For equation

$$ax^2 + bx + c = 0$$

We have

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Many Dots

$$x_1, x_2, \ldots, x_n \quad 1, 2, \cdots, n \quad \vdots \quad \ddots$$

Dets

$$\begin{pmatrix} a & b & g \\ c & d & h \\ e & f & i \end{pmatrix} \quad \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad \begin{Bmatrix} a & b \\ c & d \end{Bmatrix} \quad \begin{vmatrix} a & b \\ c & d \end{vmatrix} \quad \begin{Vmatrix} a & b \\ c & d \end{Vmatrix}$$

Case Function

$$y = \begin{cases} -x, & x \leq 0 \\ x, & x > 0 \end{cases}$$

Newton-Leibniz formula

$$\int_a^b f(x)\,dx = F(x)\big|_a^b = F(b) - F(a)$$

Chemistry

$$\Delta_r G_m^{\ominus}(T) = -RT \ln K^{\ominus} = -zFE^{\ominus}$$

For more common conditions

$$\Delta_r G_m(T) = \Delta_r G_m^{\ominus} + RT \ln Q$$

and we can easily calculate other temperature's by

$$\ln \frac{K_2^{\ominus}}{K_1^{\ominus}} = -\frac{\Delta_r H_m^{\ominus}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

because

$$\ln K^{\ominus} = \frac{-\Delta_r H_m^{\ominus}}{RT} + \frac{\Delta_r S_m^{\ominus}}{R}$$

Chemical Battery

$$E = \varphi(+) - \varphi(-)$$

$$\varphi = \varphi^{\ominus} + \frac{RT}{zF} \ln \frac{c(Oxidation\ state)/c^{\ominus}}{c(Reduction\ state)/c^{\ominus}}$$

$$(z = Trans\ e^-)$$

$$(For\ example: O_2 + 2H_2O + 4e^- = 4OH^-; z = 4)$$

有电池 $Ag|Ag^+(a_1)|Br^-(a_2)|AgBr(s)|Ag$，已知：AgBr(s) 溶度积 25℃时为 5×10^{-13}，$\varphi^\ominus(Ag^+/Ag)=0.799V,\varphi^\ominus(Br_2/Br_-)=1.065V$。

（1）写出此电池阳极和阴极表面的电极反应以及总电池反应。

（2）计算 $Br^-|AgBr(s)|Ag$ 半电池反应的标准电极电势。

（3）计算 $AgBr(s)$ 的标准生成 Gibbs 函数变 $\Delta_rG_m^\ominus(AgBr(s),298.13K)$

Solve:

(1) 阳极：$Ag-e^-=Ag^+$

阴极：$AgBr+e^-=Ag+Br^-$

总的：$AgBr(s)=Ag^++Br^-$

(2)：即为阴极反应 $AgBr+e^-=Ag+Br^-$

可知 $\varphi^\ominus(+)=E^\ominus+\varphi^\ominus(-)$

$-zFE^\ominus=-RT\ln K^\ominus$

解得：$\varphi^\ominus(+)=0.0713$ V

(3)：构造原电池：$Ag-e^-=Ag^+$(-)、$\frac{1}{2}Br_2+e^-=Br^-$(+)、

总反应：$Ag+\frac{1}{2}Br_2=AgBr$

$\Delta_rG_m^\ominus(AgBr(s),298.13K)=-zFE^\ominus$

其中：$E^\ominus=\varphi^\ominus(+)-\varphi^\ominus(-)=1.065-0.799=0.266V$

解得：$\Delta_rG_m^\ominus(AgBr(s),298.13K)=-25.67\ \mathrm{KJ}\cdot\mathrm{mol}^{-1}$

将 40.0mL 0.10mol · L^{-1} $AgNO_3$ 溶液和 20.0mL 6.0mol · L^{-1} 氨水混合并稀释至 100mL。试计算:

(1) 平衡时溶液中 Ag^+、$[Ag(NH_3)_2]^+$ 和 NH_3 的浓度;

(2) 加入 0.010mol KCl 固体，是否有 AgCl 沉淀产生?

(3) 若要阻止 AgCl 沉淀产生，则应取 12.0mol · L^{-1} 氨水多少毫升?

Solve:

(1)

Picture:

Picture 1: Zhongli&Raiden Shogun are talking each other.