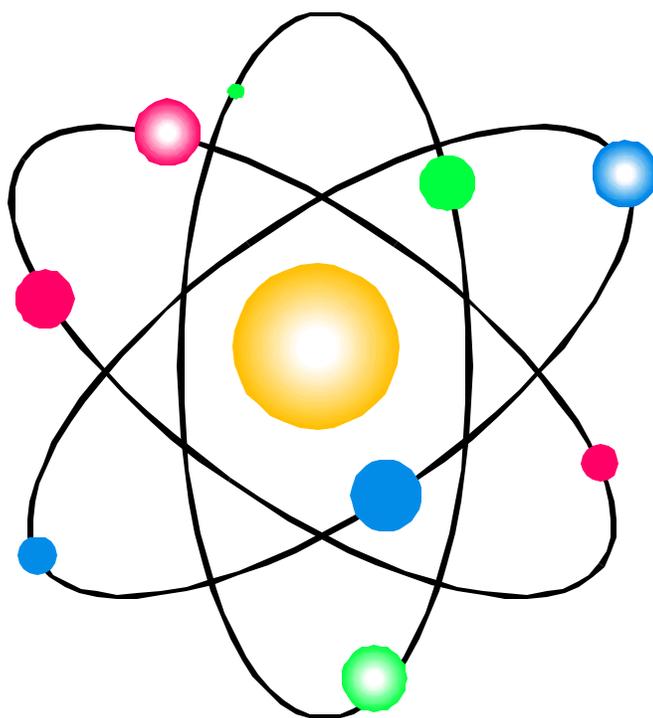


# MINERAL INFORMATION KIT



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## METALLIC MINERALS

- GOLD** = A soft yellow mineral, the native metallic element Au. Specific gravity of pure gold is 19.3. It is often naturally alloyed with silver, copper or other metals, and is found as nuggets and grains in gravel, and in veins associated with quartz
- = Crystals form as cubes or octahedra, but are rare. The usual habits are as grains, flakes, nuggets, and dendritic masses. The bright, rich yellow colour is resistant to tarnishing. Gold is opaque, and its lustre is metallic.

### Mode of Formation:

Forms mainly in hydrothermal veins, often associated with quartz and sulfides. It also occurs in place deposits of unconsolidated sand, and in sandstone and conglomerate. It is possible to find alluvial gold in grains or nuggets, in stream beds. Panning for gold by sifting the sediments is an age-old method of looking for this rare and valuable mineral. Gold can be confused with pyrite and chalcopyrite at first, but only a few tests are needed to identify it

### Economic Use / Usage

1. In jewelry
2. In dentistry - inlays, crowns, bridges and orthodontic appliances
3. In electronic devices, especially in printed circuits, board connectors, and mutualized circuitry.
4. Gold containing brazing alloys is important to aerospace industry especially in jet engine assembly.
5. As a reflector of infrared radiation in radiant heating and drying devices and heat insulating windows in large buildings.
6. For decoration of porcelain and glass dinnerwares; gold leaf is used for decoration of buildings; gold alloys are used in rupture disc in chemical process equipment.
7. For medallion, small bars and other similar items.
8. For monetary reserve.

- SILVER** = A soft white mineral; the native metallic element Ag. It is often alloyed with small amounts of gold and other elements. It occurs in stringers and veins and in the upper parts of silver-sulfide lodes.
- = Crystals are rare. They form as cubes and octahedra, sometimes in parallel bands. The usual habits are wires, scales, dendrites, and massive. Silver is silver white in color, though it tarnishes on exposure to the atmosphere. It produces a silvery white streak. Silver is opaque and the luster is metallic

### Formation:

Forms in hydrothermal veins, and in the oxidized regions of ore deposits, with gold, and other silver minerals, and metallic sulphides. Silver forms 20 to 25 percent of the gold and silver alloy, called electrum.

### Economic Use / Usage:

1. For the production of coins.
2. For the production of ornamental ware.
3. In the photographic industry.

4. In the electrical and electronic fields.
5. In the pharmaceutical industry, as a vital chemical for the manufacture of medicines.
6. In the food industry.
7. As silver plating for decorative purposes.

**COPPER** = A reddish or salmon-pink isometric mineral, the native metallic element Cu. It is ductile and malleable; a good conductor of heat and electricity, usually dull and tarnished; and formerly an important ore.

