Mark scheme – Introducing Chemical Reactions

Question			Answer/Indicative content	Marks	Guidance
1			D ✓	1 (AO2.2)	
			Total	**1**	
2			D ✓	1 (AO1.1)	
			Total	**1**	
3			D ✓	1(AO2.2)	
			Total	**1**	

4.

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

5.

	i	Na_2O (s) + H_2O (l) → **2**NaOH (aq) Formulae ✓ Balancing ✓ State symbols ✓	3 (AO2.1) (AO1.2) (AO2.1)	**ALLOW** any correct multiple, including fractions **ALLOW** = **OR** ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae e.g. NAO + H_2O →**2**NaOH State symbols mark is independent of formulae & balancing marks
	ii	Hydroxide / OH– ions]	1 (AO1.1)	
	iii	Sodium sulfate✓	1 (AO2.1)	**ALLOW** Na_2SO_4 **IGNORE** incorrect formulae if correct name is given
	iv	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 100 award 2 marks** pH increased by 2 concentration decreases by a factor of 10 × 10 ✓ 100 ✓	2 (AO2.2)	**ALLOW** for 1 mark pH increase by 1, so concentration decreased by a factor of 10

6.

		FIRST CHECK ANSWER ON ANSWER LINE **If answer = 297 award 3 marks** Relative formula mass of $MgCO_3$ = 24.3 + 12 + 16 × 3 = 84.3 ✓ Number of moles = $25 \times \frac{1000}{84.3} = 296.5599051$ = 297 ✓ (to 3 sig fig)	3 (AO2.2 × 2) (AO1.2)	**DO NOT ALLOW** 84 **ALLOW ECF** from incorrect RFM of $MgCO_3$ eg RFM of 84, number of moles = 298 **ALLOW** ECF for sig fig mark
		Total	**3**	

7.

			$N_2 + 3H_2 \rightleftharpoons 2NH_3$ Formulae ✓ Balancing ✓	2(AO 2.2)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** = / → instead of ⇌ **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae eg $N_2 + 3H_2 \rightleftharpoons 2Nh_3$ **Examiner's Comments** Most candidates were able to write the correct balanced symbol equation for the reaction of nitrogen with hydrogen. One mark was given for the correct reactants and products and one mark for the correct balancing. The balancing mark was dependent on the correct formulae, but one mark was allowed for a balanced equation with minor errors in subscripts or formulae. For example, $N_2 + 3H2 \rightleftharpoons 2Nh_3$, would gain one mark. When candidates did not gain marks, it was often because they wrote 6H as a reactant, rather than $3H_2$. **AfL** Although it was not penalised in this question, candidates should be taught to use the ⇌ symbol for a reversible reaction, rather than an →.
			Total	**2**	

8.

	i	$3Pb + 8HNO_3 \rightarrow 3Pb(NO_3)_2 + 2NO + 4H_2O$ Formulae ✓ Balancing ✓	2 (AO1.1) (AO2.2)	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae e.g. $3PB + 8HNO_3 \rightarrow 3Pb(NO_3)_2 + 4H_2O$ **Examiner's Comments** Higher ability candidates were able to write the correct balanced symbol equation for the reaction of lead with nitric acid. One mark was given for the correct reactants and products and 1 mark for the correct balancing. The balancing mark was dependent on the correct formulae, but 1 mark was allowed for a balanced equation with a minor error in subscripts or formulae. Most candidates gained 1 mark for the correct reactants and products but were unable to correctly balance the equation.
	ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.10 award 4 marks** M_r of $Pb(NO_3)_2$ = 331.2 **or** 207g of Pb would produce 331.2g of $Pb(NO_3)_2$ / 20.7g of Pb would produce 33.12g of $Pb(NO_3)_2$ ✓	4 (AO3 × 2.2)	**ALLOW** 331 **ALLOW ECF** from balanced equation in (i) **ALLOW** 3 marks for 0.1 (ie not 2 sig figs)