

First-Year Chemistry

2. Stoichiometry and Reactions

Read: Zumdahl Chapter 4; Damji & Green: Chapter 1: pp. 33-40; Chapter 9: pp. 286-292; Chapter 10: pp.322-330

Presumed knowledge (from GCSE)

Reactions: Ion-exchange reactions, Acid reactions and Redox reactions

- Acid, base
- coefficient, balanced chemical reaction, ion exchange reaction (precipitation reaction), displacement reaction, neutralization reaction
- redox (oxidation-reduction) reaction, reduction, oxidation,

Concepts to be mastered:

To master a concept, you must be able to do three things:

1. define the concept,
2. explain the concept, and
3. give an example of the concept.

Solution Stoichiometry

- solution, solute, solvent, types of solutions, saturated, unsaturated, supersaturated, concentrated, dilute, molarity, stock
- volumetric flask, titration, titrant, analyte, indicator, buret, pipet, end-point, stoichiometric point, equivalence point

Reactions: Ion-exchange reactions, Acid reactions and Redox reactions

- molecular equation, full ionic equation, net ionic reaction, spectator ion(s)
- solubility rules, soluble, insoluble, strong acid, weak acid, monoprotic acid, diprotic acid, polyprotic acid, organic acid, inorganic acid
- oxidizing agent, reducing agent, oxidation state

Skills to be mastered:

To master a skill, you must be able to

1. recognize when the skill is needed,
2. recognize what information is needed to execute the skill,
3. execute the skill, and
4. assess whether the skill has been executed correctly.

Solution Stoichiometry

- | | Further problems | Zumdahl problems |
|---|------------------|------------------|
| • Given two of moles of solute, volume of solution, and molarity of the solution, determine the third | | 15-22 |
| • Given mass and/or volume and molarity information about the reactants in a chemical reaction: | | 69-70, 72-81 |
| ♦ determine mass or mole of each product formed | 1, 4, 5 | |
| ♦ determine limiting reagent | | |
| ♦ determine excess reagent(s) | | |
| ♦ determine amount by which excess reagent(s) is(are) in excess | | |

- ◆ determine %yield if given above information and actual yield
 - ◆ determine ion concentrations remaining in solution if reaction is in solution
 - Given the concentration of the solute, calculate the concentration of an ion in solution 3
 - Perform calculations involving dilutions 2 23-28
- Reactions: Ion-exchange, acid and redox reactions**
- Predict the products of ion exchange reaction and write net ionic reaction (equation) 6 29-44, 71
 - Know and use solubility rules 6 29-44
 - Know what acids decompose into a gas and water
 - Know and be able to write equations for the general reactions of acids with metals, oxides, hydroxides, carbonates, hydrogencarbonates, sulfites and sulfides 45-56
 - Know and use strong and weak acids in ion exchange reactions
 - Recognize and distinguish between nonelectrolyte, weak electrolyte and strong electrolyte 11-14
 - Assign oxidation states to elements in a chemical species 7 57-60
 - Balance redox reactions in general and also those in acidic or basic solution 8, 9 63-68, 82
 - Identify reduction, oxidation, reducing agent, oxidizing agent 9 61-62