Office Hours: M 1:30pm – 3:00pm
(in Park 169) W 11:00am – 12:00pm
or by appointment (email me)
or just email me with questions!

TA Hours w/ Dana: Th 6:00pm – 7:00pm
(in Park 273) F 4:30pm – 6:00pm

Q-center: https://www.brynmawr.edu/inside/offices-services/q-center/q-center-schedule

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Mol Calculations

Mass % Composition

9/14/2026

Achieve HW #2 due Monday 9/14 at 10:00am
Achieve HW #3 due Thursday 9/17 at 8:00pm

Exam 1 in lecture on Friday (everything **before** mass % composition)

Learning Objectives

- Calculate formula masses for covalent and ionic compounds
- Define the amount unit mole and the related quantity Avogadro's number
- Explain the relation between mass, moles, and numbers of atoms or molecules, and perform calculations deriving these quantities from one another

- Calculate the percent composition of a compound (by mass)

How many donuts are there in 7 dozen?

The Mole and Avogadro's Number

The *mole* is the SI unit for counting particles.

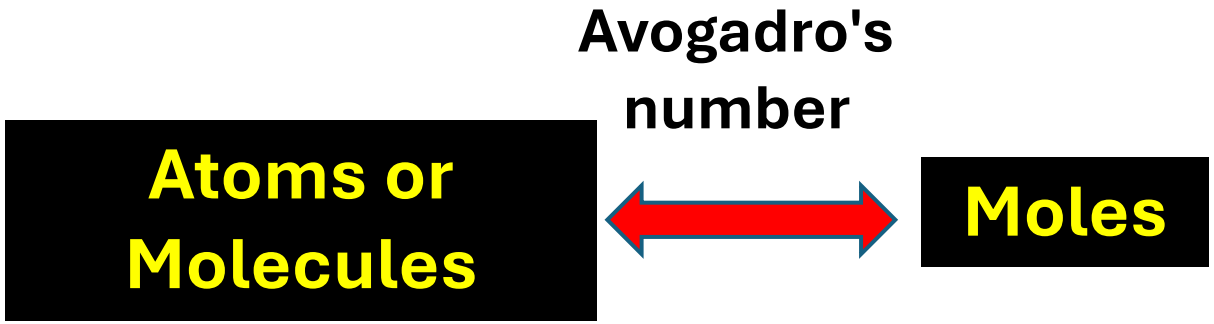
Useful for counting very very large numbers of things (like atoms and molecules)!

1 mole of C atoms = 6.02×10^{23} C atoms

1 mole of H_2O molecules = 6.02×10^{23} H_2O molecules

The number 6.02×10^{23} is Avogadro's number.

The Mole and Avogadro's Number



$$\frac{1\ \text{mol}}{6.02 \times 10^{23}\ \text{atoms}} \quad \text{or} \quad \frac{6.02 \times 10^{23}\ \text{atoms}}{1\ \text{mol}}$$

$$\frac{1\ \text{mol}}{6.02 \times 10^{23}\ \text{molecules}} \quad \text{or} \quad \frac{6.02 \times 10^{23}\ \text{molecules}}{1\ \text{mol}}$$

The Mole and Avogadro's Number

How many molecules are contained in 4.0 moles of water (H_2O)?

