Essay {Paper02}

[MRSM11-10]

(*a*) {soalan tertinggal}
210 kJ heat is released when 1 mole of copper is displaced by zinc from copper(II) sulphate solution.

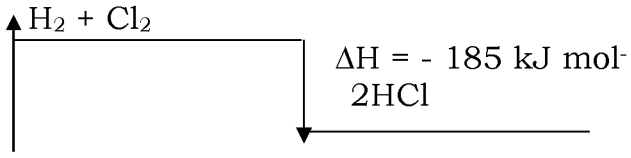
Jawapan
Mol copper sulphate = MV/1000 = 1.0 X 50/1000 = 0.05 mol
ΔH = 210 kJ mol^{-1}

Q = mol X ΔH = 0.05 X 210 = 10.5 kJ

Then
θ = Q/mc = 10500 /[50X4.2] = 50.0 °C

(*b*) (i) Equation : $H_2 + Cl_2 \rightarrow 2HCl$
2. heat absorb by reactants =436 + 243 = + 679 kJ
3. heat released by product = 2[432] = -864 kJ
4. Heat change is = -864 + (+679) = - 185 kJ
5. The reaction Exothermic reaction

(ii) Energy



(*c*) Procedure of the experiment
1. 100 cm^3 of 0.1 mol dm^{-3} of copper(II) sulphate into the polystyrene cup
2. Record the initial temperature of solution by using a thermometer
3. Add 5 g of Zinc into the polystyrene cup
4. stir the mixture,
5. and take the highest reading of thermometer. Record the reading.

Calculation the heat of displacement.

1. mol of Copper(II) sulphate = MV/1000 = n

2. heat change by experiment , Q = mcθ
m = mass of solution = 100 g
c = water heat specific = 4.2
θ = final temperature – initial tempeture
3. Heat of displacement, ΔH = Q/n = - X $kJmol^{-1}$

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[SPM2010-10]

A(i) P : methanoic acid/ etahonoic acid/ propanoic acid
Q: hydrochloric acid / nitric acid

(ii).1. Q is strong acid
2. P is weak acid
3. Q dissociate completely in water // p dissociate partially in water
4. some of the heat given out during neutralisation is used by acid P molecules to dissociate completely to form hydrogen ion

b. 1. (1.0 x 100)/1000 //0.1 [1]
2. 100 + 100 // 200 [2]
3. 0.1 x 55000 // 5500
4. 5500/(200x4.2) //6.5 C//6.55C

c. 1. Measure 100 cm3 [20 – 200 cm3] of sodium 1.0 mol dm-3 [0.1 – 2.0 moldm-3] solution
2. pour the solution into a plastic/polystryrene cup
3. record initial temperature of the solution
4.Measure 100 cm3 [20 – 200 cm3] of hydrochloric acid 1.0 mol dm-3 [0.1 – 2.0 moldm-3] solution
5. pour the solution into another plastic/polystryrene cup
6. record initial temperature of the solution
7. pour acid P/Q **quickly** into the sodium hydroxide solution
8. stir the mixture
9. record the **highest** temperature reached

10. Initial temperature of acid P/Q = T1
Initial temperature of NaOH = T2
Average Initial temperature = (T1+ T2)/2 = Ta
Highest temperature = Tb

11. heat given out = mco = 200 x 4.2 x (Tb – Ta)

12. Heat of neutralisation = - x/0.1 = -G kJmol-1

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[MRSM10-10]

(*a*) Mol of hydrochloric acid = 1 x 50/1000 = 0.05 mol

2 mol HCl react to produce 50.4 kJ
0.05 mol of HCl react to produce = 0.05/2 x 50.4 = 1.26 kJ

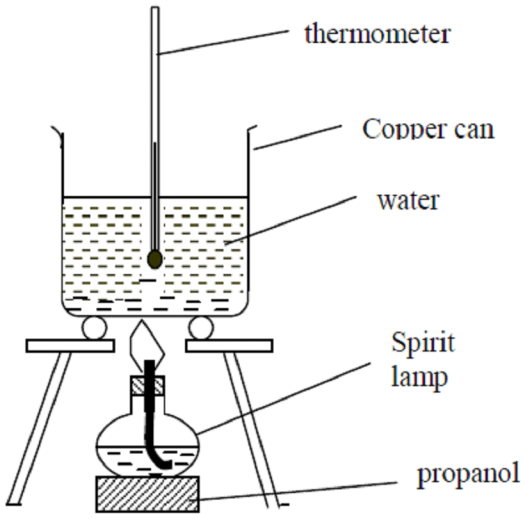
$\theta = H/mc$

$= \frac{1.26 \times 1000}{(50)(4.2)} = 6\ ^\circ C$

(*b*) (i) (i) $C_3H_7OH + 9/CO_2 \rightarrow 3CO_2 + 4H_2O$ // $C_4H_9OH + 6O_2 \rightarrow 4CO_2 + 5H_2O$

