Construction Material

Semester- 3rd

Contents:

- Classification of stones
- Rocks & it's types
- Bricks & it's classification
- Cement & it's composition
- Paints and it's composition

- *Construction planning* is a fundamental and challenging activity in the management and execution of construction projects.

Classification of stones :

- The term rock is commonly defined as a hard mass of mineral matter having, as a rule, no definite external form.
- The word stone is applied indiscriminately to all classes of hard rocks.

Description of Classes:

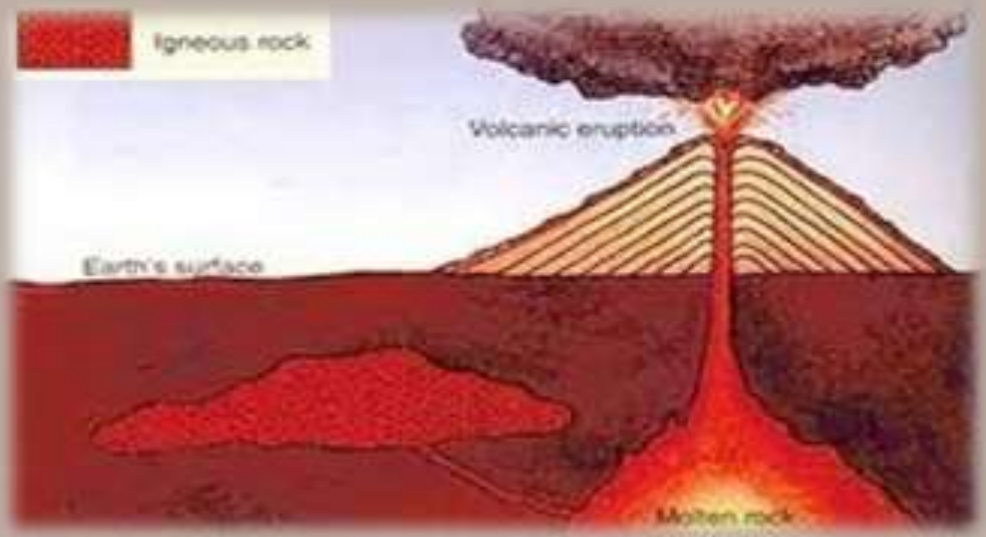
Rocks are classified as follows:

1. According to geological origin-
   Igneous, Sedimentary and Metamorphic
2. According to the physical form-
   Stratified, Unstratified and Foliated.
3. According to their chemical composition–
   Silicious, Argillaceous and Calcerous.

GEOLOGICAL CLASSIFICATION:

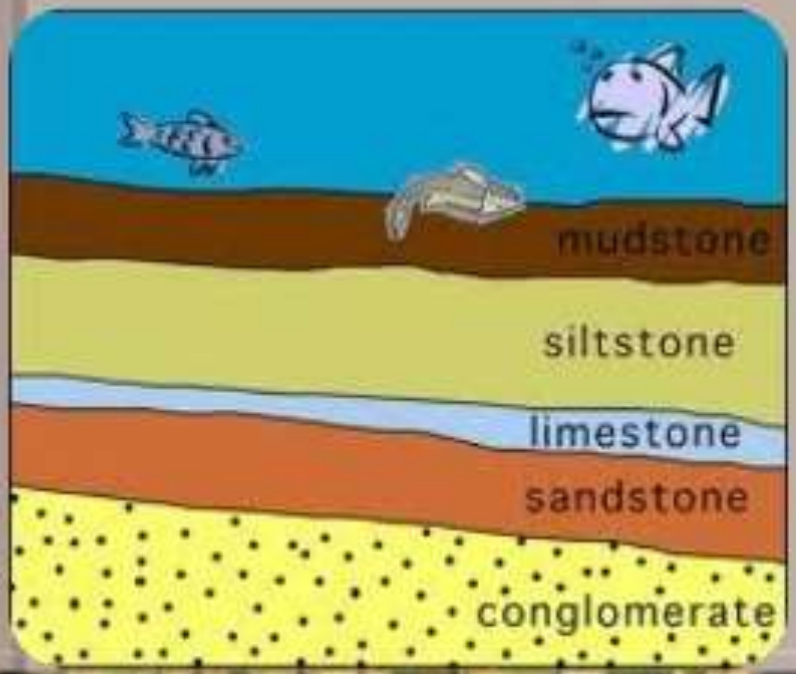
IGNEOUS ROCK:

