CH17A

I. Oxidation number (O.N.):

a. for element (single-atom species), O.N. = 0;
b. O.N. of a monoatomic ion is the same as its ionic charge, e.g., Na^+, O.N. of Na = 1
c. A compound contains O, O.N. (O) is typical "-2", except peroxide(-1), e.g., H_2O_2
   H is typical "+1", except hydride(-1), e.g., NaH
   1A is typical "+1", 2A is typical "+2"
   6A is typical "-2", 7A is typical "-1"
d. The Sum of the O.N. must be zero for electrically neutral compounds or
   the charge of the ion

II. Redox reaction

a. LORA: Lost e-, Oxidation, Reductant, Anode, (-)
   GROC: Gain e-, Reduction, Oxidant, Cathode, (+)
b. Balancing redox reactions: (1) 2 half reactions
   (2) balance atoms (acidic: H^+/H_2O, basic: $H_2O/2OH^-$)
   (3) balance charges by e^-
   (4) add 2 half reactions with the same e^- gain and lost.

III. Electrochemical cells: Galvanic/Voltaic cells ($E_{cell} > 0$)

a. $E_{cell} > 0$
b. intensive property, does not affected by the coefficient
c. $E_{cell} = E_{cathode} + E_{anode} = E^0(\text{red}) + E^0(\text{oxi})$
d. Larger E^0, stronger oxidant; smaller E^0, stronger reductant
e. cell notation: anode || cathode, e.g., $Zn_{(s)}|Zn^{2+} || Cu^{2+}|Cu_{(s)}$
   if reactants are all solution or gas, use <u>Pt or C</u> to serve as electrode
f. structure of a Galvanic cells and e^- flow

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17.I and II

1. Balance the following equation in basic solution using the lowest possible integers and give the coefficient of hydroxide ion.
   $MnO_4^-(aq) + C_2O_4^{2-} \rightarrow MnO_2(s) + CO_3^{2-}(aq)$ [**4**]

2. Balance the following equation in acidic solution using the lowest possible integers and give the coefficient of H^+.
   $Cl_2(aq) + H_2S(aq) \rightarrow S + Cl^-(aq)$ [**2**]

3. Balance the following equation in basic solution using the lowest possible integers and give the coefficient of OH^-.
   $Ag(s) + CN^-(aq) + O_2(g) \rightarrow Ag(CN)_2^-(aq) + OH^-(aq)$ [**4**]

4. Balance the following equation in acidic solution using the lowest possible integers and give the coefficient of H_2O.
   $Cu(s) + HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + NO_2 + H_2O(aq)$ [**2**]

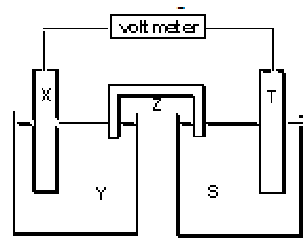
5. Balance the following equation in acidic solution using the lowest possible integers and give the coefficient of H_2O.
   $NaCl(s) + H_2SO_4(aq) + MnO_2 \rightarrow Na_2SO_4(aq) + MnCl_2 + H_2O(aq) + Cl_2$ [**2**]

6. Balance the following equation in basic solution using the lowest possible integers and give the coefficient of H_2O.
   $CrO4^{2-}(aq) + Cu(s) \rightarrow Cr(OH)_3(s) + Cu(OH)_2(aq)$ [**8**]

7. Identify the oxidizing agent and the reducing agent in the reaction.
   $NO_3^-(aq) + 4Zn(s) + 7OH^-(aq) + 6H_2O(l) \rightarrow 4Zn(OH)_4^{2-}(aq) + NH_3(aq)$

17.III

8. Determine E_{cell} for the following reaction, using the given standard reduction potentials: [**1.4**]
$Ni^{2+}(aq) + Ti(s) \rightarrow Ni(s) + Ti^{2+}(aq)$, E^o for $Ti^{2+}(aq)$ = -1.63 V, E^o for $Ni^{2+}(aq)$ = -0.23 V
Assume X is Ti(s), specify Y,Z,S,T, and direction of electron flow.



9. Consider the following half-reactions. Which of these is the strongest reducing agent listed here? [**Cr(s)**]
$Au^+(aq) + e^- \rightarrow Au(s)$ E^o = 1.69 V
$N_2O(g) + 2\ H^+(aq) + 2\ e- \rightarrow N_2(g) + H_2O(l)$ E^o = 1.77 V
$Cr^{3+}(aq) + 3\ e^- \rightarrow Cr(s)$ E^o = -0.74 V