[5] 1. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $E^\circ = +0.77\,V$

$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$ $E^\circ = +1.51\,V$

$Fe^{2+} \rightleftharpoons Fe^{3+} + e^-$ $-0.77\,V$ とみなすことができ

E° が負の還元体 Fe^{2+} が電子を出し

E° がより正の酸化体 MnO_4^- が電子を受け取る

$\Rightarrow 5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

よって右に進む

2. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $E^\circ = +0.77\,V$

$Ce^{4+} + e^- \rightleftharpoons Ce^{3+}$ $E^\circ = +1.61\,V$

E° が正で大きな Ce^{4+}（酸化体）が電子を受け取る $\longrightarrow$ Fe は電子を出す

$(Ce^{4+} + e^-) + Fe^{2+} \rightleftharpoons Ce^{3+} + (Fe^{3+} + e^-)$

反応は左に進む

[6] $Cu^{2+} + 2e^- \rightleftharpoons Cu \quad E^\circ = +0.34\,V$ E_1

$Zn^{2+} + 2e^- \rightleftharpoons Zn \quad E^\circ = -0.76\,V$ E_2 } 標準電位

$$Cu: E_1 = 0.34 + \frac{0.0592}{2} \log_{10} \frac{a(Cu^{2+})}{a(Cu^{2+})}$$

$$E_2 = -0.76 - \frac{0.0592}{2} \log_{10} \frac{a(Zn)}{a(Zn^{2+})}$$

起電力 $\Delta E = E_1 - E_2 = 0.34 - (-0.76) + \frac{0.0592}{2} \log_{10} \frac{a(Cu^{2+})\,a(Zn)}{a(Cu)\,a(Zn^{2+})}$

固体は $a(Cu) = a(Zn) = 1$ となるので

$$\Delta E = E_1 - E_2 = 1.10 + \frac{0.0592}{2} \log_{10} \frac{a(Cu^{2+})}{a(Zn^{2+})}$$

$$= 1.10 + \frac{0.0592}{2} \log_{10} \frac{0.2}{1.8} = 1.07\ V$$

[7]

1. $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$

$6Fe^{2+} + Cr_2O_7^{-} + 14H^+ \rightleftharpoons 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

2. $0.00500\ mol/L \times 0.01500\ L \times 6 = 4.50 \times 10^{-4}\ mol$

[8]

1. $E = E_0^{\circ} + \frac{RT}{2F} \ln \frac{[O_2][H^+]^2}{[H_2O_2]}$

$$E = E_{Mn}^{\circ} + \frac{RT}{5F} \ln \frac{[MnO_4^-][H^+]^8}{[Mn^{2+}]}$$

2. $E = E_0^{\circ\prime} + \frac{RT}{2F} \ln \frac{[O_2]}{[H_2O_2]}$, $E_0^{\circ\prime} = E_0^{\circ} + \frac{RT}{5F} \ln [H^+]$

$$E = E_{Mn}^{\circ\prime} + \frac{RT}{5F} \ln \frac{[MnO_4^-]}{[Mn^{2+}]}, \quad E_{Mn}^{\circ\prime} = E_{Mn}^{\circ} + \frac{8RT}{5F} \ln [H^+]$$

3. $E_0^{\circ\prime} = 0,682\,V + 0,0592\,V \cdot \log 0,5 = 0,664\,V$

$$E_{Mn}^{\circ\prime} = 1,51\,V + 0,0592\,V \cdot \log 0,5 = 1,48\,V$$

4. $E_{equiv.} = \frac{2E_0^{\circ\prime} + 5E_{Mn}^{\circ\prime}}{2+5} = \frac{2 \times 0,664 + 5 \times 1,48}{7} = 1,25\,V$ //