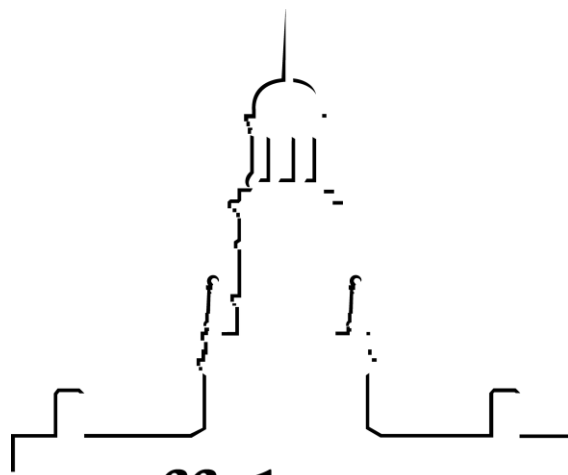# Chapter 3
Compositions of Substances and Solutions

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Atomic mass

○ Mass of one atomic element

- From periodic table.

- The atomic mass of Na is _____ amu.

Mass of Compounds

- Covalent compounds (H_2O, CH_4, etc)
  - Molecular mass (MM)
  - Formula mass (FM)
  - Molecular mass is preferred, but either one is used

- Ionic compounds (NaCl, $CaCl_2$, etc)
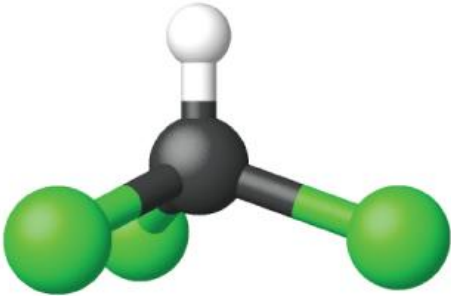 - Only formula mass (FM) is used

Molecular Mass (MM)

o Mass of a covalent compound

o Add up the atomic masses of the atoms from periodic table

o The molecular mass (formula mass) of H_2O is _____ u.
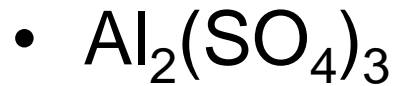
Molecular Mass (MM)

- $CHCl_3$

Element	Quantity		Average atomic mass (amu)		Subtotal (amu)
C	1	×	12.01	=	12.01
H	1	×	1.008	=	1.008
Cl	3	×	35.45	=	106.35
			Molecular mass		119.37

Formula Mass (FM)

o Mass of one unit of an ionic compound

o Add the atomic masses of all the atoms in the formula

o The formula mass of NaCl is _____ amu.

Formula mass (FM)

- $Al_2(SO_4)_3$

   How many Al atoms?

   How many S atoms?

   How many O atoms?

Mole (mol)

Avogadro's number

$$1 \text{ mole} = 6.022 \times 10^{23} \text{ particles(units)}$$

o 1 mole (mol) is the number of atoms in exactly 12 grams of ^{12}C atoms

$$\text{Mass of one } ^{12}C \text{ atom} = 12 \, amu$$

$$\text{Mass of one mole of } ^{12}C \text{ atoms} = 12 \, g$$
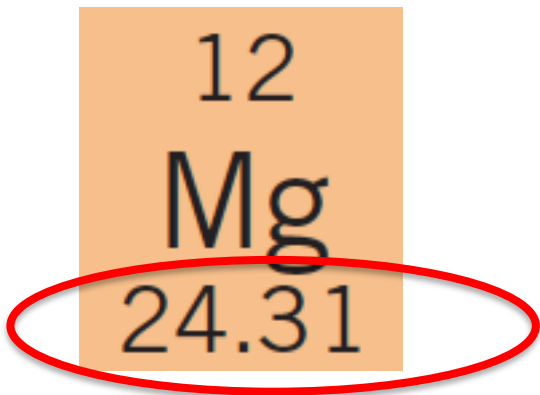
Molar mass

o Molar mass of an element or a compound (g/mol)

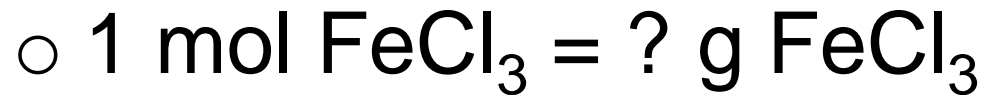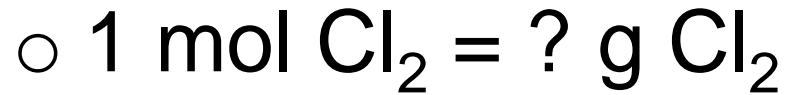The mass in grams of one mole of the substance

How to calculate molar mass?

Molar mass of an atom

o The mass of 1 mol of atoms (6×10^{23} atoms)

Simply, change amu with g from the atomic mass of an element in the periodic table

12

Mg

24.31

Molar mass

- 1 mol Cl_2 = ? g Cl_2

- 1 mol $FeCl_3$ = ? g $FeCl_3$

Molar mass

o The molar mass of Na is _____ g/mol.

o The molar mass of H_2 is _____ g/mol.

o The molar mass of H_2O is _____ g/mol.

o The molar mass of NaCl is _____ g/mol.

Let's make it clear

- Atomic number

- Mass number

- Atomic mass (AM)

- Formula mass (FM)

- Molecular mass (MM)

- Molar mass

- # of moles

1. Br

2. Ne

3. O_3

4. H_2O

5. $CaCl_2$

6. $C_6H_{12}O_6$

Mass and # of moles

o Calculate the # of moles of Cu present in a 35.8 g pure Cu wire.

Converting grams to moles

How many moles are in 50.0 g of PbO_2?
(AM Pb = 207.2 amu, O = 16.00 amu)

Practice — How many formula units are in 50.0 g of PbO_2? (FM PbO_2 = 239.2 amu)

Find the number of CO_2 molecules in 10.8 g of dry ice

Find the number of C atoms in 10.8 g of dry ice

Find the number of O atoms in 10.8 g of dry ice

Practice — What is the mass of 4.78×10^{24} NO_2 molecules?

Homework

To be announced
HW3a