

# SOLUTION HOME WORK CH # 16

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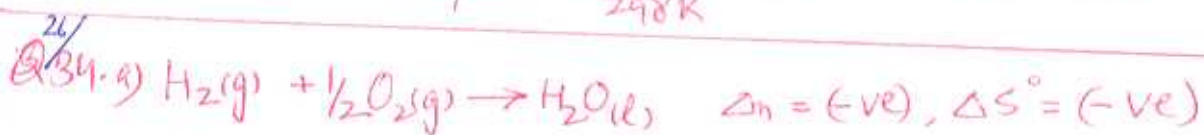
Q. 20/20: Entropy increase from solid  $\rightarrow$  liquid  $\rightarrow$  Gas,  
Mixing  $\rightarrow$  increase entropy.

a, b, and d  $\rightarrow \Delta S$  (+ve)

c, e  $\rightarrow \Delta S$  (-ve)

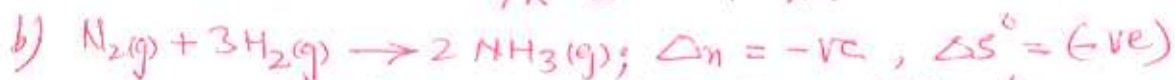
21/22. a)  $\Delta S_{\text{sur}} = -\frac{\Delta H}{T} = \frac{-(-2221 \text{ kJ})}{298 \text{ K}} = 7.45 \times 10^3 \text{ J/K}$

b)  $\Delta S_{\text{sur}} = -\frac{\Delta H}{T} = \frac{-112 \text{ kJ}}{298 \text{ K}} = -0.376 \text{ kJ/K} = -376 \text{ J/K}$

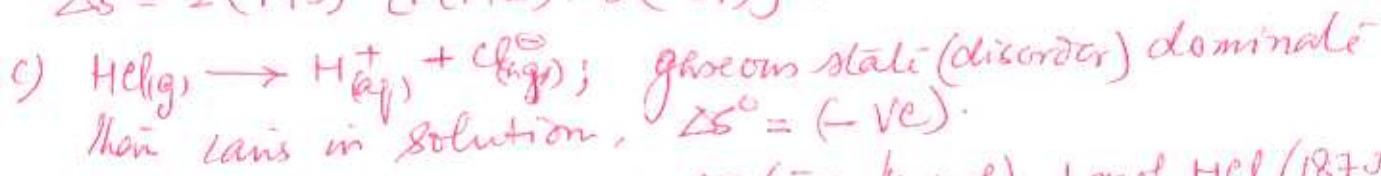


$$\Delta S^\circ = 1 \text{ mol H}_2\text{O}(\text{l}) (70 \text{ J/K}\cdot\text{mol}) - [1 \text{ mol H}_2(\text{g}) (131 \text{ J/K}\cdot\text{mol}) + \frac{1}{2} \text{ mol O}_2(\text{g}) (205 \text{ J/K}\cdot\text{mol})]$$

