

The Mole

IB PHYSICS | THERMAL PHYSICS

Grouping Items

We can use many different terms to describe the amount of substance.



A **pair** of shoes

_____ shoes



A **dozen** roses

_____ roses

BONUS!

A Baker's Dozen =

A Score =

A Gross =

Counting Atoms

The primary counting unit for atoms is called

The Mole

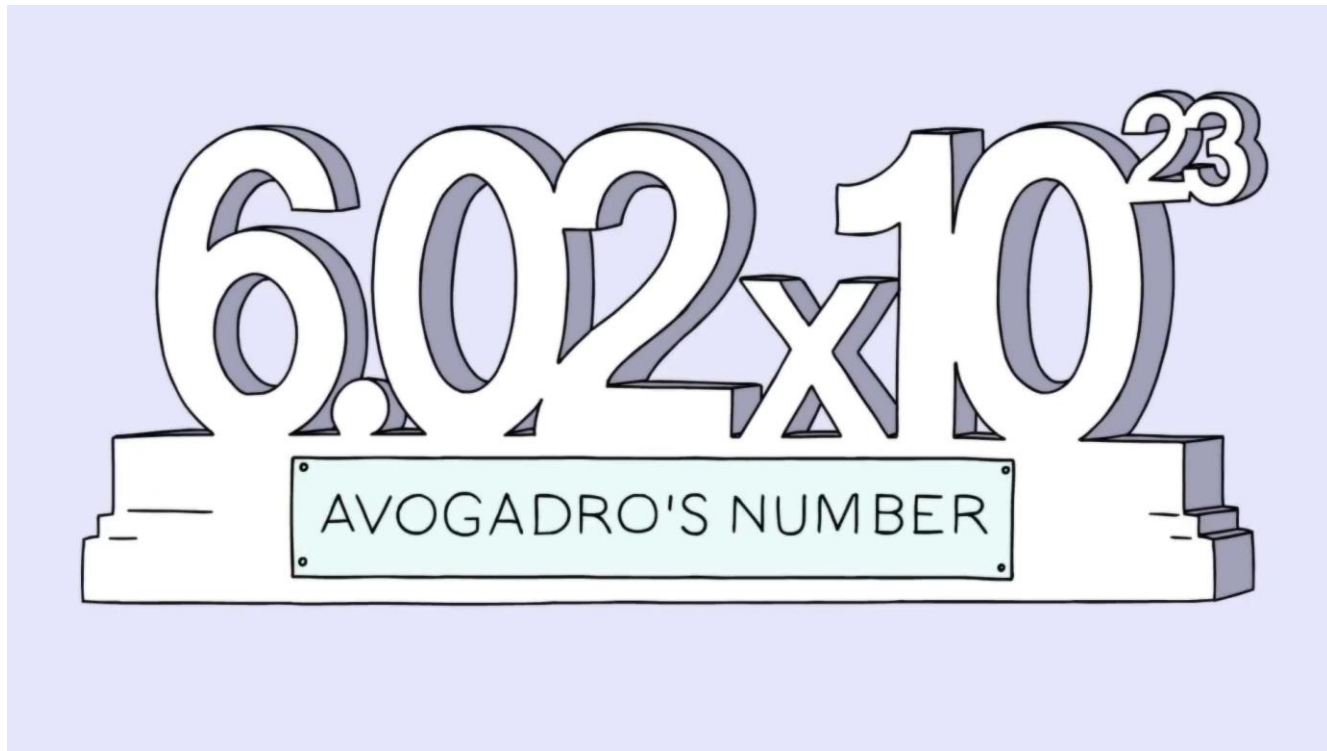
1 mole =

*This is also called **Avogadro's Number** named after the scientist who first proposed this concept*





How Big is a Mole??



602,000,000,000,000,000,000,000

How Big is a Mole??

A Mole of Moles

What would happen if you were to gather a mole (unit of measurement) of moles (the small furry critter) in one place?

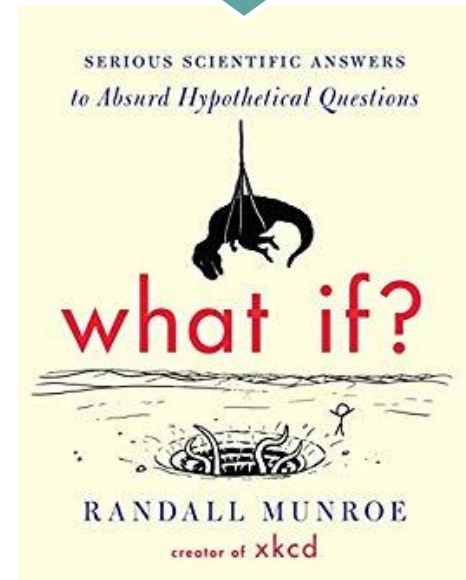
—Sean Rice

Things get a bit gruesome.

First, some definitions. A mole is a unit. It's not a typical unit, though. It's really just a number—like “dozen” or “billion.” If you have a mole of something, it means you have 602,214,129,000,000,000,000,000 of them (usually written 6.022×10^{23}). It's such a big number because it's used for counting numbers of molecules, which there are a lot of.



