

EZPZ Unit 6 Review: Moles and Math

Part 1: Fill out the chart

Name	Ionic or Covalent?	Formula	Random question
tricarbon octahydride	covalent	C_3H_8	What's the molar mass of this compound? 44.09 g/mol
aluminum chloride	ionic	$AlCl_3$	What's the molar mass of this compound? 133.33 g/mol
potassium carbonate	ionic	K_2CO_3	How many moles of ions are in this compound? 3 mol ions
tin (IV) chlorate	ionic	$Sn(ClO_3)_4$	What is the % composition of tin? 26.23 % Sn
boron trifluoride	covalent	BF_3	What's the molar mass of this compound? 67.81 g/mol
calcium phosphate heptahydrate	ionic (hydrate)	$Ca_3(PO_4)_2 \cdot 7H_2O$	What is the % composition of water? 28.91 % H_2O

Part 2: Mole Math

- How many formula units are in 0.429 mol of sodium bromide?
2.58 x 10²³ formula units NaBr
- How many atoms of oxygen are in 78.21g of magnesium nitrite?
1.619 x 10²⁴ atoms O
- How many ammonium ion (NH_4)¹⁺ are there in 396.24 g of ammonium sulfate?
3.6103 x 10²⁴ ions NH_4^+
- What is the mass in grams of 3.17 moles of chlorine?
225 g Cl_2
- How many grams are in 3.94×10^{24} molecules of diphosphorous tetroxide?
929 g P_2O_5
- How many nitride ions are in aluminum nitride?
1 N^{3-} ion
- What is the number of moles in 4.17×10^{23} formulas units of copper (II) chlorite?
0.693 mol $Cu(ClO_2)_2$
- Calculate the number of carbon atoms in 25.0 grams of isopropyl alcohol (C_3H_8O).
7.51 x 10²³ atoms C
- Which sample represents the greatest number of moles?
 - 44.01 g CO_2 1 mol
 - 1.0 moles C_3H_8 1 mol
 - 6.022×10^{23} molecules C_4H_{10} 1 mol
 - 18.02 g H_2O 1 mol
 - All of the sample have the same number of moles.
- Which of the following contains the largest number of molecules?
 - 10.0 g CH_4
 - 10.0 g C_2H_6
 - 10.0 g SO_2
 - 10.0 g Xe

Part 3: Empirical & Molecular

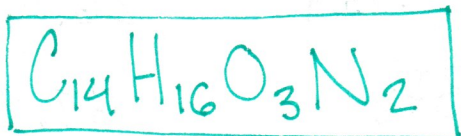
1. What is the empirical formula of C_8H_{16} ?



2. What is the empirical formula of $N_3H_6C_3H_{12}$?



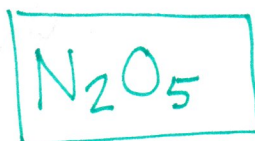
3. An unknown compound contains the following percents by mass: C: 60.86%, H: 5.83%, O: 23.16%, and N: 10.14%. Find the empirical formula.



4. A compound containing nitrogen and oxygen is decomposed in the laboratory and produces 24.5 g nitrogen and 70.0 g oxygen. Calculate the empirical formula of the compound.

$$N: 24.5 \text{ g N} \times \frac{1 \text{ mol N}}{14.01 \text{ g N}} = \frac{1.75 \text{ mol N}}{1.75} = 1 \times 2 = 2$$

$$O: 70.0 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = \frac{4.38 \text{ mol O}}{1.75} = 2.5 \times 2 = 5$$



5. Butanedione—a main component responsible for the smell and taste of butter and cheese—contains the elements carbon, hydrogen, and oxygen. The empirical formula of butanedione is C_2H_3O , and its molar mass is 86.09 g/mol. Find its molecular formula.

$$2 \times 12.01 + 3 \times 1.008 + 16.00 = 43.044 \text{ g/mol}$$

$$\frac{86.09}{43.044} = 2 \times C_2H_3O = \boxed{C_4H_6O_2}$$

6. The empirical formula of a compound is CH_2O . Its molecular mass is 60 g/mol. What is its molecular formula?

$$12.01 + 2 \times 1.008 + 16 = 30.026 \text{ g/mol}$$

$$\frac{60}{30.026} = 2 \times CH_2O = \boxed{C_2H_4O_2}$$

7. A compound with the percent composition shown next has a molar mass of 60.10 g/mol. Determine its molecular formula. C: 39.97%, H: 13.41%, N: 46.62% Assume 100. g

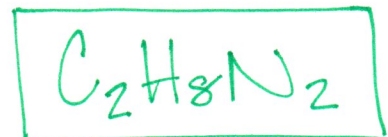
$$C: 39.97 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = \frac{3.33 \text{ mol C}}{3.33} = 1$$

$$12.01 + 4 \times 1.008 + 14.01 = 30.052$$

$$H: 13.41 \text{ g H} \times \frac{1 \text{ mol H}}{1.008 \text{ g H}} = \frac{13.30 \text{ mol H}}{3.33} = 4$$

$$\frac{60.10}{30.052} = 2 \times CH_4N$$

$$N: 46.62 \text{ g N} \times \frac{1 \text{ mol N}}{14.01 \text{ g N}} = \frac{3.33 \text{ mol N}}{3.33} = 1$$



