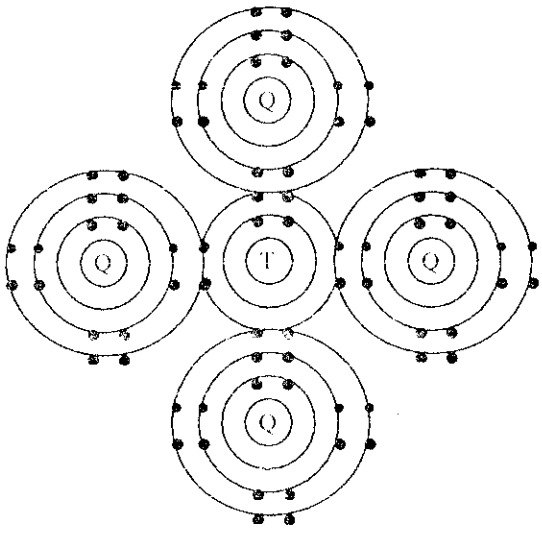
JABATAN PELAJARAN NEGERI SELANGOR

PROGRAM PENINGKATAN PRESTASI SAINS & MATEMATIK 2009

JAWAPAN KIMIA 2
Section A

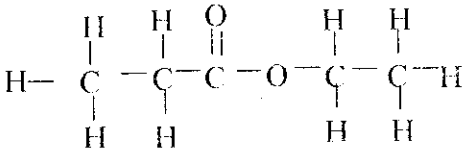
<table>
<tr><td>1</td><td>(a)</td><td></td><td>[able to state the defination correctly]
Empirical formula shows the simplest ratio of atom of each element in a compound.</td><td>1</td><td>.....1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>[able to state the apparatus correctly]
Crucible</td><td>1</td><td>.....1</td></tr>
<tr><td></td><td>(c)</td><td></td><td>[able to name a correct metal and to explain]
magnesium / aluminium / calcium
It is reactive towards oxygen gas</td><td>1
1</td><td>.....2</td></tr>
<tr><td></td><td>(d)</td><td></td><td>[able to list two precautions correctly]
1. Metal M strip is polished with sandpaper.
2. The crucible lid is opened and closed at interval.
3. The heating, cooling and weighing process is repeated until the crucible and its content show a constant mass
(Any two answer)</td><td>1
1
1</td><td>.....2</td></tr>
<tr><td></td><td>(e)</td><td></td><td>[able to show the calculation correctly]
<table>
<tr><td>Element</td><td>M</td><td>O</td></tr>
<tr><td>Mass,g</td><td>29.45 – 24.05 = 5.4</td><td>34.25 – 29.45 = 4.8</td></tr>
<tr><td>Number of mol</td><td>$\frac{5.4}{27}$ = 0.2</td><td>$\frac{4.8}{16}$ = 0.3</td></tr>
<tr><td>Mol ratio</td><td>2</td><td>3</td></tr>
</table>
Empirical formula of metal M oxide is M_2O_3</td><td>1
1
1</td><td>.....3</td></tr>
<tr><td></td><td></td><td></td><td>TOTAL</td><td></td><td>.....9</td></tr>
</table>

2	(a)		*[Able to state the meaning of an element correctly]* Example : Substance that cannot be broken down into simpler substances physically or chemically	1	1
	(b)	(i)	*[Able to state the number of valence electrons in atom Q]* Example: seven / 7	1	
		(ii)	*[Able to write the electron arrangement of atom Q correctly]* Example:2.8.7	1	2
	(c)	(i)	*[Able to write the formula of ion P]* Example : P^{-}	1	
		(ii)	*[Able to state the element which will formed an ionic compound with P correctly]* Example: Q	1	
		(iii)	*[Able to write the chemical formula of the compound correctly]* Example: PQ	1	3
	(d)		*[Able to state why the reason correctly]* Example: Element U is not reactive // does not cause explosion	1	1
	(e)	(i)	*[Able to draw the electron arrangement correctly]*  1 st mark: - showing the sharing of electrons and correct number of electrons in each shell 2 nd mark – correct label and correct number of electron pairs being shared	1 1	2

