“Glass is an amorphous (non-crystalline) solid material that exhibits a glass transition, which is the reversible transition in amorphous materials (or in amorphous regions within semicrystalline materials) from a hard and relatively brittle state into a molten or rubber-like state. Glasses are typically brittle and can be optically transparent. The most familiar type of glass, used for centuries in windows and drinking vessels, is soda-lime glass, composed of about 75% silica (SiO_2) plus sodium oxide (Na_2O) from soda ash, lime (CaO), and several minor additives. Often, the term *glass* is used in a restricted sense to refer to this specific use.

While fused quartz (primarily composed of SiO_2) is used for some special applications, it is not very common due to its high glass transition temperature of over 1200 °C (2192 °F). Normally, other substances are added to simplify processing. One is sodium carbonate (Na_2CO_3, "soda"), which lowers the glass transition temperature. However, the soda makes the glass water soluble, which is usually undesirable, so lime (calcium oxide[CaO], generally obtained from limestone), some magnesium oxide (MgO) and aluminium oxide (Al_2O_3) are added to provide for a better chemical durability. The resulting glass contains about 70 to 74% silica by weight and is called a soda-lime glass. Soda-lime glasses account for about 90% of manufactured glass.

Most common glass contains other ingredients added to change its properties. Lead glass or flint glass is more 'brilliant' because the increase defractive index causes noticeably more specular reflection and increased optical dispersion. Adding barium also increases the refractive index. Thorium oxide gives glass a high refractive index and low dispersion and was formerly used in producing high-quality lenses, but due to its radioactivity has been replaced by lanthanum oxide in modern eye glasses. Iron can be incorporated into glass to absorb infrared energy, for example in heat absorbing filters for movie projectors, while cerium(IV) oxide can be used for glass that absorbs UV wavelengths.

The following is a list of the more common types of silicate glasses, and their ingredients, properties, and applications:

1. **Fused silica glass, vitreous silica glass**: silica (SiO_2). Has very low thermal expansion, is very hard and resists high temperatures (1000–1500 °C). It is also the most resistant against weathering (alkali ions leaching out of the glass, while staining it). It is used for high temperature applications such as furnace tubes, melting crucibles, etc.
2. **Soda-lime-silica glass, window glass**: silica 72% + sodium oxide (Na_2O) 14.2% + magnesia (MgO) 2.5% + lime (CaO) 10.0% + alumina (Al_2O_3) 0.6%. Is transparent, easily formed and most suitable for window glass. It has a high thermal expansion and poor resistance to heat (500–600 °C). Used for windows, containers, light bulbs, tableware.
3. **Sodium borosilicate glass, Pyrex**: silica 81% + boric oxide (B_2O_3) 12% + soda (Na_2O) 4.5% + alumina (Al_2O_3) 2.0%. Stands heat expansion much better than window glass. Used for chemical glassware, cooking glass, car head lamps, etc. Borosilicate glasses (e.g. Pyrex) have as main constituents silica and boron oxide. They have fairly low coefficients of thermal expansion (7740 Pyrex CTE is 3.25×10^{-6}/°C as compared to about 9×10^{-6}/°C for a typical soda-lime glass), making them more dimensionally stable. The lower CTE also makes them less subject to stress caused by thermal expansion, thus less vulnerable to cracking from thermal

shock. They are commonly used for reagent bottles, optical components and household cookware.

4. **Lead-oxide glass, crystal glass**: silica 59% + soda (Na_2O) 2.0% + lead oxide (PbO) 25% + potassium oxide (K_2O) 12% + alumina 0.4% + zinc oxide (ZnO) 1.5%. Has a high refractive index, making the look of glassware more brilliant (crystal glass). It also has a high elasticity, making glassware 'ring'. It is also more workable in the factory, but cannot stand heating very well.
5. **Aluminosilicate glass**: silica 57% + alumina 16% + boric oxide (B_2O_3) 4.0% + barium oxide (BaO) 6.0% + magnesia 7.0% + lime 10%. Extensively used for fiberglass, used for making glass-reinforced plastics (boats, fishing rods, etc.). Also for halogen bulb glass.

Another common glass ingredient is "cullet" (recycled glass). The recycled glass saves on raw materials and energy; however, impurities in the cullet can lead to product and equipment failure. Fining agents such as sodium sulfate, sodium chloride, or antimony oxide may be added to reduce the number of air bubbles in the glass mixture. Glass batch calculation is the method by which the correct raw material mixture is determined to achieve the desired glass composition.

Low Iron Glass / Ultra Clear

Low iron glass is sometimes called ultra clear glass with less than 200 ppm iron content with high performance and multi-functions.

Low iron glass is more translucent.

Low iron clear glass is mainly used for high end buildings, high grade furniture, decorative glass, imitating crystal , light glass, high transparency special buildings , high grade deep processed glass and PV glass curtains.”