

Molar Mass Practice

Find out what one mole of each of the following compounds weighs

1. NaBr

$$\text{Na: } 1 \times \underline{\quad} = \underline{\quad}$$

$$\text{Br: } 1 \times \underline{\quad} = \underline{\quad} +$$

$$\underline{\quad} \text{ g/mol}$$

2. PbSO₄

$$\text{Pb: } 1 \times \underline{\quad} = \underline{\quad}$$

$$\text{S : } 1 \times \underline{\quad} = \underline{\quad}$$

$$\text{O : } 4 \times \underline{\quad} = \underline{\quad} +$$

$$\underline{\quad} \text{ g/mol}$$

3. Ca(OH)₂

$$\text{Ca: } 1 \times \underline{\quad} = \underline{\quad}$$

$$\text{O : } 2 \times \underline{\quad} = \underline{\quad}$$

$$\text{H : } 2 \times \underline{\quad} = \underline{\quad} +$$

$$\underline{\quad} \text{ g/mol}$$

4. Na₃PO₄

$$\text{Na: } \underline{\quad} \times \underline{\quad} = \underline{\quad}$$

$$\text{P : } \underline{\quad} \times \underline{\quad} = \underline{\quad}$$

$$\text{O : } \underline{\quad} \times \underline{\quad} = \underline{\quad} +$$

$$\underline{\quad} \text{ g/mol}$$

To get molar mass:

1. List the elements
2. Count the elements
3. Multiply by mass number
4. Add the masses

Example: H₂O

$$\text{H: } 2 \times 1 = 2$$

$$\text{O: } 1 \times 16 = 16$$

$$\text{Mass: } 16 + 2 = \mathbf{18 \text{ g/mol}}$$



N: $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

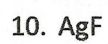
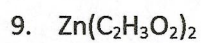
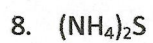
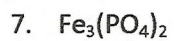
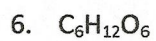
H : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

C : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

O : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} +$

$\underline{\hspace{1cm}} \text{ g/mol}$

No help for the last five!! I've left room for work at the bottom.



Gram/ Mole Conversions

Part One: Convert *moles* to *grams*

1. 5 mol Na_2SO_4

Na: $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

S : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

O : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} +$

$\underline{\hspace{1cm}} \text{ g/mol}$

5 mol x $\underline{\hspace{1cm}} \text{ g/mol} = \underline{\hspace{1cm}} \text{ g}$

2. 3 mol NaNO_3

Na: $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

N : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

O : $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} +$

$\underline{\hspace{1cm}} \text{ g/mol}$

3 mol x $\underline{\hspace{1cm}} \text{ g/mol} = \underline{\hspace{1cm}} \text{ g}$

To convert moles to grams

1. Get the molar mass of the compound
2. **Multiply** the number of *moles* you have been given by the **molar mass**

Example: Convert 12 moles of H_2O to grams.

H: $2 \times 1 = 2$

O: $1 \times 16 = 16$

Mass is 18g/mol

12 mol x 18g/mol = **216 g**

Complete the next three without help

3. 7.5 mol $(\text{Hg}_2)_3(\text{PO}_3)_2$

4. 2 mol MgSO_4

5. 4 mol KBrO_3

Part Two: Convert *grams* to *moles*

6. 4g CuSO₄

Cu: ____ x ____ = ____

S : ____ x ____ = ____

O : ____ x ____ = ____ +

____ g/mol

4g ÷ ____ g/mol = ____ g

7. 43g NaCl

Na: ____ x ____ = ____

Cl : ____ x ____ = ____ +

____ g/mol

43g ÷ ____ g/mol = ____ g

To convert grams to moles

1. Get the molar mass of the compound
2. **Divide** the number of **grams** you have been given by the **molar mass**

Example: Convert 10 g of H₂O to grams.

H: 2x 1= 2

O: 1x16=16

Mass is 18g/mol

10g ÷ 18g/mol = **0.56 moles**

Think: Do I have more than one mole, or less than one mole? Does my answer make sense?

Complete the next three without help

8. 10g HBr

9. 3 g Cr(NO₃)₃

10. 15 g Mg₃N₂

Percent Composition by Mass

Find the **percent composition by mass** for each of the following compounds

1. CaS

$$\text{Ca} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{S} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$\underline{\quad}$ g/mol

2. SrI_2

$$\text{Sr} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{I} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$\underline{\quad}$ g/mol

3. Li_3N

$$\text{Li} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{N} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$\underline{\quad}$ g/mol

4. $\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2$

$$\text{Ca} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{C} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{H} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{O} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

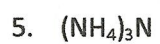
To get percent composition:

1. Find the molar mass of the compound
2. Divide each elements part of the mass by the whole thing
3. Multiply each number by 100

Example: Get the percent composition by mass for each element in H_2O

$$\text{H: } 2 \times 1 = 2 \div 18 \times 100 = \mathbf{11.11\%}$$

$$\text{O: } 1 \times 16 = 16 \div 18 \times 100 = \mathbf{88.89\%}$$

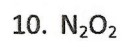


$$\text{N} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\text{H} : \underline{\quad} \times \underline{\quad} = \underline{\quad} \div \underline{\quad} \times 100 = \underline{\quad} \%$$

$$\underline{\quad} \text{g/mol}$$

Now do the last 5 without help



Empirical Formulas

Calculate the **empirical formula** for each of the following percent compositions

1. 24.7% calcium, 1.2% hydrogen, 14.8% carbon, and 59.3% oxygen

$$\text{Ca: } 24.7\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{H: } 1.2\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{C: } 14.8\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{O: } 59.3\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



