

Mark Scheme

1.

		D ✓	1 (AO1.1)	
		Total	1	

2.

		D ✓	1 (AO2.2)	
		Total	1	

3.

		A ✓	1(AO 1.1)	
		Total	1	

4.

a	i	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = $0.00125 / 1.25 \times 10^{-3}$ award 2 marks</p> <p>Moles = $\frac{\text{volume}}{24} / \frac{0.030}{24} / \frac{30}{24,000}$ ✓ = $0.00125 / 1.25 \times 10^{-3}$ ✓</p>	2 (AO2.2)	ALLOW 1 mark only for $30 \div 24$ or $0.030 \div 24,000$, correctly calculated
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	ii	$0.0025 / 2.5 \times 10^{-3} \text{ (g)} \checkmark$	1 (AO2.2)	unit not needed ALLOW ECF from (i) ie 2 x answer from (i)
	b	<p>Moles of chromium = $\frac{10.40}{52.0} = 0.2 \checkmark$</p> <p>Moles of nickel = $\frac{17.61}{58.7} = 0.3 \checkmark$</p> <p>Idea that ratio is 2:3 / ratio isn't 1:1 so <u>equation 2</u> \checkmark</p>	3 (AO2.2)	<p>ALLOW other methods of calculation eg 10.40g of chromium forms $\frac{10.40 \times 58.7}{52.0}$ $= 11.74\text{g}$ nickel $\frac{11.74 \times 2}{3} = 17.61\text{g}$ of nickel</p> <p>So, equation 2</p> <p>ALLOW answers that show equation 1 is not correct</p> <p>Third marking point is dependent on correct mathematical reasoning</p>
		Total	6	

5.

	a	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.24 / 2.243 / 2.2 (dm³) award 2 marks</p> <p>Moles of ammonium chloride = $5.00 \div 53.5$ or 0.0935 \checkmark</p> <p>Volume of ammonia = moles \times 24 = 0.0935×24 = $2.24 / 2.243 / 2.2$ (dm³) \checkmark</p>	2(AO 2.2)	<p>ALLOW 0.09 / 0.094</p> <p>ALLOW ECF from moles of ammonium chloride if first mark not awarded</p>
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				Many candidates still forget to convert cm^3 to dm^3 before calculating moles or concentrations – see also Question 22(c).
	ii	<p>Correct choice of concordant results – 36.3 and 36.2 ✓</p> <p>Mean = $(36.30 + 36.20) \div 2$ = 36.25 (cm^3) ✓</p>	2(AO 2.2)	<p>ALLOW 1 mark for ECF from any incorrect choice of concordant values eg 35.875 / 35.88 / 35.9 (cm^3) if all values are used</p> <p>Examiner's Comments</p> <p>Many candidates correctly selected the concordant results from titrations 1 & 4 to calculate the mean volume as 36.25 cm^3.</p> <p>Lower ability candidates tended to calculate the mean from all four titres; 1 mark was given.</p>
		Total	7	

6.

	A	1	
	Total	1	

7.

	C	1	
	Total	1	

8.

i	<p>Titrate ammonia against sulfuric acid to obtain volumes needed for complete neutralisation (1)</p> <p>Add these volumes without the use of indicator (1)</p> <p>Slow evaporation of reaction mixture / heat reaction mixture over a steam bath (1)</p> <p>Burette and other chemical apparatus not suitable for using large quantities / very difficult to use a steam bath in the large scale (1)</p>	4	<p>ALLOW heat neutral mixture with carbon or charcoal and then filter off carbon</p> <p>ALLOW Slow evaporation of filtrate / heat filtrate over a steam bath if method involving carbon is used</p>
ii	<p>34 (g or tonnes) of ammonia makes 132.1 (g or tonnes) of ammonium sulfate / 17 (g or tonnes) of ammonia makes 66 (g or tonnes) of ammonium sulfate (1)</p> <p>So 51 tonnes makes 198.1 tonnes of ammonium sulfate (1)</p>	2	<p>ALLOW one mark for correct calculation of M_r for ammonia AND ammonium sulfate</p> <p>IGNORE units for the first marking point</p> <p>ALLOW one mark for 2 moles of ammonia makes 1 mole of ammonium sulfate</p>
Total		6	

	<p>OR</p> <p>$2 \times 53.5 = 107\text{g}$ ammonium chloride produces $2 \times 24 = 48\text{ dm}^3$ ammonia ✓</p> <p>So 5.00g of ammonium chloride produces $\frac{5 \times 2 \times 24}{2 \times 53.5}$</p> <p>$= 2.24 / 2.243 / 2.2\text{ (dm}^3\text{)}$ ammonia ✓</p>		<p>ALLOW 2.16 (ECF from 0.09)</p> <p><u>Examiner's Comments</u></p> <p>Higher ability candidates correctly calculated the volume of ammonia gas as 2.24dm^3. Examiners gave error carried forward for correctly converting an incorrectly calculated number of moles to a volume.</p> <p>Common errors in this calculation included</p> <ul style="list-style-type: none"> • using $107 (2 \times 53.5)$ as the formula mass before calculating the number of moles of NH_4Cl to give an answer of 1.12 • just multiplying $5(\text{g}) \times 24$ • dividing the number of moles by 24 • converting 24dm^3 to cm^3 before multiplying by the number of moles
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