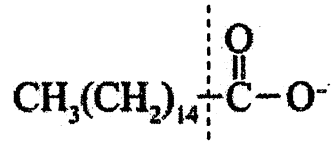
BK9 - *MARKING SCHEME*
SIJIL PELAJARAN MALAYSIA 2015
4541/2 CHEMISTRY *Paper* 2

Section A

1	(a)	(i)	Chemical formula that shows the actual number of atoms of each element that are present in a molecule of the compound		1
		(ii)	Carbon, Oxygen, Nitrogen and Hydrogen		1
		(iii)	$CO(NH_2)_2$.		1
	(b)	(i)	Volume of helium gas = 1 x 24 = 24 dm^3		1
		(ii)	Number of oxygen atom = 1 x 2 x 6.02 $x10^{23}$ = 1.204 x 10^{24}		1
	(c)	(i)	*Reactant* : Magnesium carbonate Products : Magnesium oxide and Carbon dioxide	1 1	...2
		(ii)	<table><tr><th>Substance</th><th>Type of particle</th></tr><tr><td>MgO</td><td>ion</td></tr><tr><td>CO_2</td><td>molecule</td></tr></table>		1
		(iii)	**1 mol** of $MgCO_3$ decompose to produce **1 mol** of MgO and **1 mol** of CO_2		1
			TOTAL		**9**

2	(a)		The vertical columns in the Periodic Table		1
	(b)		Group 1		1
	(c)		19		1
	(d)		2.1		1
	(e)	(i)	Sodium hydroxide and hydrogen		1
		(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$	1+1	...2
		(iii)	2 mol Na → 1 mol H_2 Volume H_2 = 1 × 24 // 24 dm^3	1 1	...2
			TOTAL		**9**

3	(a)	(i)	A		1
		(ii)	Saponification		1
		(iii)	Sodium chloride		1
	(b)	(i)	<table><tr><th>Cleaning agent</th><th>Formation of scum</th><th>Effectiveness as cleaning agent</th></tr><tr><td>A</td><td>**formed**</td><td>**Not effective**</td></tr><tr><td>B</td><td>**not formed**</td><td>**effective**</td></tr></table>	1 1	2
		(ii)	Ca^{2+} / Mg^{2+}		1
	(c)		 Dissolves in oily stain Dissolves in water	1+1	2
	(d)		*Sample answer:* Biological enzyme To clean blood stain	 1 1	 2
			TOTAL		**10**

4	(a)		Electrolyte is a substance which can conduct electricity in molten state / aqueous solution		1
	(b)	(i)	Brown solid is deposited // Becomes thicker		1
		(ii)	$Cu^{2+} + 2e \rightarrow Cu$		1
		(iii)	Electrical to Chemical energy		1
		(iv)	Does not change		1
		(v)	The rate of Cu^{2+} ion discharged at the cathode same with the rate of Cu^{2+} ion formed at the anode. The concentration/ number of Cu^{2+} ion remains unchanged.	1 1	 ...2
	(c)	(i)	*Sample answer:* Sulphuric / Hydrochloric acid [*Any suitable electrolyte*]		1
		(ii)	H^+ ion is discharged to produce hydrogen gas $2H^+ + 2e \rightarrow H_2$	1 1	...2
			TOTAL		**10**

5	(a)		Heat change when H^+ ion combines with OH^- ion to form 1 mol of water.		1
	(b)		$HCl + NaOH \rightarrow NaCl + H_2O$		1
	(c)	(i)	Number of mole of NaOH/HCl $= \frac{2.0 \times 50}{1000}$ // 0.1		1
		(ii)	Heat change = 100 x 4.2 x (41-28) J // 5460 J		1
		(iii)	1 mol H_2O released $\frac{5460}{0.1}$ J // 54600 J Heat of neutralisation, $\Delta H = -54.6$ kJ mol^{-1}		1 1
	(d)		Energy $H^+ + OH^-$ // HCl + NaOH $\Delta H = -54.6$ kJ mol^{-1} H_2O // NaCl + H_2O		3
	(e)	(i)	Less than 54.6 kJ mol^{-1}		1
		(ii)	Heat released is absorbed /used by the **molecule** of ethanoic acid to ionise completely		1
			TOTAL		**11**