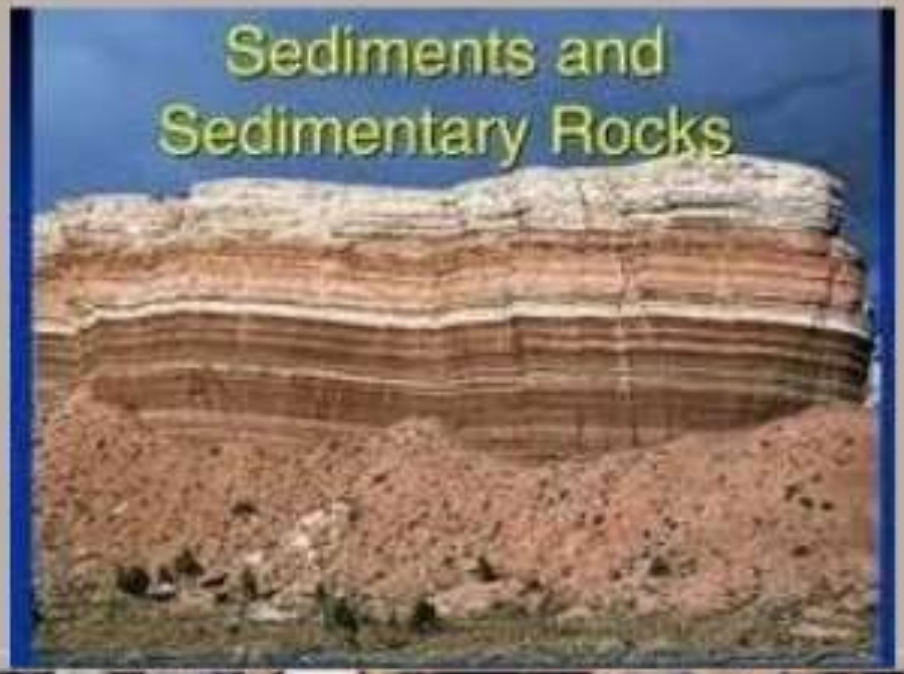
- Igneous Rock, rock formed when molten or partially molten material, called magma, cools and solidifies. The inner layers of the earth are at a very high temperature causing the masses of silicates to melt.



SEDIMENTARY ROCKS:

- Sedimentary rocks are types of rock that are formed by the deposition and subsequent cementation of that material at the Earth's surface and within bodies of water.





METAMORPHIC ROCKS:

- Metamorphic Rock is a type of rock formed when rocky material experiences intense heat and pressure in the crust of the earth. This change from one mineral assemblage to another is called metamorphism.

Physical Classification of Rocks:

Based on the structure, the rocks may be classified as:

1. Stratified rocks
2. Unstratified rocks

Stratified Rocks:

The layering that occurs in most sedimentary rocks and in those igneous rocks formed at the Earth's surface, as from lava flows and volcanic fragmental deposits. The layers range from several millimeters to many meters in thickness and vary greatly in shape

Unstratified:

These rocks are not stratified. They possess crystalline and compact grains. They cannot be split in to thin slab. Granite, trap, marble etc. are the examples of this type of rocks.

