HONORS CHEMISTRY UNIT 15 NOTES: REDOX REACTIONS

NET IONIC EQUATIONS

Steps

1. Complete and Balance the equation
2. Assign phases to all substances
3. Determine if they are Strong, Weak, or Nonelectrolytes
4. Ionize/Dissociate Strong electrolytes ONLY
5. Eliminate spectator ions
6. Rewrite equation in net ionic form

Sample problems

1. BaCl2(aq) + (NH4)2CO3(aq) →
2. Na2CO3(aq) + HCl(aq) →
3. Al(s) + HCl(aq) →
4. SrCO3(s) + HC2H3O2(aq) →
5. H3PO4 + KOH →

DETERMINING OXIDATION NUMBERS

Oxidation numbers

**Rules for assigning oxidation numbers**

|  |  |  |
| --- | --- | --- |
|  |  | 1. The oxidation number for an atom in its elemental form is always zero.
	* A substance is elemental if both of the following are true:
		+ only one kind of atom is present
		+ charge = 0
	* Examples:
		+ S8: The oxidation number of S = 0
		+ Fe: The oxidation number of Fe = 0
2. The oxidation number of a monoatomic ion = charge of the monatomic ion.
	* Examples:
		+ Oxidation number of S2- is -2.
		+ Oxidation number of Al3+ is +3.
3. The oxidation number of all Group 1A metals = +1 (unless elemental).
4. The oxidation number of all Group 2A metals = +2 (unless elemental).
5. Hydrogen (H) has two possible oxidation numbers:
	* +1 when bonded to a nonmetal
	* -1 when bonded to a metal
6. Oxygen (O) has two possible oxidation numbers:
	* -1 in peroxides (O22-)....pretty uncommon
	* -2 in all other compounds...most common
7. The oxidation number of fluorine (F) is always -1.
8. The sum of the oxidation numbers of all atoms (or ions) in a neutral compound = 0.
9. The sum of the oxidation numbers of all atoms in a polyatomic ion = charge on the polyatomic ion.
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|  |  | When assigning oxidation numbers to the elements in a substance, take a systematic approach. Ask yourself the following questions:1. Is the substance elemental?
2. Is the substance ionic?
3. If the substance is ionic, are there any monoatomic ions present?
4. Which elements have specific rules?
5. Which element(s) do(es) not have rules?
	* Use rule 8 or 9 from above to calculate these.
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Sample problems: Assign oxidation states to all atoms in the following molecules

* + 1. CO2
		2. SF6
		3. NO3-
		4. NaCl
		5. K2SO4
		6. NH4Cl
		7. CaH2

OXIDATION AND REDUCTION REACTIONS

Oxidation

Reduction

How do you tell if a reaction is a redox reaction?

HCl (aq)+ NaOH(aq) → NaCl(aq) + H2O(l)

Cu(s) + 2AgNO3(aq) → 2Ag(s) + Cu(NO3)2(aq)

Substance Oxidized

Substance Reduced

Oxidizing Agent

Reducing Agent

Identifying the above

MnO4- + Cu → Cu2+ + Mn2+

ClO4- + MnO2 → ClO- + MnO4-

BALANCING REDOX REACTIONS: RULES

Sample Problems: balance the following redox reactions

Fe2+ + MnO4- → Fe3+ + Mn2+ (in acid)

NO3- + I- → NO + I2 (in acid)

MnO4- + SO2 → Mn2+ + SO42- (in acid)

CrO2 + ClO- → CrO42- + Cl- (in base)

Bi3+  + SnO22- → Bi + SnO32- (in base)

ELECTROCHEMISTRY

Cathode

Anode

Electrolytic Cells

Galvanic/Voltaic Cells

Determining Cell Potential

Sample problems

Li1+ + e → Li

Ni2+ + 2e → Ni

Cu2+ + 2e → Cu

Zn2+ + 2e → Zn

Al3+ + 3e → Al

Ag1+ + e → Ag

Au3+ + 3e → Au

Cu2+ + 2e → Cu