PENTAKSIRAN DIAGNOSTIK AKADEMIK SBP 2014
SIJIL PELAJARAN MALAYSIA

PERATURAN PEMARKAHAN

CHEMISTRY
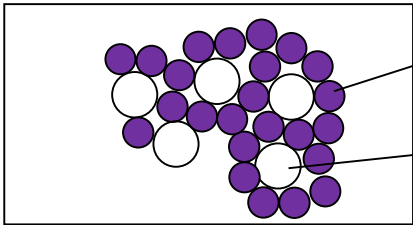4541

PENTAKSIRAN DIAGNOSTIK AKADEMIK SBP 2014
SKEMA KERTAS 1
CHEMISTRY 4541/1

1	C	26	C
2	C	27	C
3	C	28	B
4	D	29	D
5	D	30	D
6	C	31	A
7	D	32	A
8	A	33	B
9	D	34	B
10	C	35	D
11	D	36	D
12	D	37	A
13	A	38	D
14	A	39	B
15	B	40	C
16	A	41	C
17	D	42	A
18	C	43	B
19	C	44	B
20	A	45	B
21	B	46	D
22	A	47	A
23	B	48	C
24	B	49	C
25	B	50	A

SECTION A
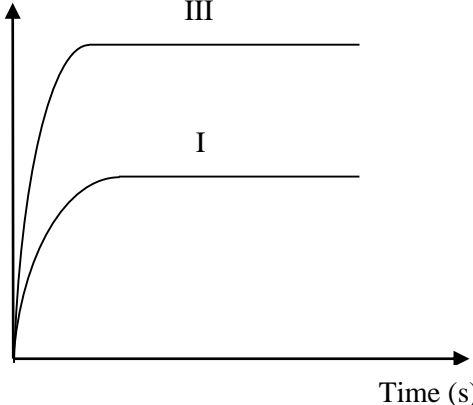
Question			Mark scheme	Sub Mark	Total Mark
1	(a)		Electron	1	1
	(b)		2.8	1	1
	(c)	(i)	• The atomic size of potassium is bigger	1	
			• The attraction force between nucleus/proton and electron is weaker	1	
			• Easier to donate valence electron	1	3
		(ii)	• Potassium moves very fast/ rapidly on the surface of water	1	
			• Burns with reddish purple/ lilac flame	1	
			• Produce hiss/pop sound	1	2
			Any two		
	(d)	(i)	Atoms of the same element which have the same number of proton (proton number) but different number of neutrons (nucleon number)	1	1
		(ii)	To detect the leakage of underground pipes	1	1
			TOTAL		**9**

Question			Mark scheme	Sub Mark	Total Mark
2	(a)	(i)	n = 12	1	
			A = Carbon-12 / C-12	1	2
		(ii)	$0.5 \times 6.02 \times 10^{23} \times 5$	1	
			$= 1.505 \times 10^{24}$	1	2
	(b)	(i)	To allow oxygen to enter the crucible	1	1
		(ii)	Lead is less reactive metal towards oxygen// lead react slowly with oxygen	1	1
	(c)	(i)	Number of mol $CuCO_3 = \dfrac{6.2}{64 + 12 + 16(3)} = \dfrac{6.2}{124} = 0.05$	1	
			1 mol $CuCO_3$: 1 mol CO_2		
			0.05 mol $CuCO_3$: 0.05 mol CO_2	1	
			Volume of CO_2 gas = $0.05 \times 24 / 1.2$ dm^3	1	3
			TOTAL		**9**

Question			Mark scheme	Sub Mark	Total Mark
3	a	i	Bronze	1	1
		ii	• *Correct label* • *Size of atoms Cu smaller than atom Sn*	1 1	2
		iii	To increase the hardness/strength of pure metal	1	1
		iv	Light Withstand high pressure/ strong	1 1	2
3	b	i	Saponification *r: wrong spelling*	1	1
		ii	Palm/ olive/ sunflower **oil** **concentrated** sodium /potassium hydroxide solution.	1 1	2
		iii	To reduce the solubility of soap in water// To precipitate out soap	1	1
			Total		**10**

