

(19.58) a) $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

$$\Delta G_{rxn} = [2 \Delta G_{HCl}] - [\Delta G_{(H_2)} + \Delta G_{(Cl_2)}]$$

$$[2(-95.27)] - [0 + 0]$$

$$-190.5 \text{ kJ}$$

Spont

Mar 22-9:38 AM

What Temp will it become spont?

ΔG

$\Delta G = \Delta H - T \Delta S$

$0 = \Delta H - T \Delta S$

$\Delta H = T \Delta S$

$T = \frac{\Delta H}{\Delta S} = \frac{572}{0.179} = 3195.53 \text{ K}$

Want ↑ T

As temp ↑ ΔG ⊖

Mar 22-9:55 AM

$\Delta G = \Delta H - T\Delta S$ vs $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

NOT under-
STD conditions

STD conditions
298 K, 1 atm

$\Delta G = \Delta G^\circ + RT \ln Q$

NOT AT EQ $\frac{[P_{prod}]^{coeff}}{[P_{react}]^{coeff}}$

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NOT AT EQ

$\Delta G = \Delta G^\circ + RT \ln Q$

$Q = \Delta G^\circ + RT \ln K$

AT EQ

$Q = K$
AND
 $\Delta G = 0$

AT EQ

$\Delta G^\circ = -RT \ln K$

$K < 1$
 $\ln K = \ominus$
 $\therefore \Delta G^\circ = \oplus$
Not Spont

$K = 1$
 $\ln 1 = 0$
 $\Delta G^\circ = 0$

$K > 1$
 $\ln K = \oplus$
 $\Delta G^\circ = \ominus$
Spont

Mar 22-10:18 AM

$$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$$

 $\frac{1 \text{ atm}}{1}$

 $\frac{3 \text{ atm}}{3}$

 $\frac{0.5 \text{ atm}}{2}$

Find ΔG at 298K if.

$\Delta G = \Delta G^\circ + RT \ln Q$

$\Delta G = -33.32 + (8.314 \times 10^{-3})(298) \ln \left[\frac{(0.5)^2}{(1)(3)^3} \right]$

$\Delta G = -44.77 \text{ kJ}$

Table C

$\Delta G^\circ = \Delta G^\circ_{\text{prod}} - \Delta G^\circ_{\text{ren}}$

$\Delta H^\circ = 2(-16.66) - (\emptyset + 3(\emptyset))$

$\Delta H^\circ = -33.32$

Mar 22-10:27 AM

$$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$$

 $\frac{1 \text{ atm}}{1}$

 $\frac{3 \text{ atm}}{3}$

 $\frac{0.5 \text{ atm}}{2}$

$$Q = \frac{(\text{NH}_3)^2}{(\text{N}_2)(\text{H}_2)^3}$$

$\Delta G = \Delta G^\circ + RT \ln Q$

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$$\Delta G^\circ = -RT \ln K$$

$$-33.32 = -(8.314 \times 10^{-3})(298) \ln K$$

$$K = 6.92 \times 10^5$$

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