Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

bond enthalpies are averages from many different compounds; they apply to gases, but some substances in the reaction may be liquids

2.2

broken: $4(414) + 2(498) = 2652$; formed: $2(804) + 4(463) = 3460$; $\Delta H = 2652 - 3460 = \mathbf{-808\ kJ\ mol^{-1}}$

2.3

route: C $\rightarrow$ CO_2 then backwards $CO_2 \rightarrow$ CO; $\Delta H = -394 - (-283) = \mathbf{-111\ kJ\ mol^{-1}}$

2.4

lattice enthalpy $= 107 + 496 + 121 - 349 - (-411) = \mathbf{+786\ kJ\ mol^{-1}}$

3.1

(a) the enthalpy change of a reaction is independent of the route, provided the initial and final states are the same

(b) $\Delta H = \Delta H_1 - \Delta H_2 = -66.5 - 11.7 = \mathbf{-78.2\ kJ\ mol^{-1}}$

(c) it is hard to add exactly the right amount of water; the solid would partly dissolve / the reaction is slow, so the temperature change cannot be measured accurately

(d) $Q = 50.0 \times 4.18 \times 6.2 = 1296$ J; $\Delta H_1 = -\dfrac{1.296}{0.0200} = \mathbf{-64.8\ kJ\ mol^{-1}}$

(e) heat lost to the surroundings

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