

Exothermic - releases
heat $\Delta H -$

Endothermic - gains
heat $\Delta H +$

ΔS favors product
+ ΔS
increase in
disorder

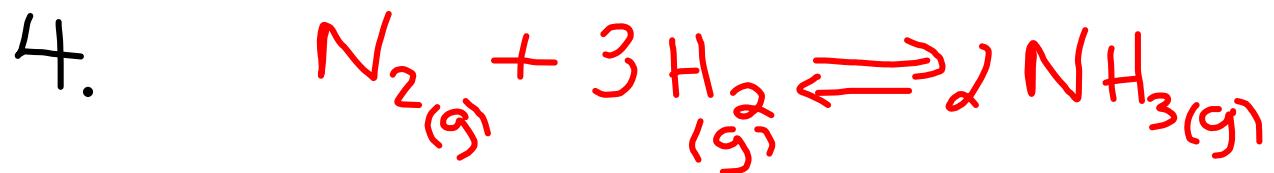
- ΔG is a
Spontaneous rxn

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



800°C

1073 K



$$\Delta H_{rxn} = (2(\text{NH}_3)) - (1(\text{N}_2) + 3(\text{H}_2))$$

$$\Delta H_{rxn} = (2(-46.11)) - (0 + 3(0))$$

$$\Delta H_{rxn} = -92.22 \text{ kJ}$$

$$\Delta S_{rxn} = -198.94 \text{ J/K}$$

$$\Delta S_{rxn} = -.19894 \text{ kJ/K}$$

$$\Delta G = -92.22 - ((1073)(-.19894))$$

$$\Delta G =$$

$$121.24 \text{ KJ}$$

not spontaneous

$$\Delta G = -RT \ln(K)$$

↙ temp (K)

↗ 8.3145 J / K · mol

↖ equilibrium

$$-\frac{\Delta G}{RT} = \ln(K)$$

$$K = e^{-\Delta G / RT}$$

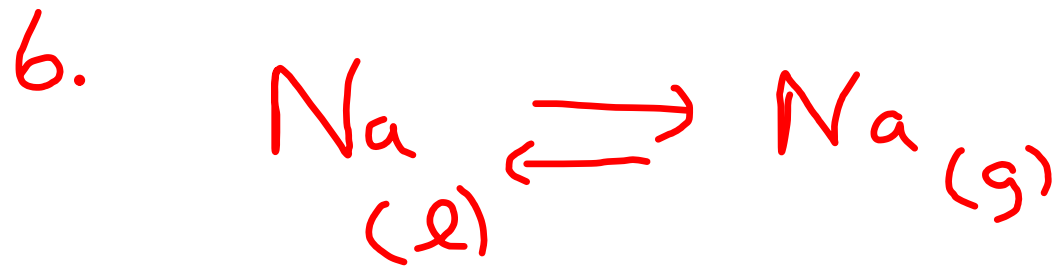
5.

$$e^{-\left(\frac{13.1590}{\left(\frac{121.24 \text{ kJ}}{(.0083145 \frac{\text{kJ}}{\text{K}})(1073 \text{ K})}\right)}\right)}$$

$$\frac{8.3145 \text{ J}}{\text{K} \cdot \text{mol}} = .0083145 \frac{\text{kJ}}{\text{mol} \cdot \text{K}}$$

$$K = 1.25296 \times 10^{-6}$$

favors the reactants
b/c K is small.



ΔG at boiling pt is at
equilibrium $\Delta G = 0$

$$\Delta H_{rxn} = \Delta H(Na_{(g)}) - \Delta H(Na_{(s)})$$

$$\Delta H = 107.68 - 2.41$$

$$\Delta H = 105.27 \text{ KJ}$$

$$\Delta S = \Delta S(\text{Na}_{(g)}) - \Delta S(\text{Na}_{(e)})$$

$$\Delta S = 153.61 - 57.85$$

$$\Delta S = 95.76 \text{ J/K}$$

$$\Delta S = .09576 \text{ kJ/K}$$

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

$$0 = (105.27) - T \times (.09576)$$

$$T = 1099.3 \text{ K}$$

$$T = 826^{\circ}\text{C}$$

HW 7, 12