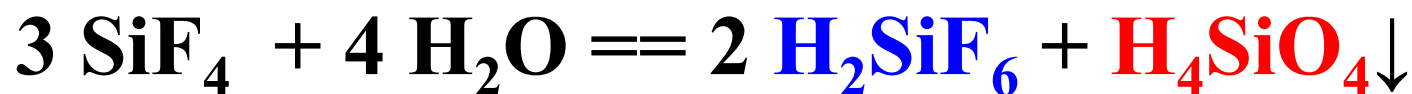
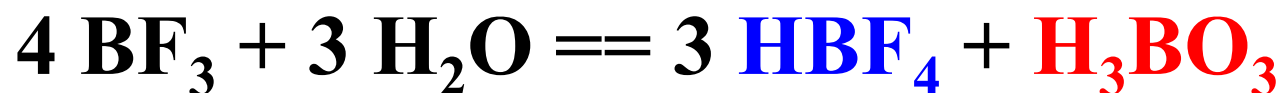


第八章作业(p₂₇₈₋₉)

8: 解释现象

1) **B**: 缺电子原子; **Si**有3d轨道, 参与杂化扩展成键; 能接受**O**或**F**的孤对电子, 易水解。



CF₄中**C**: 满足8电子要求, 且无可扩展的轨道

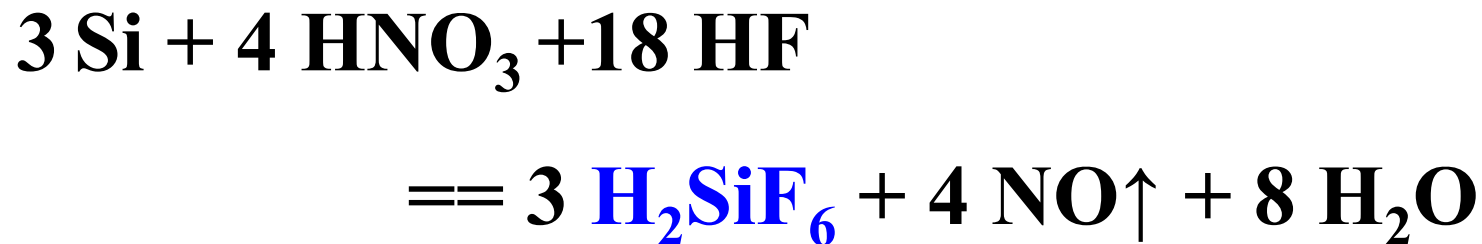
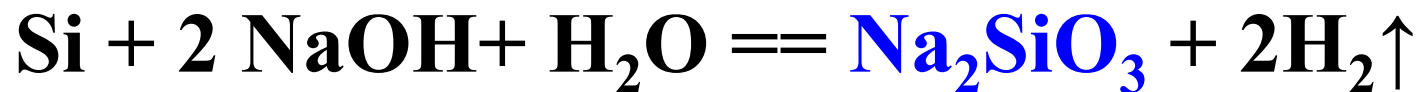


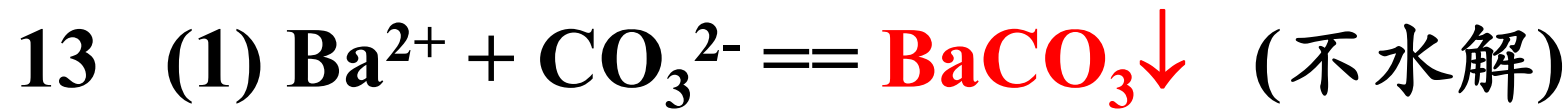
碳酸酸性强于硅酸; 且硅酸在水中溶解度较小

3) **Si**在高温下易与**活泼金属或碳**反应形成**SiC**和**M_xSi**等化合物，不易从纯硅中除去；

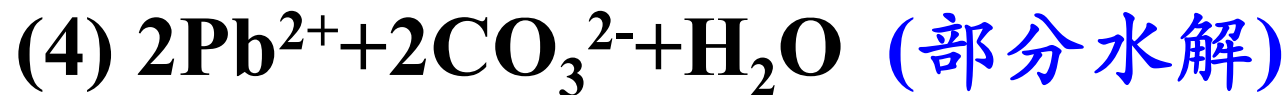
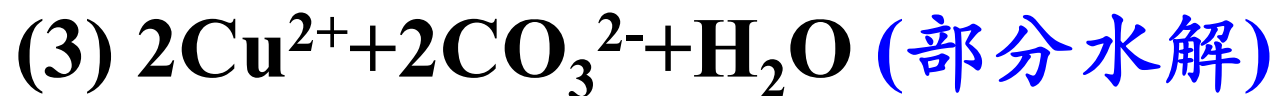
B与金属反应形成**硼化物**，不易除去。