**Economic Use / Usage:**

Electrical - In the manufacture of electrical equipment, and supplies such as electric motors, generators, fans, blowers industrial control and related apparatus in electrical instruments. Construction - for roofing and plumbing materials; brass & bronze for decorative utilitarian items for public buildings and private home.

Machinery - in the production of non-electrical industrial machinery; for tubing in valves and distillation plants or sea water desalination.

Transportation - in the automobile industry; in railroad transportation, airplane manufacture and in marine appliances. For watches, clocks, microscopes, projectors, and popular materials in utensils, jewelry, and finishing and decorative items coins; as fungicide and insecticides; tin copper vessels for milk processing.

**IRON** = A heavy magnetic, malleable and ductile chemically active mineral, the native metallic element Fe. Native iron is rare in terrestrial rocks but common in meteorites. In combination with other elements, iron occurs in a wide range of ores and in most igneous rocks. It is the most widely used of the metals.

**Iron Ore** = Ferruginous rock containing one or more minerals from which metallic iron may be profitably extracted. The chief ores of iron consist mainly of the oxides; hematite ( $\text{Fe}_2\text{O}_3$ ); goethite ( $\text{FeO}(\text{OH})$ ); magnetite ( $\text{Fe}_3\text{O}_4$ ); and the carbonate, ( $\text{FeCO}_3$ ).

**Iron Formation:**

A chemical sedimentary rock, typically thin-bedded and/or finely laminated, containing at least 15% iron of sedimentary origin, and commonly containing layers of chert. The iron may be present as oxide, silicate, carbonate, or sulfide. Most iron formation is of Precambrian age. Cf: ironstone, jaspilite. Many terms are essentially synonymous, among them taconite, itabirite, banded hematite quartzite, banded iron formation, and calico rock.

**Economic Use / Usage:**

1. Shell of melting furnaces.
2. Production of various types of steel for industrial use.
3. Construction purposes (reinforcement bars).
4. Manufacture of ferro-alloys, high-density concrete aggregates, Ferrites, and a mineral additive to animals feeds.

**LEAD** = A soft heavy malleable isometric mineral; the native metallic element Pb. Lead rarely occurs in the native form, being found mostly in combinations, esp. galena.

= A soft heavy metal, malleable, but only slightly ductile, and the most corrosion resistant of the common metals. Refined lead is metallic lead from which all desired quantities of impurities have been removed by metallurgical processing; the minimum purity of refined lead is 99.85%

**Economic Use / Usage:**

1. In storage batteries (lead-acid) for automobiles/battery powered Vehicles. Lead storage batteries furnish emergency powers for hospitals, theaters and stores, and power for portable radios, tools, golf carts, lawn mowers and portable pumps. (Batteries in automobiles has got about 20 pounds of lead and have an average life expectancy of 2 to 3 years.)
2. As anti-knock additive in gasoline. Lead tetraethyl or tetramethyl improves performance of high compression engines by controlling the flame propagation rate. This results in more even combustion and greater efficiency.
3. In materials for construction. Lead sheets and foil in glass windows, walls of hospital x-ray rooms & structures containing nuclear activity. Lead waste piping and caulking is still required in many building codes and chemical plants.
4. Other uses such as in ammunition, paints and electrical cable sheathing.

**ZINC** = is a bluish-white metal with atomic weight of 65.37. Its characteristic properties are density, 7.13 grams per cubic centimeter at 25°C; melting point, 419.6°C; and boiling point; 907°C. It is chemically active and alloys readily with other metals. When it is produced from newly mined ores, it is termed primary zinc. But when zinc is produced from scrap or residues, it is termed secondary re-distilled or re-melt zinc, depending on the recovery process.

**Economic Usage :**

1. Zinc coating protects galvanized iron sheets against rust.
2. Zinc sheets are used for gutters, roofing and wash boards.
3. In chemical industry, it's used as reducing agent in the manufacture of certain dyes.
4. Precipitant for copper, arsenic, antimony & cadmium from zinc solutions.
5. Zinc anodes, zinc cyanides, and zinc oxides are useful in zinc electroplating.
6. Zinc in rods or thin sheets are used in dry batteries.
7. Zinc oxide, the white pigment that absorbs ultraviolet, reinforces the paint film when combined with drying oils, making it tough and flexible.
8. Yellow zinc chromate pigment, specified for primers, is used in light metals in aircraft construction.
9. Salt of zinc chloride is employed in textile plants for crimping wool.
10. Used in rubber manufacture in the form of stearate, laurate and oleate.
11. Zinc sulfate is widely used in agriculture as anti-fungicide spray in citrus cultivation.

