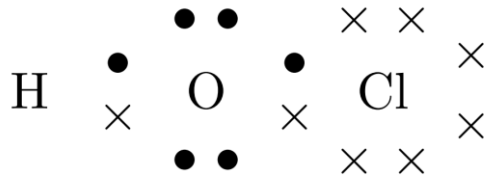
Junior Chemistry Challenge 2026

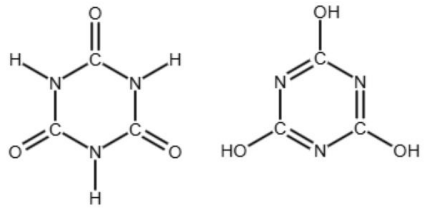
Mark Scheme

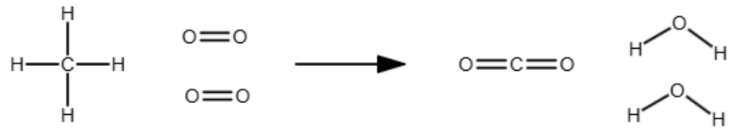
Question 1 – Multiple Choice

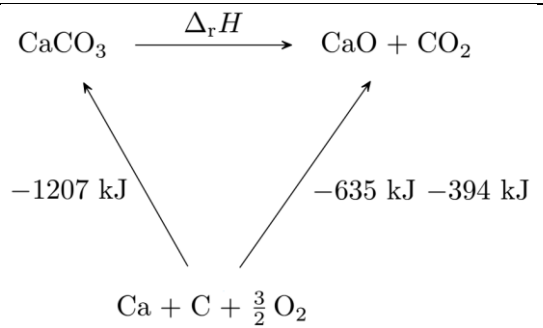
a) **C** – X and Y will react to form an ionic compound
b) **A** – $CaCO_3 \rightarrow CaO + CO_2$
c) **E** – CsF
d) **B** – ^1H: 80%, ^2H: 20%
e) **D** – Li
f) **D** – The average iodine atom has more neutrons than the average tellurium atom
g) **B** – Excess NiO is easier to remove than excess H_2SO_4
h) **E** – Cyclohexene
i) **A** – NH_4ClO_4
j) **E** – 25 mL

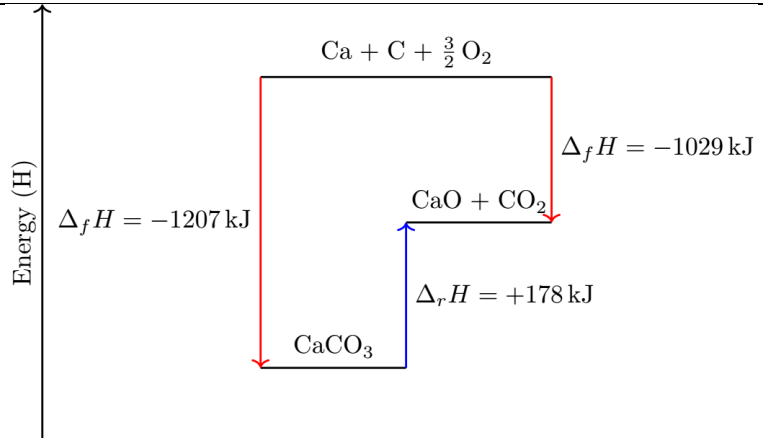
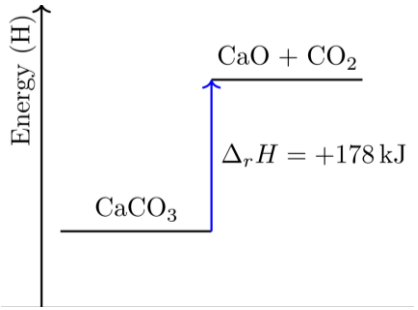
Question	Answer	Additional Guidance	Mark
2(a)	 One shared pair between Cl-O AND between O-H **(1)** All other electrons correct **(1)**	REJECT a dot and cross diagram with H^+ and ClO^-	2
2(b)	$2\ NaCl + 2\ H_2O \rightarrow Cl_2 + H_2 + 2\ NaOH$ Correct formulae for reactants and products **(1)** Correct balancing **(1)**	ALLOW multiples Balancing mark dependent on correct formulae	2