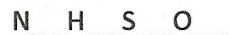
2. 21.2% nitrogen, 6.06% hydrogen, 24.3% sulfur, and 48.45% oxygen

$$\text{N: } 21.2\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{H: } 6.06\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{S: } 24.3\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{O: } 48.45\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

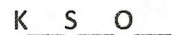


3. 44.82% potassium, 18.39% sulfur, 36.79% oxygen

$$\text{K: } 44.82\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{S: } 18.39\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{O: } 36.79\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



To get an empirical formula:

1. Pretend the % is really **g**.
2. Convert the grams to moles
3. Divide each of the moles by the smallest one. Round to a whole number only if **very close**.
4. Use the new numbers as subscripts

Example: Get the empirical formula for a compound that is 11.11% hydrogen and 88.89% oxygen.

$$\text{H: } 11.11\text{g} \div 1 = 11.11 \text{ mol} \div 5.56 = 2$$

$$\text{O: } 88.89\text{g} \div 16 = 5.56 \text{ mol} \div 5.56 = 1$$

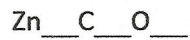
The formula is **H₂O**

4. 52.0% zinc, 9.6% carbon, 38.4% oxygen

$$\text{Zn: } 52.0\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{C: } 9.6\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

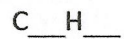
$$\text{O: } 38.4\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



5. 92.2% carbon, 7.76% hydrogen

$$\text{C: } 92.2\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

$$\text{H: } 7.76\text{g} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



Now, try three more without any help:

6. 11.775g tin and 3.180 g oxygen (*already in grams, just set up the problem like normal*)
7. 21.6% sodium, 33.3% chlorine, 45.1% oxygen
8. 19.3% sodium, 26.9% sulfur, 53.8% oxygen

Molecular Formulas

Calculate the molecular formula from the information given in the problems below

1. An unknown compound has an empirical formula of P_2O_5 and a molecular mass of 284g. What is the molecular formula for this compound?

$$P: \underline{\quad} \times \underline{\quad} = \underline{\quad}$$

$$O: \underline{\quad} \times \underline{\quad} = \underline{\quad} +$$

$$\underline{\quad} \text{ g/mol}$$

$$\underline{\quad} \text{ g/mol} \div \underline{\quad} \text{ g/mol} = \underline{\quad}$$

$$P_{2 \times \underline{\quad}} O_{5 \times \underline{\quad}} = P_{\underline{\quad}} O_{\underline{\quad}}$$

2. A compound has an empirical formula of C_2OH_4 and a molecular mass of 88g/mol. What is the molecular formula of this compound?

$$C: \underline{\quad} \times \underline{\quad} = \underline{\quad}$$

$$H: \underline{\quad} \times \underline{\quad} = \underline{\quad}$$

$$O: \underline{\quad} \times \underline{\quad} = \underline{\quad} +$$

$$\underline{\quad} \text{ g/mol}$$

$$\underline{\quad} \text{ g/mol} \div \underline{\quad} \text{ g/mol} = \underline{\quad}$$

$$C_{2 \times \underline{\quad}} O_{4 \times \underline{\quad}} H_{4 \times \underline{\quad}} = C_{\underline{\quad}} O_{\underline{\quad}} H_{\underline{\quad}}$$

To get a molecular formula, you will need:

- The **empirical formula** of the molecule in question

- The **molecular mass** of the molecule in question

1. Get the molar mass of the empirical formula.

2. Divide the **molecular mass** by the mass of the empirical formula

3. Multiply the subscripts of the empirical formula by the number you got in #2

Example: A molecule has an empirical formula of H_2O and a molecular mass of 72 g/mol. What is its molecular formula?

$$H: 2 \times 1 = 2$$

$$O: 1 \times 16 = 16$$

Mass is 18 g/mol

$$72 \text{ g/mol} \div 18 \text{ g/mol} = 4$$

$$H_{2 \times 4} O_{1 \times 4} = H_8 O_4$$

More on back!

Do the remaining problems without help

3. A compound has an empirical formula of C_4H_4O and a molecular mass of 136 g/mol. What is the molecule's molecular formula?
4. A compound has an empirical formula of $CFBrO$ and a molecular mass of 255 g/mol. What is the molecule's molecular formula?
5. A compound has an empirical formula of C_2H_8N and a molecular mass of 46 g/mol. What is the molecule's molecular formula?

Unit 7 Review

The following problems are a review of what you have learned in unit seven. No help problems or examples are given. Use the unit pages to help you solve these problems.

Part One: Convert moles to grams

1. 12 mol PtCl_4
2. 5 mol $\text{C}_2\text{H}_4\text{O}_2$

Part Two: Convert grams to moles

3. 3 g $\text{C}_5\text{H}_{12}\text{O}_2$
4. 8 g NH_3

Part Three: Give the percent composition for each element in the following compounds

5. NaOH
6. PbSO_4
7. FeBr_3
8. $\text{Fe}(\text{OH})_3$

Part Four: Find the empirical for compounds with the following percent compositions

9. 10.04% carbon, 0.84% hydrogen, 89.12% chlorine
10. 30.43% nitrogen and 69.57% oxygen
11. 82.40% nitrogen and 17.60% hydrogen
12. 88.8% copper and 11.2% oxygen

More on back

Part Five: Find the molecular formula for the following compounds

13. Empirical formula is CH_2 , molecular mass is 28 g/mol
14. Empirical formula is C_2HCl , molecular mass is 179 g/mol
15. Empirical formula is $\text{C}_3\text{H}_2\text{O}$, molecular mass is 216 g/mol