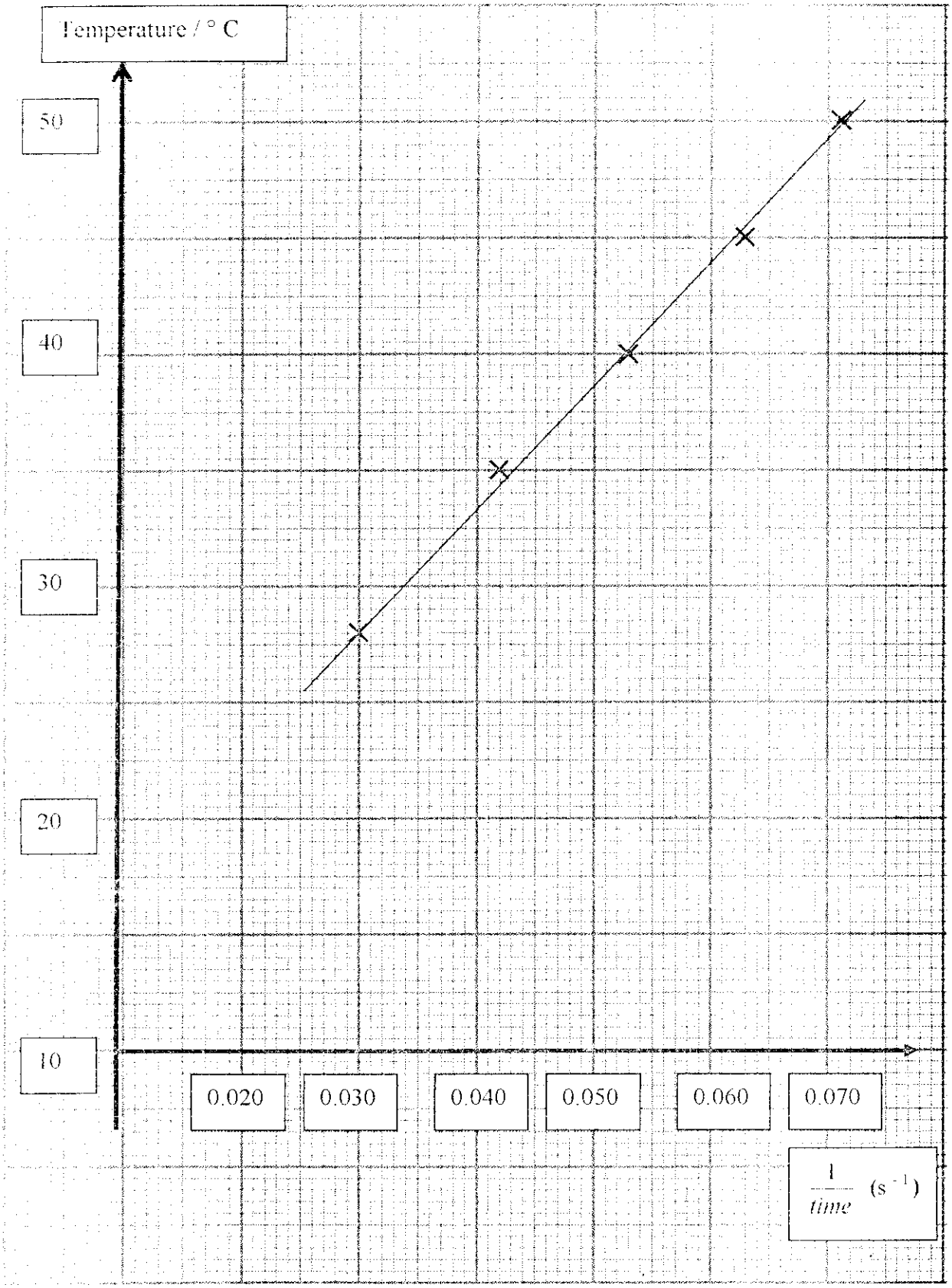
		(ii)	*[Able to state one physical properties of compound]* Example: low melting point & boiling point // does not conduct electricity // insoluble in water // soluble in organic solvants	1	1
			TOTAL		10

