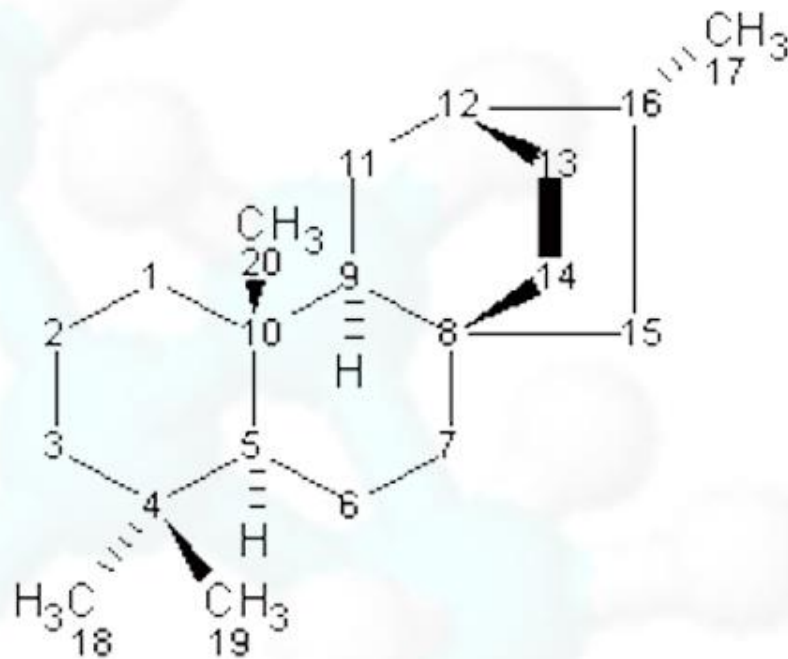
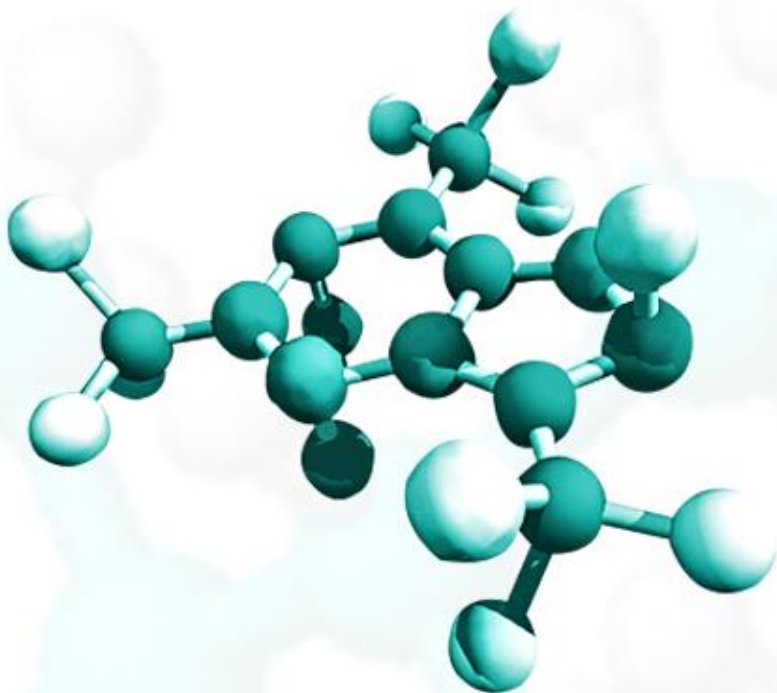
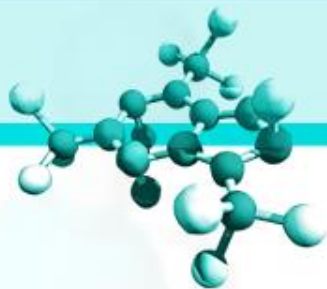




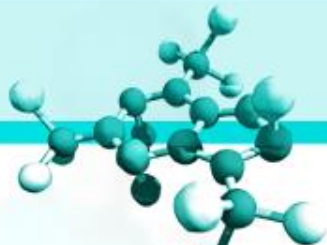
Chapter One

Introduction to Chemistry



- **What is Chemistry?**
- Chemistry is The study of **Matter** and changes it undergoes.
- Matter *is anything that occupies space and has mass*
- Thus Matter is everything around us.

