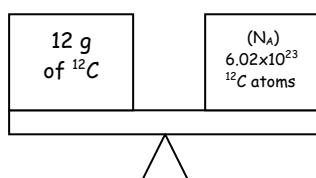
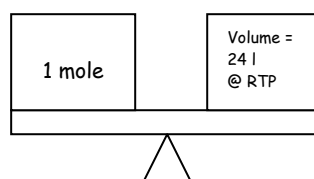
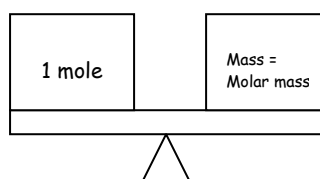
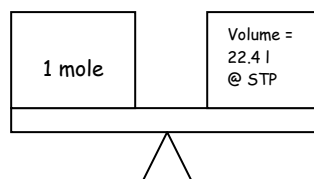
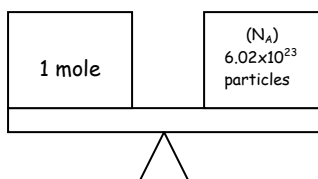


HANDOUT

| | | | |
|---------|--------------|-------------|----------------------|
| Module: | Chemistry | Topic: | Stoichiometry |
| Tutor: | Dr. Liakatas | Date given: | |



Particle = atom (C, N), molecule (H₂, O₂), ion (Cl⁻, Na⁺)

STP = standard temperature and pressure = 0 °C and 1 atm

RTP = room temperature and pressure = 20 °C and 1 atm

Relative atomic mass (A_r) = the mass of an *atom* relative to 1/12 of the atom of carbon-12 (¹²C) having a mass of exactly 12. It has no unit.

Relative molecular mass (M_r) = the mass of a *molecule* relative to 1/12 of the atom of carbon-12 (¹²C) having a mass of exactly 12. It has no unit.

Molar mass (M) = mass of one mole of a substance. Its unit is g·mol⁻¹

- ▶ Atomic mass if substance is an atom
- ▶ Molecular mass if substance is a molecule
- ▶ Formula mass if substance is an ionic compound

| | |
|----------------------------|--|
| 1 mole of particles | <ul style="list-style-type: none">▶ contains 6.02 × 10²³ particles▶ has a mass equal to the molar mass and▶ (if a gas) has a volume of 22.4 @ STP or 24 l @ RTP |
|----------------------------|--|

HANDOUT

Empirical formula = *simplest whole number ratio* of the atoms of each element in the compound

Molecular formula = *actual number* of the atoms of each element in the compound. It is a multiple of the empirical formula

How to find empirical formula:

- 1) find the mass of each element (in g or %)
- 2) find the moles of each element by dividing with the molar mass
- 3) divide with the smallest of these numbers
- 4) if results are integers -> they are the coefficients of the empirical formula
if results not integers -> multiply all with the smallest integer to get integers

How to find molecular formula:

- 1) find empirical formula
- 2) find molar mass of empirical formula
- 3) find molar mass of compound (if not given)
- 4) divide molar mass of compound by molar mass of empirical formula
- 5) multiply coefficients of empirical formula by this number

Balanced (stoichiometric) chemical equation = same number of atoms on both sides

State symbols: (s) = solid, (l) = liquid, (g) = gas, (aq) = solution in water

Limiting reagent (reactant) = reactant that finishes first

Reactant in excess = reactant that remains after reaction is over

Theoretical yield = mass of products derived from the stoichiometry of the reaction

Actual yield = actual mass of products obtained when reaction takes place

Efficiency = (actual yield/theoretical yield) × 100%

How to find limiting reagent:

- 1) find the moles of *each* reactant
- 2) divide moles of each reactant with its stoichiometric coefficient
- 3) the smallest number corresponds to the limiting reagent

Note: for mass/volume calculations, use the moles of the limiting reagent *before* the division by the coefficient

How to perform mass/volume calculations:

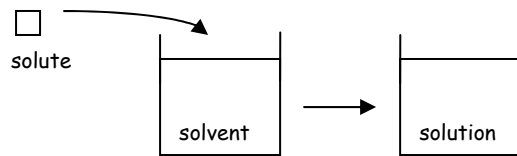
- 1) balance the chemical equation
- 2) transform known masses/volumes to moles
- 3) if more than one reactant, find the limiting reagent
- 4) use stoichiometric ratios to find moles of unknown quantity
- 5) transform moles found to mass/volume

Solution = a homogenous mixture of two or more substances

Solvent = liquid in excess in which dispersion occurs

Solute = solid/liquid/gas dissolved

HANDOUT



$$\text{Concentration (C)} = \frac{\text{amount of solute (mol)}}{\text{Volume of solution (dm}^3\text{)}} \quad M = \text{mol} \cdot \text{dm}^{-3}$$

Low concentration -> **dilute** solution (NOT weak)

High concentration -> **concentrated** solution (NOT strong)