**MANGANESE** = The term manganese ore is being used for those ores containing 35 percent or more manganese; Ferruginous manganese ore for those containing 10 to 35 % manganese; and manganiferous iron ore for those containing 5 to 10 percent manganese. Manganese deposits are normally associated with chert and occur as lenses in the basalt. The chert contains layers of manganese; although higher concentration is along the footwall of the manganiferous chert.

**Economic Usage/ Use:**

1. Used as an alloy in the manufacture of a special type of steel.
2. Used in the manufacture of dry-cell batteries, glasses, paints, pigments, dyes and fertilizer. Manganese is alloyed with copper for manufacture of manganese bronzes for ship propellers and other applications, and to produce other manganese-copper alloys. The manganese is introduced as electrolytic metal or as a master alloy made from the metal.
3. Manganese dioxide ores are used as oxidants in the production of hydroquinone, used chiefly in photographic developers, and in production of rubbers and plastics.
4. Manganese ores (carbonate ore), ferromanganese, manganese metal powder, and manganese chemicals are used in the manufacture of welding-rod coatings and fluxes.

**MOLYBDENUM** = is a silvery white metallic element having a specific gravity of 10.2 and a very high melting point. It has a good thermal conductivity and a corresponding low coefficient of thermal expansion. Like chromium and tungsten, which are in the same periodic chart group, molybdenum is characterized by the ability to function as both metal and a non-metal.

**Economic Use / Usage:**

1. Molybdenum is used in manufacturing of special alloy steels, because addition of it intensifies the effect of other alloying elements.
2. Molybdenum can replace tungsten wholly or in part. It increases the torsional tensile strength, as well as elasticity without decreasing the ductility of the steel.
3. Used for alloys, parts of jet engines and gas engines.
4. Used as plate element in radio and power valves; As electrodes in mercury vapor lamps.
5. Structural parts of missiles and rockets; air crafts and space systems.
6. As sodium molybdate, serves as blue dye for silk and wool.
7. Molybdenum disulfide is used in dry lubricant in the form of pastes, powder and spray or water suspension.
8. Molybdenum oxide is catalyst for hydrogenation of oil.
9. Molybdenum compounds are used as laboratory reagents, in ceramic manufacture, and in various types of manufacturing.

**URANIUM** = Uranium (U), atomic no.92 was discovered in the mineral pitchblende in Germany in 1789 and derives its name from the planet Uranus. It is the last member of the series of naturally occurring elements in the Periodic Table. Chemically, pure Uranium has a specific gravity of 19.05, almost that of gold. Uranium is highly reactive chemically. A fresh surface, silvery gray in color, rapidly oxidizes to black oxide in air at room temperature.

**Economic Use / Usage:**

1. Uranium is used as a nuclear fuel for power reactors; Also used in nuclear programs including weapons propulsion, underground tests, research and development, and in space applications.
2. Uranium is better suited than lead for gamma-ray, and x-ray shielding.
3. Depleted Uranium is particularly suitable for missile ballast, for control surface balancing and counterweights in aircraft and space vehicles and for payload simulation in test space vehicles.
4. Useful in military applications as equipment parts, ammunition & special purpose artillery shells.
5. In Chemicals used for ceramic and glass industries.
6. In catalysts used in plastic industries for acrylonitrile production.
7. Used as a colorant in glass and ceramics, and in steel and nonferrous metallurgy.

8. In electrical industry, used as targets in x-rays tubes, electrodes in ultraviolet light sources, and resistors in incandescent lamps.

**NICKEL** = is a silver white metal of medium hardness, highly malleable and ductile, and slightly magnetic. Nickel possesses great resistance to chemical atmospheric corrosion and transmits this property to its alloys.

=Nickel does not occur in the native state.

= Nickel is an important alloying metal used in all branches of the metal industry. It imparts to its alloys toughness, strength, and lightness, and anti-corrosion, electrical and thermal qualities.