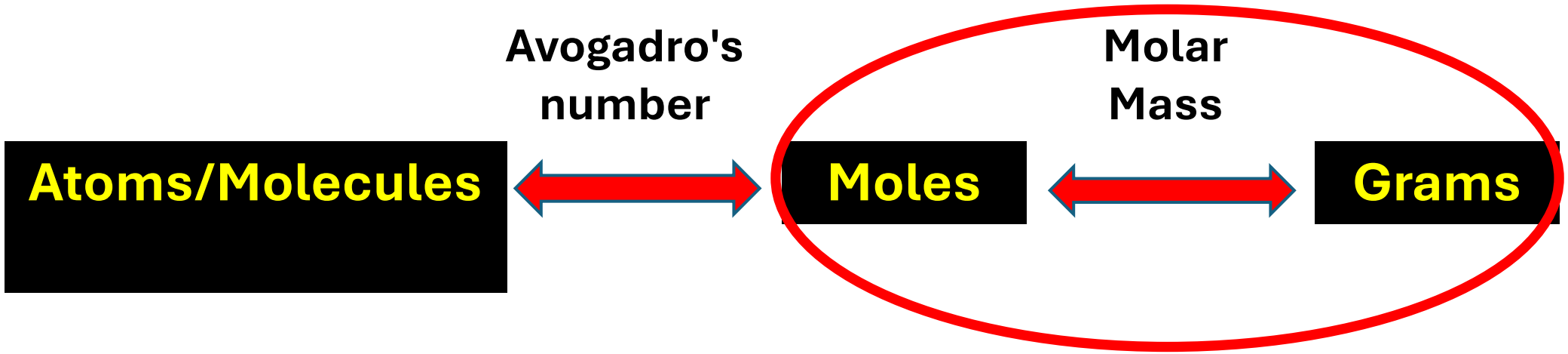
1 mol = 6.02×10^{23} "things" (i.e. atoms, molecules, etc)

The Mole and Avogadro's Number

Example: A silver ring contains 1.1×10^{22} silver atoms. How many moles of silver are there?

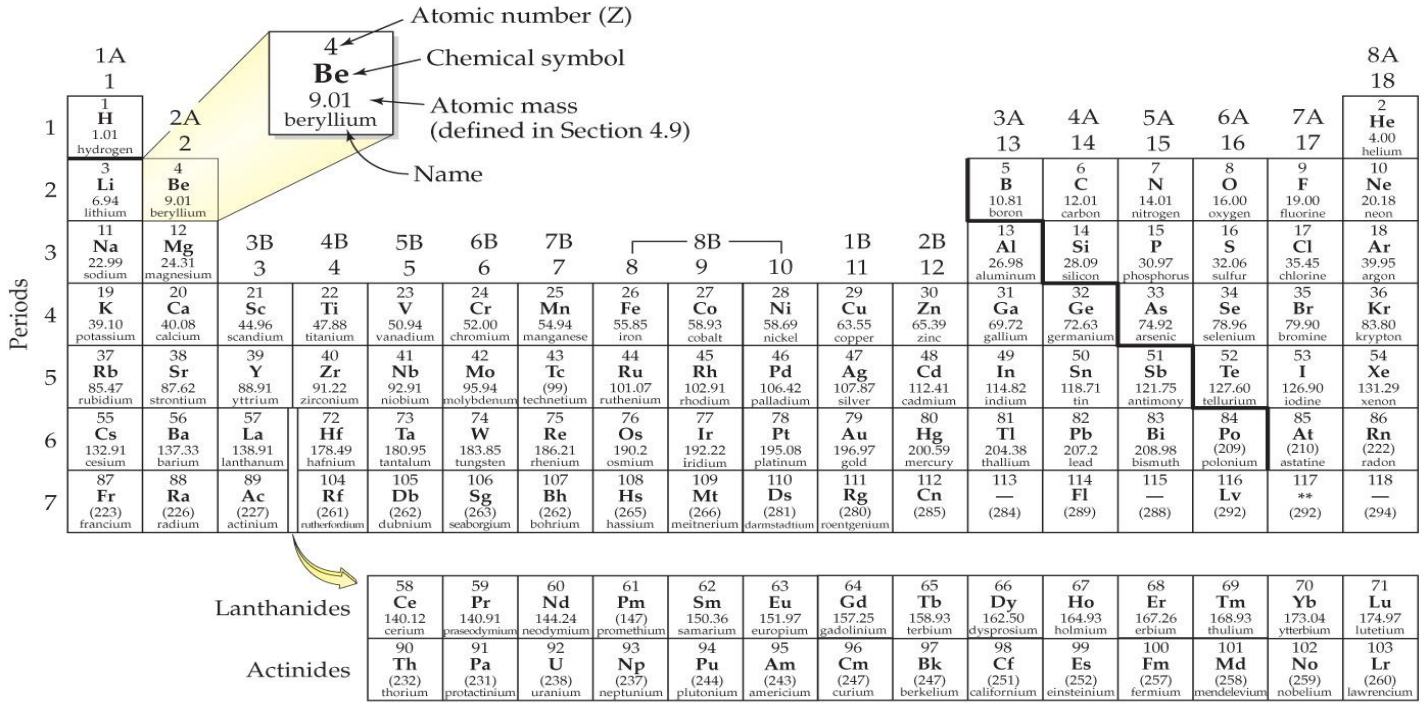
1 mol = 6.02×10^{23} "things" (i.e. atoms, molecules, etc)

