

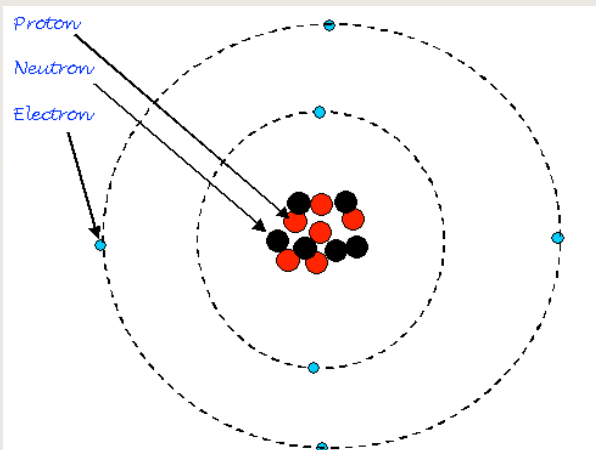
Molar Mass

The mass of 1 mole of a substance in grams

How do we find the mass of a mole of a certain element?

official definition:

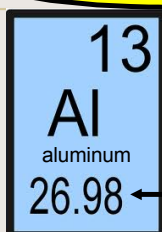
mole= # of atoms in exactly 12.000 g of pure ^{12}C



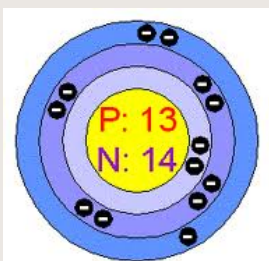
Carbon-12 or ^{12}C



How do we find the mass of a mole of a certain element?



What is this number?



1. $13\text{ P} + 14\text{ N} = 27\text{ amu}$

One Al atom has a mass of about 27amu (atomic mass units)



2.

One mole of Al (6.02×10^{23} atoms) has a mass of 27 grams

How do we find the mass of a mole of a certain element?

1 mole = 6.022×10^{23} particles
= the atomic mass of an element
(expressed in grams)

Periodic Table of Elements

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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Use the periodic table

It's really a conversion chart!

Carbon, C

What is the mass of 1 mole of C?

12.0 grams



How many atoms?

6.022×10^{23} atoms



What is the mass of $\frac{1}{2}$ mole of C?

6.0 grams



Gold, Au

What is the mass of 1 mole of Au?

197.0 grams = 1 mol Au



How many atoms?

6.022×10^{23} atoms



What is the mass of $\frac{1}{2}$ mole of Au?

98.5 grams



$$\frac{0.5 \text{ mol Au}}{1 \text{ mol Au}} \times 197 \text{ g} = 98.5$$

Magnesium, Mg

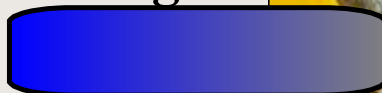
What is the mass of 1 mole of Mg ?

24.3 grams



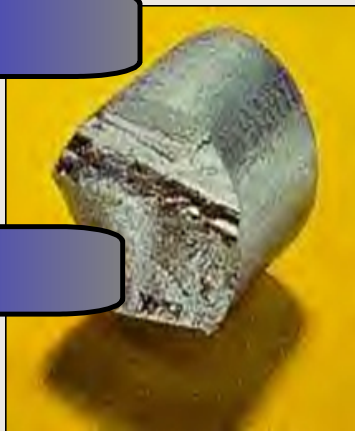
What is the mass of 2 moles of Mg ?

48.6 grams



How many atoms?

