

6. THE MOLE

CH30S

UNIT 1 - ELEMENTS & COMPOUNDS

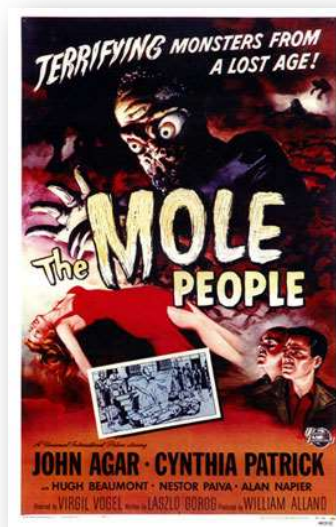
1

QUANTIFYING ATOMS & MOLECULES

Atoms and molecules are extremely small.

If they are so small and so light, how can we weigh them?

We weigh large numbers of them.



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THE MOLE CONCEPT

1 dozen = 12

1 gross = 144

1 ream = 500

1 mole = 6.02×10^{23}



This is called **Avogadro's number**

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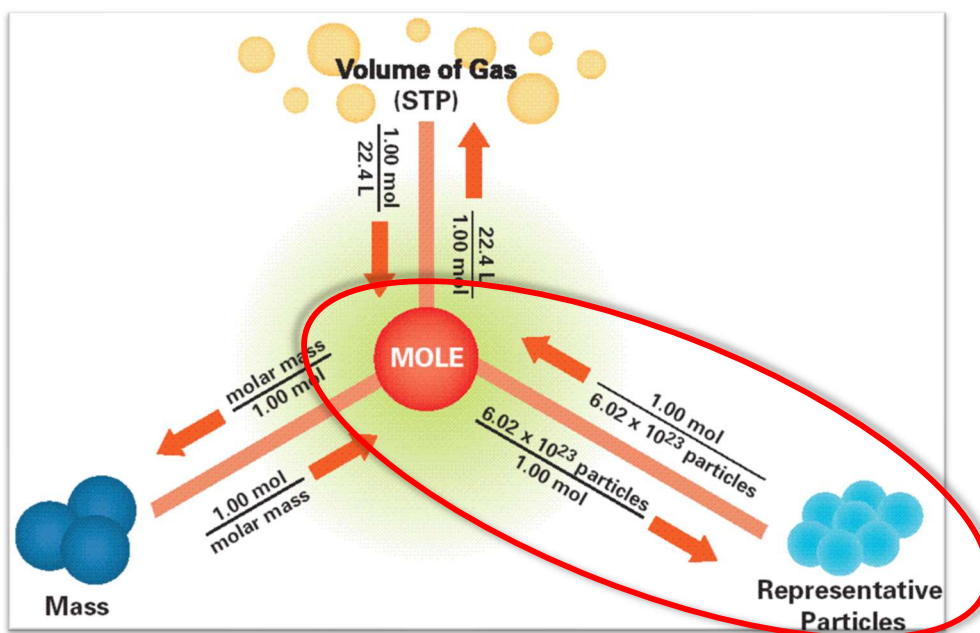
A MOLE IS A BIG, BIG NUMBER!

The mole is a **large number** of particles. The following conversion factor can be used to convert between particles and moles of any substance.

$$\frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mole}} \quad \text{OR} \quad \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ particles}}$$

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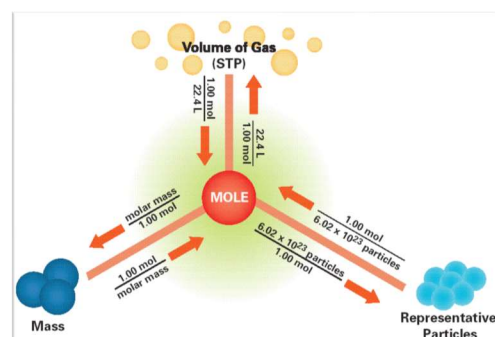
THE MOLE MAP



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EXAMPLE #1

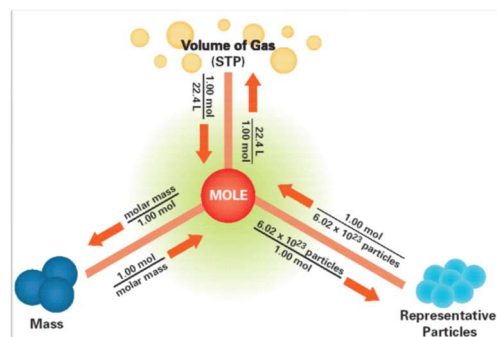
If your pencil contained 9.5×10^{23} **atoms** of carbon in the form of graphite, how many **moles** of carbon does your pencil contain?