Question			Mark scheme	Sub Mark	Total Mark
4	a)	i)	Oxidation number of iron = +3	1	1
		ii)	Carbon	1	1
		iii)	Reducing agent	1	1
		iv)	$2Fe_2O_3 + 3C \longrightarrow 4Fe + 3CO_2$ // $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$ *1 – correct formula for reactant and product* *2 - balanced chemical equation*	1 + 1	2
	b)	i)	Brown colour	1	1
		ii)	Bromine	1	1
		iii)	0 to -1	1	1
		iv)	Reduction	1	1
		v)	Acidified potassium manganate(VII) solution // Acidified potassium dichromate (VI) solution	1	1
			Total		**10**

Question			Explanation	Mark	Σ Mark
5	a)	i)	Molecule	1	**1**
		ii)	Test tube P	1	
			Hydrogen ion is not present/ ethanoic acid exists as molecule	1	**2**
			R : water is not present		
	b)		X = 0.005	1	
			• Sulpuric acid is a diprotic acid while hidrochloric acid is a monoprotic acid	1	
			• Double concentration of hydrogen ion	1	**3**
	c)	i)	Hydrogen chloride	1	**1**
			Reject: Hydrochloric acid		
		ii)	Acidic	1	**1**
		iii)	Procedure:		
			Add distilled water	1	
			Add silver nitrate solution	1	
			Observation:	1	
			A white precipitate formed		**3**
			Total		**11**

Question		Mark scheme	Sub Mark	Total Mark
6	(a)	$Zn + 2H^+ \rightarrow Zn^{2+} + H_2$	1+1	2
	(b)	Temperature and concentration	1+1	2
	(c)	1. The rate of reaction in Experiment II is higher than Experiment I 2. The temperature in experiment II is higher 3. The kinetic energy of hydrogen ions is higher 4. The frequency of collision between **zinc atoms and hydrogen ions** is higher// The frequency of effective collision between **zinc atoms and hydrogen ions** is higher	1 1 1 1	4
	(d)	 • *Correct curve which shows the volume is double*	1	1
	(e)	1. Cut the meat into smaller size 2. Larger total surface area of meat will absorb more heat OR 1. Cook in pressure cooker 2. High pressure in pressure cooker increase the temperature	1 1 1 1	2
		TOTAL		11

Section B (20 marks)
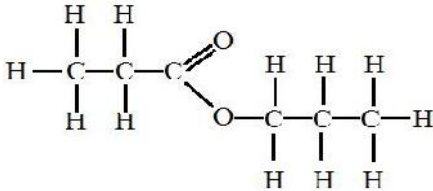
Question		Rubric		Marks	Total Mark
7(a)	(i)	1. Heat change $= mc\theta$ $= 100 \times 4.2 \times 6.5$ // 2730 Joule// 2.73 kJ		1	
		2. Number of mol of water $= \dfrac{1 \times 50}{1000} = 0.05 mol$		1	
		3. Heat of neutralisation $= \dfrac{2730}{0.05}$ // $\dfrac{2.73}{0.05}$		1	
		$= -54600 Jmol^{-1}$ // $-54.6 kJmol^{-1}$		1	**4**
	(ii)	1. 6.5°C // same.		1	
		2. Potassium hydroxide and sodium hydroxide are strong alkali// Both alkali are ionize completely in water// Number of moles of hydroxide ion in both alkali is the same		1	**2**
7(b)	(i)	Example of reaction: Set 1: Neutralization between acid and alkali// combustion ethanol/ alkane/ alkene// precipitation of silver chloride/ lead(II) chloride // any suitable reaction.		1	
		Set 2: Decomposition of carbonate/ nitrate salts // dissolving ammonium salts in water// any suitable reaction		1	**2**
	(ii)		**Set I**	**Set II**	1+1	
		Type of reaction	Exothemic reaction// heat is released to surrounding.	Endothermic reaction // Heat is absorbed from surrounding.		
		Temperature change	Temperature of the mixture increases.	Temperature of the mixture decreases.	1+1	
		Energy content	The total energy content of reactants is higher than products.	The total energy content of reactants is lower than products.	1+1	
		Energy change	Chemical energy to heat energy.	Heat energy to chemical energy.	1+1	**8**
7(c)		1. Heat of combustion of butanol is higher than propanol.		1	
		2. The number of carbon atom per molecule of butanol is higher/ greater than propanol.		1	
		3. The number of carbon dioxide and water molecules formed is higher/ greater.		1	
		4. More heat energy is released.		1	**4**
		Total		**20**	