Part 1:

$$\underline{\underline{C_3H_8}}: 3 \times 12.01 + 8 \times 1.008 = \boxed{44.09 \text{ g/mol}}$$

$$\underline{\underline{AlCl_3}}: 26.98 + 3 \times 35.45 = \boxed{133.33 \text{ g/mol}}$$

$$\underline{\underline{K_2CO_3}}: 2 K^+ + 1 CO_3^{2-} = \boxed{3 \text{ ions}}$$

$$\underline{\underline{Sn(ClO_3)_4}}: \frac{118.71}{118.71 + 4 \times 35.45 + 12 \times 16} \times 100 = \boxed{26.23\% \text{ Sn}}$$

$$\underline{\underline{BF_3}}: 10.81 + 3 \times 19.00 = \boxed{67.81 \text{ g/mol}}$$

$$\underline{\underline{Ca_3(PO_4)_2 \cdot 7H_2O}}: \frac{7(2 \times 1.008 + 16)}{3 \times 40.08 + 2 \times 30.97 + 8 \times 16.00 + 7(2 \times 1.008 + 16)} \times 100 = \boxed{28.91\% \text{ H}_2\text{O}}$$

Part 2:

$$1. 0.429 \text{ mol NaBr} \times \frac{6.02 \times 10^{23} \text{ formula units NaBr}}{1 \text{ mol NaBr}} = \boxed{2.58 \times 10^{23} \text{ formula units NaBr}}$$

$$2. 78.21 \text{ g Mg(NO}_2)_2 \times \frac{1 \text{ mol Mg(NO}_2)_2}{116.32 \text{ g Mg(NO}_2)_2} \times \frac{4 \text{ mol O}}{1 \text{ mol Mg(NO}_2)_2} \times \frac{6.02 \times 10^{23} \text{ atoms O}}{1 \text{ mol O}} = \boxed{1.619 \times 10^{24} \text{ atoms O}}$$

$$3. 396.24 \text{ g (NH}_4)_2\text{SO}_4 \times \frac{1 \text{ mol (NH}_4)_2\text{SO}_4}{132.144 \text{ g (NH}_4)_2\text{SO}_4} \times \frac{2 \text{ mol NH}_4^+}{1 \text{ mol (NH}_4)_2\text{SO}_4} \times \frac{6.02 \times 10^{23} \text{ ions NH}_4^+}{1 \text{ mol NH}_4^+} = \boxed{3.6103 \times 10^{24} \text{ ions NH}_4^+}$$

$$4. \quad 3.17 \text{ mol Cl}_2 \times \frac{70.90 \text{ g Cl}_2}{1 \text{ mol Cl}_2} = \boxed{225 \text{ g Cl}_2}$$

$$5. \quad 3.94 \times 10^{24} \text{ molecules P}_2\text{O}_4 \times \frac{1 \text{ mol P}_2\text{O}_5}{6.02 \times 10^{23} \text{ molecules P}_2\text{O}_5} \times \frac{141.94 \text{ g P}_2\text{O}_5}{1 \text{ mol P}_2\text{O}_5} = \boxed{929 \text{ g P}_2\text{O}_5}$$



$$7. \quad 4.17 \times 10^{23} \text{ formula units Cu(ClO}_2)_2 \times \frac{1 \text{ mol Cu(ClO}_2)_2}{6.02 \times 10^{23} \text{ formula units Cu(ClO}_2)_2} = \boxed{0.693 \text{ mol Cu(ClO}_2)_2}$$

$$8. \quad 25.0 \text{ g C}_3\text{H}_8\text{O} \times \frac{1 \text{ mol C}_3\text{H}_8\text{O}}{60.094 \text{ g}} \times \frac{3 \text{ mol C}}{1 \text{ mol C}_3\text{H}_8\text{O}} \times \frac{6.02 \times 10^{23} \text{ atoms C}}{1 \text{ mol C}} = \boxed{7.51 \times 10^{23} \text{ atoms C}}$$

$$10. \text{ a) } 10.0 \text{ g CH}_4 \times \frac{1 \text{ mol CH}_4}{16.042 \text{ g CH}_4} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol CH}_4} = \boxed{3.75 \times 10^{23} \text{ molecules CH}_4}$$

$$\text{b) } 10.0 \text{ g C}_2\text{H}_6 \times \frac{1 \text{ mol C}_2\text{H}_6}{30.068 \text{ g C}_2\text{H}_6} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol C}_2\text{H}_6} = 2.00 \times 10^{23} \text{ molecules C}_2\text{H}_6$$

$$\text{c) } 10.0 \text{ g SO}_2 \times \frac{1 \text{ mol SO}_2}{64.06 \text{ g SO}_2} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol SO}_2} = 9.40 \times 10^{22} \text{ molecules SO}_2$$

$$\text{d) } 10.0 \text{ g Xe} \times \frac{1 \text{ mol Xe}}{131.29 \text{ g Xe}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol Xe}} = 4.59 \times 10^{22} \text{ molecules Xe}$$

Part 3:

Assume 100. g

$$3. \text{ C: } 60.86 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = \frac{5.07}{0.72} = 7.04 \times 2 = 14$$

$$\text{H: } 5.83 \text{ g H} \times \frac{1 \text{ mol H}}{1.008 \text{ g H}} = \frac{5.78}{0.72} = 8.03 \times 2 = 16$$

$$\text{O: } 23.16 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = \frac{1.45}{0.72} = 1.45 \times 2 = 3$$

$$\text{N: } 10.14 \text{ g N} \times \frac{1 \text{ mol N}}{14.01 \text{ g N}} = \frac{0.72}{0.72} = 1 \times 2 = 2$$

