

- 1 Tindak balas penyesaran berlaku apabila suatu logam disesarkan daripada larutan garamnya oleh logam yang lebih elektropositif.

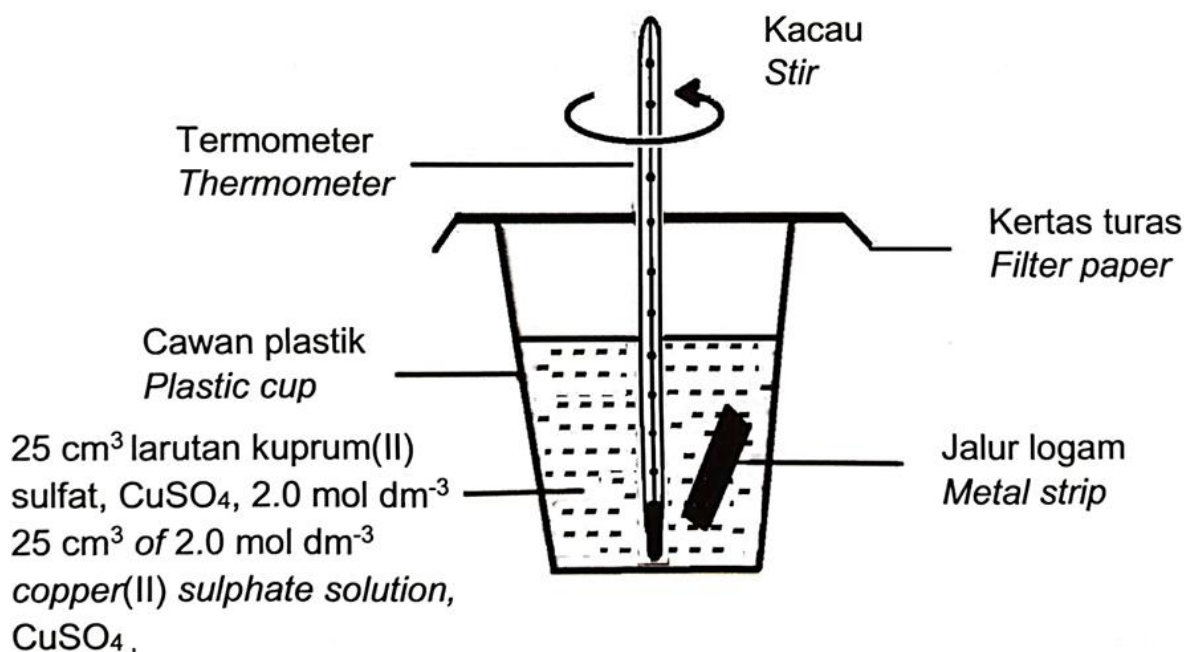
Anda dikehendaki menjalankan satu eksperimen untuk menentukan haba penyesaran kuprum daripada larutan kuprum(II) sulfat, CuSO_4 , 2.0 mol dm^{-3} oleh logam magnesium dan logam zink.

A displacement reaction occurs when a metal is displaced from its salt solution by a more electropositive metal.

You are required to carry out an experiment to determine the heat of displacement of copper from copper(II) sulphate, CuSO_4 , 2.0 mol dm^{-3} solution with magnesium metal and zinc metal.

Rajah 1 menunjukkan susunan radas eksperimen yang akan dijalankan.

Diagram 1 shows the apparatus set-up of the experiment that will be conducted.



Rajah 1
Diagram 1

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- (c) Lengkapkan Jadual 2 untuk merekodkan keputusan bagi eksperimen ini.
Complete Table 2 to record the results of the experiment.

Logam Metal	Suhu awal larutan kuprum(II) sulfat ($^{\circ}\text{C}$) <i>Initial temperature of copper(II) sulphate solution ($^{\circ}\text{C}$)</i>	Suhu tertinggi campuran ($^{\circ}\text{C}$) <i>Highest temperature of the mixture ($^{\circ}\text{C}$)</i>	Perubahan suhu ($^{\circ}\text{C}$) <i>Change in temperature ($^{\circ}\text{C}$)</i>
Magnesium			
Zink			

Jadual 2
 Table 2

[3 markah]
 [3 marks]

- (d) Berdasarkan keputusan dalam Jadual 2, hitung haba penyesaran bagi tindak balas antara larutan kuprum(II) sulfat dengan magnesium.

Based on the results in Table 2, calculate the heat of displacement for the reaction between copper(II) sulphate solution and magnesium.

[Muatan haba tentu air = $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$, ketumpatan air = 1.0 g cm^{-3}]

[Specific heat capacity of water = $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$, density of water = 1.0 g cm^{-3}]

Bilangan mol larutan, n Number of moles of solution, n	$= \frac{MV}{1000}$
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Perubahan haba, Q Heat change, Q	$= mc\theta$
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Haba tindak balas, ΔH Heat of reaction, ΔH	$= \frac{Q}{n}$
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[3 markah]
 [3 marks]

- (e) Lukiskan gambar rajah aras tenaga bagi tindak balas di antara larutan kuprum(II) sulfat dengan magnesium.
Draw an energy level diagram for the reaction between copper(II) sulphate solution and magnesium.