Taken from the book “What if?” by Randall Munroe



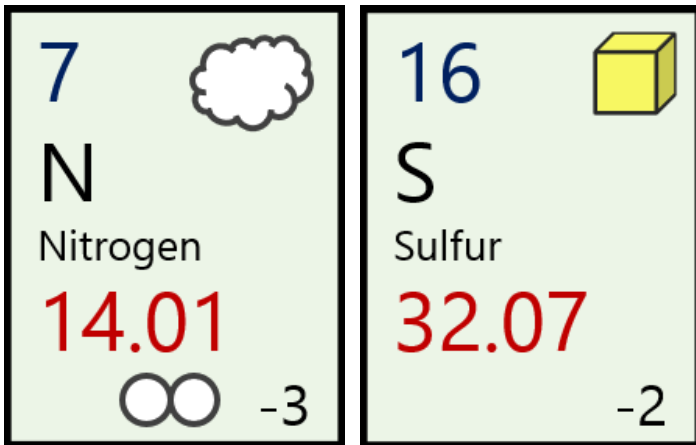
Example IB Questions

10. The mole is defined as
- A. $\frac{1}{12}$ the mass of an atom of the isotope carbon-12.
 - B. the amount of a substance that contains as many elementary entities as the number of atoms in 12 g of the isotope carbon-12.
 - C. the mass of one atom of the isotope carbon-12.
 - D. the amount of a substance that contains as many nuclei as the number of nuclei in 12 g of the isotope carbon-12.

Molar Mass

Molar Mass – the mass of _____ of a substance

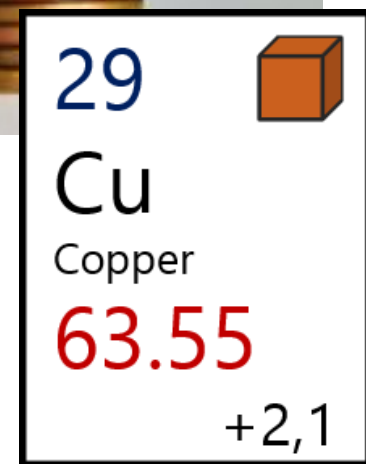
Unit



Molar Mass

1 mole of copper can be represented by this stack of pure copper pennies

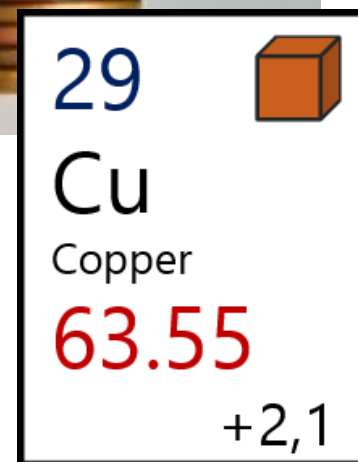
How many atoms are in 1 mole of copper?



Molar Mass

1 mole of copper can be represented by this stack of pure copper pennies

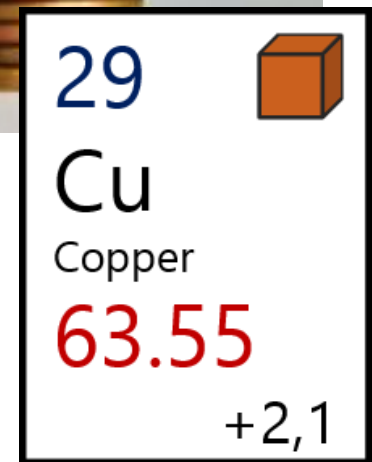
What is the mass of one mole of copper?



Molar Mass

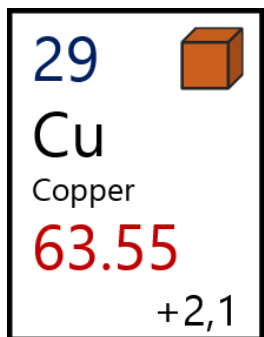
1 mole of copper can be represented by this stack of pure copper pennies

What is the mass of one atom of copper?

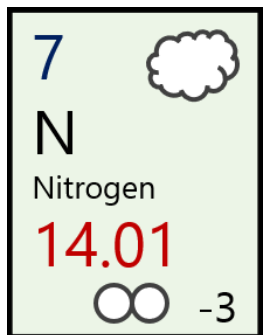


More than one mole...

How much mass would 3 moles of Copper have?



How many moles are in 28 g of Nitrogen?



Example IB Questions

11. What is the mass of carbon-12 that contains the same number of atoms as 14 g of silicon-28?

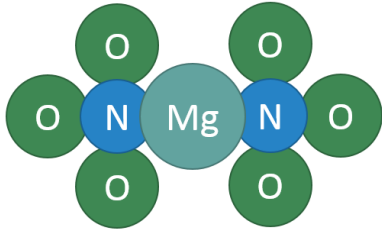
- A. 6 g
- B. 12 g
- C. 14 g
- D. 24 g

11. A sample contains 4 g of helium and 20 g of neon. The mass number of helium is 4 and the mass number of neon is 20.

What is the ratio $\frac{\text{number of atoms of neon}}{\text{number of atoms of helium}}$?

- A. 0.2
- B. 1
- C. 5
- D. 80



More than one atom...





What is the mass of one mole of Magnesium Nitrate?



12	
Mg	
Magnesium	
24.31	
+2	

7	
N	
Nitrogen	
14.01	
 -3	

8	
O	
Oxygen	
16.00	
 -2	

Lesson Takeaways

- ❑ I can describe the importance of having a large quantity like the “mole” defined
- ❑ I can use the average atomic weight of an element or compound to convert between mass and moles and numbers of atoms