3	(a)	(i)	*[Able to name salt X correctly]* Ammonium sulphate	1	1
		(ii)	*[Able to write the balanced equation correctly]* $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$	1	1
		(iii)	*[Able to show the calculation correctly]* $\frac{M_a V_a}{M_b V_b} = \frac{1}{2}$ $\frac{1.0 \times V_a}{1.0 \times 25} = \frac{1}{2}$ $V_a = 12.5\ cm^3$	1 1	2
		(iv)	*[Able to describe the next step correctly]* Add 12.5 cm^3 of sulphuric acid to 25 cm^3 of 0.5 mol dm^{-3} ammonia solution without phenolphthalein.	1	1
		(v)	*[Able to state the name of the method correctly]* Crystallisation	1	1
	(b)	(i)	*[Able to name salt Y correctly]* Copper(II) chloride	1	1
		(ii)	*[Able to state two observations correctly]* Gas bubbles are produced The white solid dissolves Blue solution is formed } Any two answers	2	2
		(iii)	*[Able to state the reason of copper (II) carbonate is added in excess]* So that all the hydrochloric acid reacts completely	1	1
		(iv)	*[Able to name the type of reaction correctly]* Double decomposition	1	1
			TOTAL		11

4	(a)	(i)	*[able to state the change in oxidation number correctly]* Example: Change in oxidation number : – 3 to 0	 1	
		(ii)	*[Able to state the type of reaction correctly]* Example : Oxidation	 1	 2
	(b)	(i)	*[able to compare reaction using bromine and chlorine gas correctly]* Example: Reaction using chlorine gas is more reactive	 1	
		(ii)	*[able to explain the difference correctly]* Example: Size of chlorine atom is smaller than that of bromine atom The force of attraction between the nucleus and the valence electron is stronger in the chlorine atom	 1 1	3
	(c)	(i)	*[able to state the role of bromine]* Example: As an oxidizing agent	 1	
		(ii)	*[able to explain thefunction of bromine]* Example : oxidation number of bromine reduces from 0 to – 1 // bromine accepts electrons from Fe^{2+} ions	 1	2
	(d)		*[able to give a test to show that reaction has occurred]* Example : Aqueous sodium hydroxide / aqueous ammonia / potassium thiocyanide solution is added to the product Brown precipitate/blood red solution is formed	 1 1	2
	(e)		[able to give the observation for the tetrachloromethane layer] Example : The tetrachloromethane layer turns purple colour	 1	1
			TOTAL		10

5	(a)	(i)	*[able to state the general formula correctly]* C_nH_{2n} ; n=1,2,3,4.....	1	
		(ii)	*[able to state name and molecular formula of compound correctly]* Propane. C_3H_8	1	
		(iii)	*[able to explain the boiling point increase as the number of carbon atom increases per molecule]* The size of the molecule increase / bigger More heat is required to overcome the stronger attraction force between molecules	1 1	4
	(b)		*[able to state the reaction]* Hydrogenation // Addition reaction	1	1
	(c)	(i)	*[able to state the catalyst used in the experiment]]* Phosphoric acid // concentrated sulphuric acid	1	
		(ii)	*[able to write a balanced chemical equation]* $C_2H_4 + H_2O \rightarrow C_2H_5OH$	1	2
	(d)	(i)	*[able to state the function of concentrated sulphuric acid]* As a catalyst // dehydrating agent	1	1
		(ii)	*[able to state of substance K]* propanoic acid	1	1
		(iii)	*[able to draw the structural formula of substance X correctly]* 	1	1
			TOTAL		10

6	(a)		[able to state the colour of sulphur correctly] Example: Light Yellow / *kuning muda*	1	1
	(b)		[able to explain how to measure a fixed quantity of sulphur produced correctly] Example: 1. A piece of white paper marked 'X' was placed under the conical flask 2. The time taken for enough sulphur to produce and cover the mark 'X' until it disappear from sightis measured	1 1	2
	(c)	(i)	[able to calculate the $\frac{1}{time}$ correctly] Example: $\frac{1}{time}$ (s^{-1}) | 0.030 | 0.042 | 0.053 | 0.063 | 0.071 $\frac{1}{masa}$ (s^{-1})	1	1
		(ii)	[able to draw the graph correctly] 1. both axes are labelled correctly with units and all 5 points transferred correctly 2. A straight line is drawn.	1 1	2
	(d)	(i)	[able to state the relationship correctly] Example: When the temperature increases, the rate of reaction increases	1	1
		(ii)	[able to explain using the collision theory] Example: 1. Increase in temperature increases the kinetic energy of thiosulphate ions / particles // Thiosulphate ions move faster 2. Frequency of collision between thiosulphate ions and hydrogen ions increases. 3. Frequency of effective collision increases	1 1 1	3
TOTAL					10


