2. Atoms, molecules and stoichiometry

2.4 Reacting masses and volumes

Paper 3

Marking Scheme

Q1.

(b)(i)	$MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$	1

Q2.

(a)(iii)	$0.18/90 \times 2 \times 6.02 \times 10^{23} = 2.408 \times 10^{21}$ (atoms) OR **2.4(1) × 10^{21}** (atoms) **M1** no mole ethanedioic acid	$0.18 / 90 = 0.0020$	1
	M2 no mole ethanedioic acid × 2	$0.0020 \times 2 = 0.0040$	1
	M3 no mole ethanedioic acid × 6.02×10^{23}	2.4×10^{21}	1

Q3.

(d)(i)	**M1** moles of $As_2S_3 = 0.198 / 246.1 / 8.05 \times 10^{-4}$ **M2** moles SO_2 (using moles of As_2S_3 as limiting factor) = $2.41(36) \times 10^{-3}$ moles ($6 / 2 \times 8.05 \times 10^{-4}$) Volume $SO_2 = 2.41(36) \times 10^{-3} \times 24 = 0.0579\ dm^3$ **M3** Moles O_2 used in reaction = $8.05 \times 10^{-4} \times 9 / 2 = 3.62 \times 10^{-3}$ Volume O_2 used in reaction = $3.62 \times 10^{-3} \times 24 = 0.0869\ dm^3$ **M4** Final total volume gas = (0.1 – 0.0869) + 0.0579 = [0.0131 + 0.0579] = <u>0.071</u>(0) dm^3 **M4 ONLY award 4th mark if the final answer rounds to <u>0.071</u>** Answer to minimum of 2 sig figs **MAX 3 for using** ecf from M1 to M2 to M3 and M4 **Award all 4 marks if final answer rounds to 0.071**	4

Q4.

(d)(i)	**M1** moles of $NH_3 = 1.50 \times 10^6 \times 10^6 \div 17 = 8.82 \times 10^{10}$ **M2** mass of $CaCN_2 = \frac{½ \times M1 \times 80.1}{10^6} = 3.53 \times 10^6$	2

Q5.

(e)	**M1** *number of mol in sample of NH_4NO_3* 40t NH_4NO_3 = 500 000 mol ammonium nitrate **M2** *ratio of mol NO_2: NH_4NO_3* 3/2 mol NO_2 :1 mol NH_4NO_3 **M3** *volume of no mol NO_2 at rtp using 1 mol = 24dm³* 18 000 000 dm^3 of NO_2	3

Q6.

(c)		*method 1*	*method 2*	
	M1	1 / 28 (= 0.035714)	1 : 88 / 28 (= 3.14286)	**1**
	M2	2 × M1 (= 1 / 14 = 0.07143)	M1 / 44 (= 0.071429)	**1**
	M3	M2 × 24 = 1.7 dm^3	M2 × 24 = 1.7 dm^3	**1**