Foliated rocks:

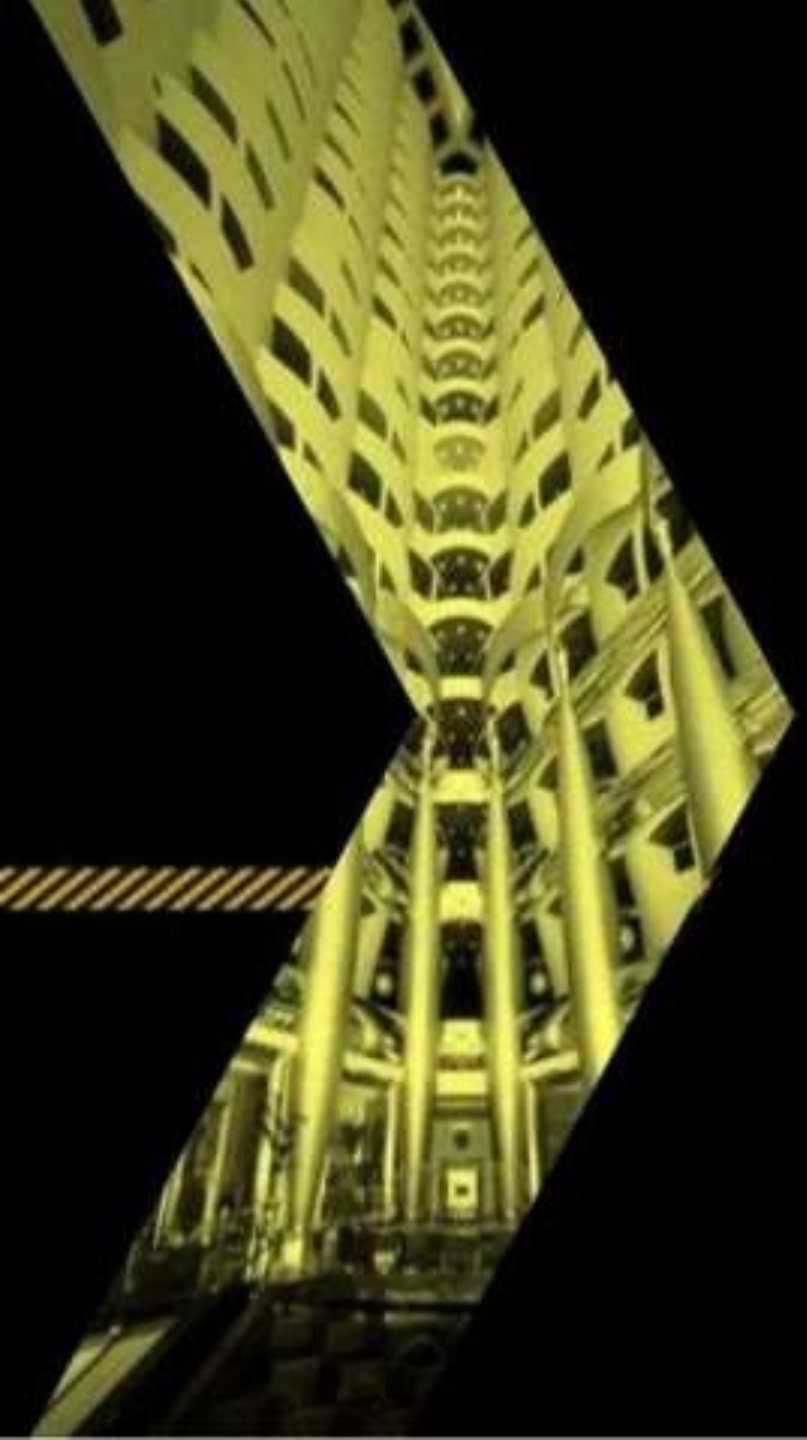
Metamorphic rock is formed when existing rock (whether it is sedimentary, igneous, or another metamorphic rock) is changed by intense pressure and temperature. Typically, this happens deep within the Earth, or near volcanoes.

BRICKS

A small rectangular block typically made of fired or sun dried clay, used in building and other construction.

