

DOZEN = 12

MOLE =  $6.02 \times 10^{23}$  AVOGADRO'S NUMBER

10 million in 1 second

$$6.02 \times 10^{23} \times \frac{1 \text{ sec}}{10,000,000} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ days}}{24 \text{ hr}} \times \frac{1 \text{ yrs}}{365 \text{ days}}$$

$$= 1908929477 \Rightarrow 1.9 \text{ billion years}$$

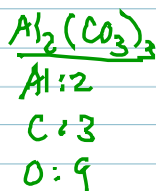
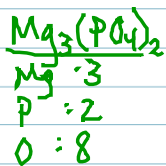
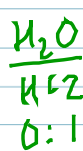
How many molecules of  $\text{NO}_2$  are in  
a 1.23 mole sample of  $\text{NO}_2$ ?

$$1.23 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 7.40 \times 10^{23} \text{ molecules } \text{NO}_2$$

How many moles of  $\text{CO}_2$  are in a  $1.75 \times 10^{26}$   
molecule sample?

$$1.75 \times 10^{26} \text{ molecules} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} = 290.70 \text{ mol}$$

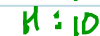
### Counting atoms



hydrate

formula = #  $\text{H}_2\text{O}$

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  copper(II) sulfate pentahydrate



DOZEN = 12

MOLE =  $6.02 \times 10^{23}$

AUGUSTIN'S NUMBER

10 million in 1 second

$$6.02 \times 10^{23} \times \frac{1 \text{ sec}}{10,000,000} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ days}}{24 \text{ hr}} \times \frac{1 \text{ (yrs)}}{365 \text{ days}}$$

$$= 19089329477 \Rightarrow 1.9 \text{ billion years}$$

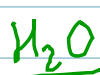
How many molecules of  $\text{NO}_2$  are in a 1.23 mole sample of  $\text{NO}_2$ ?

$$1.23 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 7.40 \times 10^{23} \text{ molecules } \text{NO}_2$$

How many moles of  $\text{CO}_2$  are in a  $1.75 \times 10^{26}$  molecule sample?

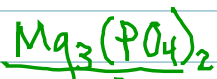
$$1.75 \times 10^{26} \text{ molecules} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} = 290.70 \text{ mol}$$

### Counting atoms



H: 2

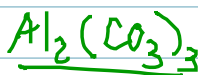
O: 1



Mg: 3

P: 2

O: 8



Al: 2

C: 3

O: 9

hydrate

Formula • #  $\text{H}_2\text{O}$

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  copper(II) sulfate pentahydrate

Cu: 1

S: 1

O: 9

H: 10

## Formula mass

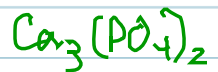


$$\text{N}: 1 \times 14.01 = 14.01$$

$$\text{H}: 4 \times 1.01 = 4.04$$

$$\text{Cl}: 1 \times 35.45 = 35.45$$

$$\underline{53.50 \text{ amu}}$$



$$\text{Ca}: 3 \times 40.08 = 120.24$$

$$\text{P}: 2 \times 30.97 = 61.94$$

$$\text{O}: 8 \times 16.00 = 128.00$$

$$\underline{310.18 \text{ amu}}$$

MOLAR MASS → the mass of one mole of a substance

\* EXACTLY the same number as the formula mass, but the unit is grams



$$\text{H}: 2 \times 1.01 = 2.02$$

$$\text{O}: 1 \times 16.00 = \underline{16.00}$$

$$18.02 \text{ g} = 1 \text{ mole}$$

$$18.02 \text{ g/mole}$$

What is the mass of 7.14 moles of  $\text{H}_2\text{O}$ ?

$$7.14 \text{ moles} \times \frac{18.02 \text{ g}}{1 \text{ mole}} = 128.66 \text{ g H}_2\text{O}$$