Name _____ Date _____ Class _____

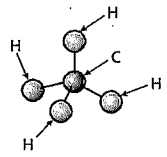
CHAPTER 11 STUDY GUIDE FOR CONTENT MASTERY

Section 11.3 Moles of Compounds

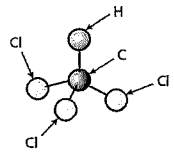
In your textbook, read about chemical formulas and the mole, the molar mass of compounds, and conversions among mass, moles, and number of particles.

Study the table and the diagram of a methane molecule and a trichloromethane molecule. Then answer the following questions.

Element	Molar Mass (g/mol)
Hydrogen	1.01
Carbon	12.01
Chlorine	35.45



CH_4



$CHCl_3$

1. What elements and how many atoms of each does a molecule of methane contain?
   carbon, 1 atom; hydrogen, 4 atoms
2. What elements and how many atoms of each does a molecule of trichloromethane contain?
   carbon, 1 atom; hydrogen, 1 atom; chlorine, 3 atoms
3. How many moles of each element are in a mole of methane?
   1 mol C; 4 mol H
4. How many moles of each element are in a mole of trichloromethane?
   1 mol C; 1 mol H; 3 mol Cl
5. Which of the following values represents the number of carbon atoms in one mole of methane? 6.02×10^{23}; 12.0×10^{23}; 18.1×10^{23}; 24.1×10^{23}
   6.02×10^{23}
6. Which of the following values represents the number of chlorine atoms in one mole of trichloromethane? 6.02×10^{23}; 1.20×10^{24}; 1.81×10^{24}; 2.41×10^{23}
   1.81×10^{24}
7. Which of the following values represents the molar mass of methane? 13.02 g/mol; 16.05 g/mol; 52.08 g/mol; 119.37 g/mol
   16.05 g/mol
8. Chloromethane (CH_3Cl) has a molar mass of 50.49 g/mol. Which of the following values represents the number of molecules of CH_3Cl in 101 grams of the substance? 3.01×10^{23}; 6.02×10^{23}; 1.20×10^{24}; 6.08×10^{26}
   1.20×10^{24}

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CHAPTER 11 STUDY GUIDE FOR CONTENT MASTERY

Section 11.5 The Formula for a Hydrate

In your textbook, read about naming and analyzing hydrates.

Use each of the terms below just once to complete the passage.

anhydrous	crystal structure	desiccants	formula unit
hydrate	hydration	water molecules	water of hydration

A(n) **(1)** hydrate is a compound that has a specific number of water molecules bound to its atoms. Molecules of water that become part of a hydrate are called waters of **(2)** hydration. In the formula for a hydrate, the number of **(3)** water molecules associated with each **(4)** formula unit of the compound is written following a dot.

The substance remaining after a hydrate has been heated and its waters of hydration released is called **(5)** anhydrous. The ratio of the number of moles of **(6)** water of hydration to one mole of the anhydrous compound indicates the coefficient of H_2O that follows the dot in the formula of the hydrate. Because the anhydrous form of the hydrate can absorb water into its **(7)** crystal structure, hydrates are used as **(8)** desiccants, which are drying agents.

Complete the table of hydrates.

Chemical Formula	Name
$CdSO_4$	Cadmium sulfate, anhydrous
$CdSO_4 \cdot H_2O$	9. Cadmium sulfate monohydrate
10. $CdSO_4 \cdot 4H_2O$	Cadmium sulfate tetrahydrate

Solve the following problem. Show your work in the space provided.

11. A 2.00-g sample of a hydrate of iron(II) chloride produces 1.27 g of anhydrous iron(II) chloride ($FeCl_2$) after heating. Determine the empirical formula and the name of the hydrate.
    $2.00\text{ g } FeCl_2 \cdot xH_2O - 1.27\text{ g } FeCl_2 = 0.73\text{ g } H_2O$
    $0.73\text{ g } H_2O \times 1\text{ mol } H_2O/18.02\text{ g } H_2O = 0.040\text{ mol } H_2O$
    $1.27\text{ g } FeCl_2 \times 1\text{ mol } FeCl_2/126.75\text{ g } FeCl_2 = 0.0100\text{ mol } FeCl_2$
    $0.040\text{ mol } H_2O/0.0100\text{ mol } FeCl_2 = 4\text{ mol } H_2O/1\text{ mol } FeCl_2$
    $4\text{ mol } H_2O : 1\text{ mol } FeCl_2$
    $FeCl_2 \cdot 4H_2O$
    iron(II) chloride tetrahydrate