Question		Rubric	Marks	Total marks
8(a)	(i)	Group 17	1	
		Atom has 7 valence electrons	1	
		Period 2	1	
		Atom has 2 shells filled with electrons	1	**4**
	(ii)	$2Fe + 3B_2 \rightarrow 2FeB_3$ // $2Fe + 3Cl_2 \rightarrow 2\ FeCl_3$		
		Correct formula of reactants and product	1	
		Balanced equation	1	**2**
	(iii)	1. Element A more reactive than element B	1	
		2. Atomic size A is smaller than B	1	
		3. The nucleus force of attraction toward electrons become stronger// The attraction forces between proton and electrons become stronger	1	
		4. Easier to receive electrons	1	**4**
8(b)	(i)	1. Hydrogen atom has an electron arrangement of 1.	1	
		2. Nitrogen atom has an electron arrangement of 2.5.	1	
		3. Hydrogen and nitrogen atoms share electrons to achieve stable duplet/ octet electron arrangement.	1	
		4. One hydrogen atom contributes one electron for sharing,	1	
		5. One nitrogen atom contributes three electrons for sharing.	1	
		6. One nitrogen atom share electrons with three hydrogen atoms.	1	**6**
		[*Sample of answer:* **One nitrogen atom** *contributes* **three valence electrons❸**, *while three* **hydrogen atoms**, *each contributes* **one valence electron❹** *to be* **shared❺** *to achieve stable electron arrangement* **❻**]		
	(ii)	1. Boiling point of ammonia is lower than the room temperature// ammonia has low boiling point.	1	
		2. Ammonia exists as molecule// covalent compound.	1	
		3. Weak intermolecular/ Van der Waals forces between molecules.	1	
		4. Little/ less heat energy needed to overcome the force.	1	**4**
		Total		**20**

Section C (20 marks)

Question		Rubric	Marks	Total marks
9(a)		Cathode : Pure copper	1	
		Electrolyte : Copper(II) sulphate/ nitrate/ chloride solution	1	
		half equation at anode: $Cu \rightarrow Cu^{2+} + 2e^-$	1	
		half equation at cathode: $Cu^{2+} + 2e^- \rightarrow Cu$	1	**4**
9(b)	(i)	X: Aluminium/ magnesium/ zinc / iron / tin/ lead [*Reject : sodium /potassium*]	1	
		Reason: X is more electropositive than copper// X is located higher than copper in Electrochemical Series.	1	
		Y: Silver/ aurum (gold)	1	
		Reason: Y is less electropositive than copper// Y is located lower than copper in Electrochemical Series.	1	**4**
	(ii)	Voltage of the cell is 2.2 V	1	
		Negative terminal is X.	1	**2**
9(c)		**Procedure:** 1. Metal strips are **cleaned** with sandpaper.	1	
		2. [2 - 5] cm^3 of each nitrate solution are **poured** into four separate test tubes.	1	
		3. A strip of metal P is **placed** into each of the solutions.	1	
		4. **Observations** on the deposition of metals are **recorded**.	1	
		5. Steps 1 to 4 are **repeated** using strip metals Q, R and S to replace strip metal P.	1	

Result:

Salt solution / Metal strip	Nitrate solution P	Nitrate solution Q	Nitrate solution R	Nitrate solution S
P		√	√	√
Q	X		√	√
R	X	X		√
S	X	X	X	

√: Deposition of metal occurs
X: No deposition of metal occurs

Explanation:
6. Metal P can displace metals Q, R and S from their salt solutions. Thus, P is placed at the highest position in the electrochemical series.
7. Metal Q can only displace metals R and S from their salt solutions. Thus, metal Q is placed higher than metals R and S but lower than metal P in the electrochemical series.
8. Metal R can only displace metal S from its salt solution. Thus, metal R is placed higher than metal S but lower than metals P and Q in the electrochemical series.
9. Metal S cannot displace any metals from their salt solutions because it is placed at the lowest position in the electrochemical series.

