

CHAPTER 6

6.1 Minerals Found In The Earth's Crust

- mineral : is a naturally occurring solid element or compound with a definite crystalline structure and chemical composition.
- natural elements : gold, silver (argentum), platinum and mercury.
- natural compounds : oxides, carbonates, sulphides and silicates.

Elements That exist in some natural compounds

Natural Mineral	Mineral Content	Elements In The Minerals
Bauxite	Aluminium oxide	Aluminium, oxygen
Cassiterite	Tin oxide	Tin, oxygen
Hematite	Iron oxide	Iron, oxygen
Magnetite	Magnesium carbonate	Magnesium, carbon, oxygen
Malachite	Copper carbonate	Copper, carbon, oxygen
Limestone/ marble / calcite	Calcium carbonate	Calcium, carbon, oxygen
Galena	Lead sulphide	Lead, sulphur
Pyrite	Iron sulphide	Iron, sulphur
Chalcocite	Copper sulphide	Copper, sulphur
Kaolin (clay)	Aluminium silicate	Aluminium, silicon, oxygen
Mica	Potassium aluminium silicate	Potassium, aluminium, silicon, oxygen

Properties of Mineral

1. Hardness of minerals

- The hardness of a mineral refers to its resistance on being scratched.
- The hardness of a mineral is measured in **Mohs**.
- Generally, all metal oxides, sulphides and carbonates are hard minerals

2. The solubility of minerals in water

- Most metal oxides, metal sulphides and metal carbonates do not dissolve in water. Except for potassium and sodium compounds.

3. Effect of heat

Metal oxides	Metal sulphides	Metal carbonates
<ul style="list-style-type: none"> most metal oxides are stable and do not decompose when they are heated except oxides formed by non-reactive metals such as gold, mercury and silver <p style="text-align: center;">heat</p> <p>» silver oxide → silver + oxygen</p> <p style="text-align: center;">heat</p> <p>» mercury oxide → mercury + oxygen</p>	<ul style="list-style-type: none"> When heated, sulphides will decompose into metal oxides and sulphur dioxide <p style="text-align: center;">heat</p> <p>» metal sulphide + oxygen → metal oxide + sulphur dioxide</p> <p style="text-align: center;">heat</p> <p>» iron sulphide + oxygen → iron oxide + sulphur dioxide</p> <ul style="list-style-type: none"> Sulphur dioxide can be tested with <ol style="list-style-type: none"> Acidified potassium manganate(VII) solution (purple→colourless) Acidified potassium dichromate(VI) solution (orange→green) 	<ul style="list-style-type: none"> Heat decomposes metal carbonate into metal oxide and releases carbon dioxide <p style="text-align: center;">heat</p> <p>» metal carbonate → metal oxide + carbon dioxide</p> <p style="text-align: center;">heat</p> <p>» zinc carbonate → zinc oxide + carbon dioxide</p> <ul style="list-style-type: none"> carbon dioxide can be tested by passed through clear limewater, the limewater turns milky. sodium carbonate and potassium carbonate are stable and do not decompose by heat

6.2 Reactions Between Metals And Non-metals

Reactions between metals & oxygen	Reactions between metals & sulphur
<ul style="list-style-type: none"> Most metal, except mercury, silver and gold, combine with oxygen to form metal oxides when heated. <p style="text-align: center;">heat</p> <p>» metal + oxygen → metal oxide</p> <p style="text-align: center;">heat</p> <p>» zinc + oxygen → zinc oxide</p> <ul style="list-style-type: none"> Different metals have different reactivity with oxygen Potassium manganate(VII) crystals is heated to supply oxygen. Glass wool prevents the Potassium manganate(VII) crystals from mixing with metal filings 	<ul style="list-style-type: none"> when metals react with sulphur, metal sulphides are formed. <p style="text-align: center;">heat</p> <p>» metal + sulphur → metal sulphide</p> <p style="text-align: center;">heat</p> <p>» lead + sulphur → lead sulphide</p> <p style="text-align: center;">heat</p> <p>» iron + sulphur → iron sulphide</p> <ul style="list-style-type: none"> Different metals have different reactivity with oxygen

6.3 Silicon Compounds

Silica

- Silicon + Oxygen → silicon dioxide / silica
- Examples: sand, sandstone, flint, quartz