Temperature / ° C
50
40
30
20
10
0.020
0.030
0.040
0.050
0.060
0.070
$\frac{1}{time}$ (s^{-1})

Section B

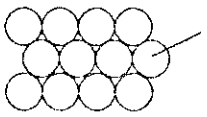
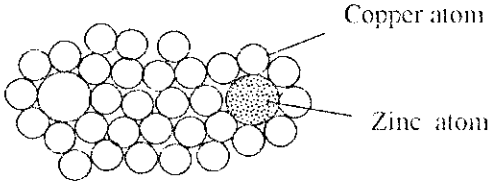
7	(a)		*[able to give the definition correctly]* The heat released when 1 mole of the substance is burnt completely in excess oxygen to produce carbon dioxide and water.	1	1
	(b)	(i)	*[able to write a balanced equation correctly]* $2\ C_3H_7OH + 9O_2 \rightarrow 6\ CO_2 + 8\ H_2O$	1	
		(ii)	Number of moles of $C_3H_7OH = \frac{0.6}{60} = 0.010$ mol 2 mol of C_3H_7OH releases 6 mol of CO_2. 0.010 mol C_3H_7OH releases $\frac{6}{2} \times 0.010$ mol of CO_2 $\therefore 0.030 \times 24\,000 cm^3 = 720 cm^3$ // 0.72 dm^3 of CO_2	1 1	
		(iii)	Heat that is releases = 0.010×2017 kJ = 20.17 kJ/ 10085 J	1 1	5
	(c)	(i)	*[Able to give the following information]* 1. The reaction between lead(II) nitrate and sodium chloride produces lead(II) chloride and sodium nitrate as represented by the equation $Pb(NO_3)_2 + 2NaCl \rightarrow PbCl_2 + 2NaNO_3 \quad \Delta H_1$ 2. The reaction between lead(II) nitrate and potassium chloride produces lead(II) chloride and potassium nitrate as represented by the equation $Pb(NO_3)_2 + 2KCl \rightarrow PbCl_2 + 2KNO_3 \quad \Delta H_2$ 3. In both reaction, the heat released is due to the formation of 1 mol of lead(II) chloride. 4. $Pb^{2+} + 2Cl^- \rightarrow PbCl_2$ 5. Sodium chloride and potassium chloride are soluble salts // Na^+, K^+ and NO_3^- are observer ions does not take part in the reaction and 6. do not contribute to the heat of precipitation of lead(II) chloride.	1 1 1 1 1 1	6

	(c)	(ii)	1.	Neutralisation is a reaction between hydrogen ions and hydroxide ions to form 1 mol of water.	1	
			2.	$H^+ + OH^- \rightarrow H_2O \quad \Delta H = -57.4 kJmol^{-1}$	1	
			3.	Hydrochloric acid is a strong acid // undergo complete ionization in water to produce hydrogen ions	1	
			4.	Sodium hydroxide is a strong alkali // undergo complete ionization in water to produce OH^- ion	1	
			5.	Formation of 1 mol of water produces $57.4 kJmol^{-1}$	1	
			6.	Ethanoic acid is a weak acid // undergo partial ionization in water to produce hydrogen ions	1	
			7.	Heat energy is absorbed to dissociate the ethanoic acid molecules	1	
			8.	Thus, the heat of neutralisation between ethanoic acid and sodium hydroxide ions is less than that of between hydrochloric acid and sodium hydroxide.	1	8
				TOTAL		20