1.204×10^{24} atoms



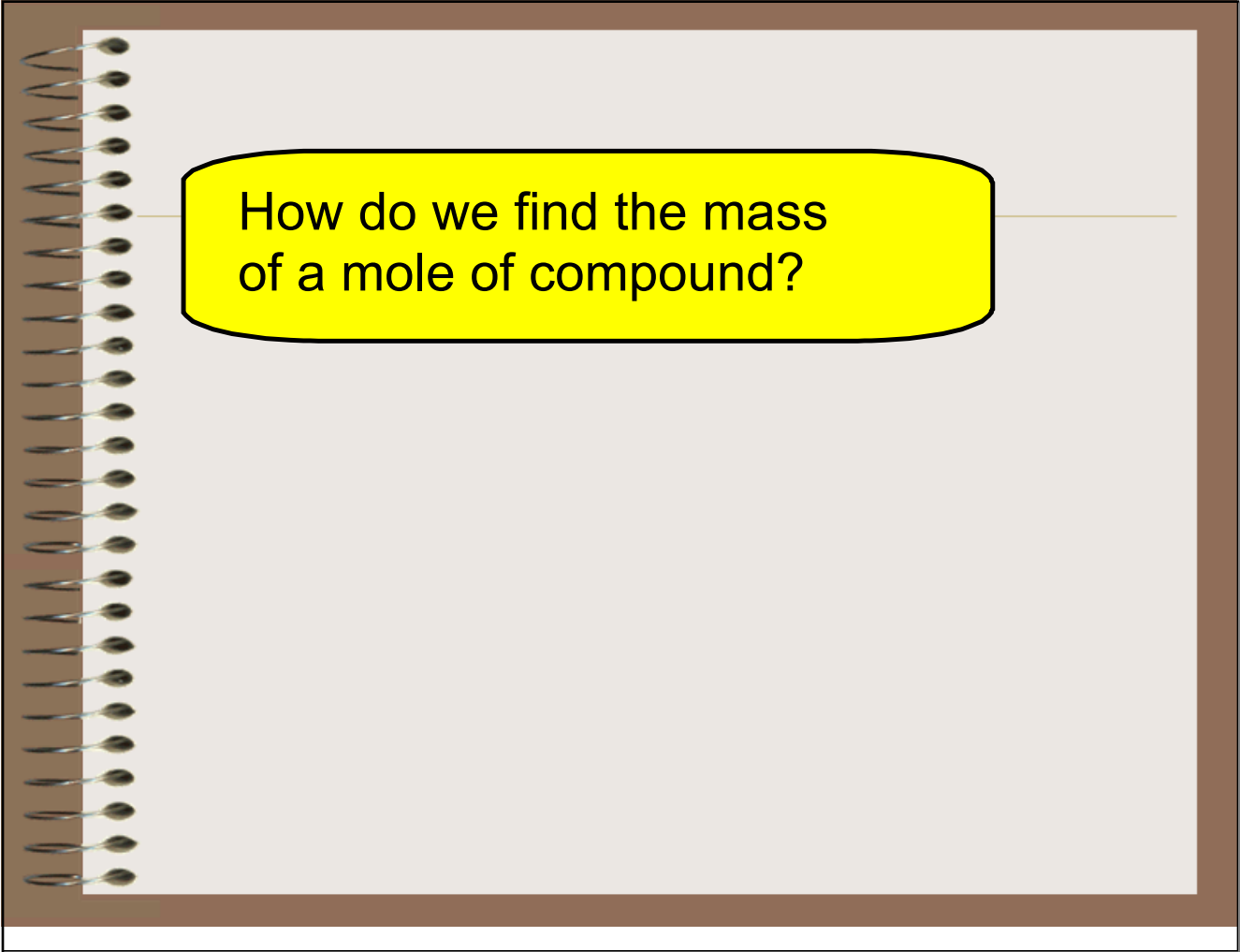


these all contain 1 mole of atoms:

12.0 grams of C

197.0 grams of Au


24.3 grams of Mg.

A spiral-bound notebook with a brown cover and a light gray page. A yellow callout box with a black border is positioned in the upper left quadrant of the page. The box contains the text "How do we find the mass of a mole of compound?".

How do we find the mass
of a mole of compound?

Molar Mass:

The mass of 1 mole of a substance in grams


element or compound

A.K.A.

Also known as: formula mass (formula weight) or
gram formula mass or
molecular mass (molecular weight)

Molar Mass of a Compound



1. List elements in compound
2. multiply no. of atoms in compound x ave. atomic mass (from PT)
3. add products to get total, in grams/mole

1.

$$\text{H} = 2 \times 1.0 = 2.0 \text{ g}$$

$$\text{O} = 1 \times 16.0 = 16.0 \text{ g}$$

2.