$$= 70 \text{ J/K} - 234 \text{ J/K} = -164 \text{ J/K}$$

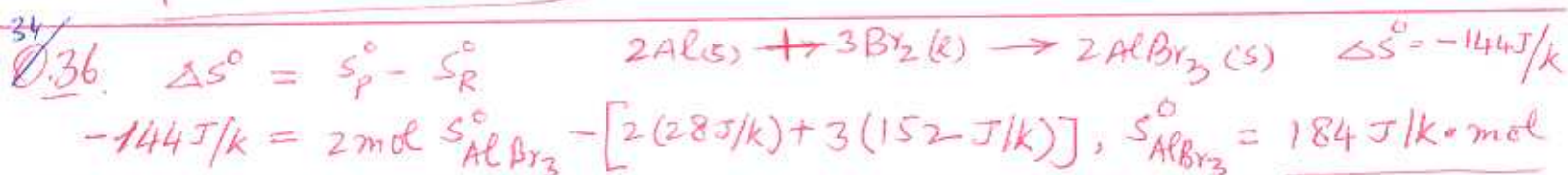


$$\Delta S^\circ = 2(193) - [1(192) + 3(131)] = -199 \text{ J/K}$$

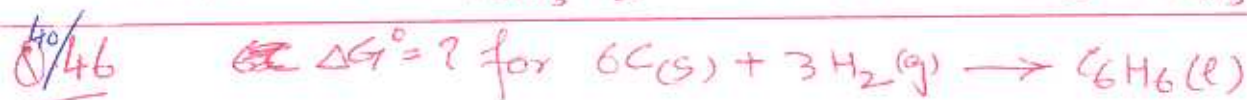


$$\Delta S^\circ = 1 \text{ mol H}^+(\text{aq}) + 1 \text{ mol Cl}^-(\text{aq}) (57 \text{ J/K}\cdot\text{mol}) - 1 \text{ mol HCl} (187 \text{ J/K}\cdot\text{mol})$$

$$\Delta S^\circ = -130 \text{ J/K}$$



$$-144 \text{ J/K} = 2 \text{ mol } S_{\text{AlBr}_3}^\circ - [2(28 \text{ J/K}) + 3(152 \text{ J/K})], S_{\text{AlBr}_3}^\circ = 184 \text{ J/K}\cdot\text{mol}$$



$$\Delta G^\circ = -(-6399) \text{ kJ} = +3199 \text{ kJ}$$



$$\Delta G^\circ = 6(-394) \text{ kJ} = -2464$$

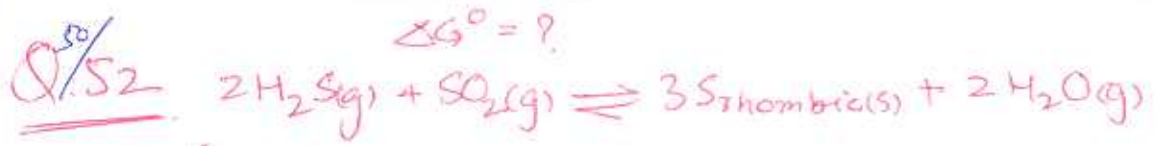


$$\Delta G^\circ = 3(-237) \text{ kJ}$$



$$= -811 \text{ kJ}$$

$$\Delta G^\circ = 125 \text{ kJ}$$



$\Delta G^\circ = 3(0) + 2(-229) - [2(-34) + 1(-300)] = -90 \text{ kJ}$

$\Delta G = \Delta G^\circ + RT \ln \frac{P_{\text{H}_2\text{O}}^2}{P_{\text{H}_2\text{S}}^2 \times P_{\text{SO}_2}} = -90 \text{ kJ} + \frac{(8.3145)(298)}{1000} \text{ kJ}$   
 $\left[ \ln \frac{(0.030)^2}{(1.0 \times 10^{-4})^2 (0.010)} \right]$

$\Delta G = -90 \text{ kJ} + 39.7 \text{ kJ} = -50.3 \text{ kJ}$

Q.66  $\Delta G = \Delta H - T\Delta S$   
 At boiling point  $\Delta G = 0$  so  $\Delta S = \frac{\Delta H_{\text{vap}}}{T}$

For Methane:  $\Delta S = \frac{8.20 \times 10^3 \text{ kJ/mol}}{112 \text{ K}} = 73.2 \text{ J/mol}\cdot\text{K}$

For Hexane:  $\Delta S = \frac{28.9 \times 10^3 \text{ kJ/mol}}{342 \text{ K}} = 84.5 \text{ J/mol}\cdot\text{K}$

$V_{\text{methane}} = \frac{nRT}{P} = \frac{1.00 \text{ mol} (0.08206) (112 \text{ K})}{1.00 \text{ atm}} = \boxed{9.19 \text{ L}}$

$V_{\text{hexane}} = \frac{nRT}{P} = \frac{1.00 \text{ mol} (0.08206) (342 \text{ K})}{1.00} = \boxed{28.1 \text{ L}}$

Volume increase  $\rightarrow$  Entropy increase  
 $\Delta S > 0$  (+ve)  
 $V > 0$   
 Volume decrease  $\rightarrow$  Entropy decrease  
 $\Delta S < 0$  (-ve)  
 $V < 0$