Chapter One / Introduction



Is a form of matter that has a definite (constant) composition and distinct properties. Example: water, sugar and gold

Matter

Is a combination of two or more substances in which the substances retain their distinct identities. Example: Air, soft drink, and pizza

Pure substance

Mixture

Element

Compound

Homogeneous

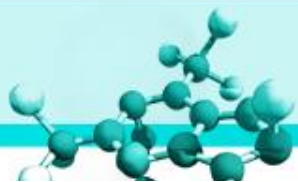
Heterogeneous

Is a substance that cannot be separated into simpler substances by chemical means

Is a substance composed of atoms of two or more elements chemically united in fixed proportions. Example: water, ammonia

Is a mixture in which the composition is the same throughout. Example: sugar in water

Is a mixture in which the composition is not the same uniform. Example: fruit salad



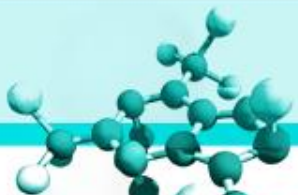
Pure substance *Is a form of matter that has a definite (constant) composition and distinct properties.*

Example: water, sugar and gold

Element *Is a substance that cannot be separated into simpler substances by chemical means*

Compound *Is a substance composed of atoms of two or more elements chemically united in fixed proportions.*

Example: water, ammonia



Mixture

Is a combination of two or more substances in which the substances retain their distinct identities.

Example: Air, soft drink, and pizza

Homogeneous

Is a mixture in which the composition is the same throughout.

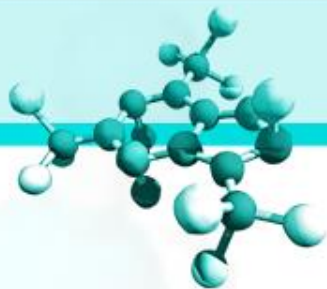
Example: sugar in water

Heterogeneous

Is a mixture in which the composition is not the same uniform.

Example: fruit salad

Chapter One / Introduction



Element



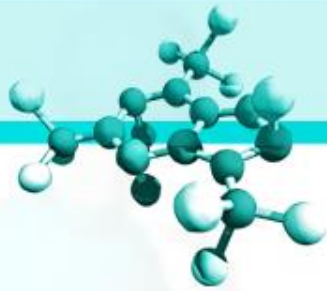
compound



Heterogeneous mixture



Homogeneous mixture



States of matter

Gas

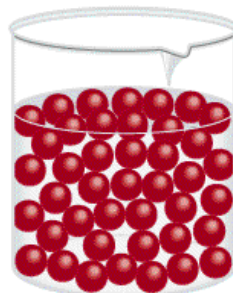
- *Molecules are separated by distance*
- *Have no definite shape*
- *Have no definite volume*



Gas

Liquid

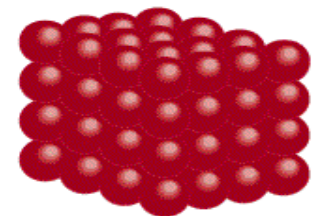
- *Molecules are close together but not held so rigidly in position and can move past on another*
- *Have no definite shape*
- *Have a definite volume*



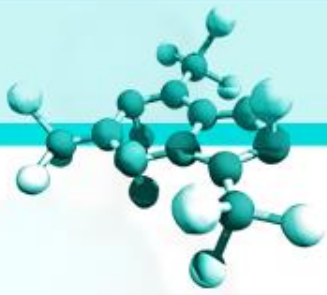
Liquid

Solid

- Molecules are held close together in orderly fashion with little freedom of motion.
- Have a definite shape
- Have a definite volume