3.

$$18.0 \text{ g/mol}$$

molar mass of water = 18.0 grams/mole

Calculate the molar masses:

HCl

$$\begin{array}{r} \text{H} \quad 1 \times 1.0 \\ \text{Cl} \quad 1 \times 35.5 \\ \hline 36.5 \end{array}$$



CO₂

$$\begin{array}{r} \text{C} \quad 1 \times 12.0 = 12.0 \\ \text{O} \quad 2 \times 16.0 = 32.0 \\ \hline 44.0 \text{ g/mol CO}_2 \end{array}$$



Calculate the molar masses:



$$\begin{aligned} \text{Mg} & 3 \times 24.3 = 72.9 \\ \text{P} & 2 \times 31.0 = 62.0 \\ \text{O} & 8 \times 16.0 = \underline{128.0} \end{aligned}$$

262.9 g/mol

Mg₃(PO₄)₂



P. 23 # 1-14



$$\text{Mg} \quad 1 \times 24.3 = 24.3$$

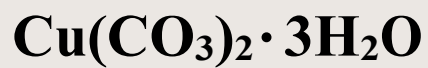
$$\text{O} \quad 2 \times 16.0 = 32.0$$

$$\text{H} \quad 2 \times 1.0 = \underline{2.0}$$

58.3 g/mol



Calculate the molar masses:
of a hydrate



How Do I Convert
Moles to Mass
and Back?

Moles of
substance

**Molar
Mass**

Mass of
substance

1. Underline "given" -- start with this
2. Circle "goal" -- end with this unit
3. Convert using factors (ratios)-- to cancel units

Calculate the number of moles in 20.0 g of Silver:

$$108 \text{ g Ag} = 1 \text{ mol Ag}$$

$$2.54 \text{ cm} = 1 \text{ in}$$

$$\frac{20.0 \text{ g Ag}}{108 \text{ g Ag}} \times \frac{1 \text{ mol Ag}}{108 \text{ g Ag}}$$

=

$$0.19 \text{ mol Ag}$$

1. Underline "given" -- start with this
2. Circle "goal" -- end with this unit
3. Convert using factors (ratios)-- to cancel units

Calculate the number of grams in 3 moles of Silver:

$$\underline{108} \text{ g} = 1 \text{ mol Ag}$$

$$\frac{3 \cancel{\text{ mol}} \text{ Ag}}{1 \cancel{\text{ mol}}} \times \frac{108 \text{ g}}{1} = \boxed{}$$

324 g Ag

Calculate the number of moles in 6.0 g of HC₂H₃O₂:

1. Underline "given" -- start with this
2. Circle "goal" -- end with this unit
3. Convert using factors (ratios)-- to cancel units

$$\frac{26.00 \text{ g NaOH}}{40.00 \text{ g NaOH}} \times \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} = 0.65 \text{ mol}$$

Calculate the number of moles in 26.00 g of NaOH:

1. Underline "given" -- start with this
2. Circle "goal" -- end with this unit
3. Convert using factors (ratios)-- to cancel units

$$\frac{26.00 \text{ g NaOH}}{40.00 \text{ g NaOH}} \times \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} = 0.65 \text{ mol}$$

1. Underline "given" -- start with this
2. Circle "goal" -- end with this unit
3. Convert using factors (ratios)-- to cancel units

Calculate the number of grams in 3 moles of Silver chloride:

$$\underline{\hspace{10em}} = \boxed{\hspace{4em}}$$

1. Underline "given" -- start with this
2. Circle "goal" -- end with this unit
3. Convert using factors (ratios)-- to cancel units

Calculate the number of moles in 30.0 g of calcium fluoride:

Conversion?

$$\frac{\text{_____}}{\text{_____}} = \boxed{\text{_____}}$$

Calculate the number of g in 0.02 moles of $\text{HC}_2\text{H}_3\text{O}_2$:

_____ = g