6	(a)		Hydrogen gas		1
	(b)		[Label of axes] [Uniformly scale] [Correct plotted and smooth graph]	1 1 1	...3
	(c)		[Draw tangent line at 90 s] [Calculate gradient of the tangent line] [Correct answer: 0.110 – 0.150 cm^3s^{-1}]	1 1 1	...3
	(d)	(i)	Sulphuric acid is a diprotic acid, hydrochloric acid is a monoprotic acid.		1
		(ii)	Number of hydrogen ions per unit volume in sulphuric acid is higher. Frequency of collision between H^+ ions and magnesium atoms become higher. Frequency of effective collision between the particles higher.	1 1 1	...3
			TOTAL		**11**

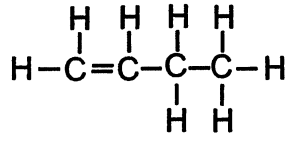
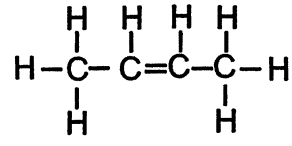
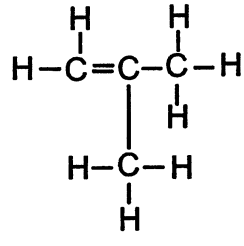
Section B

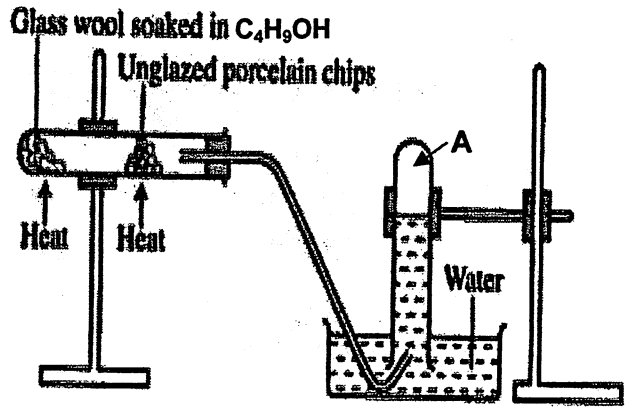
7	(a)		Volume of NaOH = 22.10 , 22.05 , 22.10	1	
			The average volume of NaOH = $\frac{22.10 + 22.05 + 22.10}{3}$ // $= 22.08\ cm^3$	1	
			$NaOH + HCl \rightarrow NaCl + H_2O$	1+1	
			Number of moles of NaOH = $\frac{0.1 \times 22.08}{1000}$ // 0.002 mol	1	
			1 mol of NaOH → 1 mol of HCl // 0.002 mol of NaOH→ 0.002 mol of HCl	1	
			Concentration of HCl = $\frac{0.002 \times 1000}{25}$ // 0.08 mol dm^{-3}	1	...7
	(b)		Hydrochloric acid ionises completely in water to produce hydrogen ions // Hydrochloric acid is a strong acid.	1	
			Ethanoic acid ionises partially in water to produce hydrogen ion // Ethanoic acid is a weak acid.	1	
			The concentration of hydrogen ions in hydrochloric acid higher than in ethanoic acid.	1	
			The higher the concentration of hydrogen ions the lower the pH value.	1	...4
	(c)	(i)	W : Sulphuric acid	1	
			X : Ammonia	1	
			Y : Ethanoic acid	1	...3
		(ii)	Ammonium sulphate	1	
			Fertiliser	1	
			$H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$	1+1	...4
		(iii)			

	Substance W	Substance Y
Basicity	Diprotic	Monoprotic
Strength of acid	Strong acid	Weak acid

