با سلام. لطفا مسایل تکمیلی انتخاب شده را به صورت مفهومی بازنویسی و 3 مسئله انتخاب شده را حل نمایید.

مسایل تکمیلی انتخاب شده:

FOLLOW-UP PROBLEM 21.2 In one compartment of a voltaic cell, a graphite rod dips into an acidic solution of $K_2Cr_2O_7$ and $Cr(NO_3)_3$; in the other compartment, a tin bar dips into a $Sn(NO_3)_2$ solution. A KNO_3 salt bridge joins them. The tin electrode is negative relative to the graphite. Draw a diagram of the cell, show the balanced equations, and write the cell notation.

21.2

$$6K_2MnO_4(aq) + KIO_3(aq) + 3H_2O(l)$$

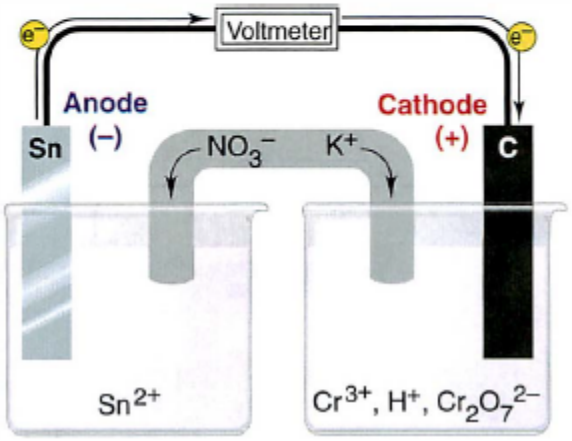
$$Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^- \quad \text{[anode; oxidation]}$$

$$6e^- + 14H^+(aq) + Cr_2O_7^{2-}(aq) \longrightarrow 2Cr^{3+}(aq) + 7H_2O(l) \quad \text{[cathode; reduction]}$$

$$3Sn(s) + Cr_2O_7^{2-}(aq) + 14H^+(aq) \longrightarrow 3Sn^{2+}(aq) + 2Cr^{3+}(aq) + 7H_2O(l) \quad \text{[overall]}$$

Cell notation:

$$Sn(s) \mid Sn^{2+}(aq) \parallel H^+(aq), Cr_2O_7^{2-}(aq), Cr^{3+}(aq) \mid \text{graphite}$$



FOLLOW-UP PROBLEM 21.4 Is the following reaction spontaneous as written?

$$3Fe^{2+}(aq) \longrightarrow Fe(s) + 2Fe^{3+}(aq)$$

If not, write the equation for the spontaneous reaction, calculate E°_{cell}, and rank the three species of iron in order of decreasing reducing strength.

21.4 $Fe^{2+}(aq) + 2e^- \longrightarrow Fe(s)$ $\quad E° = -0.44\ V$

$2[Fe^{2+}(aq) \longrightarrow Fe^{3+}(aq) + e^-]$ $\quad E° = 0.77\ V$

$3Fe^{2+}(aq) \longrightarrow 2Fe^{3+}(aq) + Fe(s)$

$E°_{cell} = -0.44\ V - 0.77\ V = -1.21\ V$

The reaction is nonspontaneous. The spontaneous reaction is

$2Fe^{3+}(aq) + Fe(s) \longrightarrow 3Fe^{2+}(aq)$ $\quad E°_{cell} = 1.21\ V$

$Fe > Fe^{2+} > Fe^{3+}$

FOLLOW-UP PROBLEM 21.6 Consider a voltaic cell based on the following reaction: $Fe(s) + Cu^{2+}(aq) \rightleftharpoons Fe^{2+}(aq) + Cu(s)$. If $[Cu^{2+}] = 0.30\ M$, what must $[Fe^{2+}]$ be to increase E_{cell} by 0.25 V above $E°_{cell}$ at 25°C?

21.6 $Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-$ $\quad E° = -0.44\ V$

$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$ $\quad E° = 0.34\ V$

$Fe(s) + Cu^{2+}(aq) \longrightarrow Fe^{2+}(aq) + Cu(s)$ $\quad E°_{cell} = 0.78\ V$

So $E_{cell} = 0.78\ V + 0.25\ V = 1.03\ V$

$$1.03\ V = 0.78\ V - \frac{0.0592\ V}{2} \log \frac{[Fe^{2+}]}{[Cu^{2+}]}$$

$$\frac{[Fe^{2+}]}{[Cu^{2+}]} = 3.6\times10^{-9}$$

$[Fe^{2+}] = 3.6\times10^{-9} \times 0.30\ M = 1.1\times10^{-9}\ M$

21.7 $Au^{3+}(aq; 2.5\times10^{-2}\ M)$ [B] $\longrightarrow$ $Au^{3+}(aq; 7.0\times10^{-4}\ M)$ [A]

$$E_{cell} = 0\ V - \left(\frac{0.0592\ V}{3} \times \log \frac{7.0\times10^{-4}}{2.5\times10^{-2}}\right) = 0.0306\ V$$

FOLLOW-UP PROBLEM 21.8 Write half-reactions showing the products you predict will form in the electrolysis of aqueous $AuBr_3$.

21.8 The reduction with the more positive electrode potential is

$Au^{3+}(aq) + 3e^- \longrightarrow Au(s)$; $E° = 1.50\ V$ [cathode; reduction]

Because of overvoltage, O_2 will not form at the anode, so Br_2 will form:

$2Br^-(aq) \longrightarrow Br_2(l) + 2e^-$; $E° = 1.07\ V$ [anode; oxidation]

FOLLOW-UP PROBLEM 21.9 Using a current of 4.75 A, how many minutes does it take to plate onto a sculpture 1.50 g of Cu from a $CuSO_4$ solution?

21.9 $Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$; therefore,

$2\ mol\ e^-/1\ mol\ Cu = 2\ mol\ e^-/63.55\ g\ Cu$

$$\text{Time (min)} = 1.50\ \text{g Cu} \times \frac{2\ \text{mol e}^-}{63.55\ \text{g Cu}} \times \frac{9.65\times10^4\ \text{C}}{1\ \text{mol e}^-} \times \frac{1\ \text{s}}{4.75\ \text{C}} \times \frac{1\ \text{min}}{60\ \text{s}} = 16.0\ \text{min}$$

مسایل انتخاب شده

21.7 Balance the following skeleton reactions and identify the oxidizing and reducing agents:

(a) $ClO_3^-(aq) + I^-(aq) \longrightarrow I_2(s) + Cl^-(aq)$ [acidic]

(b) $MnO_4^-(aq) + SO_3^{2-}(aq) \longrightarrow MnO_2(s) + SO_4^{2-}(aq)$ [basic]

(c) $MnO_4^-(aq) + H_2O_2(aq) \longrightarrow Mn^{2+}(aq) + O_2(g)$ [acidic]

21.16 What is the difference between an active and an inactive electrode? Why are inactive electrodes used? Name two substances commonly used for inactive electrodes.

21.22 Write the cell notation for the voltaic cell that incorporates each of the following redox reactions:

(a) $Al(s) + Cr^{3+}(aq) \longrightarrow Al^{3+}(aq) + Cr(s)$

(b) $Cu^{2+}(aq) + SO_2(g) + 2H_2O(l) \longrightarrow Cu(s) + SO_4^{2-}(aq) + 4H^+(aq)$