Chemistry 102
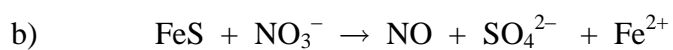
<div align="center">
**REVIEW QUESTIONS**
Chapter 19
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1. For each of the following unbalanced equations, (i) write the half-reactions for oxidation and reduction, and (ii) balance the overall equation in acidic solution using the half-reaction method.

   a) $MnO_2 + Cl^- \rightarrow Mn^{2+} + Cl_2$

   b) $FeS + NO_3^- \rightarrow NO + SO_4^{2-} + Fe^{2+}$

2. Balance the following redox reaction in acidic solution, and determine the oxidizing and reducing agents.
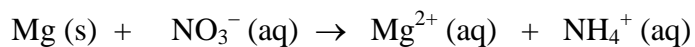
$$Mg\ (s) + NO_3^-\ (aq) \rightarrow Mg^{2+}\ (aq) + NH_4^+\ (aq)$$

3. Balance the following redox reaction in basic solution, and determine the oxidizing and reducing agents.

$$Al \ (s) \ + \ NO_3^- \ (aq) \ \rightarrow \ Al(OH)_4^- \ + \ NH_3 \ (aq)$$

4. Balance the following redox reaction in basic solution, and determine the oxidizing and reducing agents.

$$Fe(OH)_3 \ (aq) \ + \ OCl^- \ (aq) \ \rightarrow \ FeO_4^{2-} \ (aq) \ + \ Cl^- \ (aq)$$
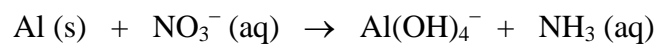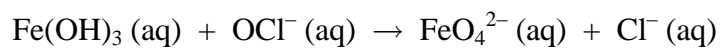
5. The diagram below shows a voltaic cell with the anode on the left side and the cathode on the right side. Given that this is a magnesium and aluminum cell,

> ➢ identify metals A and B,
> ➢ identify solutions A and B,
> ➢ write half-reactions for each electrode,
> ➢ direction of electron flow,
> ➢ the polarities of the anode and the cathode,
> ➢ calculate the cell potential, and
> ➢ write a shorthand cell notation.
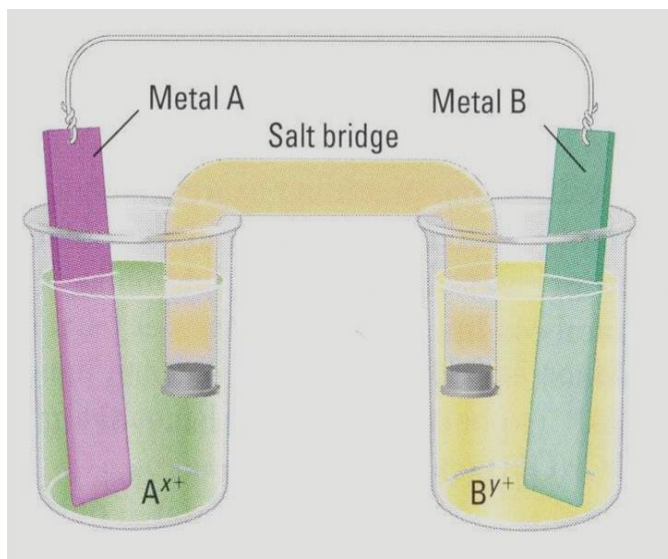
6. A voltaic cell employs the reaction:

$$Sn\ (s)\ +\ 2\ Ag^+\ (aq)\ \rightarrow\ Sn^{2+}\ (aq)\ +\ 2\ Ag\ (s)$$
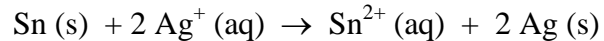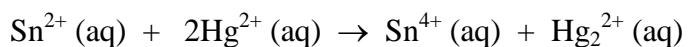
Calculate the voltage produced by this reaction under standard conditions at 25°C. (Use table 18.1 in your textbook for standard reduction potentials).