1 1 ...2

TOTAL **20**

8	(a)	(i)	*Saturated hydrocarbon* : X Contains only single covalent bond between carbon atoms // C - C single covalent bond *Unsaturated hydrocarbon* : Y Contains at least one double covalent bond between carbon atoms // C = C double covalent bond	1 1 1 1	...4
		(iii)	Percentage of carbon by mass per molecule of hydrocarbon Y is higher. *Calculation* : $\%\text{ of C in Y} = \frac{4(12)}{4(12)+8(1)} \times 100$ $= \mathbf{85.71}\ \%$ $\%\text{ of C in X} = \frac{4(12)}{4(12)+10(1)} \times 100$ $= \mathbf{82.76}\ \%$	1 1	...2
		(iii)	[*Any one structural formula of the isomers*] [Correct structural formula] [Correct name] *Answer* :  But-1-ene  But-2-ene  Methylpropene	1 1	...2
		(iv)	Hydrogenation // Addition of hydrogen Temperature : 180 °C Catalyst : Nickel // Platinum $C_4H_8 + H_2 \rightarrow C_4H_{10}$	1 1 1 1	...4

	(b)	(i)	A : Butene B : Ethanoic acid Process II : Esterification	1 1 1	...3
		(ii)	*Chemical equation* : Process I : $C_4H_8 + H_2O \rightarrow C_4H_9OH$	 1+1	...2
		(iii)	*Diagram*:  [*Functional diagram*] [*Labels*] Chemical equation: $C_4H_9OH \rightarrow C_4H_8 + H_2O$	 1 1 1	...3
			TOTAL		**20**

Section C

9		(a)	Add baking powder/sodium bicarbonate/bicarbonate soda. Baking powder produce carbon dioxide gas Add Ammonium nitrate//lime stone Fertilise//neutralise alkaline soil	1 1 1 1	...4
		(b)	Salt P = Lead(II) carbonate Residue X = PbO Gas Y = CO_2 Acid M = HNO_3 $PbO + 2HNO_3 \rightarrow Pb(NO_3)_2 + H_2O$	1 1 1 1 1+1	...6
		(c)	1. Salt A = $Ba(NO_3)_2$ 2. Salt B = Na_2SO_4 // K_2SO_4 3. [*Apparatus* : beaker, filter funnel, filter paper] 4. Pour [20-100] cm^3 of [0.1-2.0] mol dm^{-3} Barium nitrate solution into a beaker. 5. Add [20-100] cm^3 of [0.1-2.0] mol dm^{-3} sodium sulphate solution. 6. Stir the mixture. 7. Filter. 8. Rinse the residue with **distilled water**. $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$ 9. [*Formula of reactants*] 10. [*Formula of products*]	1 1 1 1 1 1 1 1 1 1	...10
			TOTAL		**20**

10	(a)		A Sea water contain salt Salt is an electrolyte	1 1 1	...3
	(b)		*Sample answer:* A : Bromine/chlorine water // acidified $KMnO_4$ solution B : Zinc Fe^{2+} undergo oxidation reaction because release electron. Bromine water undergo reduction because gain electron $Fe^{3+} + e \rightarrow Fe^{2+}$ $Zn \rightarrow Zn^{2+} + 2e$ Yellow/brown solution to green	 1 1 1 1 1 1 1	...7
	(c)		*Sample answer :* *Oxidising agent* : Acidified potassium manganate(VII) solution / [*any other suitable oxidizing agent*] *Reducing agent* : Iron(II) solution / [*any other suitable reducing agent*] *Procedure*: 1. Pour dilute sulphuric acid into a U-tube. 2. Using a dropper/add slowly iron(II) sulphate solution into the U-tube and acidified potassium manganate(VII) solution at the another arm of the U-tube. 3. Put carbon electrode in each side of the arm of the U-tube. 4. Connect the electrodes to a galvanometer by using connecting wires // Complete the external circuit. 5. Record the observation. *Observation*: The green colour of iron(II) solution turns to brown. The purple colour of acidified potassium manganate(VII) change to colourless. [*Diagram*]	 1 1 1 1 1 1 1 1 1 1+1	***Max*** 10
				TOTAL	**20**

END OF MARKING SCHEME