			Marks	Total marks
			1	
			1	
			1	
			1	
			1	10
		Total		**20**

Question		Rubric	Marks	Total marks
10(a)		Chemical equation: $C_3H_7OH + \dfrac{9}{2}O_2 \rightarrow 3CO_2 + 4H_2O$ // Chemical equation: $2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$ *Correct formula of reactants and product* *Balanced equation* Volume of gas X 1. Based on equation; $\dfrac{9}{2}$ mol O_2 : 3 mol CO_2 0.3 mol O_2 : 0.2 mol CO_2 2. Volume of CO_2 = 0.2 x 24 = 4.8dm³ //4800cm³	 1 1 1 1	4
10(b)		Structural formula of ester C Name: propyl propanoate <table><tr><td></td><td>Propanol</td><td>Ester C</td></tr><tr><td>Functional Group</td><td>Hydroxyl / -OH</td><td>Carboxylate/ -COO</td></tr><tr><td>Solubility in water</td><td>Soluble in water</td><td>Insoluble in water</td></tr></table>	1 1 1+1 1+1	6
10(c)		**Apparatus**: test tubes, dropper. **Materials**: bromine water // acidified potassium manganate (VII) solution, hexane, hexane. **Procedure:** 1. [2 – 5] cm³ of liquid in bottle P is poured into a test tube. 2. 2 cm³/ A few drop of bromine water// acidified potassium manganate(VII) solution is added to the test tube. 3. The mixture is shaken. 4. Any changes is observed and recorded. 5. Steps 1 to 4 are repeated by using the liquid in bottle Q to replace the liquid in bottle P. **Observation:** <table><tr><th>Set</th><th>Observation</th></tr><tr><td>**Liquid in bottle P**</td><td>Brown bromine water decolourised // purple acidified potassium manganate(VII) solution decolourised.</td></tr><tr><td>**Liquid in bottle Q**</td><td>No change.</td></tr></table> Liquid in bottle P is hexene. Liquid in bottle Q is hexane. [*a: P is hexene, Q is hexane*]	1 1 1 1 1 1 1 1 1 1	
		Total		**20**

Kertas 3

Question	Rubric	Score
1 (a)	*Able to record all readings accurately to one decimal point with unit* *Answer :* Set I (0.24 mol dm^{-3}) 17.0 s Set II (0.20 mol dm^{-3}) 20.0 s Set III (0.16 mol dm^{-3}) 25.0 s Set IV (0.12 mol dm^{-3}) 33.0 s Set V (0.08 mol dm^{-3}) 50.0 s	3
	Able to record any 4 readings accurately / all readings correctly but without decimal point/without unit	2
	Able to record any 3 readings correctly but without decimal point/without unit	1
	No response given or wrong response or less than 3 correct readings	0

Question	Rubric	Score
1 (b) (i)	*Able to state the observation correctly* Suggested answer: Mark X disappears from sight// Precipitate/solid is formed // Solid covers X	3
	Able to state the observation less correctly Suggested answer: Mark X disappears	2
	Able to state idea of observation Suggested answer: Precipitate// Solid// Reaction occurs	1
	No response given / wrong response	0