4) **Si**在氧化性酸中形成**SiO₂ (不溶于酸)**，因而发生钝化；但**SiO₂**可溶于强碱或**HF**。





完全水解 ($\text{Cr}^{3+}/\text{Al}^{3+}$ 等高价阳离子)



14: $\text{CO}_3^{2-} + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{OH}^-$ (只考虑第一级水解)

$$K_h^\ominus = \frac{K_w^\ominus}{K_a^\ominus} = \frac{1.0 \times 10^{-14}}{5.61 \times 10^{-11}} = 1.78 \times 10^{-4}$$

在 CO_3^{2-} 水解达到平衡时, 溶液中 $[\text{OH}^-] = x \text{ mol}\cdot\text{L}^{-1}$

$$\frac{x^2}{(0.10 - x)} = 1.78 \times 10^{-4}$$

溶液中 $[\text{OH}^-] = 4.13 \times 10^{-3} \text{ mol}\cdot\text{L}^{-1}$

(1) 对于 Al^{3+} , $J = [\text{Al}^{3+}] \times [\text{OH}^-]^3 = 0.10 \times (4.13 \times 10^{-3})^3$
 $= 7.04 \times 10^{-9} > K_{\text{sp}}^\ominus(\text{Al}(\text{OH})_3)$ **$\text{Al}(\text{OH})_3$ 沉淀!**

14: 溶液中 $[\text{OH}^-] = 4.13 \times 10^{-3} \text{ mol}\cdot\text{L}^{-1}$

(2) Ca^{2+} , $J_1 = [\text{Ca}^{2+}] \times [\text{CO}_3^{2-}] = 0.10 \times (0.10 - 4.13 \times 10^{-3})$
 $= 9.59 \times 10^{-3} > K_{\text{sp}}^{\ominus}(\text{CaCO}_3)$ **CaCO_3 沉淀!**

$J_2 = [\text{Ca}^{2+}] \times [\text{OH}^-]^2 = 0.10 \times (4.13 \times 10^{-3})^2 = 1.71 \times 10^{-6} <$
 $K_{\text{sp}}^{\ominus}(\text{Ca}(\text{OH})_2)$ **$\text{Ca}(\text{OH})_2$ 不沉淀!**

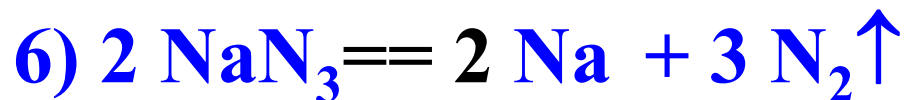
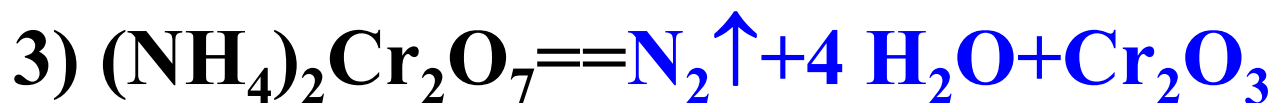
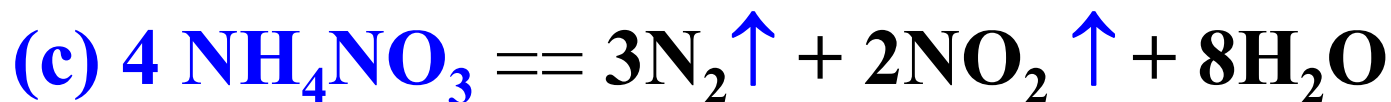
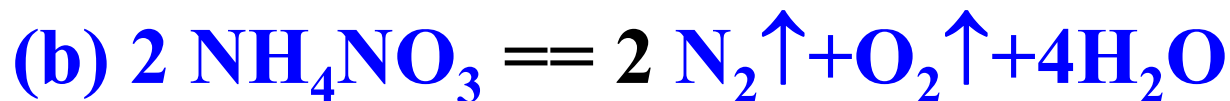
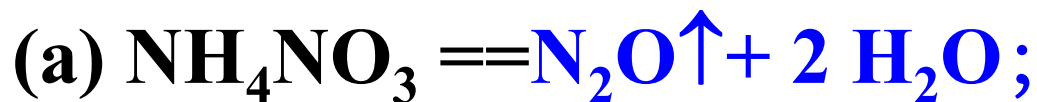
(3) Pb^{2+} , $J_1 = [\text{Pb}^{2+}] \times [\text{CO}_3^{2-}] = 0.10 \times (0.10 - 4.13 \times 10^{-3})$
 $= 9.59 \times 10^{-3} > K_{\text{sp}}^{\ominus}(\text{PbCO}_3)$ **PbCO_3 沉淀!**