7. The standard voltage (E°) for the voltaic cell shown below is +0.68 volts.

$$In\,|\,In^{3+}\,|\,|\,Cu^{2+}\,|\,Cu$$

Determine the standard reduction potential for: $In^{3+} + 3\ e^- \rightarrow In$

8. A voltaic cell used the reaction shown below:

$$Sn^{2+}\ (aq)\ +\ 2Hg^{2+}\ (aq)\ \rightarrow\ Sn^{4+}\ (aq)\ +\ Hg_2^{2+}\ (aq)$$

a) Calculate the voltage for this reaction under standard conditions.
   (Use Table 18.1 in your textbook for standard reduction potentials)
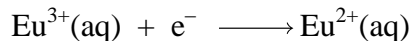
b) Calculate $\Delta G°$ for this reaction.

9. A voltaic cell uses the reaction shown below, with a measured standard cell potential of 1.19 V:

$$Tl^{3+} (aq) + 2 Cr^{2+} (aq) \longrightarrow Tl^{+} (aq) + 2 Cr^{3+} (aq)$$

a) Write the two half-cell reactions.

b) What is the $E°$ for the reduction of Tl^{3+}?

c) Sketch the voltaic cell, label the anode and the cathode, and indicate the direction of the electron flow.

10. For each pair of substances below, use Reduction Potentials in your textbook to determine the one that is the stronger oxidizing agent:

   a) $Br_2(l)$ or $I_2(s)$

   b) $Ag^{+}(aq)$ or $Cu^{+} (aq)$

   c) $Cl_2(g)$ or $Au^{3+}(aq)$

   d) $Mg(s)$ or $K(s)$

   e) $H_2O_2(aq)$ or $Cr_2O_7^{2-} (aq)$

11. The standard cell potential for the reaction shown below is –0.43 V:

$$Eu^{3+}(aq) + e^- \longrightarrow Eu^{2+}(aq)$$

Use table of reduction potentials in your textbook to suggest two substances capable of reducing Eu^{3+} to Eu^{2+}.

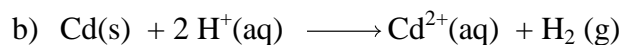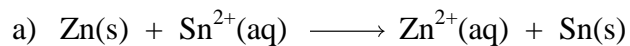12. The standard cell potential for the reaction shown below at 298 K is 2.20 V:

$$2\ Al\ (s) + 3\ I_2\ (s) \longrightarrow 2\ Al^{3+}(aq) + 6\ I^-\ (aq)$$
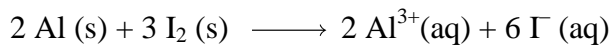
Calculate the emf generated by this cell when

$$[Al^{3+}] = 4.0 \text{ x } 10^{-3}M$$
$$[I^-] = 0.010\ M$$

13. Use the standard reduction potentials listed in your textbook to determine the equilibrium constant for each of the following reactions:

a) $Zn(s) + Sn^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Sn(s)$

b) $Cd(s) + 2\ H^+(aq) \longrightarrow Cd^{2+}(aq) + H_2\ (g)$

14. A voltaic cell utilizes the reaction shown below at 298 K:

$$2 \text{ Al(s)} + 3 \text{ Mn}^{2+} \text{ (aq)} \longrightarrow 2 \text{ Al}^{3+} \text{ (aq)} + 3 \text{ Mn(s)}$$

a) Calculate the emf for this cell under standard conditions.

b) Calculate the emf for this cell when $[\text{Al}^{3+}] = 1.5$ M and $[\text{Mn}^{2+}] = 0.10$ M.

15. Use the standard reduction potentials listed in your textbook to determine the equilibrium constant the following reactions:

$$\text{O}_2\text{(g)} + 4 \text{ H}^+\text{(aq)} + 4 \text{ Fe}^{2+}\text{(aq)} \longrightarrow 4 \text{ Fe}^{3+}\text{(aq)} + 2 \text{ H}_2\text{O(l)}$$