Name ______________________ Date __________ Class __________

CHAPTER 8 Text Reference: Section 8-10

Practice Problems

1. What is the mass of 7.50 moles of sulfur dioxide (SO_2)? ($S = 32.1$ g/mol; $O = 16.0$ g/mol) 481 g

2. What is the mass of 0.438 mole of ammonium chloride (NH_4Cl)? ($N = 14.0$ g/mol; $H = 1.0$ g/mol; $Cl = 35.5$ g/mol) 23.4 g

3. How many moles are there in 250.0 g of sodium phosphate (Na_3PO_4)? ($Na = 23.0$ g/mol; $P = 31.0$ g/mol; $O = 16.0$ g/mol) 1.524 mole

4. How many moles are there in 993.6 g of potassium sulfate (K_2SO_4)? ($K = 39.1$ g/mol; $S = 32.1$ g/mol; $O = 16.0$ g/mol) 5.701 mole

5. How many atoms are there in 3.00 moles of sodium (Na)? 1.81×10^{24} atoms

6. How many atoms are there in 1.638×10^{-9} mole of lithium (Li)? 9.861×10^{14} atoms

7. How many molecules are there in 4.55 moles of nitrogen (N_2)? 2.74×10^{24} molecules

8. How many atoms of nitrogen (N) are there in 2.18 moles of nitrogen (N_2)? 2.62×10^{24} atoms N_2

9. How many atoms are there in 0.663 mole of water (H_2O)? 1.20×10^{24} atoms

10. How many moles are there in 15.5×10^{23} molecules of carbon dioxide (CO_2)? 2.57 mol

11. How many moles are there in 1.326×10^{12} molecules of carbon tetrachloride (CCl_4)? 2.203×10^{-12} mole

12. What is the volume occupied by 4.20 moles of oxygen gas (O_2) at STP? 94.1 dm^3

13. What volume does 0.0147 mole of nitrogen dioxide gas (NO_2) occupy at STP? .329 dm^3

14. How many moles are there in 45.0 dm^3 of methane gas (CH_4) measured at STP? 2.01 mole

15. How many moles are there in 0.335 dm^3 of argon gas (Ar) at STP? 1.50×10^{-2} mol

16. Calculate the percentage composition of lithium oxide (Li_2O). ($Li = 6.94$ g/mol; $O = 16.0$ g/mol) 46% Li, 54% O

17. What is the percentage composition of dinitrogen tetroxide (N_2O_4)? ($N = 14.0$ g/mol; $O = 16.0$ g/mol) 30% N, 70% O

18. What is the percentage composition of a carbon–oxygen compound, given that a 95.2-g sample of the compound contains 40.8 g of carbon and 54.4 g of oxygen? 43% C, 57% O

19. What is the percentage composition of a sulfur–chlorine compound, given that a 30.9-g sample of the compound is found to contain 9.63 g of sulfur and 21.3 g of chlorine? 31% S, 69% Cl

20. A sample of a compound that has a mass of 0.432 g is analyzed. The sample is found to be made up of oxygen and fluorine only. Given that the sample contains 0.128 g of oxygen, calculate the percentage composition of the compound. 70% F, 30% O

21. Find the empirical formula of a compound, given that the compound is found to be 47.9% zinc (Zn) and 52.1% chlorine (Cl) by mass. ($Zn = 65.4$ g/mol; $Cl = 35.5$ g/mol) $ZnCl_2$

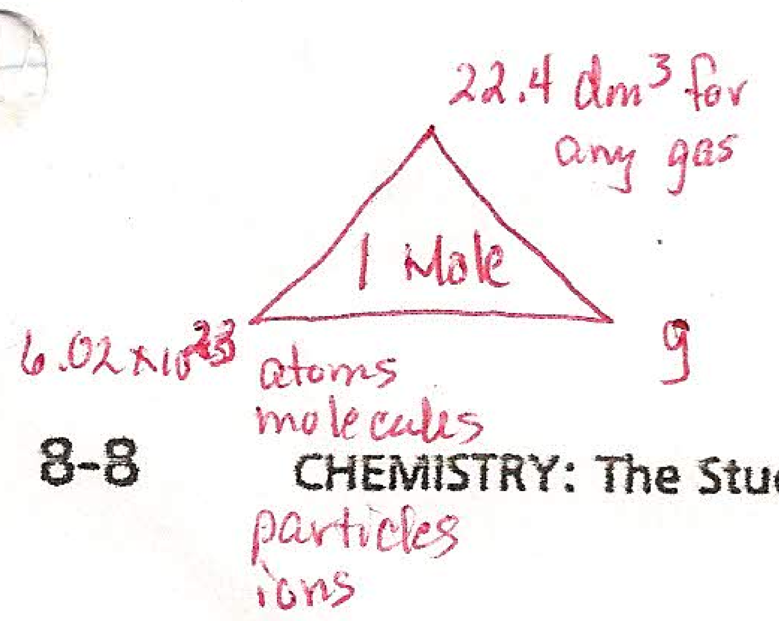
22. Find the empirical formula of a compound, given that a 48.5-g sample of the compound is found to contain 1.75 g of carbon (C) and 46.75 g of bromine (Br). ($C = 12.0$ g/mol; $Br = 79.9$ g/mol) CBr_4

