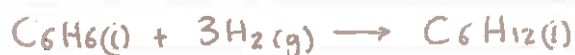


Entropy Questions

① Predict the feasibility of each of the following reactions at the stated temperature by calculating both $\Delta S_{\text{surrounding}}$ and ΔS_{total} .



② Benzene can be hydrogenated to make cyclohexane:



a) The enthalpy changes of combustion (in kJ mol^{-1}) are:

$$\Delta H_c^\ominus \text{C}_6\text{H}_6(\text{l}) = -3276$$

$$\text{H}_2(\text{g}) = -286$$

$$\text{C}_6\text{H}_{12}(\text{l}) = -3920$$

Calculate the enthalpy change for the hydrogenation of benzene.

b) Calculate $\Delta S_{\text{surroundings}}$ if the reaction occurs at 330K.

c) Calculate ΔS_{system} from the standard entropy values (in $\text{J K}^{-1} \text{mol}^{-1}$):

$$S^\ominus = \text{C}_6\text{H}_6(\text{l}) = 173$$

$$\text{C}_6\text{H}_{12}(\text{l}) = 204.4$$

$$\text{H}_2(\text{g}) = 130.6$$

d) Calculate ΔS_{total} and comment on the feasibility of the reaction at 330K.

3) This is about the possible reduction of zinc oxide by carbon monoxide at 1000K.



ΔH_f^\ominus (kJ mol ⁻¹)	S^\ominus JK ⁻¹ mol ⁻¹
ZnO(s) -348	ZnO 43.6
CO(g) -111	CO(g) 197.6
Zn(s) 0	Zn(s) 41.6
CO ₂ (g) -394	CO ₂ (g) 213.6

a) Calculate the enthalpy change for the reaction.

b) Calculate ΔS_{system} .

c) Calculate $\Delta S_{\text{surroundings}}$ at 1000K.

d) Calculate ΔS_{total} and comment on the feasibility of the reaction at 1000K.