(iii) (ii) 1. Heat of combustion of butanol is higher than propanol.
2. The number of carbon atom per molecule butanol is bigger than propanol
3. Butanol produce more carbon dioxide and water molecules than propanol // more bonds are formed // energy content is higher in butanol.
4. Released more heat energy

(c) Diagram:
1. Functional apparatus
2. Label



Arrangement of apparatus is functional
- can with water, thermometer, spirit lamp with alcohol
- no wire gauze, thermometer not touching surface, flame touching can
- Labeled water, alcohol, [metal] can

Procedure:
1. (100-250 cm3) of water is measured and poured into a copper can and the copper can is placed on a tripod stand.
2. The initial temperature of the water is measured and recorded.
3. A spirit lamp with ethanol is weighed and its mass is recorded.
4. The lamp is then placed under the copper can and the wick of the lamp is lighted up immediately.
5. The water in the can is stirred continuously until the temperature of the water increases by about 20- 50 °C.
6. The flame is put off and the highest temperature reached by the water is recorded.
7. The lamp and its content are weighed and the mass is recorded.

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[SBPtrial09-10]

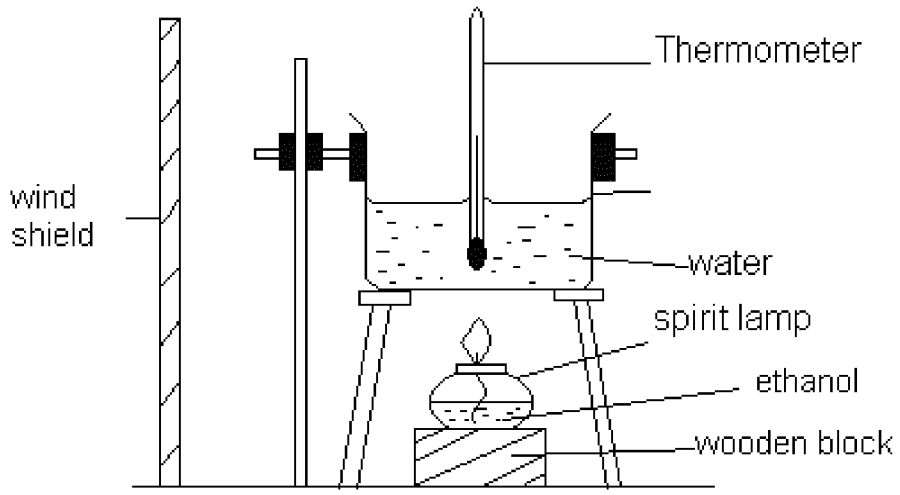
(a)

Reaction I	Reaction II
Endothermic//heat absorbed from the surrounding	Exothermic//heat released to the surrounding
The total energy of content of calcium nitrate and potassium carbonate/reactant is lower than the total energy content of calcium carbonate and potassium nitrate/product	The total energy of the content of zinc and copper(II) sulphate/reactants is higher than the total energy content of zinc sulphate and copper/product
Heat absorbed during the reaction is 66 kJ mol^{-1}	Heat released during the reaction is 50.4 kJ mol^{-1}

(b) Heat of combustion of butanol is higher than propanol
The molecular size/number of carbon atom per molecule butanol is bigger/higher than propanol
Butanol produce more carbon dioxide and water molecules than propanol//released more heat energy

(c) Methanol/ethanol/ propanol,

Diagram:
-labelled diagram
-arrangement of apparatus is functional



Procedure :

1. (100-250 cm^3)of water is measured and poured into a copper can and the copper can is placed on a tripod stand
2. The initial temperature of the water is measured and recorded
3. A spirit lamp with ethanol is weighed and its mass is recorded
4. The lamp is then placed under the copper can and the wick of the lamp is lighted up immediately
5. The water in the can is stirred continuously until the temperature of the water increases by about 30°C.
6. The flame is put off and the highest temperature reached by the water is recorded.
7. The lamp and its content is weighed and the mass is recorded

[Step 1 =1; Step 2, 6 = 1; Step 3, 7 = 1; Step 4, 5 = 1]

