Answer on the question #62981, Chemistry / General Chemistry

Question:

Given the standard enthalpy changes for the following two reactions:
(1) 4C(s) + 5H2(g)C4H10(g)..... ΔH° = -125.6 kJ
(2) C2H2(g)2C(s) + H2(g).....ΔH° = -226.7 kJ
what is the standard enthalpy change for the reaction:
(3) 2C2H2(g) + 3H2(g)C4H10(g).....ΔH° = ? kJ

Solution:

The reaction equation:

$$2C_2H_{2(g)} + 3H_{2(g)} \rightarrow C_4H_{10(g)} \quad (3)$$

The reactions given the standard enthalpy change:

$$4C_{(s)} + 5H_{2(g)} \rightarrow C_4H_{10(g)}, \Delta H = -125.6\ kJ \quad (1)$$

$$C_2H_{2(g)} \rightarrow 2C_{(s)} + H_{2(g)}, \Delta H = -226.7\ kJ \quad (2)$$

As it can be seen from the equations, to get the reaction (3), we need to multiply all the coefficients of the reaction (2) by two and add to the reaction (1).

According to the Hess's law, the change of enthalpy in a chemical reaction is independent of the pathway between the initial and final states. We can use this law to calculate the change in enthalpy for our reaction:

$$\Delta H_{rxn} = \Delta H_{(1)} + 2 \cdot \Delta H_{(2)} = -125.6(kJ) - 2 \cdot 226.7(kJ) = -579\ kJ$$

Answer: The standard enthalpy change for the reaction (3) is -579 kJ