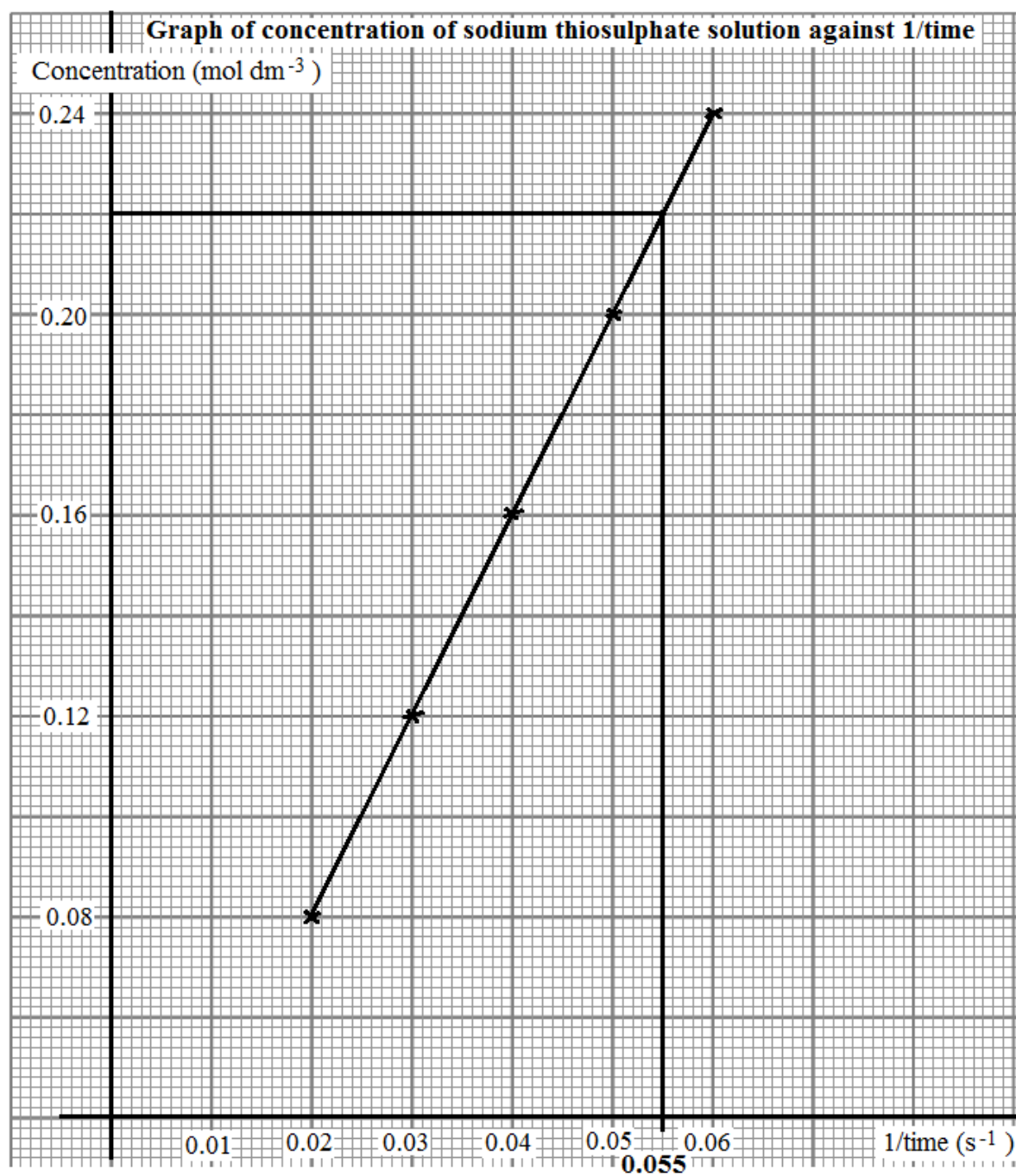| Question	Rubric	Score
1 (b) (ii)	*Able to state the inference correctly* Suggested answer: Sulphur is formed	3
	Able to state the inference less correctly Suggested answer: Acid reacts with sodium thiosulphate // Insoluble substance formed	2
	Able to state idea of inference Suggested answer: Reaction occurs Rate of reaction affected by concentration	1
	No response given / wrong response	0

Question	Rubric	Score
1 (c)	*Able to complete the table with all correct value with 2 decimal place* Answer : 	Concentration/mol dm^{-3}	Time / s	$\frac{1}{Time}$ / s^{-1}
0.24	17.0	0.06
0.20	20.0	0.05
0.16	25.0	0.04
0.12	33.0	0.03
0.08	50.0	0.02		3
	Able to complete the table with 4 correct values	2
	Able to complete the table with 3 correct values	1
	No response given or wrong response	0

Question	Rubric	Score
1 (d)	*Able to state **all three** variables correctly* Suggested answer: *Manipulated variable:* Concentration of sodium thiosulphate solution *Responding variable:* Time taken for mark X to disappear from sight // rate of reaction *Constant variable:* Volume of sodium thiosulphate // Temperature // size of conical flask // concentration and volume of sulphuric acid	3
	*Able to state **any two** variables correctly*	2
	*Able to state **any one** variables correctly*	1
	No response or wrong response	0