Solid



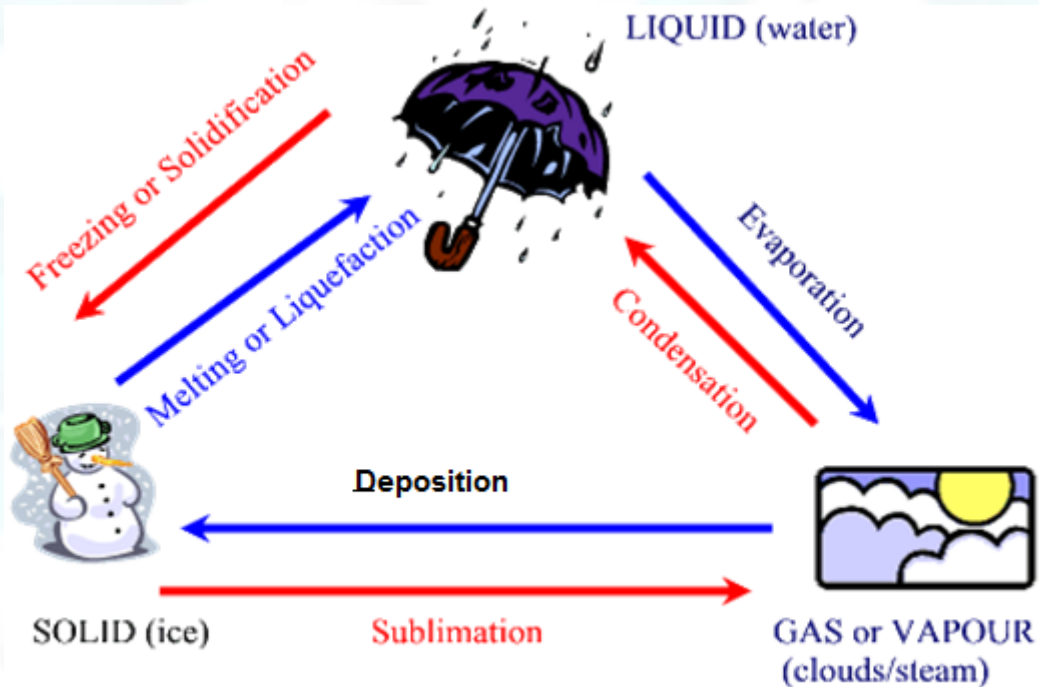
Chapter One / Introduction

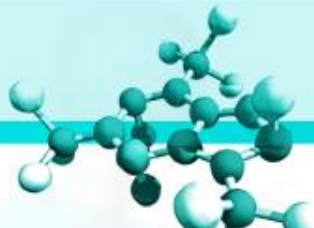
States of matter

Gas

Liquid

Solid

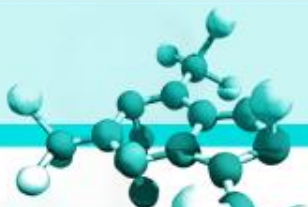




Measurement in chemistry

- In every measurement there is a number followed by a unit.
- Units are essential to stating measurements correctly.
- The international system of units (SI) is used world wide to reports result.
- There are seven SI base units as following:

Base Quantity	Name of unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electrical current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd



Derived Units

❖ Derived units are unit made up of combination of SI base units such as:

(1) area (A) = Length x width

Then The unit of area is

unite of Length x unite of width:

i.e unite of area = m x m = m²

(2) velocity (v) = Distance/ time or d/t

then the unit of velocity or speed

= unite of distance / unite of time

i.e unite of velocity = m / s or ms⁻¹



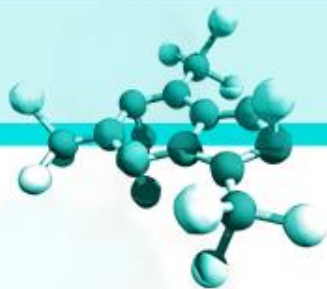
Working with larger and smaller units

The SI solves the problem of fractions and larger numbers by creating larger and smaller units by modifying the basic units with decimal factors and prefixes.

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{18}	Exa	E	10^{-1}	deci	d
10^{15}	Peta	P	10^{-2}	centi	c
10^{12}	Tera	T	10^{-3}	milli	m
10^9	Giga	G	10^{-6}	micro	<i>u</i>
10^6	Mega	M	10^{-9}	nano	n
10^3	kilo	K	10^{-12}	pico	p
10^2	Hecto	H	10^{-15}	femto	f
10^1	deka	da	10^{-18}	Atto	a



Prefix	Factor	Examples	Symbol
Kilo-	1000 (10^3)	1 kilometer = 1000 meter (10^3) 1 kilogram = 1000 gram	km kg
deci-	1/10 (10^{-1})	1 decimeter = 0.1 meter (10^{-1})	dm
centi-	1/100 (10^{-2})	1 centimeter = 0.01 meter (10^{-2})	cm
milli-	1/1000 (10^{-3})	1 millimeter = 0.001 meter (10^{-3}) 1 milligram = 0.001 gram 1 millisecond = 0.001 second	mm mg ms
micro	1/1,000,000 (10^{-6})	1 micrometer = 0.000,001 meter (10^{-6}) 1 microgram = 0.000,001 gram	um ug
nano-	1/1,000,000,000 (10^{-9})	1 nanometer = 10^{-9} meter 1 nanogram = 10^{-9} gram	nm ng



1- prefix to Base unit

- To remove a prefix from a value, insert the numerical value of the prefix in place of the symbol.