#### **Economic Use / Usage:**

1. Used in Chemicals and Allied Products and Petroleum Refining and Allied Products: because of its ability to handle strong and caustic effect, and to resist saline corrosion.
2. Fabricated Metal Products. Metal products such as cutlery, hand tools, and general hardware to plate and sheet metal boilers, kettles and duct work.
3. Aircraft and Parts. In aircraft such as gas turbines, turbo super chargers, and jet engines; stainless steel, managing steel and alloy steel are used in airframes, and all electroplated parts of aircraft.
4. Motor Vehicles and Equipment. Buses vans and tank trucks whose bodies bear nickel.
5. Electrical Machinery, Equipment and Supplies. Such as glass-to-metal seals and transistors.
6. Household Appliances. Such as in stainless steel, and in electroplating.
7. Machinery, except Electrical.
8. General Building Construction.
9. Ship and Boat Building and Repairing.
10. Other uses such as, in salt form, its used as catalyst; hydrogenation of fats and oils; In batteries and fuel cells; In ceramics to form a bond between enamel and iron.
11. Marketed in the form of nickel cathodes, powder, briquettes, pellets, ingots and shot.
12. Used in monetary exchange in the form of coins; manufacture of tableware, musical and dental instruments, jewelry & some physical and chemical laboratory wares.

**CHROMITE** = A brownish-black to iron-black mineral of the spinel group:  $(Fe, Mg)(Cr, Al)_2O_4$ . It occurs in octahedral crystals as an accessory mineral and basic and ultrabasic igneous rocks. It also occurs massive and in detrital deposits. Chromite is the most important ore of chromium.

= The crystals are octahedral, but rarely occurs. The usual habits are massive, granular, or modular. Chromite is black to brownish-black, and the streak is dark brown. The mineral is opaque, and has a metallic lustre with hardness of 5.5 and a specific gravity of 4.5 to 4.8. Its melting point is 15 to 45° C to 1730 °C.

#### **Economic Use / Usage:**

1. Transportation – automotive trim and appliances
2. Construction - for roofing
3. In leather tanning, textile dyes, catalyst, wood and water treatment, metal treatment (corrosion and inhibitor), drilling material.
4. Fabricated metal product – as molding material in foundries in the production of metal casting;
5. In iron and steel processing glass making in stainless steel and for cements processing.

**TITANIUM AND VANADIUM** – are commonly associated with each other and other metals. These mineral sands which resulted from the weathering of in-land host rocks are made available for beach concentration through the combined action of water and gravity.

**Economic Use / Usage:**

TITANIUM

1. Used as a minor alloy for steel; as coatings of welding rods.
2. Used dominantly as pigment mineral in toilet articles, linoleum, artificial silk, white ink, colored glass, pottery glazes.
3. For tinting artificial teeth.
4. For dyeing leather and cloth.

VANADIUM

1. Used as an alloy to toughen steel
2. Desired for axles, piston, crankshafts, and pins
3. Used where strain, shocks fatigue are involved
4. Increasingly used as a catalyst, replacing platinum, in electrical, chemical, ceramic, paint, dye and printing industries.

**PYRITE** = A common yellow isometric mineral  $FeS_2$ . It is dimorphous with marcasite, and often contains small amounts of other metals. Pyrite has a brilliant metallic luster and an absence of cleavage, and has been mistaken for gold (which is softer and heavier) It commonly crystallizes in cubes, octahedrons or pyritohedrons. Pyrite is the most widespread and abundant of the sulfide minerals and occurs in all kinds of rocks. It is an important ore of sulfur.

= Any of the various metallic-looking sulfides, of which pyrite (“iron pyrites”) is the commonest. The term is used with a qualifying term that indicates the component metal; e.g. “copper pyrites” (chalcopyrite) when used popularly and without qualification, the term usually signifies pyrite.

**Economic Use / Usage:**

1. Mined for associated gold and copper
2. Burned in making sulfur dioxide
3. For making sulfuric acid

## NON-METALLIC

**CLAY** = A detrital mineral particle of any composition having a diameter less than 1/256 mm. (4 microns).

This is approximately the upper limit of size of particle that can show colloidal properties .

= An earthy, extremely fine grained sediment or soft rock composed primarily of clay size or colloidal particles, having high plasticity and a considerable content of clay minerals. Clays maybe classified by use, origin & mineral composition.