Data :

The highest temperature of water = t_2
The initial temperature of water = t_1
Increase in temperature, θ = $t_2 - t_1 = \theta$

Mass of lamp after burning = m_2
Mass of lamp before burning = m_1
Mass of lamp ethanol burnt, m = $m_2 - m_1 = m$

Calculation :
Number of mole of ethanol, C_2H_5OH, n = $\frac{m}{46}$

The heat energy given out during combustion by ethanol
= the heat energy absorbed by water
= 100x x c x θ J

Heat of combustion of ethanol
= $\frac{m\ c\ \theta}{n}$ $Jmol^{-1}$
= p/1000 kJoule

(c) No. of mol of silver nitrate = 100 X 0.5 /1000// 0.05

1 mol of silver nitrate reacted to release 105 kJ heat
Therefore, 0.05 mol silver nitrate reacted to produce $\frac{105 \text{ X } 0.05}{1}$

= - 5.25 kJ/mol

5250 = 100 X 4.2 X θ
θ = 12.5 ^{O}C

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[MRSM05-10]

(a) (i) I : $C_2H_5OH + 7/2\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$

III : $CaCO_3 \rightarrow CaO + CO_2$

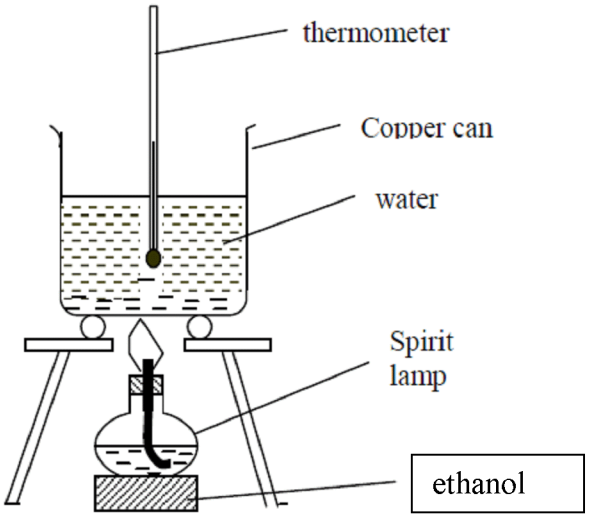
(ii) 1. heat of combustion of Propanol is higher than heat of combustion of ethanol
2. the number of carbon atom in the propanol is higher than ethanol
3. the number of moles of products also increases and heat released also higher.

(b) **Reaction I**
1. is exothermic
2. the heat released of products is higher than heat absorb by reactants
3. heat released when 1 mol ethanol burn is 1376 kJ mol-1

Reaction III
1. is endothermic
2. the heat released of products is smaller than heat absorb by reactants
3. heat absorb when 1 mol calcium carbonate decompose

(c) Diagram:

1. Functional apparatus
2. Label



Reagents : ethanol

Apparatus : spirit lamp with wick, copper can, thermometer, pipe clays triangle, wooden block, tripod stand, weighing balance, match

Procedure:
1. 250 cm^3 of water is measured and poured into a copper can and the copper can is placed on a tripod stand.
2. The initial temperature of the water is measured and recorded.
3. A spirit lamp with ethanol is weighed and its mass is recorded.
4. The lamp is then placed under the copper can and the wick of the lamp is lighted up immediately.
5. The water in the can is stirred continuously until the temperature of the water increases by about 20- 50 °C.
6. The flame is put off and the highest temperature reached by the water is recorded.
7. The lamp and its content are weighed and the mass is recorded.

Precaution step:
1. Quickly weight the ethanol with spirit lamp because ethanol easy to evaporate
2. Quickly weight the spirit lamp after the wick was flame was off.

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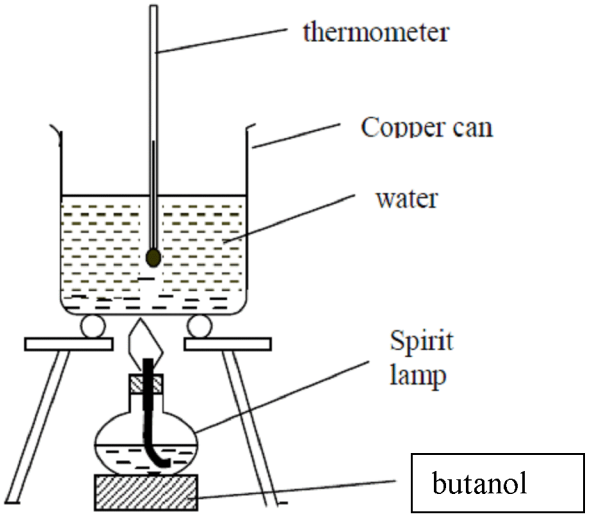
[MRSM09-10]