Question	Rubric	Score
1 (e)	*Able to state the relationship between the manipulated variable and responding variable correctly with direction.* Suggested answer : The higher / lower the concentration of sodium thiosulphate solution, the higher / lower the rate of reaction. // The higher / lower the concentration of sodium thiosulphate solution, the shorter the time taken for mark X to disappear from sight	3
	Able to state the relationship between manipulated variable and responding variable without stating the direction. Suggested answer : The higher / lower the concentration of sodium thiosulphate, the faster/slower the rate of reaction	2
	Able to state an idea of the hypothesis Suggested answer : Concentration affects the rate of reaction // The concentration change, the rate of reaction change	1
	No response or wrong response	0

Graph of concentration of sodium thiosulphate solution against 1/time

Question	Rubric	Score
1 (f)	*Able to draw a graph of concentration against 1/time by showing the following information* (1) The axes are labeled correctly with unit x-axis : concentration (mol dm^{-3}) y-axis : 1/time (1/s) (2) Uniform scale (3) size of the graph at least 50% of the graph paper (4) All points are transferred correctly (5) Smooth curve	3
	Able to draw a graph of concentration against 1/time by showing the following information (1) The axes are labeled correctly without unit (2) Uniform scale (3) All points are transferred correctly (4) Smooth curve	2
	Able to draw a graph of concentration against 1/time by showing the following information (1) The axes are labeled correctly without unit *(2) Curve / straight line on the graph*	1
	No response or wrong response	0

Question	Rubric	Score
1 (g)(i)	*Able to state the relationship between the concentration of sodium thiosulphate solution and the rate of reaction correctly* Suggested answer: The higher/lower the concentration of sodium thiosulphate solution, the rate of reaction increase/decrease	3
	Able to state the relationship between the concentration of sodium thiosulphate solution and the rate of reaction less correctly Suggested answer: The rate of reaction is directly proportional to the concentration of sodium thiosulphate// The higher the concentration of sodium thiosulphate, the rate of reaction decrease// The lower the concentration of sodium thiosulphate, the rate of reaction increase	2

	Able to give a relevant idea Suggested answer: Rate of reaction is affected by concentration// Rate of reaction is changed by the concentration// Rate of reaction is inversely proportional with concentration	1
	No response or wrong response	0

Question	Rubric	Score

1 (g)(ii)	*Able to fulfil the following criteria*
	
	(1) Extend the line on the graph
	(2) Show on the graph the way to obtain the value of 1/time
	(3) State the time with unit
	
	  1/time = 0.055
	  Time = 1/0.055
	    = 18.18 s//18.2 s
		3

	Able to fulfil any two criteria	2
	Able to fulfil any one criteria	1
	No response or wrong response	0

Question	Rubric	Score
1 (h)	*Able to state the operational definition accurately by stating what should be done and what should be observed* What should be done : when sulphuric acid is added to a higher concentration sodium thiosulphate solution What should be observed : the time taken become shorter Suggested answer : Time taken for mark 'X' to disappear from sight// Time taken for mark 'X' to disappear from sight when sulphuric acid is added into different concentration of sodium thiosulphate solution.	3
	Able to state the operational definition less accurately Suggested answer : Time taken for mark 'X' to disappear// Time taken// X mark disappear	2

	Able to give an idea for the operational definition. Suggested answer : Time for reaction to occurs	1
	No response given or wrong response	0

Question	Rubric	Score
1 (j)	*Able to classify all the reaction correctly* <table><tr><td>Fast reaction</td><td>Slow reaction</td></tr><tr><td>Neutralization Combustion Displacement</td><td>Rusting Fermentation Corrosion</td></tr></table>	3
	Able to classify any 4 reaction correctly	2
	Able to classify any 3 reaction correctly or reverse classification	1
	No response or wrong response	0

Question	Rubric	Score
2(a)	*Able to give the statement of problem correctly* Suggested answer : Does different carboxylic acids react with butanol produce esters with different odour?	3
	Able to give the statement of problem less correctly Suggested answer : Does different carboxylic acids react with butanol gives different esters?// To study different carboxylic acids react with butanol to give esters with different odours.	2
	Able to give an idea about the statement of problem Suggested answer : Different carboxylic acids/alcohol gives different esters.	1
	No response or wrong response	0

