Name

Fundamentals of simple Redox reactions

Students will be able to:
Predict the products of a simple redox reaction.
Determine the voltage of these simple redox reactions.

Note: +1 also possible

1. Predict the products of the following reactions. Determine if the reaction will run spontaneously.

   a. $Cu + Ag(NO_3)_2 \Rightarrow$ $Cu(NO_3)_2 + Ag$

   $Cu \rightarrow Cu^{+2} + 2e^-$ $-.34$
   $1e^- + Ag^{+1} \rightarrow Ag^0$ $+.80$ } $+.46$ ← yes, spontaneous

   b. $Ag + Cu(NO_3)_2 \Rightarrow$ $AgNO_3 + Cu^0$

   Notice

   $2e^- + Cu^{+2} \rightarrow Cu^0$ $+.34$
   $Ag^0 \rightarrow Ag^+ + 1e^-$ $-.8V$ } $-.46V$ NO, NON-spont.

   c. $Ca + Zn(NO_3)_2 \Rightarrow$ $Ca(NO_3)_2 + Zn^0$

   $Ca^0 \rightarrow Ca^{+2} + 2e^-$ $+2.87V$
   $2e^- + Zn^{+2} \rightarrow Zn^0$ $-.76$
   spont → $+2.11$

   d. $Zn + HCl \Rightarrow ZnCl_2 + H_2^0$

   $Zn^0 \rightarrow Zn^{2+} + 2e^-$ $+.76V$ } $+.76V$
   $2e^- + 2H^+ \rightarrow H_2^0$ 0

2. (Brady873) What spontaneous reaction occurs if Cl_2 and Br_2 are added to a solution that contains both Cl^- and Br^-? (Give reaction and potential)

   0.44 +V

   $Cl_2 + Br^- \rightarrow Cl^- + Br_2$ (+1.36, −.92)

   or $Br_2 + Cl^- \rightarrow Br^- + Cl_2$ $-.44V$

3. (Brady874b) Predict the reaction that will occur when Ni and Fe are added to a solution that contains both Ni^{2+} and Fe^{2+}. (Give reaction and potential)

   $Ni^{+2} + Fe^0 \rightarrow Ni^0 + Fe^{2+}$ (−.25, +0.44) $+0.19V$

   $Ni^0 + Fe^{2+} \rightarrow$ NO RXN $-.19V$

4. (Brady874) What would be the cell reaction and the standard cell potential of galvanic employing the following half-reactions?

   Note: 2 Reductions, 1 must get flipped

   $Al^{3+}(aq) + 3e^- \Rightarrow Al(s)$ $E = -1.66$ V ← flip

   $Cu^{2+}(aq) + 2e^- \Rightarrow Cu(s)$ $E = +.34$ V

   $Al \rightarrow Al^{+3} + 3e^-$ $+1.66V$
   $Cu^{+2} + 2e^- \rightarrow Cu^0$ $+.34V$
   $+2.00V$

   Which half-cell would be the anode?

   ↳ oxidation = anode
   Reduction = Cathode

Normal AP Reduction chart Not sufficient. or online

5. (Brown767) Using the standard reduction potentials listing in your text, calculate the standard emf for the cell reaction listed here.

$Cr_2O_7^{-2}(aq) + 14H^+(aq) + 6I^-(aq) \Rightarrow 2Cr^{3+}(aq) + 3I_2(s) + 7H_2O(l)$

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

$6I^- \longrightarrow 3I_2 + 6e^-$

6. (Brown767b) A voltaic cell is based on the following two standard half-reactions:

$Cd^{2+} + 2e^- \Rightarrow Cd_{(s)}$ $-.4V$ ← Flip

$Sn^{2+} + 2e^- \Rightarrow Sn(s)$ $-.14V$

Determine the half reactions that occur at the cathode and the anode and the standard cell potential.

$Cd \longrightarrow Cd^{2+} + 2e^- + .4V$

$Sn^{2+} + 2e^- \longrightarrow Sn \quad -.14V$ } $+.26V$

Red Ox

7. (Brown770) Using the standard reduction potentials listed in your text, determine whether the following reactions are spontaneous or non-spontaneous.

a. $Cu(s) + 2H^+(aq) \Rightarrow Cu^{2+}_{(aq)} + H_2(g)$

b. $Cl_2(g) + 2I^-(aq) \Rightarrow 2Cl^-(aq) + I_2(s)$

a) $Cu^0 \longrightarrow Cu^{+2} + e^{-2} \quad +.34V$

$2e^- + 2H^+ \longrightarrow H_2 \quad 0V$ } ☹ No RxN — Voltage

b) $2e^- + Cl_2 \longrightarrow 2Cl^- \quad 1.36V$

$2I^- \longrightarrow I_2 + 2e^- \quad -.53V$ } ☺ $+.83V$