Tenaga
Energy



[2 markah]
[2 marks]

- (f) Ramalkan suhu tertinggi campuran sekiranya larutan kuprum(II) sulfat digantikan dengan larutan kuprum(II) nitrat dan ditindak balaskan dengan logam zink.
Predict the highest temperature of the mixture if the copper(II) sulphate solution is replaced with copper(II) nitrate solution and is reacted with zinc metal.

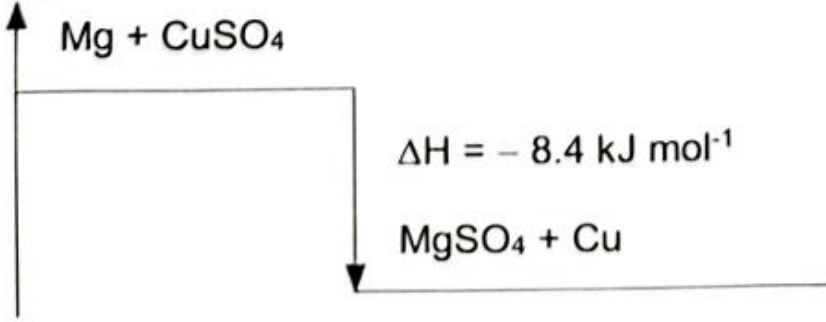
.....
[1 markah]
[1 mark]

- (g) Kelaskan bahan-bahan tindak balas yang digunakan dalam eksperimen ini kepada agen penurunan dan agen pengoksidaan.
Classify the reactants used in this experiment into reducing agent and oxidizing agent.

[2 markah]
[2 marks]

– KERTAS SOALAN TAMAT –
– END OF QUESTION PAPER –

1	(a)	1. Sukat 25 cm³ larutan kuprum(II) sulfat, CuSO₄, 2.0 mol dm⁻³ dengan menggunakan silinder penyukat dan tuang ke dalam cawan plastik. <i>Measure 25 cm³ of copper(II) sulphate solution, CuSO₄, 2.0 mol dm⁻³ using a measuring cylinder and pour into a plastic cup.</i> 2. Masukkan termometer ke dalam larutan itu dan biarkan selama dua minit. <i>Dip a thermometer into the solution and leave it aside for two minutes.</i> 3. Catatkan suhu awal larutan dalam Jadual 2. <i>Record the initial temperature of the solution in Table 2.</i> 4. Masukkan dengan cepat pita magnesium, Mg ke dalam larutan kuprum(II) sulfat, CuSO₄. <i>Quickly add magnesium ribbon, Mg into the copper(II) sulphate solution, CuSO₄.</i> 5. Tutup cawan plastik dengan kertas turas dan kacau campuran dengan termometer. <i>Cover the plastic cup with a filter paper and stir the mixture using the thermometer.</i> 6. Catatkan suhu tertinggi campuran. <i>Record the highest temperature of the mixture.</i> 7. Ulangi Langkah 1 hingga 6 dengan menggunakan jalur zink bagi menggantikan pita magnesium. <i>Repeat steps 1 to 6 by using zink strip to replace magnesium ribbon.</i>
	(b)	Suhu meningkat // <i>Temperature increases</i> Pepejal berwarna perang terendap // <i>Brown solid deposited</i> Warna biru larutan kuprum(II) sulfat menjadi biru pudar // <i>The blue colour of copper(II) sulphate become pale blue</i> (Mana-mana 1) (Any 1)

(c)	Contoh jawapan :			
	Logam Metal	Suhu awal larutan kuprum(II) sulfat (°C) Initial temperature of copper(II) sulphate solution (°C)	Suhu tertinggi campuran (°C) Highest temperature of the mixture (°C)	Perubahan suhu (°C) Change in temperature (°C)
	Magnesium			
	Zink			
	1 markah – suhu awal 1 markah – suhu tertinggi 1 markah – perubahan suhu			
(d)	Bilangan mol larutan CuSO ₄ , n = $\frac{MV}{1000}$ Number of moles of CuSO ₄ solution, n = $\frac{(2)(25)}{1000}$ = 0.05 mol Perubahan haba, Q = mcθ Heat change, Q = 25 x 4.2 x 4 = 420J // 0.42kJ Haba tindak balas, ΔH= $\frac{Q}{n}$ Heat of reaction, ΔH = $\frac{0.42 \text{ kJ}}{0.05 \text{ mol}}$ = – 8.4 kJmol ⁻¹			
(e)	Tenaga Energy  ΔH = – 8.4 kJ mol⁻¹ MgSO₄ + Cu 1 markah – rajah betul 1 markah – label betul			

	(f)	Suhu tertinggi campuran sama // tidak berubah // (menyatakan suhu tertinggi campuran sama seperti dalam (d)) <i>Highest temperature of the mixture is the same // unchanged // (express the value of highest temperature of the mixture same as in (d))</i>	
	(g)	Agen pengoksidaan <i>Oxidising agent</i>	Agen penurunan <i>Reducing agent</i>
		Kuprum(II) sulfat <i>Copper(II) sulphate</i>	Magnesium <i>Magnesium</i> Zink <i>Zinc</i>

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