GLASS

* Glass is a complex substance with no definite composition. GLASS is a homogeneous mixture of silicates of alkali & alkaline earth metals.
It is represented by a general formula

$$x.R_2O.yMO.6SiO_2$$

where R = alkali metals (Na, K etc.) &
M = alkalin earth metals (Ca, Pb, Zn etc.)

Example: Ordinary glass known as soda glass is represented by formula

$$Na_2O.CaO.6SiO_2 \rightarrow$$ soda Glass.

* GENERAL PROPERTIES OF GLASS :→

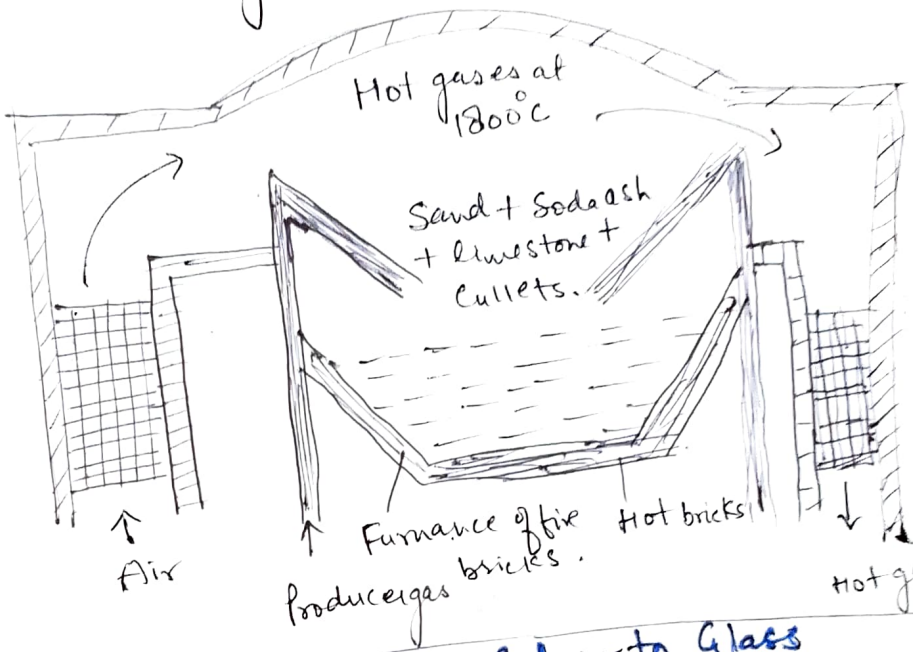
1.) It has no definite melting point.
2.) It softens on heating
3.) It has no definite Crystalline Structure
4.) Can absorb, reflect & transmit light

* Raw-material Required for Manufacturing GLASS ;→

1.) Silica → In the form of white Sand, quartz.
2.) Alkali metal → Na_2CO_3 & Na_2SO_4 for soda glass
3.) Alkaline earth metals : $CaCO_3$, Chalk, marble etc.
4.) Cullets :→ Broken piece glass to increase fusibility
5.) Oxides of heavy metal : PbO (for flint glass), ZnO etc.
6.) Feldspar : It provides Al_2O_3, which make glass resistant
7.) Decolourizer :→ To remove green or yellow colour in glass
8.) Colorants : To give Desired Colour to Glass.

Annealing: Glass articles are allowed to cool slowly by passing it through a tunnel like structure with different cooling chambers. This process is called annealing of glass.

) **Finishing**: Finishing of glass involves cleaning, polishing cutting etc.



Not to Learn

* Colouring Agent for Imparting Colour to Glass

(1) Blue Colour ⇒ Cobalt oxide or Cupric oxide.
(2) Green Colour ⇒ Chromium oxide.
(3) Yellow Colour ⇒ Cadmium Sulphine or Antimony Sulphide
(4) Red Colour ⇒ Cuprous oxide.
(5) Black Colour ⇒ ~~Cobalt oxide~~, Nickel oxide or Magnese dioxide

* Industrial Application of Glass :→

(1.) In laboratories to make various apparatus.
(2.) In medical Industry to make equipments like thermometer injection vials, medicine & saline bottles.
(3.) In making lenses, Goggles & spectacles.
(4.) To make mirror & furniture.
(5.) In making windows & door, Kitchenwares & decorative articles and also in artificial Jewellery.

