1. Calculate the enthalpy of combustion of propane, C\(_3\)H\(_8\)(g), given the following data.

\[ \Delta H_{C_3H_8(g)} = -104 \text{ kJ mol}^{-1} \quad \Delta H_C(s) = -394 \text{ kJ mol}^{-1} \quad \Delta H_{H_2(g)} = -286 \text{ kJ mol}^{-1} \]

\[ 3C(s) + 4H_2(g) \rightarrow C_3H_8(g) \quad -104 \quad \Delta_c H = 3(-394) + 4(-286) \]

\[ 3CO_2(g) + 4H_2O(l) \]

\[ \Delta H = -2222 \text{ kJ mol}^{-1} \]

2. Pentane is a good fuel that burns well in oxygen. C\(_5\)H\(_{12}\)(l) + 8O\(_2\)(g) → 5CO\(_2\)(g) + 6H\(_2\)O(l)

a. Calculate the enthalpy change for this reaction given the following enthalpies of formation:

\[ \Delta H_c / \text{kJ mol}^{-1} \quad \Delta H_{C_5H_{12}(l)} = -147 \quad \Delta H_{CO_2(g)} = -394 \quad \Delta H_{H_2O(l)} = -286 \]

\[ \Delta H = \text{[Sum } \Delta H \text{ products]} - \text{[Sum } \Delta H \text{ reactants]} \]

\[ \Delta H = 5(-394) + 6(-286) - [-147 + 0] \]

\[ \Delta H = -3539 \text{ kJ mol}^{-1} \]

b. 1.56 g of pentane was burned in a spirit burner and used to heat 100.0 g of water in a copper calorimeter. The temperature of the water rose by 28°C. Calculate the enthalpy of combustion of pentane determined by this experiment. The specific heat capacity of the solution is 4.18 J K\(^{-1}\) g\(^{-1}\).

\[ q = mc\Delta T = 100 \times 4.18 \times 28 = 11704 \text{ J} = 11704 \text{ kJ} \]

\[ \text{moles} = \frac{1.56}{72.0} = 0.02167 \]

\[ \Delta H = -\frac{q}{\text{mol}} = -\frac{11704}{0.02167} = -540 \text{ kJ mol}^{-1} \]

c. Suggest two reasons why the values obtained in a and b differ, and which is the correct value.

Correct value: a

Any 2 of: heat loss, incomplete combustion, some fuel evaporate