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EXAMPLE #2

If you breath out 4.5×10^{-3} **moles** of CO_2 every breath, how many **molecules** of carbon dioxide are you exhaling?



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MOLAR MASS

- The **atomic mass** of an element/compound is the sum of the number of protons & neutrons in the nucleus of the atom(s).
- The **molar mass** of an element/compound is the mass of one mole of particles and the unit is grams/mole.

ATOMIC MASS = MOLAR MASS!

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MOLAR MASS

He

 CO_2

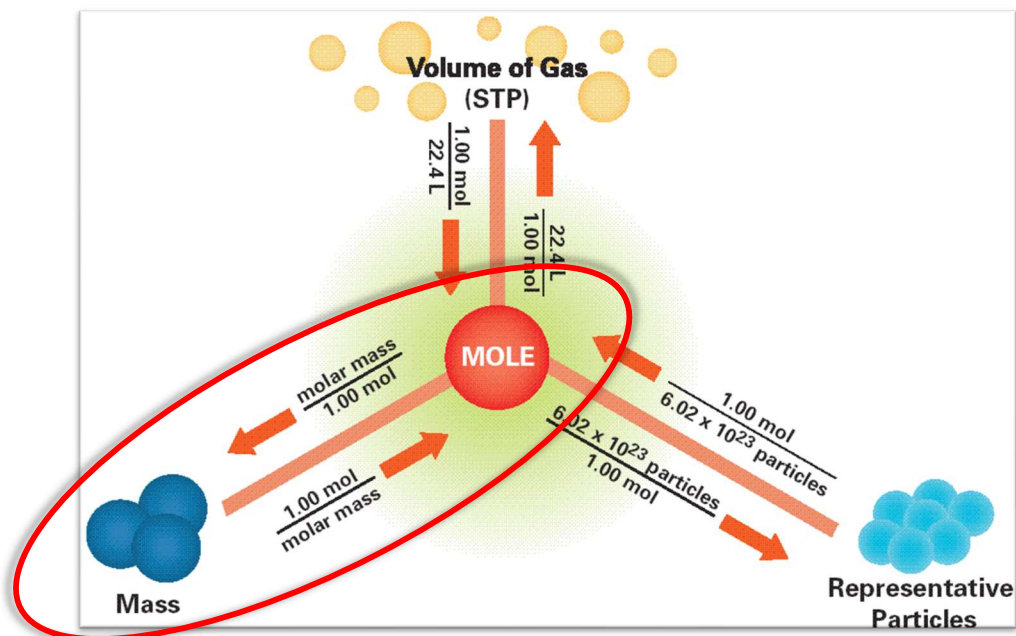
lithium nitrate

 $\text{Ni}_2(\text{CO}_3)_3$

Molar mass can be used as a conversion factor between the mass of a chemical and the number of moles of that chemical.

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THE MOLE MAP



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EXAMPLE #3

A liter of regular gasoline typically contains about **19 moles** of octane molecules (C_8H_{18}).



How many **grams** of octane would this be?

How many **molecules** of octane are present?

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EXAMPLE #4

It is recommended that a person eat no more than **6.0 g** of table salt (sodium chloride) per day.

