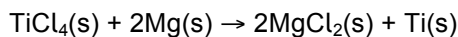




- 1 Calculate the enthalpy change for this reaction using the enthalpies of formation shown.



$$\Delta_f H / \text{kJ mol}^{-1} \quad \text{TiCl}_4(\text{s}) = -912 \quad \text{MgCl}_2(\text{s}) = -642$$

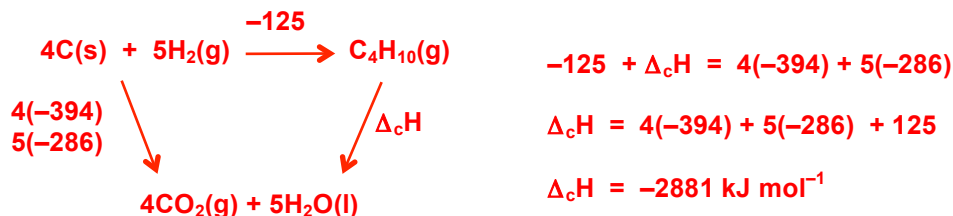
$$\Delta H = [\text{Sum } \Delta_f H \text{ products}] - [\text{Sum } \Delta_f H \text{ reactants}]$$

$$\Delta H = [2(-642) + 0] - [-912 + 0]$$

$$\Delta H = -372 \text{ kJ mol}^{-1}$$

- 2 Calculate the enthalpy of combustion of butane, $\text{C}_4\text{H}_{10}(\text{g})$, given the following data.

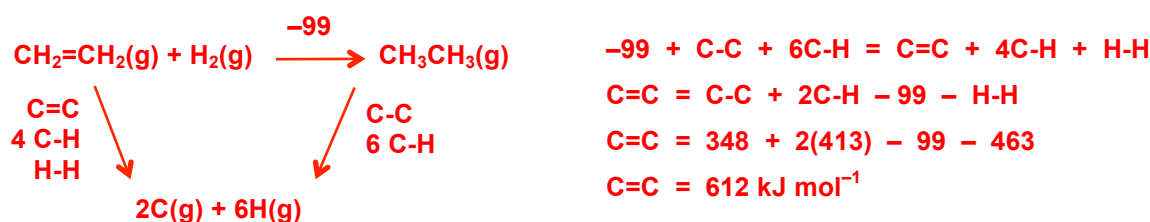
$$\Delta_f H \text{ C}_4\text{H}_{10}(\text{g}) = -125 \text{ kJ mol}^{-1} \quad \Delta_c H \text{ C}(\text{s}) = -394 \text{ kJ mol}^{-1} \quad \Delta_c H \text{ H}_2(\text{g}) = -286 \text{ kJ mol}^{-1}$$



- 3 Ethene reacts with hydrogen as shown: $\text{CH}_2=\text{CH}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{CH}_3(\text{g}) \quad \Delta H = -99 \text{ kJ mol}^{-1}$

Calculate the bond enthalpy for the C=C bond using this data and the following bond enthalpies.

$$\text{C-H} = 413, \quad \text{H-H} = 463, \quad \text{C-C} = 348 \text{ kJ mol}^{-1}$$



- 4 1.22 g of propan-1-ol, $\text{C}_3\text{H}_7\text{OH}(\text{l})$, was burned in a spirit burner and used to heat 50.0 g of water in a copper calorimeter. The temperature of the water rose by 52°C . Calculate the enthalpy of combustion of propan-1-ol determined by this experiment. The specific heat capacity of the solution is $4.18 \text{ J K}^{-1} \text{ g}^{-1}$.

$$q = mc\Delta T = 50 \times 4.18 \times 52 = 10868 \text{ J} = 10.868 \text{ kJ}$$

$$\text{moles} = \frac{1.22}{60.0} = 0.02033$$

$$\Delta H = -\frac{q}{\text{mol}} = -\frac{10.868}{0.02033} = -535 \text{ kJ mol}^{-1}$$