= Kaolin – or “China Clay” is defined as a white, clay-like material approximating the mineral kaolinite. It has a specific gravity of 2.6 and fusion point of 1,785°C. The other Kaolin group minerals such as hallocite and dickite are encompassed.

### **Economic Use / Usage:**

1. Used in manufacture of pottery, earthenware, china, cooking ware, vases, ornaments, plumbing fixtures, porcelain, stoves, tiles, linoleum, wall-paper, oil clothes, scouring soap, bricks and refractory wares.
2. Adulterant in foods, filler in paper
3. Used in building construction materials
4. Used in electrical and rubber industries.

#### a) Kaolin

1. in paper products
2. paints
3. rubber

#### b) Silica

1. in saniwares/white wares

#### c) Refractory Clay

1. in commercial refractory products, such as fire bricks, blocks of many shapes, bricks, saggars, refractory mortars & mixes.

#### d) White Clay

1. Construction – component in the manufacture of wide variety of construction materials

**BENTONITE** = A soft plastic light-colored clay formed by chemical alteration of volcanic ash. It is composed alteration of volcanic ash. It is composed essentially of montmorillonite and related minerals of the smectite group. The properties of bentonite depend largely on its ion-exchange characteristics.

= is a clay consisting essentially of smectite minerals (montmorillonite group according to some usages). The swelling type has a high sodium ion concentration and will increase materially in volume when wetted with water, whereas, the non-swelling types are usually high in calcium. Standard grades of swelling bentonite increase from 15 to 20 times their dry volume.

**Economic Use / Usage:**

1. Oil refining
2. Drilling and foundry sand
3. Bonding; sealing agent
4. In making detergents
5. In making ceramic glazes & enamels

**FULLERS'S EARTH** = A clay possessing a high adsorptive capacity , consisting largely of montmorillonite or palygorskite. It is extensively used as an adsorbent in refining and decolorizing oils and fats, and is a material bleaching agent.

= The term has neither a compositional or mineralogical connotation. The substance is defined as a non-plastic clay or clay-like material, usually high in magnesia, that has adequate decolorizing and purifying properties.

**Economic Use / Usage:**

1. Swelling sodium bentonites are used largely in drilling muds, in foundry sands
2. In pelletizing taconite iron ores.

**DIATOMACEOUS EARTH** – or Diatomite

= A light colored soft siliceous sedimentary rock, consisting chiefly of opaline fustules of the diatom. Owing to its high surface area absorptive capacity, and chemical stability, diatomite has a number of uses.

= Chemically, diatomite is essentially amorphous hydrated or opaline silica with varying amounts of contaminants such as silica sand, clay materials, metal salts and organic matter.

**Economic Use / Usage:**

1. Filtration is the major end-use of diatomite
2. Used as soft abrasives, industrial fillers, and light weight aggregates.
3. As filler or extender, is being used in paint asphalt products, paper and plastics where bulk is needed with minimum weight.
4. When anti-caking, good absorbency, and mild abrasiveness are desired;
5. As catalyst carriers utilized in petroleum refining; hydrogenation of oils, and acid manufacturing, carrier for insecticides.
6. Anti-caking agents for fertilizers and explosives, soft abrasives.
7. A source for highly reactive silica, lightweight aggregates, pozzolans, and soil conditioners.

**LIMESTONE** = A sedimentary rock consisting chiefly of the mineral calcite (calcium carbonate,  $\text{CaCO}_3$ ) with or without magnesium carbonate. Common impurities include chert and clay, limestone is the most important and widely distributed of the carbonate rocks and is the consolidated equivalent of limy mud, calcareous sand, , and/or shell fragments. It yields lime on calcination.

**Economic Use / Usage:**

1. As building stone, for residential exteriors
2. For cement manufacture
3. For metallurgical use. It serves as a flux or an additive used to lower fusion temperature of the metal;
4. It is basic ingredient in glass making, pH regulators and classifiers and chemical additive.
5. In agriculture – to lower soil acidity which maybe inherent in the soil or develop from the repeated use of chemical fertilizers and other agricultural inputs.
6. As a source of lime which maybe used for medicinal purposes, insecticides, plants and animal foods, gas absorption, precipitation dehydration and causticising.

**MARBLE**= A metamorphic rock consisting predominantly of fine- to coarse-grained recrystallized calcite and/or dolomite.