Question	Rubric	Score
2(b)	*Able to state all the variables correctly* 1. Manipulated variable: Type of carboxylic acids// Methanoic acid, ethanoic acid and propanoic acid. 2. Responding variables: Esters / Odours produced 3. Fixed variable: butanol / alcohol used	3
	Able to state any two variable correctly	2
	Able to state any one variable correctly	1
	No response or wrong response	0

Question	Rubric	Score
2(c)	*Able to state the hypothesis correctly by stating the relationship between the manipulated variable and the responding variable* <u>Suggested answer :</u> When different carboxylic acids are used, the esters formed will give different odours.	3
	Able to state the hypothesis less correctly <u>Suggested answer :</u> When different carboxylic used, different esters formed//Esters with different odours formed when different carboxylic acids are used	2
	Able to state idea of the hypothesis <u>Suggested answer :</u> Type of carboxylic acid affects esters formed	1
	No response or wrong response	0

Question	Rubric	Score
2(d)	*Able to give the apparatus and materials correctly and completely* List of apparatus : Boiling tube, beaker, test tube holder, Bunsen burner, dropper, measuring cylinder OR Round bottom flask, beaker, Liebig condenser, measuring cylinder, Bunsen burner, dropper, porcelain chips List of materials : Glacial methanoic acid, ethanoic acid and propanoic acid, butanol, concentrated sulphuric acid, water	3
	Able to give the list of aapparatus and materials correctly but not complete List of apparatus : Boiling tube, Bunsen burner,dropper Or Round bottom flask, , Bunsen burner, dropper List of materials : Methanoic acid, ethanoic acid and propanoic acid, butanol concentrated sulphuric acid	2
	Able to give an idea of list of apparatus and materials Any container, any one acid// any one alcohol,	1
	No response or wrong response	0

Question	Rubric	Score
2(e)	*Able to state all procedures correctly* **Situation 1** 1. Pour [2-5] cm^3 butanol and [2-5] cm^3 glacial methanoic acid into a boiling tube. 2. Add a few drops of concentrated sulphuric acid into the mixture. 3. Heat the mixture gently. 4. Pour the mixture into beaker half-filled with water 5. Observe and record the product formed. 6. Repeat the experiment by replacing methanoic acid with ethanoic acid and propanoic acid. **Situation 2** 1. Pour [25 - 100] cm^3 glacial methanoic acid into a round bottom flask and [25 - 100] cm^3 butanol. 2. Put in a few pieces of porcelain chips into the flask 3. Add [5 – 20] cm^3 of concentrated sulphuric acid into the mixture. 4. Reflux the mixture for about [30] minutes. 5. Observe and record the product formed. 6. Repeat the experiment by replacing methanoic acid with ethanoic acid and propanoic acid.	3
	Able to state steps 1, 2, 3,5 and 6 for Situation 1 or *Able to state steps 1, 3,4, 5, 6 for Situation 2*	2
	Able to state an idea of the experiment 1. Add [any one] carboxylic acid and any alcohol into a [suitable container].	1
	No response or wrong response	0
Question	**Rubric**	**Score**
2(f)	*Able to exhibit the tabulation of data correctly* Tabulation of data has the following aspects: 1. Two columns and at least 3 rows 2. Headings: Carboxylic acids/ Ester 　　　　　Observation 3. Name of acids/esters Suggested answer : <table><tr><td>Carboxylic acid/Ester</td><td>Observation</td></tr><tr><td>Methanoic acid/Butyl methanoate</td><td></td></tr><tr><td>Ethanoic acid/Butyl ethanoate</td><td></td></tr><tr><td>Propanoic acid/Buytl propanoate</td><td></td></tr></table>	2

	Able to exhibit the tabulation of data but less accurately		
	Tabulation of data has the following aspects:		
	1. Two columns and at least 2 rows		
	2. One heading:		
	Suggested answer :		
	Carboxylic acid/Ester	// Observation	
			1
	No response or wrong response		0

END OF MARK SCHEME