It Has Two Main Types On The Basis Of Size And Dimensions:-

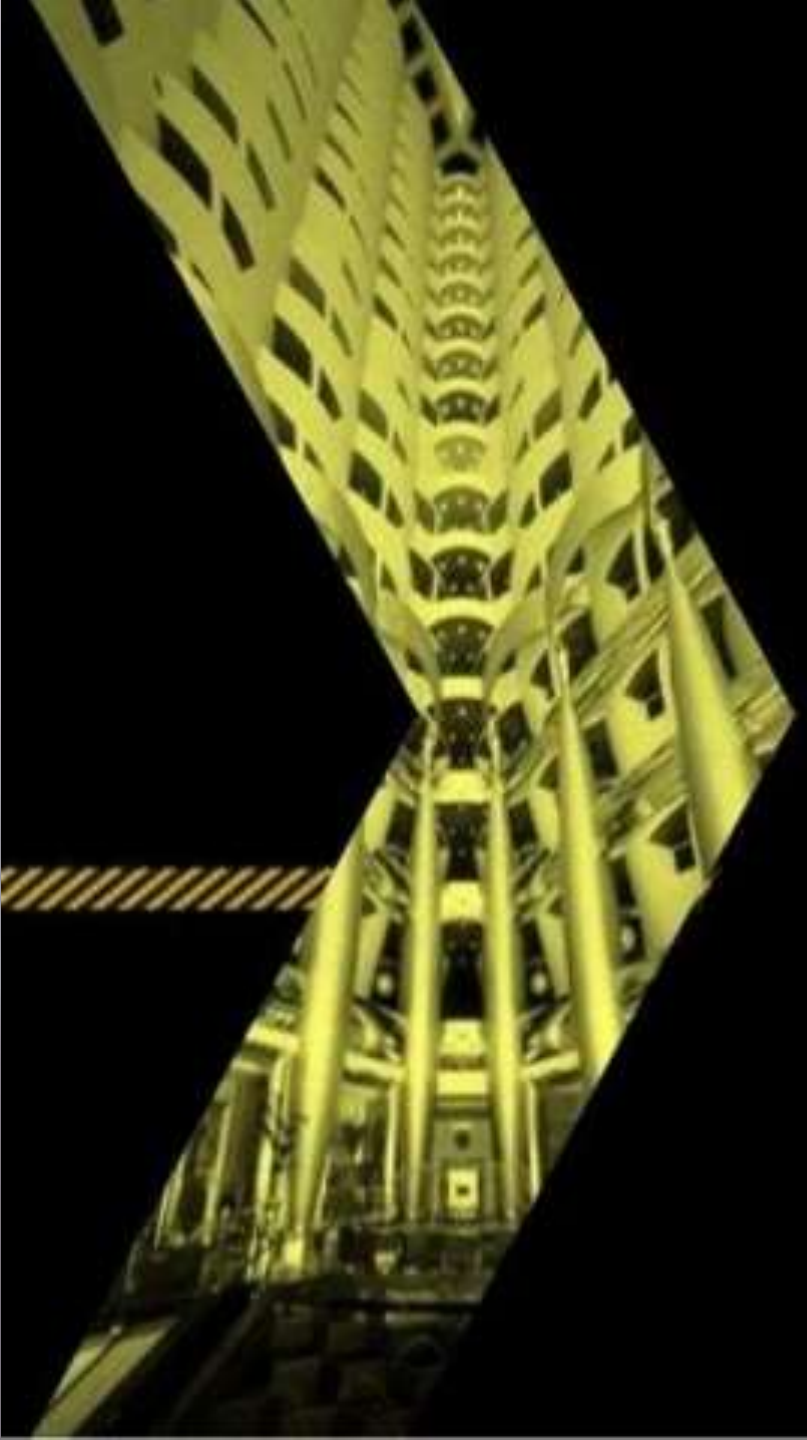
- Modular Bricks
- Traditional Bricks



Traditional Bricks

The Dimension Of Traditional Bricks

Varies From 21 To 25 Cm In Length
&
From 10 To 30 Cm In Width
&
From 7.5 To 1 Cm In Height



Modular Bricks

Indian Standard Institution Has Suggested Uniform Brick Size Is Known As Modular Brick.