23. What is the empirical formula of a compound, given that a 212.1-g sample of the compound contains 42.4 g of hydrogen (H) and 169.7 g of carbon (C)? What is the molecular formula of the compound, given that it has a gram molecular mass of 30.0 g/mol? ($H = 1.01$ g/mol; $C = 12.0$ g/mol) C_2H_6

24. A compound is known to have a gram molecular mass of 391.5 g/mol. Find the empirical and the molecular formulas of the compound, given the results of an analysis of a 310.8-g sample that reveals that the sample contains only boron (B) and iodine (I). The mass of the iodine in the sample is found to be 302.2 g. ($B = 10.8$ g/mol; $I = 126.9$ g/mol) BI_3

% Composition

Mass of element ÷ Total formula mass = % comp. for element



To find empirical formula
1. Get Moles
2. Divide All moles by smallest mole value
3. If results above are not whole numbers, multiply by 2, 3, ect to make them whole

To find molecular formula
Do above steps, Add up mass of empirical formula + compare it to molecular mass.

10 Practice Prob. Key

1. Since its a 1:2 then .172 moles produces **.344 moles**

2. Since its a 2:1 then 79.60 mole would be produced by **39.8 moles O_2**

3. $16.3 \text{ moles} \left| \frac{22.4 \text{ dm}^3}{1 \text{ mole}} \right| = \boxed{365 \text{ dm}^3}$

4. $.269 \text{ dm}^3 \left| \frac{1 \text{ mole}}{22.4 \text{ dm}^3} \right| = \boxed{.0120 \text{ moles}}$

6. $1.54 \text{ dm}^3 \text{ HF} \left| \frac{1 \text{ mole}}{22.4 \text{ dm}^3} \right| \frac{1}{2} \left| \frac{22.4 \text{ dm}^3}{1 \text{ mole}} \right| = \boxed{.77 \text{ dm}^3 \; OF_2}$

5. $71.11 \text{ dm}^3 \; N_2 \left| \frac{1 \text{ mole}}{22.4 \text{ dm}^3} \right| \frac{2}{1} \left| \frac{22.4}{1} \right| = \boxed{142 \text{ dm}^3 \; NO_2}$

7. $4.9 \times 10^5 \text{ molecules } O_2 \left| \frac{1 \text{ mole}}{\text{AV \#}} \right| \frac{2}{1} \left| \frac{\text{AV \#}}{1 \text{ mole}} \right| = \boxed{9.8 \times 10^5 \text{ formula units } CaO}$

8. $1.33 \times 10^{24} \text{ atoms} \left| \frac{1 \text{ mole}}{\text{AV \#}} \right| \frac{2}{3} \left| \frac{\text{AV \#}}{1 \text{ mole}} \right| = \boxed{8.87 \times 10^{23} \text{ atoms S}}$

9. $9.22 \times 10^{25} \text{ molecules } POF_3 \left| \frac{1 \text{ mole}}{\text{AV \#}} \right| \frac{6}{4} \left| \frac{22.4 \text{ dm}^3}{1 \text{ mole}} \right| = \boxed{5.15 \times 10^3 \text{ dm}^3 \; F_2}$

10. $7.15 \times 10^{23} \text{ atoms Fe} \left| \frac{1 \text{ mole}}{\text{AV \#}} \right| \frac{3}{2} \left| \frac{22.4 \text{ dm}^3}{1 \text{ mole}} \right| = \boxed{39.9 \text{ dm}^3 \; Cl_2}$

11. $29.8 \text{ g } Hg_2O \left| \frac{1 \text{ mole}}{417.2 \text{ g}} \right| \frac{4}{2} \left| \frac{200.6}{1 \text{ mole}} \right| = \boxed{28.7 \text{ g Hg}}$

12. $1.18 \text{ g } H_2 \left| \frac{1 \text{ mole}}{2 \text{ g}} \right| \frac{2}{2} \left| \frac{18 \text{ g}}{1 \text{ mole}} \right| = \boxed{10.5 \text{ g}}$

13. $73.0 \text{ g } HCl_g \left| \frac{1 \text{ mole}}{36.5 \text{ g}} \right| \frac{1}{2} \left| \frac{22.4 \text{ dm}^3}{1 \text{ mole}} \right| = \boxed{22.4 \text{ dm}^3 \; Cl_2}$

must be balanced

14. $1.87\ dm^3\ O_2 \left| \frac{1\ mole}{22.4\ dm^3} \right| \frac{2}{3} \left| \frac{32g}{1\ mole} \right| = \boxed{.893g\ S}$ = $\boxed{1.786g\ S}$

15. $40.3g\ Cl_2 \left| \frac{1\ mole}{71g} \right| \frac{2}{1} \left| \frac{AV\#}{1\ mole} \right| = \boxed{6.83 \times 10^{23}}$

16. $531.8g\ I_2 \left| \frac{1\ mole}{253.8g} \right| \frac{2}{1} \left| \frac{AV\#}{1\ mole} \right| = \boxed{2.52 \times 10^{24}\ atoms}$