Review #9: Redox Reactions and Electrochemistry

1. Define: oxidation, reduction, oxidizing agent, reducing agent, half reaction, anode, cathode, reduction potential and E°

2. Find the oxidation numbers of the elements in **bold** print.

a) K**Cl**O_2
b) K**Mn**O_4
c) **U**F_6
d) H_2**O**$_2$
e) **Pb**SO_4
f) Li**Br**O_4
g) **Cl**O_3^{1-}
h) Mg**Si**F_6
i) H**C**OOH
j) H_2**S**O_3
k) **Fe**$_2O_3$
l) H_2**Se**O_3

3. State whether each of the following changes is an oxidation or a reduction:

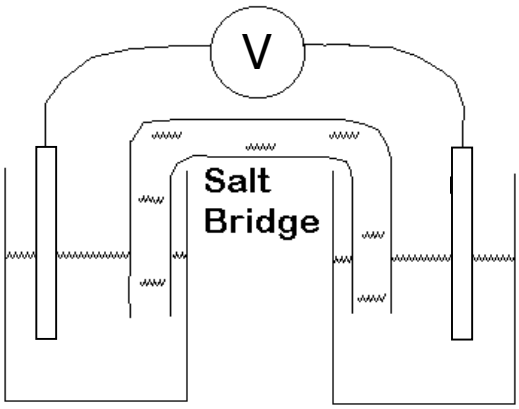
a) $NO_3^- \rightarrow NO_2$
b) $I_2 \rightarrow IO_3^-$
c) $NO_3^- \rightarrow NO$
d) $PCl_3 \rightarrow P_4$
e) $O_2 \rightarrow Na_2O_2$
f) $Fe \rightarrow FeN$
g) $Xe \rightarrow XeF_6$
h) $SO_4^{2-} \rightarrow SO_2$
i) $Cr_2O_7^{2-} \rightarrow CrO_3^{2-}$
j) $I^- \rightarrow I_2$
k) $BrO_2^{1-} \rightarrow BrO_3^{1-}$
l) $C_2H_2 \rightarrow C_2H_6$

4. Balance these oxidation-reduction equations in both acidic and basic conditions. In each equation, underline the oxidizing agent.

a) $Cr_2O_7^{2-} + C_2H_5OH \rightarrow Cr^{3+} + CO_2$
b) $HNO_3 + P \rightarrow NO + H_3PO_4$
c) $As_2O_3 + NO_3^- \rightarrow H_3AsO_4 + NO$
d) $H_2SeO_3 + Br^- \rightarrow Se + Br_2$
e) $CrO_4^{2-} + I^- \rightarrow Cr^{3+} + I_2$
f) $MnO_4^- + H_2O_2 \rightarrow Mn^{2+} + O_2$
g) $BrO_3^- + MnO_2 \rightarrow Br^- + MnO_4^-$
h) $S^{2-} + ClO_3^{1-} \rightarrow Cl^{1-} + S$
i) $Cr_2O_7^{2-} + I^- \rightarrow Cr^{3+} + I_2$
j) $CuS + NO_3^- \rightarrow Cu^{2+} + NO_2 + S$
k) $HS^- + IO_3^- \rightarrow I^- + S$
l) $IO_4^- + I^- \rightarrow I_2$
m) $Cr + NO_2^- \rightarrow CrO_2^- + N_2O_2^{2-}$

5. Consider a simple electrochemical cell using the metals zinc and aluminum:

a) Which metal is easier to oxidize, zinc or aluminum?
b) Label the Galvanic cell to the right, including the anode, which metal is the anode, the cathode, which metal is the cathode, the direction of electron flow and the direction of negative ion flow.
c) Write the half-reaction that occurs at each electrode.
d) Calculate the theoretical voltage (E°) for this cell.



6. For the following combinations of elements in electrochemical cells

i) write the net ionic equation for the reaction that will occur
ii) represent the cell using Galvanic Cell Notation
iii) calculate the theoretical voltage (E°) for each combination:

a) Cr/Cr^{3+} and Fe/Fe^{3+}
b) Al/Al^{3+} and Sn/Sn^{2+}
c) Cd/Cd^{2+} and Mg/Mg^{2+}
d) Cl_2/Cl^{1-} and Ag/Ag^{1+}