Reading: Averill 1.1-1.7; 7.1; 3.1, 3.3-3.4;

1. Atomic symbols practice

Averill Chapter 1, Section 6, Conceptual Problem 5

Give the symbol ${}^{A}_{Z}X$ for these elements, all of which exist as a single isotope:
a. beryllium
b. ruthenium
c. phosphorus
d. aluminum
e. cesium
f. praseodymium
g. colbalt
h. yttrium
i. arsenic

2. Isotopes and average atomic mass

Averill Chapter 1, Section 6, Numerical Problem 5

Copper, an excellent conductor of heat, has two isotopes: ^{63}Cu and ^{65}Cu. Use the following information to calculate the average atomic mass of copper:

Isotope	Percent Abundance (%)	Atomic mass (amu)
^{63}Cu	69.09	62.9298
^{65}Cu	30.92	64.9278

3. Isotopes and average atomic mass

Averill Chapter 1, Section 6, Numerical Problem 10

Complete the following table:

Isotope	Number of protons	Number of neutrons	number of electrons
^{57}Fe			
^{40}X		20	
^{36}S			

4. Molecular mass/molar mass

Averill Chapter 3, Section 1, Numerical Problem 3

Calculate the molecular mass or formula mass (molar mass) of each compound:
a. V_2O_4 (vanadium(IV) oxide)
b. $CaSiO_3$ (calcium silicate)
c. BiOCl (bismuth oxychloride)
d. CH_3COOH (acetic acid)
e. Ag_2SO_4 (silver sulfate)
f. Na_2CO_3 (sodium carbonate)
g. $(CH_3)_2CHOH$ (isopropyl alchohol)

5. Grams to moles

Averill Chapter 3, Section 1, Numerical Problem 8

Calculate the number of moles in $5.00X10^2$g of each substance. How many molecules or formula units are present in each sample?
a. CaO (lime)
b. $CaCO_3$ (chalk)
c. $C_{12}H_{22}O_11$ (sucrose/cane sugar)
d. NaOCl (bleach)
e. CO_2 (dry ice)

6. Moles, molecules, and molar mass

Averill Chapter 3, Section 1, Numerical Problem 16

Decide whether each statement is true or false and explain your reasoning.
a. There are more molecules in 0.5 mol of Cl_2 than in 0.5 mol of H_2.
b. One mole of H_2 has 6.022×10^{23} hydrogen atoms.
c. The molecular mass of H_2O is 18.0 amu.
d. The formula mass of benzene is 78 amu.

7. Balancing reactions

Averill Chapter 3, Section 3, Numerical Problem 2

Balance each chemical equation.
a. $Be(s) + O_2(g) \rightarrow BeO(s)$
b. $N_2O(g) + H_2O(l) \rightarrow HNO_2(aq)$
c. $Na(s) + H_2O(l) \rightarrow NaOH(aq) + H_2(g)$
d. $CaO(s) + HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l)$
e. $CH_3NH_2(g) + O_2(g) \rightarrow H_2O(g) + CO_2(g) + N_2(g)$
f. $Fe(s) + H_2SO_4(aq) \rightarrow FeSO_4(aq) + H_2(g)$

8. Writing balanced equations and finding limiting reagents

Averill Chapter 3, Section 4, Numerical Problem 12

Write a balanced chemical equation for each reaction and then determine which reactant is in excess.
a. 2.46 g barium(s) plus 3.89 g bromine(I) in water to give barium bromide
b. 1.44 g bromine(I) plus 2.42 g potassium iodide(s) in water to give potassium bromide and iodine
c. 1.852 g of Zn metal plus 3.62 g of sulfuric acid in water to give zinc sulfate and hydrogen gas
d. 0.247 g of iron metal reacts with 0.924 g of silver acetate in water to give iron(II) acetate and silver metal
e. 3.142 g of ammonium phosphate reacts with 1.648 g of barium hydroxide in water to give ammonium hydroxide and barium phosphate

9. Determining the yield of a reaction

Averill Chapter 3, Section 4, Numerical Problem 25

Aniline ($C_6H_5NH_2$) can be produced from chlorobenzene (C_6H_5Cl) via the following reaction:

$$C_6H_5Cl(l) + 2NH_3(g) \rightarrow C_6H_5NH_2(l) + NH_4Cl(s)$$

Assume that 20.0 g of chlorobenzene at 92% purity is mixed with 8.30 g of ammonia.
a. Which is the limiting reactant?
b. Which reactant is present in excess?
c. What is the theoretical yield of ammonium chloride in grams?
d. If 4.78 g of NH_4Cl was recovered, what was the percent yield?
e. Derive a general expressino for the theoretical yield of ammonium chloride in terms of grams of chlorobenzene reactant, if ammonia is present in excess.

3.091 Introduction to Solid-State Chemistry
Fall 2018