8	(a)	(i)	*[able to give the difference between the two cell and to give the reason for the modification]* 1. In the simple cell in Diagram 8.1. the zinc electrode is in contact with copper(II) sulphate solution 2. In the modified cell in Diagram 8.2 the two electrodes are immersed in their aqueous salt solutions in separate beakers, connected by salt bridge 3. In the simple cell in diagram 8.1, displacement reaction takes place// The voltage will decrease rapidly 4. In the modified cell in diagram 8.2. displacement reaction does not take place// voltage is maintained	1 1 1 1	4
		(ii)	[able to explain how the cell works] 1. Zinc is placed higher than copper in the Electrochemical Series // Zinc is at a higher position 2. Zinc has a higher tendency to donate electrons than copper 3. Zinc atom loses 2 electrons to form zinc ion 4. $Zn \rightarrow Zn^{2+} + 2e$ 5. The electrons flow through the wire ,producing a flows of electricity 6. detected by the deflection of a voltmeter needle// lighting up of a bulb 7. the electrons are received by copper ions to form copper atoms 8. $Cu^{2+} + 2e \rightarrow Cu$ 9. $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$	1 1 1 1 1 1 1 1 1	 9
	(b)	(i)	- purification of impure metal - production of chemical substances - extraction of reactive metals } Any 2	1 1	 2

		(ii)	1. the ring is clean with sand paper	1	
			2. a small current is used	1	
			3. the ring is rotated slowly while electroplating	1	
			4. at cathode : $Ag^{+} + e \rightarrow Ag$	1	
			5. at anode : $Ag \rightarrow Ag^{+} + e$	1	 5
			TOTAL		20

Section C

9	(a)	(i)	$2SO_2 + O_2 \rightarrow 2SO_3$ $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ $H_2S_2O_7 + H_2O \rightarrow 2\,H_2SO_4$	1 1 1	3
		(ii)	Temperature of the reaction in Stage II is 450-550 °C The pressure required is 1 atmosphere Vanadium(V) oxide is used as a catalyst	1 1 1	3
		(iii)	SO_3 has a very low solubility in water When SO_3 dissolves in water, a lot of heat is produced.	1 1	2
	(b)	(i)	A composite material is a structural materials made from two or more constituent materials with different properties.	1	1
		(ii)	1. Fibre glass is made from long glass fibres mixed with plastic resin as the binding material. 2. Glass is hard, strong but relatively brittle. 3. Plastic is light, flexible but not strong. 4. Fibre glass is strong, light and flexible.	1 1 1 1	4
	(c)		Pure copper  • The atoms are of the same size and arranged in an orderly manner • The layers of atoms slide over one another easily when a force is applied Brass  	1 1 1 1	

			• The copper atoms and zinc atoms in its lattice structure. • The presence of zinc atoms of different size disrupts the orderly arrangement of the copper atoms in brass • This makes it difficult for the layers of atoms to slide over one another when a force is applied.	1 1 1	7
			TOTAL		20

10	(a)		*[Able to explain the difference in the observation correctly]*		
			Example:		
			1. Hydrogen chloride does not ionize in tetrachloromethane	1	
			2. Hydrogen chloride exists as molecules in tetrachloromethane	1	
			3. Hydrogen ions are not present to react with magnesium	1	
			4. Hydrogen chloride ionizes in water to form hydrogen ion	1	
			5. Hydrogen ion in water react with magnesium	1	
			6. to produce hydrogen gas	1	
			7. $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$	1	7
	(b)		*[Able to describe two chemical test correctly]*		
			Example:		
			Test I: Reaction with zinc // any reactive metal		
			1. Put 0.5g – 2 g // a little zinc granules into a test tube containing 2 cm^3 – 10 cm^3 of solution X	1	
			2. Gas bubbles are given off	1	
			3 Place a lighted wooden splinter at the mouth of the test tube	1	
			4. The gas is hydrogen if a 'pop' sound is produced	1	
			5. $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$	1	
			Test II: Reaction with calcium carbonate // any metal carbonate		
			6. Put 0.5g – 2 g of calcium carbonate into a test tube containing 2 cm^3 – 10 cm^3 of solution X	1	
			7. Gas bubbles are given off	1	
			8. Pass the gas through limewater	1	
			9. If lime water turns chalky, the gas is carbon dioxide	1	
			10. $CO_3^{2-} + 2H^+ \rightarrow CO_2 + H_2O$	1	10
		(ii)	[Able to explain the use of a hair conditioner correctly]		
			Example:		
			1. Hair conditioner contains a mild acid // hydrogen ions	1	
			2. The alkali in shampoo is neutralized by acid // hydrogen ions in a hair conditioner	1	
			3. This leaves the hair shiny // oil is restored in neutral hair	1	3
			TOTAL		20