= In commerce, any crystallized carbonate rock, including true marble and certain types of limestone (orthomarlble), that will take a polish and can be used as architectural or ornamental stone.

= verd antique

**Economic Use / Usage:**

1. For building purposes – as seen in commercial buildings, churches, cemeteries and in private homes either as floorings, wallings, altar fronts or decorative slabs.
2. Some are made as tables, mortars, picture frames, ashtrays, engraving names & novelty items.

**DIMENSION STONE** = Stone that is quarried or cut in accordance with required dimensions.

**Economic Use / Usage:**

1. Used for commercial purposes like marble and adobe
2. In buildings for example in floorings, walls, used as broken aggregated such as crushed stone.
3. Novelty items

**SULFUR** = An orthorhombic mineral, the native non-metallic elements. It occurs in yellow crystals at hot Springs and fumaroles, and in masses or layers associated with limestone, gypsum and anhydrite, esp. in salt-dome caprock and bedded deposits.

= The crystal forms of the mineral are tabular by pyramid. Sulfur also occurs in massive, encrusting powdery and stalactitic habits. It is bright lemon-yellow to yellowish brown and the streak is white. Sulfur is transparent to translucent and has a resinous to greasy lustre.

**Economic Use / Usage:**

1. In agriculture, for the manufacture of phosphatic fertilizers
2. In industrial, for manufacturer of plastic and products including acetate, cellophane, crayon, fibers and textiles;
3. For metallurgical use, in the extraction of metal occurring in deposits mine dumps and waste.
4. Iron & Steel Production – as pickling agents to remove mill scale, rust dust and grease from the surface of steel products prior to further processing.

5. In the manufacture of woodpulp, carbon disulfide, insecticides and the fungicides, bleaching agents and dyestuffs and rubber vulcanization. Another intermediate product that is very much important is the sulfuric acid.
6. In paper products – used in the manufacture of woodpulp by the sulfate process.
7. Explosives – directly used as sulfuric acid, in the manufacture of explosives, and related nitrate processes. In incendiary weapons.
8. Paints – sulfuric acid process for the reproduction of titanium dioxide pigments
9. In petroleum Refining – associated chemical processes.
10. As fumigant, medicine, and incense in exotic religious rites.

## **SAND AND GRAVEL**

**SAND** = A detrital particle smaller than a granule and larger than a silt grain, having a diameter in the range of 1/6 to 2 mm.

**GRAVEL** = An unconsolidated natural accumulation of rounded rock fragments, mostly of particles larger than sand (diameter greater than 2mm.), such as boulders, cobbles, pebbles, granules or any combination of these; the unconsolidated equivalent of a conglomerate.

= A popular term for detrital sediment along streams or beaches, composed chiefly of pebbles and sand.

= An engineering term for rounded fragments with diameters in the range of 4.76 mm. To 76 mm (3in.)

### **Economic Use / Usage:**

1. Construction – as material for concrete aggregate blasting, felling and hollow blocks making.
2. Infrastructure projects – like bridges, roads, dams, airfields and others.

**QUARTZ** = Crystalline silica, an important rock – forming mineral, SiO<sub>2</sub>. It is next to feldspar, the commonest mineral, occurring either in transparent hexagonal crystals or in crystalline or cryptocrystalline masses. Quartz is the commonest gorgue mineral of ore deposits, forms the major proportion of most sands, and had a widespread distribution in igneous (esp. granitic) metamorphic fracture, an absence of cleavage and a hardness on the moh's scale

= one of the most common minerals, quartz forms hexagonal prisms, terminated by rhombohedra, or pyramidal shapes. Quartz faces are often striated, and the crystals twinned and distorted. It also occurs in massive, granular, concretionary, stalactitic and cryptocrystalline habits. The coloring is amazingly variable, and quartz maybe white, gray, red, purple pink, yellow, green, brown and black, as well as being colorless. It is also the source of a wide variety of semi-precious gemstones. The streak is white. Quartz is a transparent to translucent mineral, and it has a vitreous luster on fresh surfaces.

### **Economic Use / Usage:**

1. Used in Timing Devices – quartz controlled clocks and watches are increasingly popular due to their extreme accuracy
2. Traditionally used in Oscillators, filter plates, and telephone resonators.
3. Electronic – grade quartz crystals are used for the production of crystal units to production of crystal units to provide accurate frequency control for radio transmitters, radio frequency telephone circuits, and crystal controlled chronographs, and emission counters.