Example

Convert 8.53 pm to meters?

Replace p with $\times 10^{-12}$, therefore the answer is 8.53×10^{-12} m

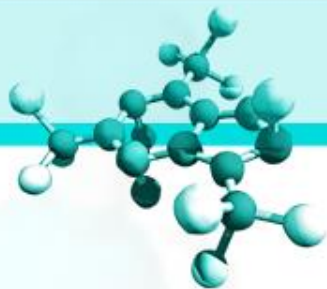
2- Base unit to prefix

- To insert a prefix into a value, insert both the prefix and the inverse of its numerical number.

Example

Convert 0.000462 g to milligrams ?

$$0.000462 \times 10^3 \text{ mg} = 0.462 \text{ mg}$$



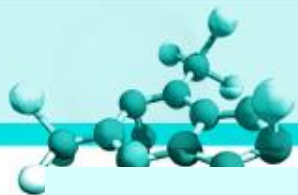
How many second are in a microseconds ?

- (a) 1×10^{-1}
- (b) 1×10^{-6}
- (c) 1×10^{-15}
- (d) 1×10^6

Which of the following is the smallest distance?

- (a) 21 m
- (b) 2.1×10^2 cm
- (c) 21 mm
- (d) 2.1×10^4 pm

Put all of them in the same unit



Example 1

A desk is found to be 1437 mm wide. What is this width expressed in meter?

Answer:

Example 2

A certain person is 172 cm tall. Express this height in decimeters.

Answer:

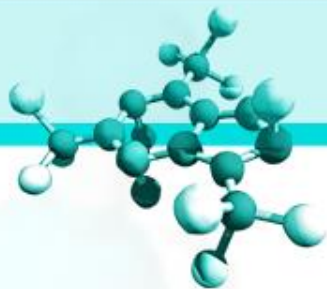


Common Units

1- Volume:

$$1 \text{ liter} = 1000 \text{ ml} = 1000 \text{ cm}^3 = 1 \text{ dm}^3$$

$$1 \text{ liter} = 1 \text{ dm}^3 \quad \text{and} \quad 1 \text{ ml} = 1 \text{ cm}^3$$



2-Temperature

- **a. Celsius scale ($^{\circ}\text{C}$, in science)**

- ☐ Freezing point of water at 0°C

- ☐ Boiling point of water at 100°C

- **b. Kelvin (K, SI unit).**

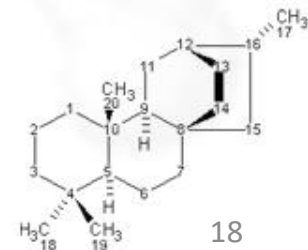
- ☐ Freezing point of water at 273 K

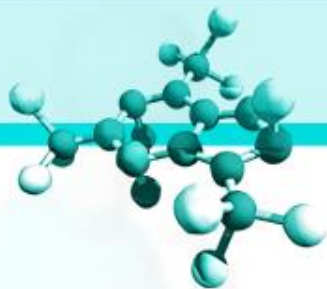
- ☐ Boiling point of water at 373 K

- **c. Fahrenheit ($^{\circ}\text{F}$, common use in US)**

- ☐ Freezing point of water at 32°F

- ☐ Boiling point of water at 212°F





Convert from degrees Celsius to Kelvin

$$T_{(K)} = T_{(^{\circ}C)} + 273$$

Convert from degrees Celsius to Kelvin

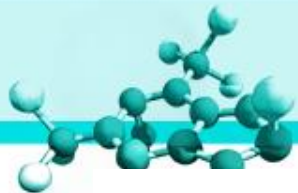
$$T_{(^{\circ}C)} = T_{(K)} - 273$$

Convert from units of degrees Celsius to degrees Fahrenheit

$$t_{(^{\circ}F)} = t_{(^{\circ}C)} \times 1.8 + 32$$

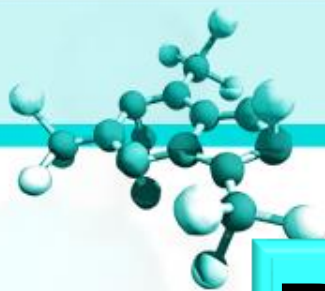
Convert from units of degrees Fahrenheit to degrees Celsius

