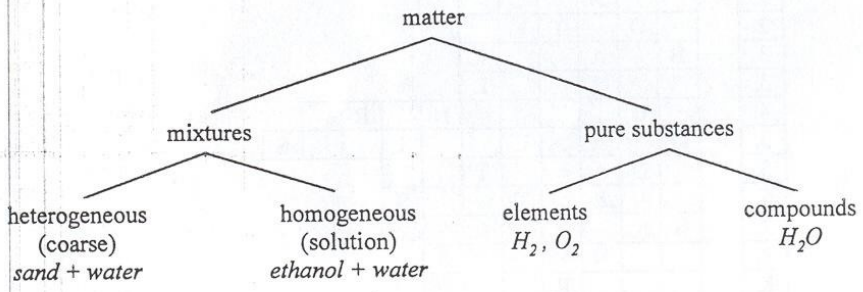
CHAPTER 2
Types of Matter

a) Classification of Matter:

Matter is anything that has mass and occupies space. It exists in three phases: *solid, liquid,* and *gas*. A *solid* has a rigid shape and a fixed volume. A *liquid* has a fixed volume but is not rigid in shape; it takes on the shape of the container. A *gas* has neither a fixed volume nor a rigid shape; it takes on both the volume and the shape of the container.

Matter can be classified into two categories - *pure substances* and *mixtures*. *Pure substances* (e.g.: water) have a fixed composition (they cannot be divided into simpler parts by physical methods) and a unique set of properties; they are either elements or compounds. *Mixtures* are composed of two or more substances; they can be either homogeneous (e.g.: ethanol in water) or heterogeneous (sand in water).

The composition of the mixture is the same throughout in a homogeneous mixture whereas in heterogeneous mixtures the composition varies throughout (most rocks fall into this category). An element is a type of matter that cannot be broken down into two or more pure substances. A compound is a pure substance that contains more than one element.



b) Separation Methods:

Many different methods can be used to separate the components of a mixture from one another. A couple of methods that are usually carried out in the laboratory are filtration and distillation. The filtration is used to separate a heterogeneous solid-liquid mixture. The mixture is passed through a barrier with fine pores such as filter paper. The distillation is used to resolve a homogeneous solid-liquid, or liquid-liquid, mixture. The more volatile liquid vaporizes, leaving the residue of the solid, or the less volatile liquid, in the distilling flask. Almost pure liquid is obtained by condensing the vapour.

c) Solutions and Their Properties:

Another name for a homogeneous mixture is a *solution*. A solution is made up of *solvent*, the substance present in largest amount, and one or more *solutes*. Most commonly, the solvent is a liquid, while solutes may be solids, liquids, or gases.

Nearly every chemical reaction takes place in homogeneous solutions. Therefore, it is important to understand the properties of solutions before we can begin to understand those reactions. The most distinct characteristic of a solution is its concentration (a measure of the relative amounts of solute and solvent in a solution).

We know various units of concentration like mass percent, mole fraction, molarity, and molality.

Molarity, the number of moles of solute per liter of solution, has the units moles / L which can be abbreviated M or c. Meanings of the abbreviations are c – molar concentration, n – molar quantum, V – volume of the solution. This is the most commonly used measure of concentration.

$$c = \frac{n}{V}$$

Molality is the number of moles of solute per kilogram of solvent and is abbreviated c_m. Meanings of the abbreviations are c_m – molal concentration, n – molar quantum, m_R – weight of the pure solvent. The major advantage of using molality c_m (instead of molarity M) as a measure of concentration is that molality is temperature independent because it, unlike molarity, includes no volume term.

$$c_m = \frac{n}{m_R}$$

Another temperature independent measure of concentration is *mass percent*. Mass percent P_w is defined as the mass of solute m divided by the mass of the solution m_s multiplied by 100 %.

$$P_w = \frac{m}{m_s} \cdot 100\ \%$$

The last measure of concentration we will discuss is called *mole fraction*. Mole fraction x is the ratio of the number of moles of solute n to the total number of moles of solution n_s.

$$x = \frac{n}{n_s}$$

There are two common ways to prepare a liquid solution. The first is to weigh out a known mass of solute and mix it with the amount of solvent just needed to achieve the desired concentration. The solvent can be weighed (in the case of c_m , P_w , x) or added to the solute into a volumetric flask to receive total volume needed for the desired concentration (in the case of c). The other method involves the dilution of a concentrated stock solution with more solvent to achieve a solution with a lower concentration than the original solution.

What factors affect the solubility of solutes in different solvents? A rule was observed that ***similar dissolves similar***. Non-polar solvents dissolve non-polar solutes better than polar solvents and polar solvents dissolve polar solutes better than non-polar solvents.

Raising the temperature of a solution will increase the solubility of most solid lutes. Likewise, increasing the pressure above a solution will increase the solubility of ost gaseous solutes.

sublimation	sublimace
substance	hmota, látka
system	soustava, systém
take on	nabýt, nabývat; vzít na sebe *co*
vapour	pára, výpary, opar, mlha

Vocabulary 2:

atomic mass unit	atomová hmotnostní jednotka
atomic relative mass	atomová relativní hmotnost
boiling	var
coarse	hrubý, drsný
composition	složení
compound	sloučenina
condensation	kondenzace
crystallization	krystalizace
density	hustota
desublimation	desublimace
dilute	zředit, rozředit
distillation	destilace
distinct	jasný, nesporný, zřetelný
electric field	elektrické pole
element	prvek
evaporate	vypařit
evaporation	vypařování, odpařování
evenly	rovnoměrně, pravidelně, ustáleně
extraction	extrakce
filtration	filtrace
float	plout, vznášet se
freezing	tuhnutí
gaseous state	skupenství plynné
gravitational field	gravitační pole
heterogenous	heterogenní
homogeneous, homogenous	homogenní
involve	zahrnovat
link	spojit
liquid state	skupenství kapalné
magnetic field	magnetické pole
mass percent	hmotnostní zlomek, procenta
matter	látka, hmota
melting	[illegible] ní
mixture	směs látek
mol	látkové množství, mol
molecular relative mass	molekulová relativní hmotnost
molarity	látková (dříve molární) koncentrace
mole fraction	molární koncentrace
pure substance	chemicky čistá látka
saturated	nasycený
separation	dělení
solid state	skupenství pevné
solubility	rozpustnost
solute	rozpuštěná látka
solution	roztok
solvent	rozpouštědlo
stir (*pt., pp.* stirred)	zamíchat, rozmíchat
stock solution	zásobní roztok