

# Moles and Compounds

Formula mass

Molar mass

Molecular mass

Molecular weight (MW)

Common terms for masses  
of compounds and  
formula units

Example:  $\text{CH}_4$

$\text{C} = 12.01 \text{ amu}$

$\text{H} = 1.008 \text{ amu} \times 4$

$16.042 \text{ amu} \Rightarrow 16.04 \text{ g/mol}$

1A	2A	8B										3A	4A	5A	6A	7A	8A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
H 1.01												B 10.8	C 12.0	N 14.0	O 16.0	F 19.0	Ne 20.2
Li 6.94	Be 9.01											Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.4	Ar 39.9
Na 23.0	Mg 24.3											Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9	Kr 83.8
K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.8	Co 58.9	Ni 58.7	Cu 63.5	Zn 65.4						
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (98)	Ru 101	Rh 101	Pd 106	Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127	Xe 131
Cs 133	Ba 137	La 139	Hf 178	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	Hg 201	Tl 204	Pb 207	Bi 209	Po (209)	At (210)	Rn (222)
Fr (223)	Ra 226	Ac 227	Th (261)	Pa (262)	U (263)	Np (262)	Pu (265)	Am (266)									

Lanthanides	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	Ce 140	Pr 141	Nd 144	Pm (145)	Sm 150	Eu 152	Gd 157	Tb 159	Dy 162	Ho 165	Er 167	Tm 169	Yb 173	Lu 175
Actinides	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	Th 232	Pa 231	U 238	Np (237)	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (260)

## Example

Calculate the molar mass of  $\text{Mg}(\text{OH})_2$ . ↖ Formula unit

$$\begin{aligned} &24.3 \\ &2(16.0) \\ &2(1.008) \\ &58.316 \text{ g/mol} \end{aligned}$$

Calculate the mass percentage of O in  $\text{Mg}(\text{OH})_2$ .

$$2(16)/58.3 = 54.9\%$$

## Example

Calculate the number of  $\text{Mg}(\text{OH})_2$  formula units in 0.1 g of  $\text{Mg}(\text{OH})_2$ .

$$0.1 \cdot \frac{1}{58.3} \cdot \frac{6.022 \times 10^{23}}{1} = 1.03 \times 10^{21}$$

Calculate the number of O atoms in 0.1 g of  $\text{Mg}(\text{OH})_2$ .

$$2(1.03 \times 10^{21}) = 2.06 \times 10^{21}$$

## Determining the Formula of a Compound

**Molecular Formula:** The actual number of atoms contained in one formula unit of the compound

Example:  $C_6H_{12}O_6$

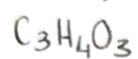
**Empirical Formula:** Simplest whole-number ratio of atoms in a compound

Example:  $C_3H_4O_3$

Analysis of a compound yields the following percent composition

Element	Percentage by Mass	Moles	Mole Ratio
C (12.01 g/mol)	40.92	3.41	1 3
H (1.008 g/mol)	4.58	4.54	1.33 4
O (16.00 g/mol)	54.50	3.41	1 3
Total	100.00		

Determine the empirical formula of the compound.



A 1.76 g sample of this compound provides 0.0100 mol. Determine its molecular formula.

$$\frac{1.76}{0.01} = 176 \text{ g/mol}$$

$$3(12.01)$$

$$4(1.008)$$

$$3(16)$$

$$88.06 \text{ g/mol}$$

$$\frac{176}{88.06} \approx 2$$