How many carbon atoms are in 5.02 mol of carbon?


Avogadro's number
Molar Mass
Atoms/Molecules
Moles
Grams

Molar Mass

The molar mass is the mass of one mole of any substance, reported in grams.



The value of the molar mass of a compound in grams equals the value of its formula weight in amu.

Molar Mass (from periodic table)

Units: g/mol $\frac{g}{mol}$

Can use as a _____ _____ to convert between grams and moles for a given subtance

What is the molar mass of S ?

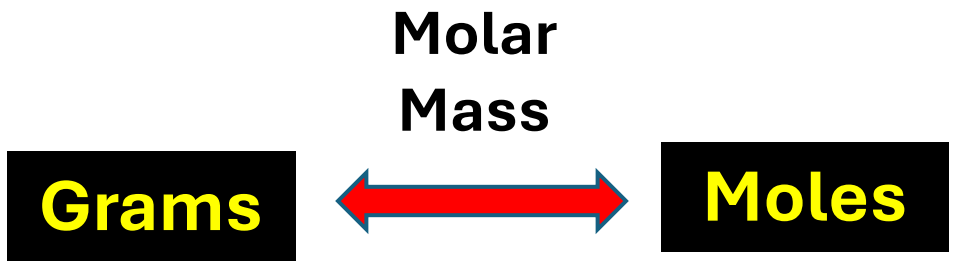
What is the molar mass of O_2 ?

What is the molar mass of $CaCO_3$?

Mass to Mole Conversions

Relating Grams to Moles

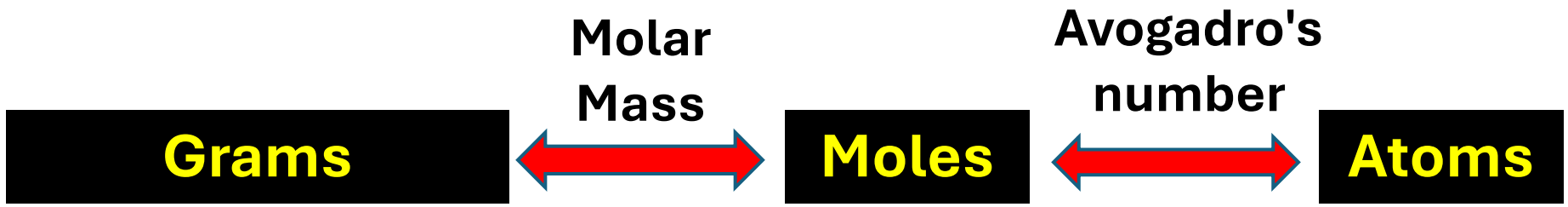
How many moles are present in 101 g of sulfur?