2(c)	Solution/products are acidic/has a low pH **(1)** Add alkali/base OR neutralise solution **(1)**	Just stating HCl (aq) present is insufficient, answer must refer to its acid nature e.g. hydrochloric **acid** ALLOW the solution is corrosive ALLOW addition of any named base	2
2(d)(i)	**1st Mark, correctly calculating the relative mass of two ClO^-:** 2x ClO^- = 2 x (35.5 + 16) = 103 **2nd Mark, correctly calculating the relative mass of $Ca(ClO)_2$:** 40 + 2 x (35.5 + 16) = 143 **3rd Mark, correctly finding the percent by mass:** (103/143) x 100% = 72%	Not including 2 ClO^-: 51.5/143 = 36% **(2)** ALLOW any sig fig except 1.	3
2(d)(ii)	**1st Mark, calculating the mass of water in the pool:** Volume = 10 x 2.5 x 50 x2 = 2500 m^3 Mass = 2500 x 1000 = 2,500,000 kg **2nd Mark, calculating mass of ClO^- needed:** 2 x 10^{-6} x 2,500,000 = 5 kg **3rd Mark, calculating mass of $Ca(ClO)_2$:** 5/0.72 = 6.94 kg	ALLOW ECF of answer from part 2(d)(i). E.g. if 36% in 2(d)(i) then 13.89kg **(3)** ALLOW any sig fig except 1.	3
2(e)	NH_2Cl **(1)**	IGNORE a 2 in front of NH_2Cl	1

2(f)	 Either structure **(2)** Incorrect structure but with correct formula ($C_3H_3N_3O_3$) **(1)**	ALLOW skeletal formula N-H and O-H bonds do not need to be explicit.	2

Question	Answer	Additional Guidance	Mark
3(a)(i)	 Quantity of each reactant and bonds in reactants correct **(1)** Quantity of each product and bonds in reactants correct **(1)**		2
3(a)(ii)	**1st Mark, calculating energy of bonds broken in the reactants:** 4(C-H) + 2(O=O) = 4(412) + 2(498) = 2644 kJ **2nd Mark, calculating energy of bonds made in the products:** 2(C=O) + 4(O-H) = 2(742) + 4(464) = 3340 kJ **3rd Mark, energy of bonds in reactants minus energy of bonds in products:** 2644 – 3340 = - 696 kJ	Had O-O in 3(a)(i): -1404 kJ **(2)** Had C-O in 3(a)(i): +72 kJ **(2)** Had O-O and C-O in 3(a)(i): -636 kJ **(2)**	3

3(a)(iii)	Average bond energies will be **different** from the specific energies of the bonds in the molecules. **(1)**	IGNORE energy losses to the environment or incomplete combustion	1
3(b)(i)	$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ **(1)**	REJECT multiples ALLOW 0.5 and 1.5/$1\frac{1}{2}$ for the fractions If all parts have the correct reactants with the correct coefficients but there are no products give **1 mark** total for all three parts.	1
3(b)(ii)	$\frac{1}{2}N_2 + \frac{3}{2}H_2 \rightarrow NH_3$ **(1)**		1
3(b)(iii)	$2\ C + 3\ H_2 + \frac{1}{2}O_2 \rightarrow C_2H_5OH$ **(1)**		1
3(c)	Reactants and products **are the same** (so there is no energy difference) **(1)** OR The energy of the bonds in the reactants and products **are the same (1)**	ALLOW no bonds are being broken or made	1
3(d)	 Formulae and balancing correct at each vertex of the Hess Cycle **(1)** Arrows pointing in correct direction **(1)** $\Delta_r H$ = -(-1207) -635 – 394 = 178 kJ **(1)**	ALLOW two arrows from elements to products representing each formation energy Arrows do not need to be labelled but an incorrect label will lose M2	3

3(e)	 Relative height of reactants, products and elements correct **(1)** Directions of arrows correct **(1)**	The following correctly drawn scores **1** (arrow doesn't have to be labelled):  y-axis energy arrow does not need to be present Levels must have correct substances allow ECF on balancing from 3(d) Arrows do not need to be labelled but an incorrect label will lose M2	2