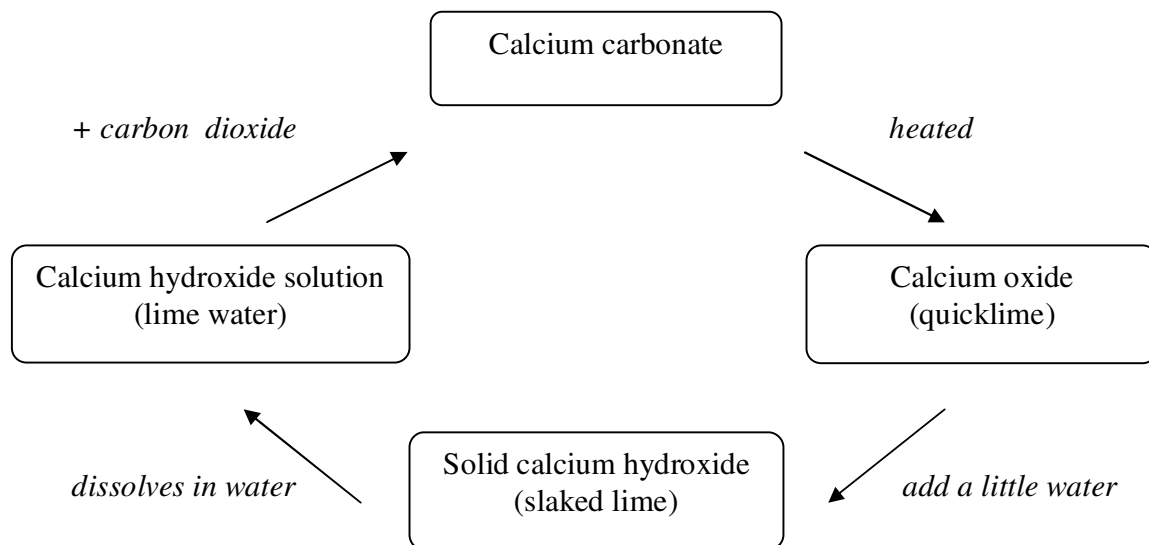
silicate

- Silicon + metal + Oxygen → silicate
- Examples: clay, mica, feldspar, asbestos, jade, ruby, topaz, emerald

Characteristics of Silicon Compounds

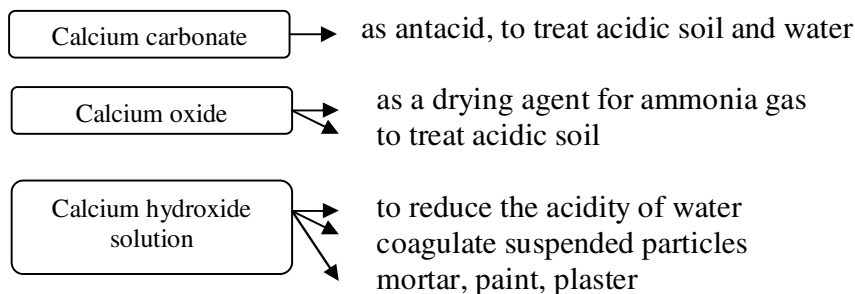
- Silica and silicate are very stable
 - » insoluble in water
 - » do not decompose when heated
 - » do not react with acid
- Sodium silicate dissolve in water
- Acidic silica dissolves in alkali to produce silicates

6.4 Calcium Compounds



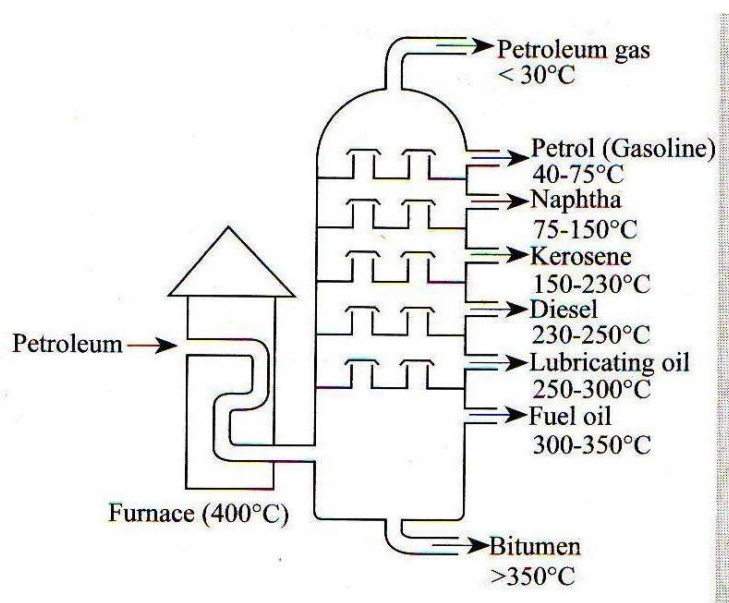
1. Calcium carbonate → calcium oxide + carbon dioxide
2. Calcium oxide + water → solid calcium hydroxide
3. Solid calcium hydroxide + water → calcium hydroxide solution
4. calcium hydroxide + carbon dioxide → calcium carbonate + water

Uses of Calcium Compounds



6.5 Natural Fuel Resources And Their Importance

- Petroleum, natural gas and coal are classified as fossil fuels.
- Fossils are the remains of dead plants and animals that have been buried in the ground for millions of years.
- Petroleum consists of a mixture of hydrocarbon compounds consisting of hydrogen and carbon atoms only.
- The various hydrocarbon compounds can be separated through fractional distillation.
- The different types of hydrocarbon can be distilled because they have different boiling points.
- The higher the boiling point of a petroleum fraction,
 - a. The darker its colour will be
 - b. The more viscous the fraction will be.
 - c. The more difficult it burns.
 - d. The more soot the flames produce.
- Uses of various fractions of petroleum.



Distillation Product	Use
Petroleum gas	For heating
Petrol	As fuel at the oil refinery and for cars
Naphtha	To make solvent, pesticides and as a base material in petrochemical industries
Kerosene	As fuel for aircraft
Diesel oil	As fuel for buses and taxis
Lubricants	For machines
Fuel oil	For ships and power stations
Bitumen	For road surfacing