COMBINATION PROBLEM 3

$$C_6H_{14}(l) + \tfrac{19}{2}\,O_2(g) \longrightarrow 6\,CO_2(g) + 7\,H_2O(l) \qquad \Delta H^o = ?$$

$$Q = mc\Delta T$$
$$Q = 25\,000 \text{ g x } 4.184\ \frac{J}{g^oC}\ (31.925\ -\ 25.000)^oC$$
$$Q = 724355 \text{ J}$$
$$Q = 724.36 \text{ kJ}$$

$$\frac{724.36 \text{ kJ}}{15 \text{ g } C_6H_{14}} \text{ x } \frac{86.20 \text{ g } C_6H_{14}}{1 \text{ mol } C_6H_{14}} = \frac{4162.63 \text{ kJ}}{1 \text{ mol } C_6H_{14}}$$

$$\Delta H = -Q$$
$$\Delta H = -4162.63 \text{ kJ}/1 \text{ mol } C_6H_{14}$$

$$C_6H_{14}(l) + \tfrac{19}{2}\,O_2(g) \longrightarrow 6\,CO_2(g) + 7\,H_2O(l) \qquad \Delta H^o = -4162.63 \text{ kJ}$$

$$\Delta H^o = [6\Delta H^o_{CO_2(g)} + 7\Delta H^o_{H_2O(l)}] - [\Delta H^o_{C_6H_{14}(l)} + \tfrac{19}{2}\,\Delta H^o_{O_2(g)}]$$
$$-4162.63 \text{ kJ} = [6(-393.5 \text{ kJ}) + 7(-285.8 \text{ kJ})] - [\Delta H^o_{C_6H_{14}} + \tfrac{19}{2}\,(0)]$$
$$\Delta H^o_{C_6H_{14}(l)} = -4361.6 \text{ kJ} + 4162.63 \text{ kJ}$$
$$\Delta H^o_{C_6H_{14}(l)} = -198.97 \text{ kJ}$$

Please note that the textbook value (pg 799) for the heat of formation of C_6H_{14} is -198.7 kJ. This is definitely close enough!