The Actual Size Is 19 ¬ 9 ¬ 9 Cm

Classification Of Bricks On The Basis Of Manufacturing Quality

1. First class bricks
2. Second class bricks
3. Third class bricks
4. Fourth class bricks

FIRST CLASS BRICKS

- MADE OF GOOD EARTH WHICH IS FREE FROM SALINE DEPOSITS AND ARE SAND MOLDED.
- BURNT THOROUGHLY WITHOUT BEING VITRIFIED AND HAVE DEEP RED, CHERRY AND COPPER COLOR.

SECOND CLASS BRICKS

- They shall be well burnt or slightly over burnt.
- They must give clear ringing sound when struck.
- The may have slight irregularities in size, shape and color.
- The minimum crushing strength of second class brick should be 70 kg per sq cm

THIRD CLASS BRICKS

- THESE BRICKS ARE SLIGHTLY UNDER BURNT OR OVER BURNT.
- THEY ARE NOT UNIFORM IN SHAPE, SIZE AND EDGES.
- THEY SHALL NOT OBSERVE WATER MORE THAN 25% OF THEIR OWN DRY WEIGHT AFTER 24 HOURS, IMMERSION IN COLD WATER.
- THEY HAVE SOME SIGNS OF EFFLORESCENCE

FOURTH CLASS BRICKS

- These are over burnt bricks which are dark in colour and are irregular in size and shape.
- These are used as aggregate in concrete and for flooring.
- Over burnt bricks are not used for building construction

Cement

- Binding Material
- Provide strength to concrete with a process called Hydration
- The ready mix of cement consist of silicate and aluminate of lime.
- Consist of seven major ingredients:-

A.) Hydrated Lime (60%-67%) CaO:- Provide strength and responsible for hydration

B.) Silica (17%-25%) SiO_2:- Provide Strength to cement due to formation of dicalcium Silicate & tricalcium Silicate

C.)Alumina (3%-8%)Al_2O_3:- Resistance against high temperature/control of temperature.

D.) Magnesia(0.1%-4%)MgO:- Responsible of Hardness

E.) Iron Oxide (0.5%-6%)FE_2O_3:-Responsible for Strength and Color of Cement

F.) Sulpher Trioxide (1%-2.25%)SO_3:- Responsible of Setting time of Cement

G.) Alkalies (Soda and Potash):- 0.1% to 1%

Types of Cement

Type	Classification	Characteristics	Applications
Type I	OPC BS EN-197-1:2000 ASTM C-150-94	Fairly high C_3S content for good early strength development Not more than 10% by weight particles will retain on BS Sieve No. 170 Chemical composition: C_3S-**tricalcium silicate**=50% (Responsible for Final setting time, produce heat) C_2S-**dicalcium silicate**=25% (Responsible for final setting time) C_3A-**tricalcium aluminate**=12% (Responsible for initial setting time and quick setting time, produce heat) C_4AF-**tetracalcium aluminoferrite**=8% (Responsible for initial setting time and quick setting time)	General construction (most buildings, bridges, pavements, precast units, etc)
Type II	Moderate sulfate resistance BS EN-197-1:2000 ASTM C-150	Low C_3A content (<8%) Chemical composition C_3S=45% C_2S=29% C_3A=6% C_4AF=12%	Structures exposed to soil or water containing sulfate ions
Type III	Rapid Hardening Cement BS EN -197-1	Grind more finely, provide more heated with high temperature in factory may have slightly more C_3S Not more than 5% by weight particles will retain on BS Sieve No. 170 Chemical composition C_3S=60% C_2S=12% C_3A=12% C_4AF=8%	Rapid construction, cold weather concreting
Type IV	Low heat of hydration (slow reacting) BS 1370-1979	Low content of C_3S (<50%) and C_3A<5% More amount of C_2S Chemical composition C_3S=30% C_2S=46% C_3A=5% C_4AF=12%	Massive structures such as dams. Now rare.
Type V	High sulfate resistance BS-4027-1996	Very low C_3A content (<5%) Chemical composition C_3S=43% C_2S=36% C_3A=4% C_4AF=12%	Structures exposed to high levels of sulfate ions
White	White color	No C_4AF, low MgO	Decorative (otherwise has properties similar to Type I)

Tests of Cement

A.) Fineness Test:- to check the particles grinding

Equipment used: BS Sieve No.170

B.) Consistency Test: To Check the %age of water required for Cement Paste

Equipment Used: Vicat Apparatus

C.) Setting Time Test: to check Initial and Final setting time of Cement

Equipment Used:- Vicat Apparatus

D.) Soundness Test: to check the changes in volume of cement paste after setting time.