Soda-lime glass or Soft glass

It is the simplest Silicate glass, made by using Sodium Carbonate, Calcium Carbonate and SiO_2. Its general formula is (low m.p.)

$$Na_2O \cdot CaO \cdot 6SiO_2$$ — Soft Glass.

Use :→ (1.) It is widely used for :
(a.) window glasses
(b.) cheap tablewares, bottles, jars etc.
(C.) cheap laboratory glassware.

(2.) :

Potash Glass or Hard Glass

It is made by fusing K_2CO_3, $CaCO_3$ & SiO_2
It composition is $K_2O \cdot CaO \cdot 6SiO_2$ — Hard Glass.

Uses (1.) It is used for making chemical apparatus
(2.) It is used for making combustion tube
(High M.P Withstand high temp.)

(3.) **LEAD Glass or Flint Glass** :→

It is made by fusing K_2CO_3, red lead, & SiO_2. Its composition is (upto 80% PbO is incorporated for dense optical glass)

$$K_2O \cdot PbO \cdot 6SiO_2$$ — LEAD GLASS

~~Uses~~ : It is bright & has higher refractive index, high specific gravity

Uses of lead Glass :→ It is used for making
- Prism, lenses, & other optical devices.
- In making high quality table-wares & art objects because of high Lustre.

Boro-silicate Glass or Pyrex Glass or JENA GLASS

It contains Boron trioxide (B_2O_3), Silica & little amount of alumina & alkali metal oxide

Percentage composition of Borosilicate Glass

Component	SiO_2	B_2O_3	Al_2O_3	K_2O	Na_2O
%	80.5 %	13 %	3 %	3 %	0.5 %

Uses :→ It is used for making;
(1.) Superior quality laboratory apparatus like flasks, beakers.
(2.) Kitchen wares.
(3.) In making television tubes
(4.) In making Electrical insulators.

Properties of Borosilicate Glass
1) High Softening Point
2) high Chemical resistant
3) Shock resistant

(5.) Alumino-Silicate Glass :→

In alumino silicate glass, there is higher percentage of Al_2O_3 & lower percentage of B_2O_3.

Component	SiO_2	Al_2O_3	B_2O_3	MgO	CaO	Na_2O
%	55 %	23 %	7 %	9 %	5 %	1 %

Uses (1) In making high pressure mercury discharge tubes.
(2) In making chemical combustion tubes & certain domestic equipments.

Properties: 1) High softening temp (Exceptionally high)

Crooke's Glass :→ or optical Glass :→

Crooke's glass is special type of optical glass which contains little cerium oxide. It is capable of absorbing ultra-violet light, which is injurious to eyes.
→ along with Phosphorous & lead silicates

Uses : (1.) It is used for manufacturing of lenses, due to high refractive index.
(2.) It is relatively soft than ordinary glass.

(7.) Safety Glass or Laminated Glass

It is prepared by placing a thin layer of plastic (cellulose acetate) between two sheets of ordinary glass.

Uses : (1) It is used for making wind-shield in automobiles & aircrafts. (Three layered)
(2) In buiding construction. (five layered glass)
(3) multilayered laminated glass is used as bullet proof (several layered) ↑ properties quite Tough.

(8.) Glass-Wool :→ It is a fibrous material

made of fine threads of glass. It has high thermal insulation

Uses : (1) In domestic & Industrial appliances like Oven, motors, vaccum cleaners
(2) It is used for filteration of acidic & other corrosive liquids.

Photochromic Glass:→

Photochromic glasses change colour in presence of Sunlight (UV radiations) & revert back to its original colour in absence of radiation.

In this glass preparation, to the borosilicate glass composition mixed silver copper nitrate & a metal halide & heated to 1200°C.