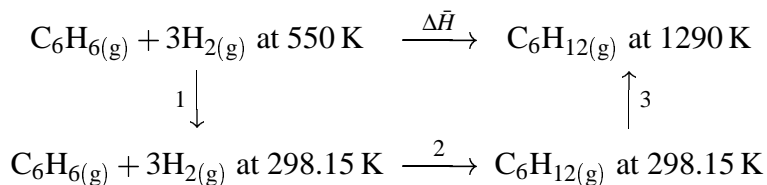


Chemistry 2720 Fall 2003 Quiz 2 Solution

It's easier to see what we're trying to do if we draw a diagram:



We want to take reactants at 550 K and make products at 1290 K. We can't do this calculation directly, so we follow the path 1 \rightarrow 2 \rightarrow 3. The required calculations are as follows:

$$\begin{aligned} \Delta\bar{H}_1 &= (\bar{C}_{P(\text{C}_6\text{H}_6)} + 3\bar{C}_{P(\text{H}_2)}) \Delta T_1 \\ &= (82.44 + 3(28.84)) \text{JK}^{-1}\text{mol}^{-1} (298.15 - 550 \text{ K}) \\ &= -42.55 \text{ kJ/mol} \\ \Delta\bar{H}_2 &= \Delta\bar{H}_{f(\text{C}_6\text{H}_{12})}^\circ - (\Delta\bar{H}_{f(\text{C}_6\text{H}_6)}^\circ + \Delta\bar{H}_{f(\text{H}_2)}^\circ) \\ &= -123.1 - 82.9 \text{ kJ/mol} = -206.0 \text{ kJ/mol} \\ \Delta\bar{H}_3 &= \bar{C}_{P(\text{C}_6\text{H}_{12})} \Delta T_3 \\ &= (105.3 \text{ JK}^{-1}\text{mol}^{-1}) (1290 - 298.15 \text{ K}) \\ &= 104.44 \text{ kJ/mol} \\ \therefore \Delta\bar{H} &= \Delta\bar{H}_1 + \Delta\bar{H}_2 + \Delta\bar{H}_3 \\ &= -42.55 + (-206.0) + 104.44 \text{ kJ/mol} = -144.1 \text{ kJ/mol} \end{aligned}$$