keeping acids.

01) Cement · Formula → tricalcium silicate ($3CaO\,SiO_2$)
Di – ($2CaO\,SiO_2$)

Definition :- Tricalcium Aluminate ($C_3 \cdot CaO \cdot Al_2O_3$)
Tetra Calcium Aluminoferrite ($4CaO \cdot Al_2O_3 Fe_2O_3$)

Cement is a dry, greenish grey powder with find 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 cements 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	0.5 to 1

Gypsum - $CaSO_4 \cdot 2H_2O$ Calcareous (limestone) Argillaceous clay (Al_2O_3 Gypsum

Applications of cement:

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

It is used to construct other concrete structure like garden seats, flow pots, dustbins.

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.

Mortor = 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 the 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.

$XR_2O.YMO.6SiO_2$

Its composition may be represented as

$XR_2O.YMO.6SiO_2$

where R = Alkali Metal (Na or K)

M = Bivalent metal (Ca or Pb)

Examples: X, Y = whole numbers

Soda lime — * Soft glass $Na_2O.CaO.6SiO_2$

Potash — * Hard glass $K_2O.CaO.6SiO_2$

Lead — * Flint glass $K_2O.PbO.6SiO_2$

In some glass SiO_2 may be replaced by Al_2O_3, Fe_2O_3, P_2O_3.

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 — low cost, resistant to water, melts easily, poor thermal resistance
2) lead glass
3) borosilicate glass — Composition $K_2O.PbO.6SiO_2$ — Lead, silica, potassium oxide

Composition of Glass:

Silica (S_2O_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 uses in insulation, sound deadening, as filter in plastics, and as Re in plastic laminates.

to Architecture Industrial:

Architecture, laboratories, electronic technology 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
Annealing
Finishing.

Soda lime (soft) $Na_2O.CaO.6SiO_2$

Potash lime (hard) $K_2O.CaO.6SiO_2$

Lead (Flint $PbO.CaO.6SiO_2$.

Lead → bright, high refractive index