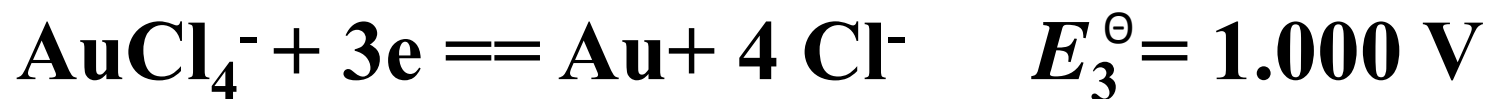
$J_2 = [\text{Pb}^{2+}] \times [\text{OH}^-]^2 = 0.10 \times (4.13 \times 10^{-3})^2 = 1.71 \times 10^{-6} >$
 $K_{\text{sp}}^{\ominus}(\text{Pb}(\text{OH})_2)$ **$\text{Pb}(\text{OH})_2$ 沉淀! 故生成 $\text{Pb}_2(\text{OH})_2\text{CO}_3$**

19: 物质受热分解的产物



2) NH_4NO_3 的热分解较为复杂，温度影响明显。





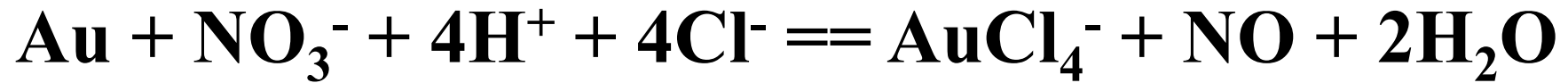
通过标准电极电势来计算Au与HNO₃或王水的反应的标准电动势。

对于前者， $E^\ominus = 0.96 - 1.498 = -0.538 < -0.20 \text{ V}$ ，
反应不可自发进行；

对于后者， $E^\ominus = 0.96 - 1.000 = -0.04 \text{ V}$ 。

该反应可通过改变反应物的浓度实现自发。

当有HCl存在时:

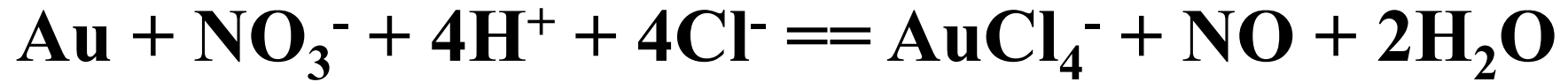


$$E = E^\theta - \frac{0.0592}{3} \lg \frac{[\text{AuCl}_4^-] \left(\frac{p_{\text{NO}}}{p_{\text{标}}}\right)}{[\text{NO}_3^-][\text{H}^+]^4[\text{Cl}^-]^4}$$

在王水中, $[\text{HCl}] = 9 \text{ mol}\cdot\text{L}^{-1}$; $[\text{HNO}_3] = 4 \text{ mol}\cdot\text{L}^{-1}$
设 $p_{\text{NO}} = 100 \text{ kPa}$, $[\text{AuCl}_4^-] = 1 \text{ mol}\cdot\text{L}^{-1}$

$$\begin{aligned} E &= (-0.04) - \frac{0.0592}{3} \lg \frac{1 \times 1}{4 \times [13]^4 [9]^4} \\ &= 0.135(\text{V}) \end{aligned}$$

当有HCl存在时:



$$E = E^\theta - \frac{0.0592}{3} \lg \frac{[\text{AuCl}_4^-] \left(\frac{p_{\text{NO}}}{p_{\text{标}}} \right)}{[\text{NO}_3^-] [\text{H}^+]^4 [\text{Cl}^-]^4}$$

由能斯特方程知, 当反应达平衡时, 最低的
 $[\text{Cl}^-] = 3.22 \text{ mol}\cdot\text{L}^{-1}$ (假设其他为热力学标态)