III. Avogadro's Number and the Mole

A. The Mole 12 i

1. The amount of substance that contains as many particles are there are in exactly 12 grams of carbon-12

2. The amount of substance that contains the Avogadro number of particles 3. The Mole is a quantity. Compare it to

a. 1 dozen =12 items

b. 1 pair = 2 items

c. 1 gross = 12 dozen = 144 items

d. 1 ream = 500 items

e. 1 mole = 6.022 x 1023 items

(6.022 x 1023 = 602,200,000,000,000,000,000,000 items)

B. Avogadro's Number

1. The number of particles in exactly one mole of a pure substance

2. Avogadro's number = 6.022 x 1023

C. Molar Mass

1. The mass of one mole of a pure substance

a. Units are grams/mole (or g/mol)

b. Molar mass of an element equals the average atomic mass in gram units

c. the NUMBER is always the same but the MASS is different depending on the item.

d. Examples:

1 dozen oranges = 12 oranges = 5 pounds

1 dozen elephants = 12 elephants = 24 tons

Each elephant weighs more than each orange

1 mole of Carbon = 12 g

1 mole of Iron = 56 g

Each atom of iron has more mass than each atom of carbon.

To calculate the mass of one mole of a substance, use the atomic mass:

a. atomic mass unit = amu

b. 1 proton = 1 amu

c. 1 neutron = 1 amu

Then change the amu to grams (same number, different units!)

Carbon has **12 amu** (6 protons and 6 neutrons) so one mole of carbon equals **12 g/mol**