

## COMBINATION PROBLEM 8



$$Q = mc\Delta T$$

$$Q = 8\,000 \text{ g} \times 4.184 \frac{\text{J}}{\text{g}^\circ\text{C}} (40 - 20)^\circ\text{C}$$

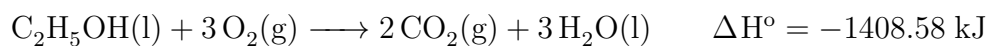
$$Q = 669\,440 \text{ J}$$

$$Q = 669.44 \text{ kJ}$$

$$\frac{669.44 \text{ kJ}}{21.9 \text{ g C}_2\text{H}_5\text{OH}} \times \frac{46.08 \text{ g C}_2\text{H}_5\text{OH}}{1 \text{ mol C}_2\text{H}_5\text{OH}} = \frac{1408.58 \text{ kJ}}{1 \text{ mol C}_2\text{H}_5\text{OH}}$$

$$\Delta H = -Q$$

$$\Delta H = -1408.58 \text{ kJ/1 mol C}_2\text{H}_5\text{OH}$$



$$\Delta H^\circ = [2\Delta H_{\text{CO}_2(g)}^\circ + 3\Delta H_{\text{H}_2\text{O}(l)}^\circ] - [\Delta H_{\text{C}_2\text{H}_5\text{OH}(g)}^\circ + 3\Delta H_{\text{O}_2(g)}^\circ]$$

$$-1408.58 \text{ kJ} = [2(-393.5 \text{ kJ}) + 3(-285.8 \text{ kJ})] - [\Delta H_{\text{C}_2\text{H}_5\text{OH}}^\circ + 3(0)]$$

$$\Delta H_{\text{C}_2\text{H}_5\text{OH}(g)}^\circ = -1644.4 \text{ kJ} + 1408.58 \text{ kJ}$$

$$\Delta H_{\text{C}_2\text{H}_5\text{OH}(g)}^\circ = -235.82 \text{ kJ}$$

Please note that the textbook value (pg 799) for the heat of formation of  $\text{C}_2\text{H}_5\text{OH}(l)$  is  $-235.2 \text{ kJ}$ . This is definitely close enough!