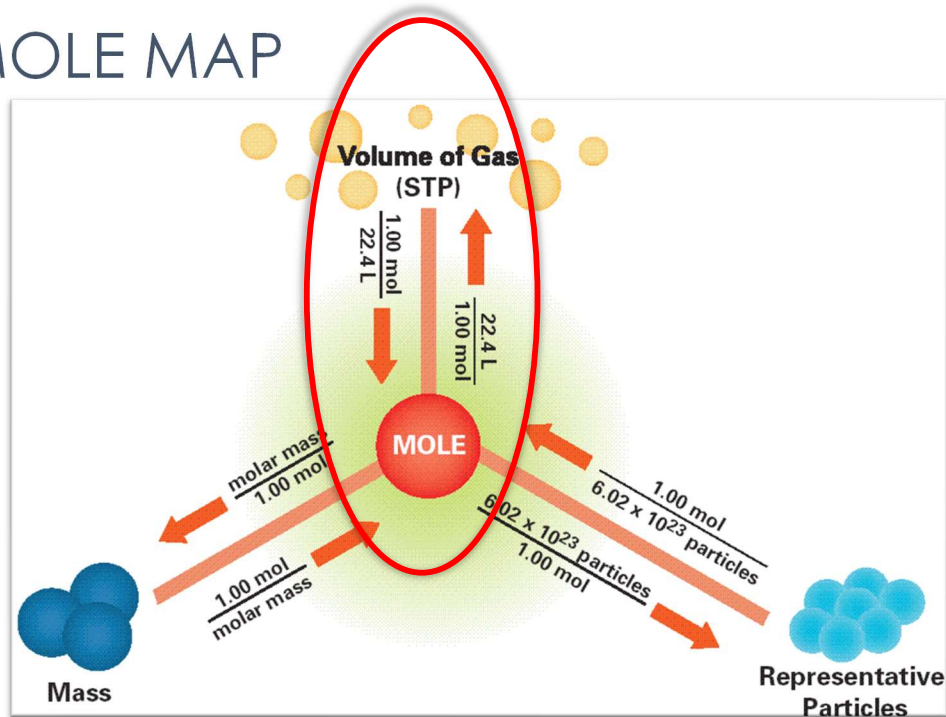


How many **moles** of salt would this be?

How many **molecules** of salt is this?

12

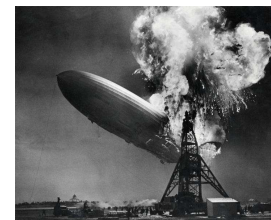
THE MOLE MAP



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EXAMPLE #5

The Hindenburg was a hydrogen filled airship that exploded spectacularly in 1937. It contained approximately **2×10^8 liters** of hydrogen gas.



How many **moles** of hydrogen was this?

How many **molecules** of hydrogen was this?

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EXAMPLE #6

A pop bottle rocket contains 4.5×10^{-2} **mol** of hydrogen gas at STP (standard temperature and pressure: 0°C and 1 atmosphere...more on this later).



How many **grams** of hydrogen would this be?

What is the **volume** of hydrogen in the bottle?

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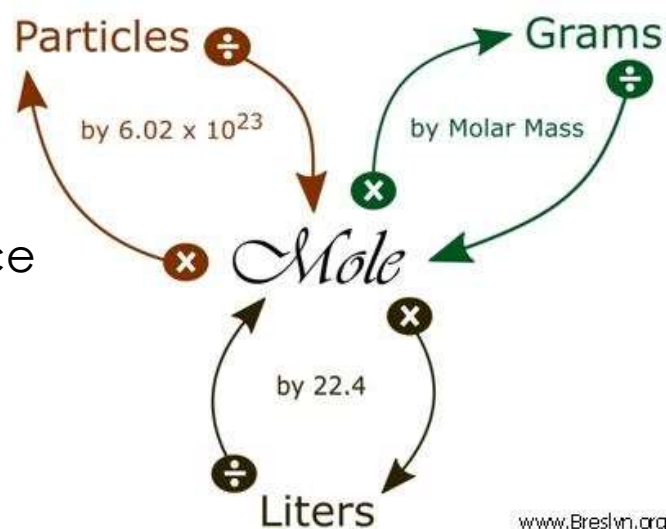
SUMMARY

1 **mole** of anything!

= **molar mass** of substance

= 6.02×10^{23} particles

= **22.4 L of gas** @ STP



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