 黎 Sir 在就讀大學時曾於全球最大美資電腦公司任實習生超過一年，大學畢業後旋即於全港大型英資電腦公司，負責主理該公司所代理的全球大型美資電腦公司儲存系統銷售業務.
- ✧ 於短短半年內將該產品線銷售業績提升超過 50%. 同時更被公司評選為"傑出表現員工 Outstanding Performer"，成功將書本上的知識靈活運用於工作上.
- ✧ 黎 Sir 為了教學理想，毅然辭去工作，全身投入教學事業，希望將自己的一套學習方法教授學生.

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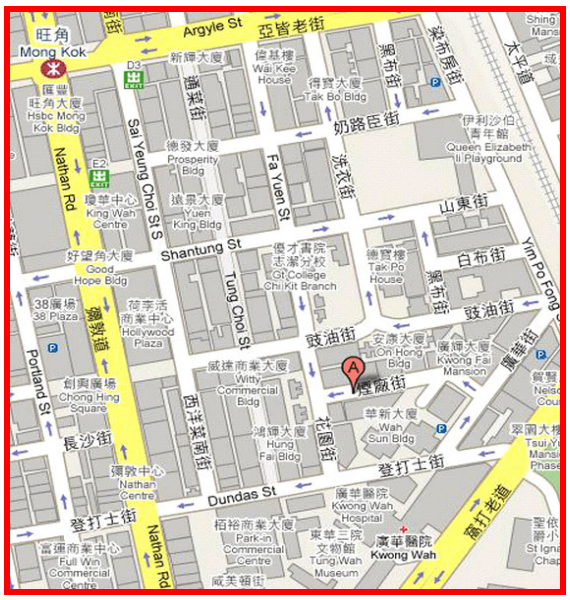

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小巴:	21K, 74, 74S

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