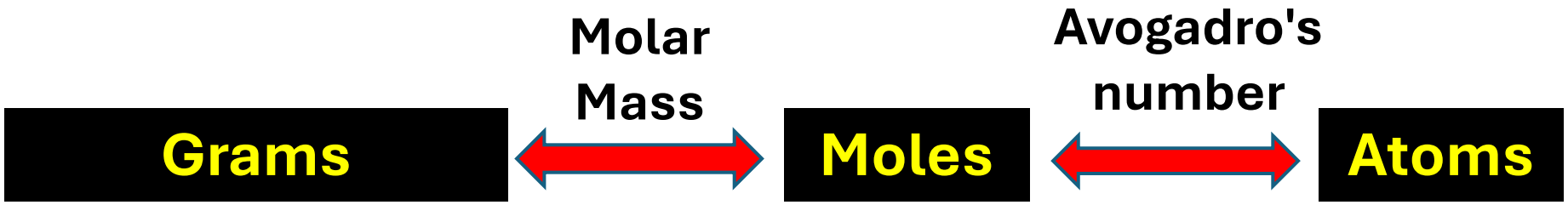
Mass to Mole Conversions

Relating Grams to atoms

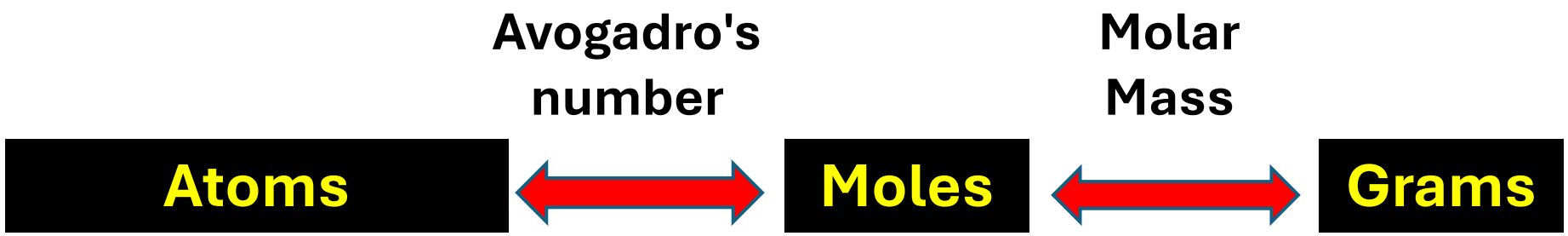
How many atoms are present in 101 g of sulfur?



How many aluminum atoms are there in an aluminum can with a mass of 16.2 g?



Calculate the mass of 1.23×10^{24} He atoms.



Mass to Mole Conversions

Relating Grams to molecules

For compounds, Avogadro's Number can also be used to express the number of molecules (not just the number of atoms)

Find the number of CO_2 molecules in 22.5 g CO_2.

Find the mass of 2.54×10^{22} molecules of $C_6H_{12}O_6$

If you have 1 dozen bicycles…

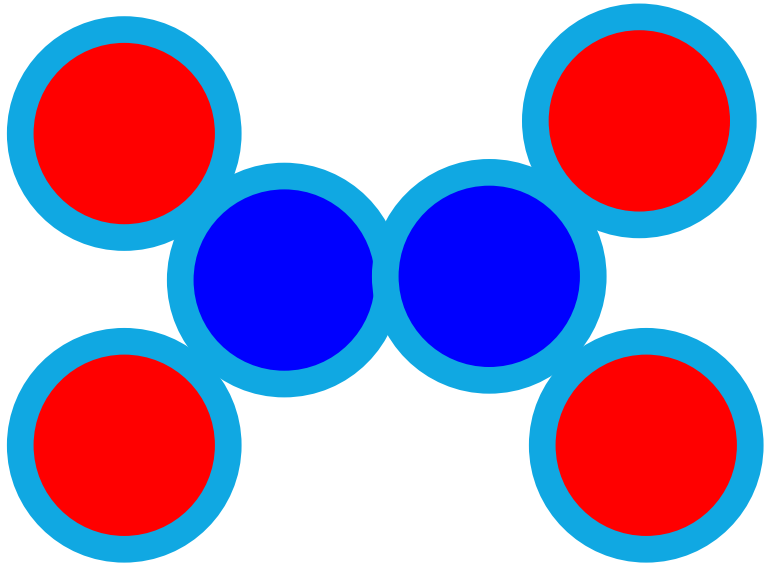
How many bicycles do you have?