(a) **Reaction I**
1. is exothermic reaction
2. Heat energy absorb by reactants is higher than heat released by formation of products
3. heat change of 1 mol is negative value kJ mol^{-1}

Reaction II
1. is endothermic reaction
2. Heat energy absorb by reactants is lower than heat released by formation of products
3. heat change of 1 mol is positive value kJ mol^{-1}

(b) Diagram:

1. Functional apparatus
2. Label



Reagents : Butanol

Apparatus : spirit lamp with wick, copper can, thermometer, pipe clays triangle, wooden block, tripod stand, weighing balance, match

Procedure:
1. 250 cm^3 of water is measured and poured into a copper can and the copper can is placed on a tripod stand.
2. The initial temperature of the water is measured and recorded.
3. A spirit lamp with butanol is weighed and its mass is recorded.
4. The lamp is then placed under the copper can and the wick of the lamp is lighted up immediately.
5. The water in the can is stirred continuously until the temperature of the water increases by about 20- 50 °C.
6. The flame is put off and the highest temperature reached by the water is recorded.
7. The lamp and its content are weighed and the mass is recorded.

Precaution step:
1. Quickly weight the butanol with spirit lamp because butanol easy to evaporate
2. Quickly weight the spirit lamp after the wick was flame was off.

(c) ΔH butanol = 2678 kJ mol-1
Mass of water , m = 500 g
Mass of butanol = 3.7 g
Molar mass butanol, C_4H_9OH = 4(12) + 9(1) + 16 + 1 = 74

Mol butanol = mass/ molar mass = 3.7/74 = 0.05 mol

Heat released, Q = mol X ΔH = 0.05 X 2678 = 133.9 kJ = 133900 J

θ = Q/mc = 133900/[500X4.2] = 63.76 °C

The maximum temperature = initial temperature + change of temperature
= 28.0 + 63.76 = 91.76 = 91.8 °C

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[MRSM04-08]

(a) Endothermic reaction
The ice absorb heat from surrounding, used to break the bond between the molecules. Then change it into liquid.

(b) (i) ΔH of butane = - 2882 kJ mol-1
Mass of water = 1000 g
Change of temperature = boiling temperature – 30 °C = 100 – 30 = 70 °C
Molar mass of butane, C_4H_{10} = 4(12) + 10(1) = 58 g/mol

Heat by experiment, Q = mcθ = 1000 x 4.2 X 70 = 294 000 = 294 $kJmol^{-1}$

Mol = heat by experiment / ΔH = 294/2882 = 0.1 mol

Mass of butane = mol X molar mass butane = 0.1 X 58 = 5.8 g

(ii) Heat released by 1g of

a. Methane = 890/16 = 55.63 Jg^{-1}

b. Butane = 2882/58 = 49.69 Jg^{-1}

Methane more efficiency than butane

(c) (i) I : $Na_2SO_4 + Pb(NO_3)_2 \rightarrow PbSO_4 + 2NaNO_3$
II : $Ca(NO_3)_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaNO_3$

(ii) 1. Change of temperature in experiment I is higher than experiment II
2. Because the metal used, lead more further than with sodium compare to calcium metal where the calcium is more shorter than with sodium.

Experiment I	Experiment II
Energy $Na_2SO_4 + Pb(NO_3)_2$ ΔH = - X kJ mol^{-} $PbSO_4 + 2NaNO_3$	Energy $Ca(NO_3)_2 + Na_2CO_3$ ΔH = - Y kJ mol^{-} $CaCO_3 + 2NaNO_3$

The heat change in experiment I is bigger than heat change in experiment II

(iii) Name the chemical : Ammonium nitrate, NH_4NO_3 and water

Explanation :
1. Contains ammonium nitrate, NH_4NO_3 and water with separated compartments.
2. Broken the barrier between two compartments by squeezing the outer bag
3. Heat is absorbed from the surroundings such as the injured area.