$$t_{(^{\circ}C)} = \frac{5}{9} \times [t_{(^{\circ}F)} - 32]$$



Example

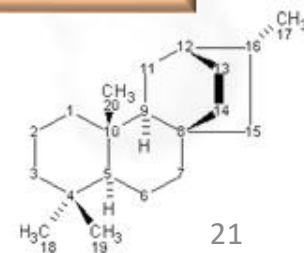
- a. Convert 20 degrees Celsius to Kelvin
- b. Convert 300 Kelvin to degrees Celsius
- c. Convert 20 degrees Celsius to degrees Fahrenheit
- d. Convert 68 degrees Fahrenheit to degrees Celsius

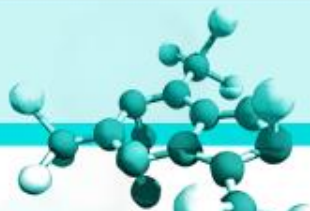


Properties of Matter

**Physical
properties**

**Chemical
properties**





Properties of Matter

Physical properties

Chemical properties

Physical Properties of Matter

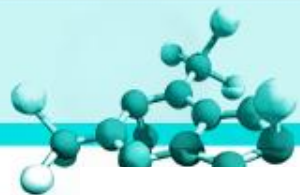
Definition

- *a characteristic of a substance that can be observed or measured without changing the composition of the substance*

ex. Density, viscosity, conductivity, malleability, melting point, boiling point

- remain the same for all pure substances

ex. water always boils at 100 and freezes at 0 °C



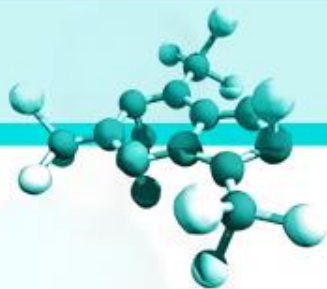
Density and specific gravity

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$$d = \frac{m}{V}$$

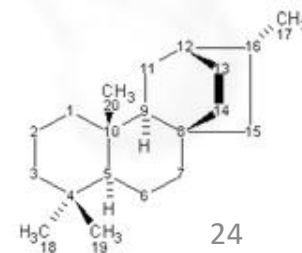
The unit of density is (g/ml)

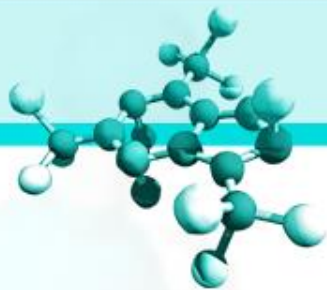
$$\text{Specific gravity (sp. gr.)} = \frac{d (\text{substance})}{d (\text{water})}$$



Example:

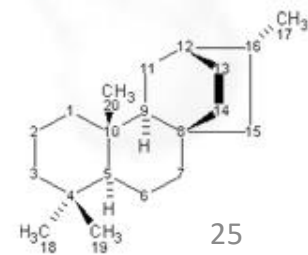
A student determines that a piece of an unknown material has a mass of 5.854 g and a volume of 7.57 cm³. What is the density of the material?

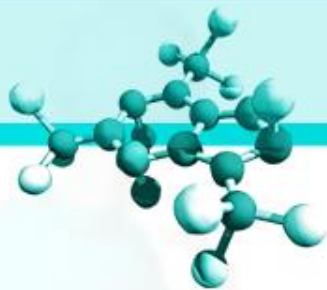




Example

A piece of silver (Ag) metal weighing 194.3 g is placed in a graduated cylinder containing 242.0 mL of water. The volume of water now reads 260.5 mL. From these data calculate the density of silver?





Chemical Properties of Matter

Definition

- *any ability to produce a change in the composition of matter*
- *can only be observed when the substances in a sample of matter are changing into a different substance*