Advanced Chemistry
Redox Reactions

Name Key

Mock Test

Part 1: Determining Oxidation Numbers

Instructions: Determine the oxidation number of each bolded element in the following substances.

1. Co in $CoCl_2$ +2
2. C in $COCl_2$ +4
3. Mn in MnO_4^{-1} +7
4. O in K_2O_2 -1
5. Br in HBrO +1
6. As in As_4 0
7. P in H_3PO_3 +3
8. Ca in Ca^{2+} +2
9. O in RbO_2 -1/2
10. Br in $MgBr_2$ -1
11. Fe in $Fe_3(PO_4)_2$ +2
12. Cr in $Cr_2O_7^{-2}$ +6
13. O in OF_2 +2
14. Cl in ClO_4^{-1} +7
15. H in CaH_2 -1

Part 2: Identifying Redox Reactions

Instructions: Determine which of the following equations represent redox reactions. MUST SHOW OXIDATION NUMBERS for full credit! If it is a redox reaction, determine which element is oxidized and which is reduced.

1) $\overset{+1\ -1}{NaI} + \overset{+1\ -2\ +1}{3HOCl} \rightarrow \overset{+1\ +5\ -2}{NaIO_3} + \overset{+1\ -1}{3HCl}$

I = Oxidized
Cl = reduced

2) $\overset{+1\ +5\ -2}{2KClO_3} \rightarrow \overset{+1\ -1}{2KCl} + \overset{0}{3O_2}$

Cl = reduced
O = oxidized

3) $\overset{-3\ +1\ -1}{2NH_4Cl} + \overset{+2\ -2\ +1}{Ca(OH)_2} \rightarrow \overset{-3\ +1}{2NH_3} + \overset{+1\ -2}{2H_2O} + \overset{+2\ -1}{CaCl_2}$

No redox reaction

Part 3: Writing Half Reactions & Balancing Redox Reactions

Instructions: Write the half reactions for each of the following equations. Identify which reaction is oxidation and which is reduction. Next balance it under acidic conditions. Finally, balance it under basic conditions.

1) $CrO_4^{-1} + S^{2-} \rightarrow Cr^{3+} + SO_4^{2-}$

a) Half Reactions

$4e^- + 8H^+ + CrO_4^{-1} \rightarrow Cr^{3+} + 4H_2O$

$4H_2O + S^{2-} \rightarrow SO_4^{2-} + 8H^+ + 8e^-$

b) Which reaction oxidized? Which reaction is reduced?

x2 → $4e^- + 8H^+ + CrO_4^{-1} \rightarrow Cr^{3+} + 4H_2O$ (reduction)

$4H_2O + S^{2-} \rightarrow SO_4^{2-} + 8H^+ + 8e^-$ (oxidation)

c) Balanced Redox in Acidic Conditions

$8e^- + 8H^+ + 2CrO_4^{-1} \rightarrow 2Cr^{3+} + 4H_2O$

$4H_2O + S^{2-} \rightarrow SO_4^{2-} + 8H^+ + 8e^-$

+8OH⁻

$8H^+ + 2CrO_4^{-1} + S^{2-} \rightarrow 2Cr^{3+} + SO_4^{2-} + 4H_2O$

d) Balanced Redox in Basic Conditions

$4H_2O + 2CrO_4^{-1} + S^{2-} \rightarrow 2Cr^{3+} + SO_4^{2-} + 4H_2O + 8OH^{-1}$

$4H_2O + 2CrO_4^{-1} + S^{2-} \rightarrow 2Cr^{3+} + SO_4^{2-} + 8OH^{-1}$

2) $Zn + NO_3^{-1} \rightarrow Zn^{2+} + NH_4^{+1}$

a) Half Reactions

x4 → $Zn \rightarrow Zn^{2+} + 2e^-$

$8e^- + 10H^+ + NO_3^{-1} \rightarrow NH_4^{+1} + 3H_2O$

b) Which reaction oxidized? Which reaction is reduced?

$Zn \rightarrow Zn^{2+} + 2e^-$ (oxidation)

$8e^- + 10H^+ + NO_3^{-1} \rightarrow NH_4^{+1} + 3H_2O$ (reduction)

c) Balanced Redox in Acidic Conditions

+10 OH⁻¹

$4Zn \rightarrow 4Zn^{2+} + 8e^-$

$8e^- + 10H^+ + NO_3^{-1} \rightarrow NH_4^{+1} + 3H_2O$

$10H^+ + NO_3^{-1} + 4Zn \rightarrow 4Zn^{+2} + NH_4^{+1} + 3H_2O$

d) Balanced Redox in Basic Conditions

$7H_2O + NO_3^{-1} + 4Zn \rightarrow 4Zn^{+2} + NH_4^{+1} + 3H_2O + 10OH^{-1}$

$7H_2O + NO_3^{-1} + 4Zn \rightarrow 4Zn^{+2} + NH_4^{+1} + 10OH^{-1}$