

# Keeping acids

01) Cement - Formula + tricalcium silicate ( $3\text{CaO} \cdot \text{SiO}_2$ )

Di - ( $2\text{CaO} \cdot \text{SiO}_2$ )

Definition :- tricalcium Aluminate ( $3 \cdot \text{CaO} \cdot \text{Al}_2\text{O}_3$ )  
tetra calcium Aluminoferrite ( $4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$ )

Cement is a dry, greenish grey powder with fine particles.

It is a binder, a chemical substance used for construction that sets, hardens and adheres to other materials to bind them together.

Process of cement production :-

There are four stages in the manufacture of portland cement.

(mixture of raw materials)

① 1) Crushing and grinding the raw materials

2) Blending the raw materials in the correct proportions.

② 3) Burning the prepared mix in a kiln

4) Grinding the burned product, known as "clinker" together with some 5 percent of gypsum

Raw materials :-

limestone, shells, and chalk or marl combined with shale, clay, slate, blast furnace slag, silica sand and iron ore.

## Dry process of cement

The moisture content in the raw material is reduced to less than 1% before the blending process occurs. size of cement = 15 microns.

## Ratio of cement mix

1 part cement to 2 parts sand to 4 parts aggregates.

## Main ingredient in cement

Limestone

It is a sedimentary type of rock naturally found on earth.

It contains  $CaCO_3$ , Quartz, clay.

## Composition of cement

Ingredient	Percentage in cement
Lime	60-65
Silica	17-25
Alumina	3-8
Magnesia	1-3
Iron oxide	0.5-6
Calcium sulfate	0.1 to 0.5
Sulfur Trioxide	1 to 3
Alkaline	
Gypsum	

Argillaceous clay (1/2%)

Calcareous (in limestone)

Gypsum -  $CaSO_4 \cdot 2H_2O$

## Applications of cement

Construction purposes like buildings, bridges, tanks, tunnels, RC, etc.

It is used to construct other concrete structure like garden seats, flower pots, ducts, etc.

It can be used in structural application such as beams, columns, slabs and foundations.

It can also be used in non-structural applications such as paving, curbing and landscaping.

Mortar = mixture of cement, sand, water.  
RC - Reinforced Concrete - Iron rods embedded in concrete.

Concrete = mixture of cement, gravel, sand and water.

Glass

## Definition :-

Glass is an inorganic solid material that is usually transparent or translucent as well as hard, brittle, and impervious to most natural elements; more or less transparent substance produced by fusion, usually consisting of mutually dissolved silica and silicates that also contain soda & lime.

Glass is supercooled liquid.  
It is amorphous solid.



Its composition may be represented as  $xR_2O \cdot yMO \cdot 6SiO_2$

where R = Alkali Metal (Na or K)  
 M = Divalent metal (Ca or Pb)  
 X, Y = whole numbers

- Examples:
- \* Soft glass:  $Na_2O \cdot CaO \cdot 6SiO_2$
  - \* Hard glass:  $K_2O \cdot CaO \cdot 6SiO_2$
  - \* Flint glass:  $K_2O \cdot PbO \cdot 6SiO_2$

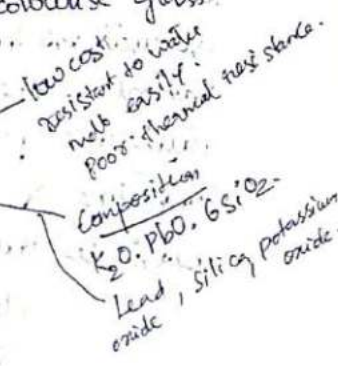
In some glass  $SiO_2$  may be replaced by  $Al_2O_3, B_2O_3, P_2O_5$ .

### Raw materials used in Glass making

- 1) sand to supply silica ( $SiO_2$ )
- 2) Alkali carbonate ( $Na_2CO_3$  or  $K_2CO_3$ )
- 3) Alkaline earth carbonate ( $CaCO_3$ , limestone) to supply quick lime ( $CaO$ )
- 4) salt cake ( $Na_2SO_4$ ) to supply  $Na_2O$
- 5) cullet - to minimise the cost of production
- 6)  $MnO_2$  - to decolourise glass.

### 3 Types of glass

- 1) Soda lime glass
- 2) lead glass
- 3) borosilicate glass



### Composition of Glass

- Silica ( $SiO_2$ ) - 71 to 78.0%
- Alumina ( $Al_2O_3$ ) - 0.5 to 1.5%
- Iron oxide ( $Fe_2O_3$ ) - 0.05 to 0.15%
- Calcium oxide ( $CaO$ ) - 5.0 to 10.0%
- Magnesium oxide ( $MgO$ ) - 2.0 to 5.0%
- Sodium oxide ( $Na_2O$ ) - 13.0 to 16.0%
- Potassium oxide ( $K_2O$ ) - 0.0 to 1.0%
- Sulphur trioxide ( $SO_3$ ) - 0.0 to 0.5%

### Application of glass to engineering

Glass fibres are used in insulation, sound deadening, as filter in plastics, and as Re in plastic laminates.

to Architecture Industrial.

Architecture, laboratories, electronic tech and manufacturing [windows, doors, bottles for drinks]

### Properties of glass:-

- Thermal properties
- Optical properties
- Chemical properties
- Electrical properties
- Mechanical properties

- Manufacture method
- Fusion of Raw material
- Shaping
- Finishing

Soda lime (soft)	$Na_2O \cdot CaO \cdot 6SiO_2$
Potash lime (hard)	$K_2O \cdot CaO \cdot 6SiO_2$
Lead (Flint)	$PbO \cdot CaO \cdot 6SiO_2$

bright, high refractive index