Chemistry of Quartz:-

Quartz is always nearly pure silica with less than 0.2 percent of total impurities. Typical chemical analyses are given in Table 2.

Oxygens /formula unit	4	4	4	4
Si	1.998208	1.997837	1.999036	1.999829
Ti	0.000722	0.000225	0	0
Al	0.000989	0	0.000473	0
Cr	0	0	0	0
Fe3+	0.000105	0.001053	0.000756	0
Fe2+	0	0.000668	0.00084	0
Mn	0.000152	0	0	0.000342
Mg	0.000238	0.002681	0	0
Ca	0.000214	0	0	0
Na	0	0	0	0
K	0	0	0	0
H	0	0	0	0
	2.000629	2.002464	2.001105	2.000171

Structure of Quartz:-

The structure of quartz consists of corner-sharing SiO4 tetrahedral so that each Si is bonded to four oxygen, and each oxygen is bonded to two silicon atoms. The resulting structure forms an open three-dimensional framework, so that quartz is classified as a tektosilicate or framework silicate.

Quartz is the stable form of SiO2 at atmospheric temperature and pressure. It is denser than tridymite and cristobalite, the high temperature forms, but less dense than the high pressure forms, coesite and stishovite. At 573 ºC, trigonal low quartz transforms reversibly to hexagonal high

quartz. The crystallographic data for quartz are outlined in Table. The structure is acentric, so exists in right- and left-handed enantiomorphism. The space groups are *P*3121 (right handed) or *P*3221 (left-handed)

Crystal System	Trigonal
Point Group	32
Space Group	$P3_121$ or $P3_221$
Unit Cell Parameters	
a	4.1937Å
c	5.4047Å
Z (No. of Formula Units per Cell)	3
Density (calculated)	2.648 g/cm^3
Density (measured)	2.65 g/cm^3

Effect of quartz on the properties of clays:

1- It reduces the elasticity of the clays because it is a non-elastic material.
2- Reduce shrinkage of clays after drying and burning.
3- Reduce tension and compression resistance.
4- The fine sand particle size reduces the resistance of the tiles against high temperatures.
5- Since the shape of sand grains is spherical or hemispherical, there are spaces between them which facilitate the release of gases released from the accelerator of the ceramic materials during the burning process and reduce the possibility of the emergence of internal stresses, which cause the emergence of cracks.

3- Feldspars:

Feldspar is the most important single group of rock forming silicate minerals. The mineral name feldspar is derived from the German words field + spar. The word (field) is field in German and (spar) is a term for light colored minerals that break with a smooth surface. Feldspar minerals are usually white or very light in color, have a hardness of 6 on the Moh` Scale of Hardness and perfect to good cleavage (plane of breakage) in two directions.

There are four chemically district groups of feldspar; Potassium feldspar (KAlSi3O3), Sodium feldspar (NaAlSi3O8), calcium feldspar (CaAlSi3O8) and Barium feldspar (BaAl2Si3O8). About 90% of produced feldspar is used by the glass and ceramic industries. Soda feldspar is preferred in glass manufacture, but Potash feldspar is more popular for

Chemical Composition of Feldspar:

Composition In a consideration of the properties of feldspars, the chemical composition is of primary importance. The chemical analysis is an important key to the behavior of the material under various conditions and is the criterion most often used in evaluating the use of a particular feldspar in a white ware body

Chemically, the feldspars are silicates of aluminum, containing sodium, potassium, iron, calcium, or barium or combinations of these elements.

Feldspar		K_2O%	Na_2O%	CaO%	AL_2O_3%	SiO_2%
Microcline	$KAlSi_3O_8$	16.9	_	_	18.4	64.7
Orthoclase	$KAlSi_3O_8$	19.9	_	_	18.4	64.7
Albite	$NaAlSi_3O_8$	_	11.8	_	19.4	68.8
Anorthite	$CaAl_2SiO_8$	_	_	20.1	36.6	43.3

Chemical composition of feldspar minerals

Mineralogical Composition of Feldspar:

Feldspar minerals are essential components in igneous, metamorphic and sedimentary rocks, to such an extent that the classification of a number of rocks is based upon feldspar content. The mineralogical composition of most feldspar can be expressed in terms of the ternary system Orthoclase ($KAlSi_3O_8$), Albite ($NaAlSi_3O_8$) and Anorthite ($CaAl_2Si_2O_8$).

Uses of Feldspar:-

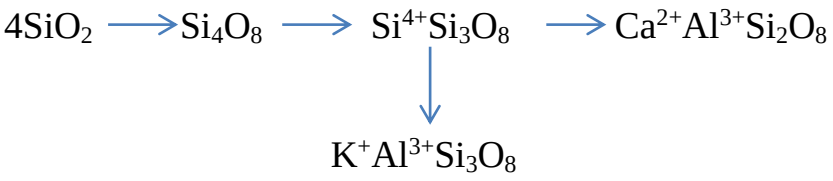
1- Glass Industry: Feldspar is an important ingredient in the manufacture of glass and an important raw material as well, because it acts as a fluxing agent, reducing the melting temperature of quartz and helping to control the viscosity of glass. The alkali content in feldspar acts as flux, lowering the glass batch melting temperature and thus reducing production costs.

2- Ceramics Industry: In the manufacture of ceramics, feldspar is the second most important ingredient after clay. Feldspar does not have a strict melting point, since it melts gradually over a range of temperatures. This greatly facilitates the melting of quartz and clays and, through appropriate mixing, allows modulations of this important step of ceramic making. Feldspars are used as fluxing agents to form a glassy phase at low temperatures and as a source of alkalis and alumina in glazes. They improve the strength, toughness, and durability of the ceramic body, and cement the crystalline phase of other ingredients, softening, melting and wetting other batch constituents.

3- Fillers: Feldspars also are used as fillers and extenders in applications such as paints, plastics and rubber. Beneficial properties of feldspars include good disperse ability, high chemical inertness, stable pH, high resistance to abrasion, low viscosity at high filler loading, interesting

refractive index and resistance to frosting. The products used in such applications are generally fine-milled grades.

The replacement of the aluminum atom inplaces of the silicon atom, causing an imbalance in the charge, which is balanced by the addition of ions of k^{+},Na^{+} and Ca^{+2}



For this reason, the Feldspar is found in nature in three types:

1- Orthoclase ($K_2O.Al_2O_3.6SiO_2$)
2- Albite ($Na_2O.Al_2O_3.SiO_2$)
3- Anorthite ($CaO.Al_2O_3.2SiO_2$)

The importance of Feldspar in the ceramic industry is due to the following:

1- Feldspar is a disintegrated material when added to the raw materials of the ceramic material industry, reducing the ell toxic point to a lesser degree, and then increasing the liquid part and the low thermal grades
2- The Feldspar is cheap.
3- Since the process of formation of ceramic materials are treated with water in the case of preparation here shows the importance of Feldspar being insoluble in water, but it is possible to form a suspension.