

### Book Problems

33. List at least three physical properties of tap water.  
Colorless, liquid, freezes at 0°C, boils at 100°C, density of 1 g/mL, etc.
34. Identify each of the following as an extensive or intensive physical property.
- a. melting point    **intensive**
  - b. mass                **extensive**
  - c. density            **intensive**
  - d. length             **extensive**
37. Classify each of the following as a physical property or a chemical property.
- a. aluminum has a silvery color                **physical**
  - b. gold has a density of 19 g/cm<sup>3</sup>                **physical**
  - c. sodium ignites when dropped in water        **chemical**
  - d. water boils at 100°C                            **physical**
  - e. silver tarnishes                                 **chemical**
  - f. mercury is a liquid at room temperature     **physical**
39. Classify each of the following as a physical change or a chemical change.
- a. breaking a pencil in two                        **physical**
  - b. water freezing and forming ice                **physical**
  - c. frying an egg                                      **chemical**
  - d. burning wood                                     **chemical**
  - e. leaves turning color in the fall                **chemical**
40. Is a change in phase a physical change or a chemical change? Explain.  
**Physical. The composition of the substance does not change.**
49. Which of the following are the same and which are different?
- a. a substance and a pure substance            **Same**
  - b. a heterogeneous mixture and a solution     **Different**
  - c. a substance and a mixture                    **Different**
  - d. a homogeneous mixture and a solution     **Same**
61. A 28.0-g sample of nitrogen gas combines with 6.0 g of hydrogen gas to form ammonia. What is the mass of ammonia formed?  
**Mass ammonia = 28.0 g + 6.0 g = 34.0 g**
62. A substance breaks down into its component elements when it is heated. If 68.0 g of the substance is present before it is heated, what is the combined mass of the component elements after heating?  
**Since Mass<sub>reactants</sub> = Mass<sub>products</sub>, Mass<sub>products</sub> = 68.0 g**
63. A 13.0-g sample of X combines with a 34.0-g sample of Y to form the compound XY<sub>2</sub>. What is the mass of the reactants?  
**Mass<sub>reactants</sub> = Mass<sub>X</sub> + Mass<sub>Y</sub> = 13.0 g + 34.0 g = 47.0 g**
64. Sodium chloride can be formed by the reaction of sodium metal and chlorine gas. If 45.98 g of sodium combines with an excess of chlorine gas to form 116.89 g sodium chloride, what mass of chlorine gas is used in the reaction?  
**Mass<sub>Cl</sub> = 116.89 g – 45.98 g = 70.91 g Cl**

### Extra Problems

1. A 102.81-g sample of lithium sulfate,  $\text{LiSO}_4$ , always contains 6.74 g of lithium, 32.07 g of sulfur, and 64.00 g of oxygen. Find the mass percentage of each element in this compound.

$$\% \text{Li} = \frac{6.74 \text{ g}}{102.81 \text{ g}} \times 100 = \boxed{6.56\% \text{ Li}}; \% \text{S} = \frac{32.07 \text{ g}}{102.81 \text{ g}} \times 100 = \boxed{31.19\% \text{ S}}; \% \text{O} = \frac{64.00 \text{ g}}{102.81 \text{ g}} \times 100 = \boxed{62.25\% \text{ O}}$$

$$\text{Check: } 6.56\% + 31.19\% + 62.25\% = 100.00\% \checkmark$$

2. A 148.33-g sample of magnesium nitrate,  $\text{Mg}(\text{NO}_3)_2$ , always contains 24.31 g of magnesium, 28.02 g of nitrogen, and the rest of oxygen.

- a. Find the mass percentage of each element in this compound.

$$\text{Mass O} = 148.33 \text{ g} - (24.31 \text{ g} + 28.02 \text{ g}) = 96.00 \text{ g}$$

$$\% \text{Mg} = \frac{24.31 \text{ g}}{148.33 \text{ g}} \times 100 = \boxed{16.39\% \text{ Mg}}; \% \text{N} = \frac{28.02 \text{ g}}{148.33 \text{ g}} \times 100 = \boxed{18.89\% \text{ N}}; \% \text{O} = \frac{96.00 \text{ g}}{148.33 \text{ g}} \times 100 = \boxed{64.72\% \text{ O}}$$

$$\text{Check: } 16.39\% + 18.89\% + 64.72\% = 100.00\% \checkmark$$

- b. From your answer to (a), determine the mass of N present in 68.2 g  $\text{Mg}(\text{NO}_3)_2$ .

$$\text{Mass N} = 68.2 \text{ g Mg}(\text{NO}_3)_2 \times \frac{18.89 \text{ g N}}{100 \text{ g Mg}(\text{NO}_3)_2} = \boxed{12.9 \text{ g N}}$$

3. Two samples containing only carbon and hydrogen are analyzed and the following masses of carbon are obtained. Are these two samples the same compound or different compounds? Show your work to justify your answer.

Analysis Data of Two Carbon Compounds					
Compound	Total Mass (g)	Mass C (g)	Mass H (g)	Mass % C	Mass % H
I	83.04	66.33	16.71	79.88	20.12
II	47.03	38.87	8.16	82.66	17.34

These are not the same compound since they have different % by mass of each element.

$$\text{Sample I: Mass H} = 83.04 \text{ g} - 66.33 \text{ g} = 16.71 \text{ g}$$

$$\% \text{C} = \frac{66.33 \text{ g}}{83.04 \text{ g}} \times 100\% = 79.88\% \text{ C}; \% \text{H} = \frac{16.71 \text{ g}}{83.04 \text{ g}} \times 100\% = 20.12\% \text{ H}$$

$$\text{Sample II: Mass H} = 47.03 \text{ g} - 38.87 \text{ g} = 8.16 \text{ g}$$

$$\% \text{C} = \frac{38.87 \text{ g}}{47.03 \text{ g}} \times 100\% = 82.65\% \text{ C}; \% \text{H} = \frac{8.16 \text{ g}}{47.03 \text{ g}} \times 100\% = 17.35\% \text{ H}$$

4. Which of the following pairs of molecules are examples of the law of multiple proportions?

- a.  $\text{CO}$  and  $\text{CO}_2$       Yes  
b.  $\text{H}_2\text{O}$  and  $\text{H}_2\text{S}$       No (the first contains O, the second contains S)  
c.  $\text{CH}_4$  and  $\text{C}_2\text{H}_6$       Yes  
d.  $\text{NO}_2$  and  $\text{HNO}_3$       No (the second contains H but not the first)