South Pasadena • AP Chemistry

Name _____

Period ___ Date ___/___/___

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OXIDATION-REDUCTION EQUATIONS

The Half-Reaction Method:

1. Write the equation as two half-reactions. Include the particles (atoms, ions, molecules) that are involved in change of oxidation state.
2. Balance each half-reaction with respect to atoms and charges; first atoms other than H and O, then O with H_2O and H with H^+, and ionic charges with electrons (e^-).
3. Equalize the number of electrons lost in the oxidation half-reaction with the number of electrons gained in the reduction half-reaction.
4. Add the two half-reactions to form a balanced net ionic equation.
5. (Basic solution) Add OH^- ions to each side of the equation to neutralize H^+ ions. Cancel H_2O molecules.

Example 1: $HCl + K_2Cr_2O_7 \rightarrow KCl + CrCl_3 + H_2O + Cl_2$

Example 2: $FeCl_2 + KMnO_4 + HCl \rightarrow FeCl_3 + KCl + MnCl_2 + H_2O$

Example 3: $S^{2-} + MnO_4^- \rightarrow S + MnO_2$ (basic solution)

Example 4: $CuS + NO_3^- \rightarrow Cu^{2+} + S + NO$ (acidic)

PROBLEMS: Balance these equations:

1. $HNO_3 + S \rightarrow NO_2 + H_2SO_4 + H_2O$

2. $KMnO_4 + HCl + H_2S \rightarrow KCl + MnCl_2 + S + H_2O$

3. $FeCl_3 + H_2S \rightarrow FeCl_2 + HCl + S$

4. $Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO_2 + H_2O$

5. $NaCl + H_2SO_4 + MnO_2 \rightarrow Na_2SO_4 + MnSO_4 + H_2O + Cl_2$

6. $HMnO_4 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$

7. $MnO_4^- + SO_3^{2-} \rightarrow Mn^{2+} + SO_4^{2-}$ (acidic)

8. $H_2O_2 + I^- \rightarrow H_2O + I_2$ (acidic)

9. $AsO_3^{3-} + I_2 \rightarrow AsO_4^{3-} + I^-$ (basic)

10. $Cr + ClO_4^- \rightarrow CrO_2^- + ClO_3^-$ (basic)