CONCENTRATION

Concentration is a measure of the amount of substance contained in a unit volume. It may be expressed as weight per unit weight, or weight per unit volume. Normally, concentration is given in percentage when weight per unit weight measurement is used. Thus, a food containing 20% fat will contain 20 g of fat in every 100 g of food.

Concentration values are also expressed as mass per unit volume—for example, mass of a solute dissolved in a unit volume of the solution. Another term used to express concentration is **molarity**, or molar concentration. Molarity is the concentration of solution in grams per liter divided by the molecular weight of the solute

Concentration is sometimes expressed by **molality**. The molality of a component A in a solution is defined as the amount of a component per unit mass of some other component chosen as the solvent. The SI unit for molality is mole per kilogram.

MOISTURE CONTENT

Moisture content expresses the amount of water present in a moist sample. Two bases are widely used to express moisture content; namely, moisture content wet basis and moisture content dry basis.

Moisture content wet basis (MC_{wb}) is the amount of water per unit mass of moist (or wet) sample.

Thus,

$$MC_{wb} = \frac{\text{mass of water}}{\text{mass of moist sample}}$$

Moisture content dry basis (MC_{db}) is the amount of water per unit mass of dry solids (bone dry) present in the sample.

Thus,

$$MC_{db} = \frac{\text{mass of water}}{\text{mass of dry solids}}$$

A relationship between MC_{wb} and MC_{db} may be developed as follows:

$$MC_{wb} = \frac{\text{mass of water}}{\text{mass of moist sample}}$$

$$MC_{wb} = \frac{\text{mass of water}}{\text{mass of water} + \text{mass of dry solids}}$$

Divide both numerator and denominator of Equation with mass of dry solids:

$$MC_{wb} = \frac{\text{mass of water/mass of dry solids}}{\frac{\text{mass of water}}{\text{mass of dry solids}} + \frac{\text{mass of dry solids}}{\text{mass of dry solids}}}$$

$$MCwb = \frac{\text{mass of water/mass of dry solids}}{\frac{\text{mass of water}}{\text{mass of dry solids}} + 1}$$

$$MCwb = \frac{MCdb}{MCdb + 1}$$

TEMPERATURE

Temperature is one of those properties that defy a precise scientific definition. We generally perceive temperature as a measure of our physiological response to“ hotness ” or “coldness. ” of temperature.

A thermometer is a commonly used instrument to measure temperature; simply, it gives us a numerical measure of the degree of hotness. Typically, in a glass thermometer, a material such as mercury or alcohol is present inside a glass capillary. This material expands in response to heat.

The temperature scale according to the SI units is the Celsius scale, named after a Swedish astronomer, Celsius. In the English system of units, we use the Fahrenheit scale, named after the German instrument maker G. Fahrenheit. Both these scales use two reference points. The ice point is a temperature of ice and water mixture in equilibrium with saturated air at one atmospheric pressure. The ice point for the Celsius scale is 0°C and 32°F in the Fahrenheit scale.

The boiling point, when a mixture of liquid and water vapor are in equilibrium at one atmospheric pressure, is 100°C in the Celsius scale and 212°F in the Fahrenheit scale.

In addition to the temperature scales, there is a thermodynamic temperature scale that does not depend on the properties of any material

The Kelvin and Celsius scales are related by the following function:

$T(\text{K}) = T(°\text{C}) + 273.15$

In most engineering calculations, the number in this equation is rounded off to 273.

PRESSURE

The gas molecules strike the inside surface of the chamber and exert a force normal to the surface. When the fluid is at equilibrium, the force exerted by the fluid per unit area of the inside chamber surface is called pressure.

Pressure is an intensive property of a system. The pressure of a fluid contained in a chamber increases with depth, because the weight of the fluid increases with depth.

Pressure may be expressed as force per unit area.

In the SI system, the units are N/m^2. This unit is also called a pascal. Since the pascal unit is small in magnitude, another unit, bar, is used, where

1 bar =105 Pa=0.1MPa =100 kPa

ENTHALPY

Enthalpy is expressed as the sum of internal energy and the product of pressure and volume:

$H = Ei + PV$ (1.21)

where H is enthalpy (kJ), E i is internal energy (kJ), P is pressure (kPa), and V is volume (m^3).

Enthalpy may also be expressed per unit mass as follows:

$H = E' + PV$ i (1.22)

where H is enthalpy per unit mass (kJ/kg), Ei′ is internal energy per unit mass (kJ/kg), and V is specific volume (m^3 /kg).

Note that enthalpy is an energy quantity only in special cases. For example, the enthalpy of air in a room is not an energy quantity, because the product of pressure and specific volume in this case is not an energy quantity. The only energy of the air in the room is its internal energy. When a fluid enters or leaves an open system, the product of pressure and volume represents flow energy. In this case, enthalpy of the fluid represents the sum of internal energy and flow energy.