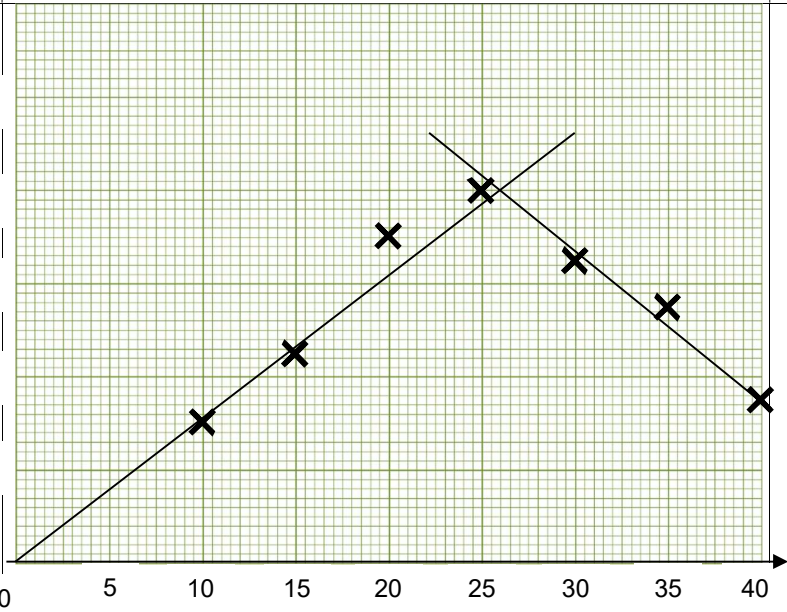


Admiralty Secondary School
Marking Scheme
4E Pure Chemistry (Paper 3)
PRELIMINARY EXAMINATION 2024

PAPER 3 (overall deduct 1 mark of consistently did not round off to 3 sf)

Qn.	Answers						Mark	Remarks	Marker's Report
1(a)	Results						5		Well done. Some students miscalculated the temperature rise.
	e x p t	volume of P /cm ³	volume of Q /cm ³	initial temperature of P /°C	highest temperature of mixture /°C	temperature rise /°C			
	1	40.00	10	29.5	32.5	3.0			
	2	35.00	15	29.5	34.0	4.5			
	3	30.00	20	29.0	36.0	7			
	4	25.00	25	29.0	37.0	8			
	5	20.00	30	29.0	35.5	6.5			
	6	15.00	35	29.0	34.5	5.5			
	7	10.00	40	29.5	33.0	3.5			
	1m: volumes must be between 15 & 35 cm ³ , and must be at least 5 cm ³ apart.								

	1m: total volume of P and Q must add up to 50 cm³ 1m: all volumes of P to nearest 0.05 cm³, all volumes of Q to nearest cm³ or nearest 0.5 cm³) 1m: temp should be recorded to 1 d.p., to the nearest 0.5 °C 1m: correct calculation for temperature rise			
(b)	 1m: correct labels & units: x-axis (vol of Q/cm³); y-axis (temperature rise/°C) 1m: appropriate scale 1m: correct plotted points, within half a small square accuracy 1m: 2 smooth lines that intersect, passing through origin (0,0)	4		Generally okay. Most students were able to plot the points correctly except for a handful. Some students did not draw the line passing through the origin. Only a small number of students drew a curve instead of a line.

2(a)	Mass of empty boiling tube / g	29.92		1	No table, minus 1m	A few students did not draw table. Some wrote weight instead of mass.
	Mass of boiling tube with C before heating / g	31.95		1		
	Mass of boiling tube and its contents after heating / g	31.46				
	1m correct headings 1m correct units and 2 d.p.					
(b)	Change in mass of C = 31.95 – 31.46 = 0.49 g			1		Well done
(c)	No. of moles of CO ₂ = 0.49/44 = 0.1114 mol Mass of CuCO ₃ reacted = 0.1114 x 124 = 1.38 g			1 1		Surprisingly badly done. Many students tried to find the number of moles of CuO even though the question stated that it contains impurities. Some divided by 24.
(d)	Initial mass of C = 31.95 – 29.92 = 2.03 g Percentage by mass of CuCO ₃ = (1.38/2.03) x 100 = 70.0 % (3 s.f.)			1	Minus 1m overall if wrong s.f. Allow ecf	Most students did not find the initial mass of C and just used 2 g. However, they were not penalised.

(e)	Perform strong heating using non-luminous flame / heat for a longer time to ensure that all the copper(II) carbonate is decomposed.	1	Reject repeat experiment	Well done

3(a)	(i)	test	observations			Well done. Some students still wrote 'white solution formed' or did not following the correct way of recording observations, resulting in ambiguous answers.
		1	White ppt formed. Insoluble in excess sodium hydroxide.	1		
		2	No ppt formed/no observable change/ no visible change	1		
		3	No ppt formed/no observable change/ no visible change/no effervescence	1		
		4	Pungent gas evolved. Gas produced turns damp red litmus paper blue. Ammonia gas is produced.	1		
		5	White ppt formed	1		
		6	Effervescence observed. Gas produced forms white ppt in limewater. CO ₂ is produced.	1		
	(ii)	Ca ²⁺ NO ₃ ⁻		1 1	Max 1m if student write both name and formulae	Quite a number of students wrote the name instead of chemical formulae
	(iii)	In test 5, a white ppt is formed, which means that <u>the cation (Ca²⁺) has been removed from the (hard) water</u>				Only students who understood how hard water is softened

	- No. of moles of iron(II) ions in 100 cm³ of A = $y \times 4 = z$ - No. of moles of iron(II) ions in 50 cm³ of hard water sample = z - Concentration of iron(II) ions in 50 cm³ of hard water sample = $z / (50/1000) = \text{ANS}$ Procedure(3m): 1m: what is measured in the experiment 1m: drawing correct titration setup with B in burette and A in conical flask 1m: correct procedure of how to carry out the titration w independent and dependent variables which add to pipette and burette, and taking average of the two best readings Data processing(2m): - correct calculation of no. of moles of B needed & correct calculation of number of moles of iron(II) in 25 cm³ of A and 100 cm³ of A, - (and hence) no. of moles of iron(II) in 50 cm³ of hard water sample, and correct calculation of concentration of iron(II) ions in 50 cm³ of hard water sample	1		
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