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[SBPtrial06-10] {Translate}

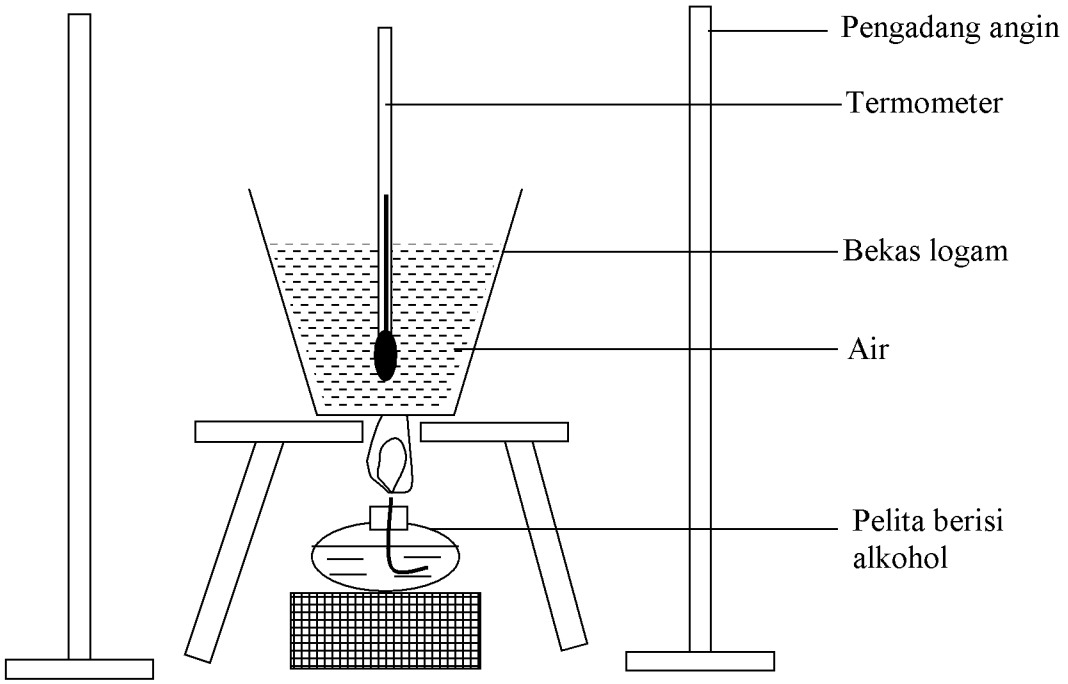
(a)(i) -termometer sepatutnya tegak dan bukannya condong
- bebuli termomemeter tidak boleh menyentuh dasar bekas
-sepatutnya bekas logam dan bukan bikar digunakan
- tiada pengadang angin
- api dari pelita tidak menyentuh dasar bekas
- menggunakan kasa dawai

Mana-mana 2 di atas

(ii) Haba yang dibebaskan = haba yang diserap air
= mcØ
= 100 X 4.2 X 50
= 21000 J @ 21 kJ

(iii) Bil. Mol M = 1.72/86 = 0.02 mol
0.02 mol Y membebaskan 21 kJ haba
Maka, 1 mol Y akan membebaskan 21/0.02 = 1050 kJ haba

(b) Senarai radas dan bahan: termometer, bekas logam, pelita, tungku kaki tiga, bongkah kayu, pengadang angin, air dan mana-mana satu alkohol(metanol, etanol, propanol dan butanol) 1



Gambar rajah berfungsi
Label betul

Kaedah:
1. (100-200) cm^3 air disukat dengan menggunakan silinder penyukat, dimasukkan ke dalam bekas logam.
2. Masukkan termometer ke dalam air dan suhu awal direkodkan
3. Sebuah pelita diisi dengan metanol, ditimbang dan jisimnya direkodkan
4. Kedudukan pelita dilaraskan supaya nyalaannya menyentuh dasar bekas loga
5. Pelita dinyalakan.
6. Apabila suhu air meningkat sebanyak (25-50) °C, nyalaan pelita dipadamkan. Bacaan tertinggi termometer direkodkan.
7. Dengan serta merta pelita berisi metanol ditimbang dan jisimnya dicatatkan.

8. Keputusan:
Jisim pelita berisi metanol sebelum pembakaran : A g
Jisim pelita berisi metanol selepas pembakaran : B g
Suhu awal air : T_1 °C
Suhu tertinggi air : T_2 °C

9. Jisim metanol yang terbakar : (A-B) = C g
Kenaikan suhu air : $T_2 - T_1 = T_3$°C

10. Jisim molekul relatif metanol, $CH_3OH = 12 + 4(1) + 16 = 32$

1. Haba pembakaran metanol, $\Delta H = -\frac{(32/C \times 100 \times 4.2 \times T_3)}{1000} \text{ kJ mol}^{-1}$

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