How many wheels do you have?

If you have 1 mol bicycles…

How many moles of wheels are there?

for every 1 molecule of N_2O_4…



$\frac{1 \text{ molecule } N_2O_4}{2 \text{ atoms N}}$

$\frac{1 \text{ molecule } N_2O_4}{4 \text{ atoms O}}$

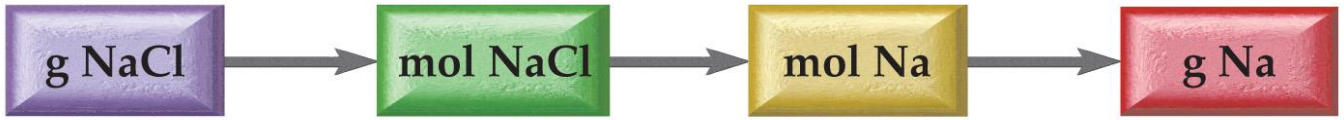
$\frac{1 \text{ mole } N_2O_4}{2 \text{ moles N}}$

$\frac{1 \text{ mole } N_2O_4}{4 \text{ moles O}}$

Calculate the number of moles of O in 18 moles of CO_2.

Determine the number of moles of O in 1.4 mol of H_2SO_4.

How many grams of sodium are in 15.0 grams of NaCl?



Example: Determine the mass of oxygen in a 5.8 g sample of sodium bicarbonate ($NaHCO_3$).

Mass % Composition of a Compound

The mass contributed by each element to the weight of a compound is the mass percent of that element.

If the mass percent of sodium in sodium chloride is 39%, then a 100 gram sample of NaCl contains 39 grams of Na

$$\text{Mass percent of element } X = \frac{\text{Mass of } X \text{ in a sample of the compound}}{\text{Mass of the sample of the compound}} \times 100\%$$

It also means that 39% of the molecular weight of NaCl is due to the weight of the Na atom.

Finding Mass Percent Composition

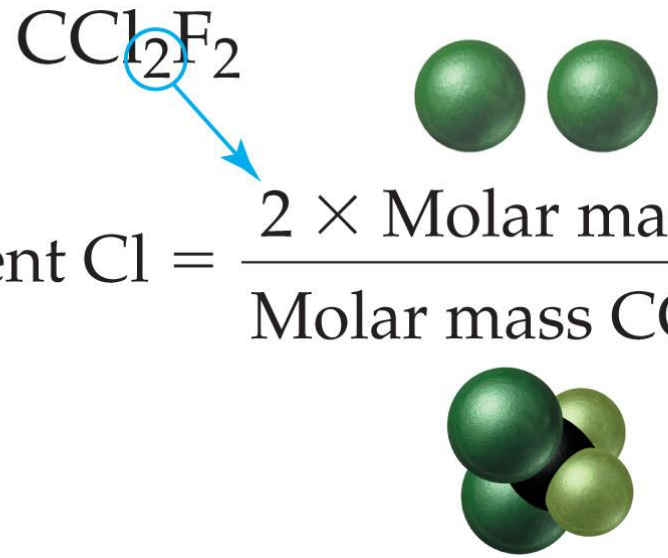
A 0.358-g sample of chromium reacts with oxygen to form 0.523 g of the metal oxide.

Find the mass percent of chromium in the product.

$$\text{Mass percent Cr} = \frac{\text{Mass Cr}}{\text{Mass metal oxide}} \times 100\%$$

Mass Percent Composition from a Chemical Formula

What is the mass percent of Cl in the compound CCl_2F_2 ?



$$\text{Mass percent Cl} = \frac{2 \times \text{Molar mass Cl}}{\text{Molar mass } CCl_2F_2} \times 100\%$$

Example: Calculate the mass percent of Cl in $C_3Cl_4F_2$.

Example: Calculate the mass percent of H in $C_{12}H_{22}O_{12}$.