

CHM 110
Chapter 4 Study Guide / Learning Objectives

Chapter four in the textbook deals with chemical reactions - how to describe them, how to predict the products of several common types of reaction, and how to calculate the relative amounts of each chemical in a chemical reaction.

At the end of this chapter, you should be able to:

[Terminology]

- Define terms related to chemical equations: chemical equation, reactant, product, phase label, molecular equation.
- Define terms related to ionic equations: complete ionic equation, net ionic equation, soluble, insoluble.
- Define terms related to simple chemical reactions: precipitation, neutralization, oxidation, reduction, acid, base.
- Define terms related to oxidation-reduction reactions: oxidizing agent, reducing agent, combination, (single) displacement, combustion, decomposition.
- Define terms related to chemical calculations: limiting reactant, excess, percent yield.

[Writing and balancing equations]

- Balance simple chemical equations using the trial and error (inspection) method
- Use phase labels to indicate the state of substances in chemical reactions: (s), (l), (g), (aq)
- Write a balanced chemical equation for a reaction given a description of the reaction.

[Molecular and ionic equations]

- Write a given chemical reaction in molecular, complete ionic, or net ionic forms.
- Apply the **solubility rules** to determine whether an ionic compound with a given chemical formula is soluble in water. See Table 4.1 on page 181.

[Simple chemical reactions - precipitation and neutralization]

- Identify a **precipitation reaction** and **write the expected products**.
- Identify the insoluble compound produced in a precipitation reaction using the **solubility rules**.
- Balance the equation for a precipitation reaction.
- Write the expected products of a **neutralization reaction** and balance.
- Identify the **acid** and **base** in a neutralization reaction.

[Oxidation-reduction reactions]

- Classify a given oxidation-reduction reaction by type: **combination, combustion, decomposition, (single) displacement**.
- Identify the species **oxidized** (*loses e^-*) and the species **reduced** (*gains e^-*) in a simple redox reaction between ionic species.
- Identify the oxidizing agent and reducing agent in a simple redox reaction between ionic species.

- Write the expected products of simple **combination** and **combustion** reactions.

[Stoichiometry]

- Calculate the amount of product (**mass, moles, or volume**) that can be produced from a given amount (**mass, moles, or volume**) of reactant (e.g. "How many moles of product C can you produce in the reaction $3A + 2B \rightarrow 4C$ if you have 1.5 moles of B and lots of A?").
- Calculate the amount of reactant (**mass, moles, or volume**) necessary to produce a given amount (**mass, moles, or volume**) of product (e.g. "If I want to produce 1.5 moles of product C in the reaction $3A + 2B \rightarrow 4C$, how many moles of B would I need to measure out?").
- Determine the limiting reactant and the amount of product that can be produced in a situation where the amount of more than one reactant is specified.(e.g. "How many moles of product C can you produce in the reaction $3A + 2B \rightarrow 4C$ if you have 1.5 moles of B and 1.5 moles of A?").
- Calculate the percent yield of a chemical reaction (e.g. "In the reaction $3A + 2B \rightarrow 4C$, if I start with 15 grams of A and lots of B and produce 3.5 grams of C, what is the percent yield?").

[Practice problems from the textbook]

- 3, 5, 11, 13, 19, 21, 47, 57, 63, 65, 71, 73