Victoria School
2022 Chemistry O Levels / 6092
Suggested Answer Key

PAPER 3

Question		Answer	Mark
1a	**i**	Blue solid turns white upon heating. Colourless liquid droplet forms at the top of the boiling tube.	1
	ii	Mass of empty boiling tube = 30.71 g Total mass of boiling tube and A = 32.95 g Total mass after the first heating = 32.39 g Total mass after the second heating = 32.28 g	4
	iii	Mass of copper(II) sulfate = 32.28 – 30.71 = **1.57 g**	1
	iv	Amount of copper(II) sulfate = 1.57/160 = **0.0098125 mol**	1
	v	Total mass of water lost = 32.95 – 32.28 = **0.67 g**	1
	vi	Total amount of water lost = 0.67 /18 = **0.0372 mol**	1
	vii	Ratio of H_2O : $CuSO_4$ = 0.0372/0.0098125 = 3.79 = 4 X = **4**	1
b	**i**	Sample A is heated twice to ensure that all water of crystallization is removed. However, as the sample still has blue particles in it/a constant mass is not obtained after the second heating, it shows that the sample still contains water of crystallization. Heating a third time would ensure more of the water of crystallisation to be removed so as to obtain a more accurate value of x that is closer to the actual value.	1 1
	ii	The value of x would be greater than 4. The student has thermally decomposed the anhydrous copper(II) sulfate to copper(II) oxide and sulfur dioxide. Thus, sulfur atoms together with the water of crystalisation has been lost. This would lead to lower amount of $CuSO_4$ and higher amount of water lost.	1 1

<table>
<tr><td>c</td><td>i</td><td>
<table>
<tr><td>Temperature of deionised water / °C</td><td>31.0</td></tr>
<tr><td>Maximum temperature of mixture / °C</td><td>36.0</td></tr>
<tr><td>Change in temperature / °C</td><td>+5.0</td></tr>
</table>
</td><td>1</td></tr>
<tr><td></td><td>ii</td><td>There is a temperature rise of 5.0 °C. Heat is released from the reaction, hence the reaction is exothermic. The enthalpy change is negative.</td><td>1</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>2</td><td>ai</td><td>
<table>
<tr><td>Test</td><td>Observations</td></tr>
<tr><td>1</td><td>No visible change.
Purple solution C decolourises when added to the colourless solution.
Effervescence of colourless gas observed.
  </td></tr>
<tr><td>2</td><td>Black solid insoluble in hydrogen peroxide.
Vigorous effervescence of a colourless gas.
Glowing splint relighted.
Gas is oxygen.
  </td></tr>
<tr><td>3</td><td>No visible change.
Colourless solution turns yellowish-brown.</td></tr>
</table>
</td><td>9</td></tr>
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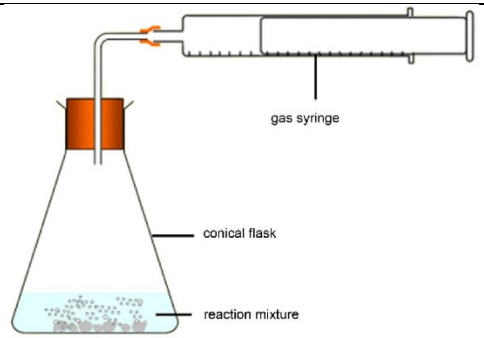
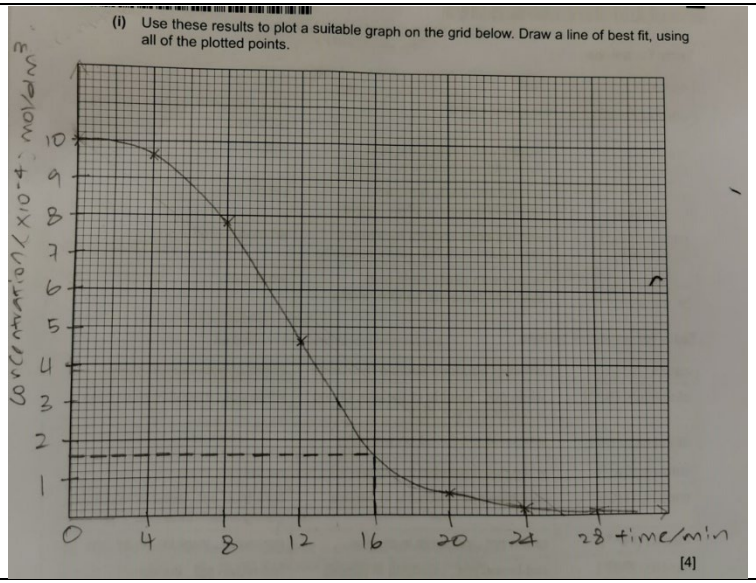
		4	No visible change.  After filtration, residue is a black solid and filtrate is a green solution.  Upon addition of sulfuric acid to filtrate, green solution turns red. Brown ppt formed, insoluble in excess sulfuric acid.		
		5	No visible change. White ppt formed.		

				
		6	Yellowish-brown ppt formed Insoluble in excess aqueous sodium hydroxide On standing, brown ppt is observed.  WhatsApp Video 2022-10-13 at 3.24.07	
	b	Reducing agent. Hydrogen peroxide decolourises purple $KMnO_4$.		1 1
	c	$MnCl_2$		1

	d	 1. Connect the other end of the rubber tubing to a dry and clean calibrated gas syringe as shown in the diagram. 2. Using a measuring cylinder, place 50.0 cm^3 of 0.1 mol/cm^3 of aqueous potassium manganate(VII) into the 250 cm^3 conical flask. 3. Using another measuring cylinder, measure 50.0 cm^3 of 0.1 mol/cm^3 of hydrogen peroxide. 4. Pour the hydrogen peroxide into the conical flask and quickly stopper it as shown in the diagram above. 5. At the same time start the stopwatch. 6. Measure the volume of oxygen gas collected after 10 minutes. 7. Repeat the experiment with 0.5 mol/dm^3 and 1.0 mol/dm^3 of aqueous potassium manganate(VII).	4

	ei		1m-Scale 1m-Line (smooth curve) 1m-Area of graph more than ½ of graph paper 1m- Points plotted correctly	4
	eii	1.60 x 10^{-4} $moldm^{-3}$		1 m value 1m units
	eiii	As time increases from 0 to 8 minutes, the concentration of potassium manganate(VII) decreases gradually. Thus the rate of reaction is slow. From 8-16 minutes, the concentration decreases rapidly, hence the rate of reaction is fast. From 16- 28 minutes, the concentration decreases slowly until constant. Hence, rate of reaction is slow.		1 1