4. Quartz and other piezoelectric materials are used electrostrictively as transducers to convert electrical forces into mechanical forces, as in loudspeakers and supersonic operators.
5. Optical purposes such as prisms, wedges, lenses.

**SILICA SAND** = An industrial term for a sand or an easily disaggregated sandstone that has a very high percentage of quartz. It is a source of silicon and a raw material of glass and other industrial products.

**Economic Use / Usage:**

1. As an additive – in the manufacture of portland cement.
2. In manufacturing industry – a component and glass envelope for electric bulbs, ferrosilicon, sodium silicate cleanser and abrasives.

**FLINT CLAY** = A smooth, flintlike microcrystalline clay rock composed dominantly of Kaolin, which breaks with a pronounced conchoidal fracture and resists staking in water. It becomes plastic upon prolonged grinding in water.

**Economic Use / Usage:**

1. Used as materials for crockery, like the coal-stoves.
2. Used as weapon during the medieval age.

**PHOSPHATE ROCK** = Any rock that contains one or more phosphatic minerals, esp. apatite, of sufficient purity and quantity to permit its commercial use as a source of phosphatic compounds or elemental phosphorus. About 90% of the world's production is sedimentary phosphate rock, or phosphorite; the remainder is igneous rock rich in apatite.

**Economic Use / Usage:**

1. Used in phosphorous and phosphoric acid for making phosphorous compounds.
2. In the iron and steel industry – rust proofing
3. In the manufacturing industry – safety matches, vermin exterminators, fireworks
4. In military paraphernalia – shells, grenades, tracer bullets, smoke screens, distress signals
5. Consumer goods – softdrinks, self-rising flour, yeast, table salt, beverage acidulants
6. In medical world – as medicines
7. In photography
8. In ceramics
9. Construction – in cements
10. Livestock & poultry – as feeds
11. In agriculture – fertilizer

**GUANO** = A phosphate or nitrate deposit formed by the leaching of bird excrement accumulated in arid regions, e.g. islands of the eastern Pacific Ocean and the West Indies. It is processed for use as a fertilizer.

= similar deposits of bat excrement, found in caves and worked for phosphate or nitrate.

**Economic Use / Usage:**

1. Agriculture – as fertilizer in forms
2. Aquatic ventures – esp. in fishponds

**PERLITE** = A volcanic glass having the composition of rhyolite, aperlitic structure and a generally higher water content than obsidian.

**Economic Use / Usage:**

1. Construction – in acoustical plaster and tiles, charcoal, barbecue, bases, insulation board filler, loose-fill insulation, packaging medium and light weight insulating concrete for roof deck and wall core filler.
2. Filter media – as filter aide by breweries to filter algae and bacteria, by water companies to make water potable and safe for human and animals.
3. Other industries – in processing of fruit juices, syrups, sugar waxes, plastic lacquers, antibiotics and countless other products.
4. Agriculture – for propagating cutting of plants; soil conditioning, carriers for insecticides and chemical fertilizers.
5. Others uses – for fire proofs structural steel construction, for masonry and floor wall tiles, as filler to add bulk to paper and paints, to clean up effluents containing only wastes, and as additive in molding sands.

**GYPSUM** = A widely distributed mineral consisting of hydrous calcium sulfate:  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ . It is the Commonest sulfate mineral, and is frequently associated with halite and enhydrite in evaporites, forming thick, extensive beds, esp. in rocks of Permian and triassic age.

= Crystals are tabular, and diamond-shaped. Twinning is common. Gypsum also occurs in massive granular (alabaster), and fibrous ( satin spar) habits. Rosette- shaped masses are called desert roses, and radiating forms are termed daisy gypsum. It varies from colorless, to white, grey, greenish, yellowish, brownish, and reddish. The streak is white. It is transparent (selenite) to opaque, with a vitreous luster (pearly on cleavages); fibrous forms may be silky, massive forms are often dull.

**Economic Use / Usage:**

1. Construction – an ingredient in the making of cement. Prefabricated products- used for interior walls, partition and ceiling.
2. Agriculture – to neutralize alkaline and saline soils
3. Manufacturing Industry – ingredient in making paints, crayons, insecticides & others
4. Production of plaster of Paris; for embedding plate glass and decorative stones.