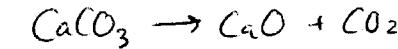


12. a. ΔS° gas is being produced - more disorder

b. find ΔG° @ 25°C

$$\Delta G^\circ = \text{RT} \ln K_298$$

$$\Delta G^\circ = (-604.03 - 394.359) - (-1128.79) = +130.40 \text{ kJ}$$



-1128.79 -604.03 -394.359

NO nonspont.

c. Need to determine signs of ΔH° , ΔS°

just look at sign of ΔH .

ΔH° is \oplus endothermic

so more favorable at higher T

$$\Delta H_f^\circ -1206.92 -635.09 -393.509$$

$$S 92.9 39.75 213.74$$

$$\Delta H^\circ = (-635.09 - 393.509) - (-1206.92) = +178.32 \text{ kJ}$$

$$\Delta S^\circ = (39.75 + 213.74) - (92.9) = 160.59 \text{ J/K}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \quad \text{both } \Delta H^\circ \text{ and } \Delta S^\circ \text{ are } \oplus$$

~~will be spontaneous at higher temps~~ $|T\Delta S|$ term $\rightarrow | \Delta H |$ term

d. $\Delta G^\circ = 0 = \Delta H - T\Delta S^\circ$

$$T = \frac{\Delta H^\circ}{\Delta S^\circ} = \frac{178.32 \text{ kJ}}{0.16059 \text{ J/K}} = 1110 \text{ K} = 837^\circ\text{C}$$

e. Yes, You could (if you felt like it) determine K at any temp.

At 837°C , ΔG° is 0, so $K = 1$

at temps higher than 837°C , $K > 1$

at temps lower than 837°C , $K < 1$ (reactant favored)

but even a reactant-favored reaction will occur to some extent. There just won't be much products at equilibrium.

13. $K_{sp} \text{ PbBr}_2 = 6.3 \times 10^{-6}$

will ppt when $Q = K_{sp}$

$$K_{sp} = [\text{Pb}^{2+}][\text{Br}^-]^2$$

$$[\text{Br}^-] = \sqrt{\frac{K_{sp}}{[\text{Pb}^{2+}]}}$$

$$[\text{Br}^-] = \sqrt{\frac{6.3 \times 10^{-6}}{0.010}} = 0.025 \text{ M}$$

When PbBr_2 starts to ppt,

$$[\text{Br}^-] = 0.025 \text{ M}$$

$$\text{so } \text{Ag}^+ = \frac{K_{sp}}{[\text{Br}^-]} = \frac{3.3 \times 10^{-13}}{0.025} = 1.3 \times 10^{-11} \text{ M Ag}^+$$

$$K_{sp} \text{ AgBr} = 3.3 \times 10^{-13}$$

$$K_{sp} = [\text{Ag}^+][\text{Br}^-]$$

$$[\text{Br}^-] = \frac{K_{sp}}{[\text{Ag}^+]} = \frac{3.3 \times 10^{-13}}{0.20} = 1.65 \times 10^{-12} \text{ Br}^-$$

AgBr will ppt first.
(starts to ppt at a lower $[\text{Br}^-]$)