Question Number	Answer	Acceptable answers	Mark
1(a)(i)	$CuCl_2$		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	An explanation linking the following points **Either** • the amount of product calculated (1) • using the equation (for the reaction) (1) **Or** • the maximum amount of {product / copper chloride} (1) • when all {reactant / copper} reacts (1)	using reacting masses amount of product when all {reactant / copper} reacts (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	$2Fe(s) + 3Br_2(g) \rightarrow 2FeBr_3(s)$ reactant formulae (1) balancing correct formulae (1) state symbols (1) s and g must be lower case	**allow** state symbol mark even if other marks not awarded	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	56 + (3 x 80) (1) = 296	give full marks for correct answer with no working	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	ratio: 56/310 (1) % iron 56/310 x 100 (%) (1) (= 18 (%))	 any number/310 x 100 (%) 18.06/18.1 give full marks for correct answer with no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iv)	HO	OH, O_1H_1, H_1O_1	**(1)**

Question number	Answer	Additional guidance	Mark
2(a)	An answer that combines the following points of understanding to provide a logical description: • (hydrogen produced as a gas so) there would be {effervescence/fizzing/ bubbles} (1) • and (calcium hydroxide produced as a solid so) the water would go {cloudy/a white precipitate would form} (1)	Allow: calcium moves (around) (1) calcium decreases in size/disappears/dissolves (1)	**(2)**

Question number	Answer	Mark
2(b)	$Mg + H_2O \rightarrow MgO + H_2$ • LHS (1) • RHS (1)	**(2)**

Question number	Answer	Additional guidance	Mark
2(c)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • In calcium the outermost electron(s) {are further away from nucleus /experience(s) greater shielding} (from the nucleus) (as shown by the electronic configuration) (1) • Therefore less attraction between nucleus and electron(s)/ the electron(s) is/are easier to remove (1)	Allow answers in terms of why reactivity of magnesium is less than that of calcium	**(2)**

Question number	Answer	Additional guidance	Mark
2(d)	• divides mass by relative atomic mass (1) • calculates simplest ratio (1) • expresses ratio correctly as empirical formula (1)	Example of calculation Ca : Br $\frac{0.2}{40}$: $\frac{0.8}{80}$ 0.005 : 0.01 1 : 2 empirical formula $CaBr_2$ Formula alone scores max 1	**(3)**

Question number	Answer	Additional guidance	Mark
3(a)(i)	• particles are same size when they should be different sizes (1) • model is in 2D but crystal is 3D (1)	Allow reverse statements giving correct information.	**(2)**

Question number	Answer	Mark
3(a)(ii)	An explanation that combines identification – knowledge (1 mark) and reasoning/justification – understanding (2 marks): • very strong bonds/ionically bonded (1) • between 2+ cations and 2– anions (1) • so requires lot of energy to separate magnesium and oxide ions to melt the solid (1)	**(3)**

Question number	Answer	Additional guidance	Mark
3(b)(i)	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$ • all formulae on correct side (2) • balancing (1)	Allow 3/4 formulae (1)	**(3)**

Question number	Answer	Additional guidance	Mark
3(b)(ii)	relative formula mass copper carbonate = 63.5 +12.0 +(3 × 16.0) = 123.5 relative formula mass copper oxide = 63.5 + 16.0 = 79.5 (1) mass copper oxide $= \frac{15.0 \times 79.5}{123.5}$ = 9.7 g to 2 s.f. (1) Answer must be to two significant figures OR moles of copper carbonate $= \frac{15.0}{123.5} = 0.121\,45$ (1) mass of copper oxide = moles $CuCO_3$ × 79.5 = 9.7 g to 2sf (1) Answer must be to two significant figures	Award full marks for correct numerical answer without working.	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)	2.4/24 moles Mg = 0.1 mol (1) and 0.2 moles H_2O has mass 0.2 × formula mass H_2O = 3.6 g (1) total mass reactants = 2.4 + 3.6 = 6.0 g is the same as total mass products = 5.8 + 0.2 = 6.0 g (1)	Award full marks for correct numerical answer without working.	**(3)**

Question Number	Answers	Acceptable Answers	Mark
4(a)(i)	A displacement		**(1)**

Question Number	Answers	Acceptable Answers	Mark
4(a)(ii)	orange	Any colour or combination of colours from brown, red, orange and yellow Ignore shade of colours Reject other colours combined with these e.g. yellow-green	**(1)**

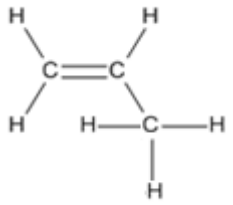
Question Number	Answers	Acceptable Answers	Mark
4(b)	**C**		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	(H_2 + Br_2 →) 2HBr • correct formula for HBr **(1)** • balancing of correct formulae **(1)**	Ignore state symbols Allow BrH **(1)**	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	[24 + 2x35.5] **(1)** (= 95)	95 with no working [24 + 2x35.5] with no answer or an incorrect answer scores **(1)**	**(1)**

Question Number	Answers	Acceptable Answers	Mark
4(e)	• relative formula mass =[23 + 19] **(1)** (= 42) • [(19/their relative formula mass) x100] **(1)** (=45.2(%)) **consequential** on their relative formula mass	(19/42) x 100 **(2)** (= 45.2 (%)) (19/[19+23]) x 100 **(2)** (= 45.2 (%)) 45/45.2 (%) with no working **(2)** Ignore additional significant figures Allow 42 seen in working **(1)** Allow (19/23) x 100 = {82.6% / 83%} **(1)**	**(2)**

Question number	Answer	Mark
5(a)	C	(1)

Question number	Answer	Additional guidance	Mark
5(b)	• molecular formula – C_5H_{10} (1) • structure (1) 		(2)

Question number	Answer	Additional guidance	Mark
5(c)(i)	• calculates relative molecular mass of C_4H_9OH (1) • calculates mass of C_4H_9OH produced (1) • final answer = 1.9 (kg) (1)	Example of calculation Relative molecular mass of C_4H_9OH = (4 × 12) + (9 × 1) + 16 + 1 = 74 Mass of C_4H_9OH produced = (74 ÷ 56) × 1.4 Accept 1.85 (kg) Award full marks for use of moles/correct numerical answer without working	(3)

Question number	Answer	Mark
5(c)(ii)	A	(1)

Question number	Answer	Mark
5(d)	• X and Y are both unsaturated/contain {multiple/double} bonds/alkenes (1) • Z is saturated/contains no {multiple/double} bonds/alkane (1)	(2)