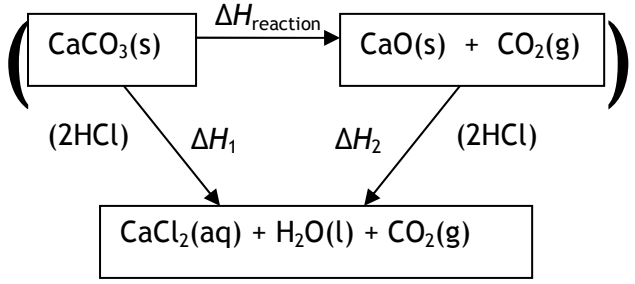
Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$ ALLOW multiples No other species to be allowed IGNORE state symbols even if incorrect	H_2CO_3 instead of "$H_2O + CO_2$" on right hand side of equation	**1**

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	 **Mark each point independently** **First mark:** All three formulae in box, ignoring state symbols (even if incorrect) **This mark is stand alone, NOT to be marked CQ on answer to (a)(i)** **(1)** **Second mark:** Two arrows, BOTH pointing downwards **(1)** **Third mark:** Left hand arrow labelled as ΔH_1 **AND** right hand arrow labelled ΔH_2 (whatever the direction of the arrows) **(1)**	Any other formulae	**3**

Question Number	Acceptable Answers	Reject	Mark
1(a)(iii)	$(\Delta H_{reaction}) = \boldsymbol{\Delta H_1 - \Delta H_2}$ This is a stand alone answer NOT to be marked CQ on (a)(ii) and/or (a)(i)	Any other expression	**1**

Question Number	Acceptable Answers	Reject	Mark
1(b)	**Any two from:** Heat /energy loss OR Heat /energy loss to surroundings OR Heat /energy loss to apparatus **(1)** Measured under non-standard conditions **(1)** Specific heat capacity of solutions is approximate **(1)** Density of solution assumed to be 1 g cm^{-3}/same as (pure) water **(1)** Large relative error in temperature measurement **(1)**	"Incomplete reaction" "Incomplete combustion" "Inaccuracy of equipment/apparatus" "Human error" CO_2 escapes Bond enthalpies Impurity of reactants Transfer losses Side-reactions	**2**

Question Number	Acceptable Answers	Reject	Mark
2 (a) (i)	(q = 250 x (31.5 − 21.0) x 4.18 =) **10972.5** (J) *IGNORE* sf except 1 sf *IGNORE* units even if incorrect *IGNORE* any sign at this stage *ALLOW* 10.97 (kJ)	10000 (J)	**1**

Question Number	Acceptable Answers	Reject	Mark
2 (a) (ii)	*(M_r* ethanol) = 46 **(1)** (Mass ethanol burned = 63.21 − 62.47 =) 0.74 (g) *ALLOW* 63.21 − 62.47 as alternative to 0.74 **(1)** (Amount of ethanol = 0.74 ÷ 46 =) 0.0161 (mol) **(1)** **NOTE***:* Moles of ethanol are CQ on molar mass and /or mass of ethanol burned *IGNORE* sf except 1 sf **NOTE***:* Correct answer with no working /limited working scores **(3)** **Mark the three points independently**	0.02 (mol) ethanol	**3**

Question Number	Acceptable Answers	Reject	Mark
2 (a) (iii)	Answer (i) ÷ (1000 x answer (ii)) **(1)** **NOTE***:* Be aware of numbers held in calculator not corresponding to what is written in answer Value and negative sign **(1)** *IGNORE* sf except 1 sf **NOTE***:* Answer consistent with (a)(i) and (a)(ii) with no working scores **(2)** **E.g.** 10.9725 ÷ (0.74 ÷ 46) = – 682 (kJ mol^{-1}) *ALLOW* Just kJ as the units **NOTE***:* If correct answer is given in J mol^{-1}, the units of J mol^{-1} must be clearly given for the second mark to be awarded.	Correct answer in J instead of J mol^{-1}	**2**

Question Number	Acceptable Answers	Reject	Mark
2 (b) (i)	100 x (1370 – Answer to (iii)) ÷ 1370 = value e.g. 100 x (1370 – 682) ÷ 1370 = 50.2 %	Incorrect rounding of final answer **(0)**	**1**

Question Number	Acceptable Answers	Reject	Mark
2 (b) (ii)	Any **three** from: Heat loss (from the beaker)/beaker not insulated/heat loss as no lid on beaker (containing the water) /no stirring **(1)** Incomplete combustion (of the alcohol)/formation of soot (on beaker) **(1)** Not all of the energy from the flame is used to heat the beaker and/or the water OR Too large a distance between flame and beaker / no draught excluder **(1)** Heat capacity of the beaker is neglected/beaker absorbs heat/glass absorbs heat **(1)** Evaporation of the (hot) alcohol **(1)** Evaporation of the (hot) water **(1)**	More accurate thermometer **Just** "experimental /human error" Experiment carried out at a different (laboratory) temperature	**3**

Question Number	Acceptable Answers	Reject	Mark
2 (b) (iii)	$2\ C(s) + 3H_2(g) + ½\ O_2(g) \rightarrow C_2H_5OH(l)$ $\downarrow \qquad\qquad \downarrow$ $2CO_2 + 3H_2O$ $\triangle H_f = 2 \times (-394) + 3 \times (-286) - (-1370)$ $= -276\ (kJ\ mol^{-1})$ Correct expression or cycle **(1)** Evidence for **both** doubling ΔH^{θ}_c [C] **and** trebling ΔH^{θ}_c [H_2] **(1)** Correct sign and answer **(1)** Correct answer with no working scores **(3)** Correct answer with an incorrect cycle **(3)** *IGNORE* units even if incorrect **Alternatively the following answers score as shown even with incorrect cycle or incorrect units** **NOTE***:* (+)276 with or without working scores **(2)** (+)690 with or without working scores **(2)** −690 with or without working scores **(1)** −552 with or without working scores **(2)** −1134 with or without working scores **(2)** (+)1134 with or without working scores **(1)** (+)10 with or without working scores **(2)** **REMINDER IF ANY OTHER ANSWER IS GIVEN: ALL WORKING MUST BE CHECKED TO SEE IF ANY MARKS CAN BE AWARDED**		**3**