

### Book Problems

- Mastering Concepts pg. 82-83 #33, 34, 37, 39, 40, 45, 46, 50, 49; Mastering Problems pg. 83 #61, 62, 63, 64
- 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 particles does not change.**
- 45. Describe the difference between a physical change and a chemical change.  
**In a physical change, the composition of the particles does not change; in a chemical change, the composition of the particles changes as the atoms rearrange to form new substances.**
- 46. Describe the characteristics of a mixture.  
**A mixture is a physical combination of two or more pure substances (at least two different kinds of particle). It does not have a constant composition and its properties are those of its components.**
- 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**
- 50. Describe how a homogeneous mixture differs from a heterogeneous mixture.  
**A homogeneous mixture has one uniform phase that may appear pure; a heterogeneous mixture has two or more distinct phases, each of which may be a pure substance or a homogeneous mixture.**
- 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<sub>ammonia</sub> = 28.0 g + 6.0 g = 34.0 g ammonia**

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  $Mass_{\text{reactants}} = Mass_{\text{products}}$ ,  $Mass_{\text{products}} = 68.0 \text{ g}$

63. A 13.0-g sample of X combines with a 34.0-g sample of Y to form the compound  $XY_2$ . What is the mass of the reactants?

$Mass_{\text{reactants}} = Mass_X + Mass_Y = 13.0 \text{ g} + 34.0 \text{ g} = 47.0 \text{ g}$

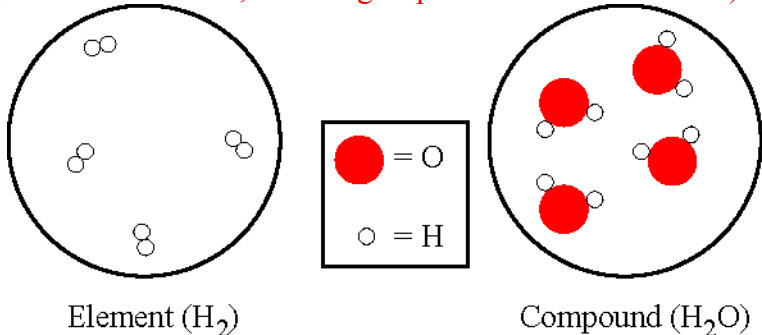
64. Sodium chloride can be formed by the reaction of sodium metal and chlorine gas. If 45.98 g of sodium combines with an excess of chlorine gas to form 116.89 g sodium chloride, what mass of chlorine gas is used in the reaction?

$Mass_{\text{Cl}} = 116.89 \text{ g} - 45.98 \text{ g} = 70.91 \text{ g Cl}$

### Extra Problems

1. What is the definition of a pure substance? What are the two kinds of pure substances? Draw two particle diagrams, using any symbols you want, to illustrate these.

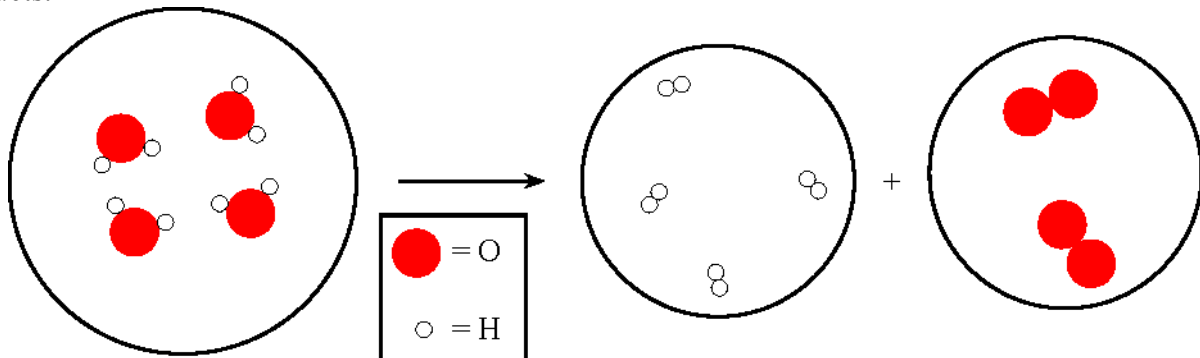
A pure substance contains only one kind of particle. These are elements (composed of one kind of atom) and compounds (composed of molecules, bonded groups of two or more atoms).



2. Classify each of the following substances as; an element (E), a compound (C), a homogeneous mixture (hom), or a heterogeneous mixture (het).

a. Silver	E	b. Magnesium carbonate	C
c. Oatmeal	Het	d. Bromine	E
e. Rust ( $Fe_2O_3$ )	C	f. Chicken soup	Het
g. Brass (an alloy)	Hom	h. Clear apple juice	Hom
i. Acetic acid	C	j. Vanadium	E

3. Draw a particle diagram showing the electrolysis of  $H_2O$  liquid into  $H_2$  and  $O_2$  gases, as demonstrated in class. Start with 4  $H_2O$  molecules and be sure to draw the correct number of H and O atoms in the products.



4. A 102.81-g sample of lithium sulfate,  $\text{Li}_2\text{SO}_4$ , 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.

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

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

5. 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.

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

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

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  $\text{Mg}(\text{NO}_3)_2$ .

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

*Whole* *Part* *Whole*

6. 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	27.03	21.59	5.44	79.87	20.13

These ARE the same compound since they have essentially the same % by mass of each element.

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

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

Sample II:  $\text{Mass H} = 27.03 \text{ g} - 21.59 \text{ g} = 5.44 \text{ g}$

$$\% \text{C} = \frac{21.59 \text{ g}}{27.03 \text{ g}} \times 100\% = 79.87\% \text{ C}; \% \text{H} = \frac{5.44 \text{ g}}{27.03 \text{ g}} \times 100\% = 20.13\% \text{ H}$$

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

- a.  $\text{CO}$  and  $\text{CO}_2$  Yes      c.  $\text{CH}_4$  and  $\text{C}_2\text{H}_6$  Yes  
 b.  $\text{H}_2\text{O}$  and  $\text{H}_2\text{S}$  No      d.  $\text{O}_2$  and  $\text{HNO}_3$  No

8. What is the property by which the periodic table is ordered?

The elements are listed in order of their atomic number.

9. What are the columns in the periodic table called? What are the rows called?

Columns are groups or families; rows are periods.

10. What kinds of elements are along the staircase? Above and right? Below and left?

Elements along the staircase (except Al) are metalloids; above and right are nonmetals; below and left are metals.

11. Name two elements that have properties similar to those of the element potassium (K). To those of krypton (Kr).

Similar to K: Li, Na, Rb, Cs, Fr (H is very different because it's a gas and the others are metals)

Similar to Kr: He, Ne, Ar, Xe, Rn, Og (they are all Noble Gases).