Equipment Used: Le Chateller Apparatus

E.)Compression Test

F.) Tensile Test

Values for Compression strength of Cement

- Ordinary Portland Cement

3 Days= 112.7 kg/m^2

7 Days=176 kg/m^2

- Rapid Hardening Cement

3 Days= 211.3 kg/m^2

7 Days=264.1 kg/m^2

Values for Tensile strength of Cement

- Ordinary Portland Cement

3 Days= 21 kg/m^2

7 Days=26 kg/m^2

- Rapid Hardening Cement

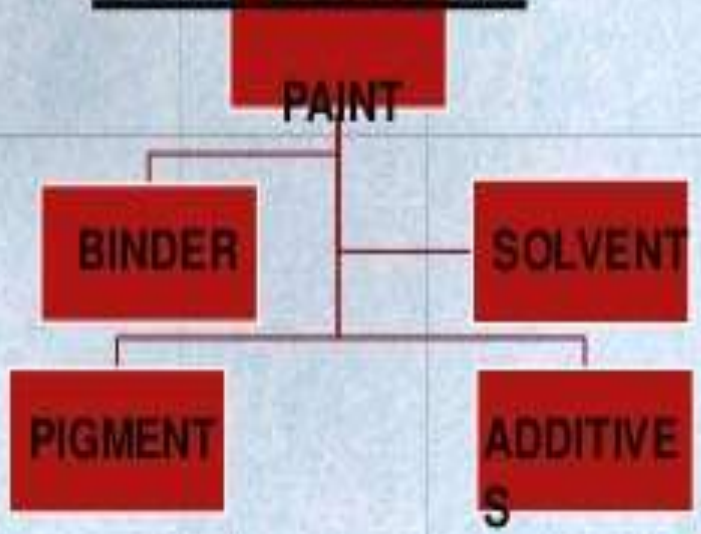
3 Days= 21 kg/m^2

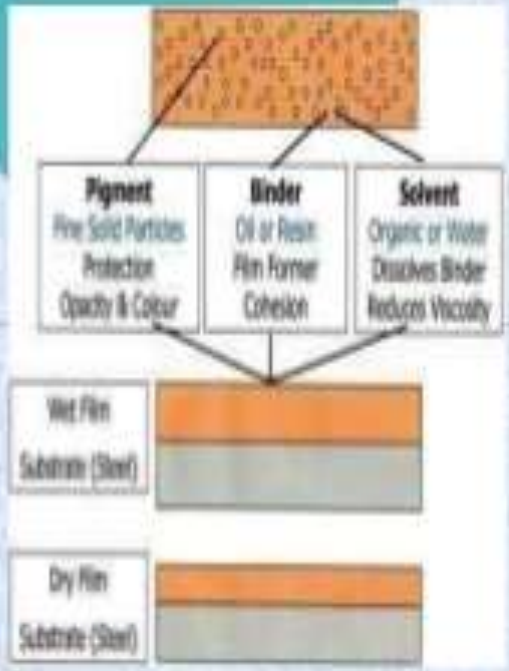
7 Days=32 kg/m^2

PAINTS

- WHAT IS PAINT??
- THE PAINTS ARE COATING OF FLUID MATERIAL AND THEY ARE APPLIED OVER THE SURFACE OF TIMBER AND METALS.
- PAINT IS A LIQUID COMPOSITION AFTER APPLICATION IT IS CONVERT IN TO A SOLID FILM.

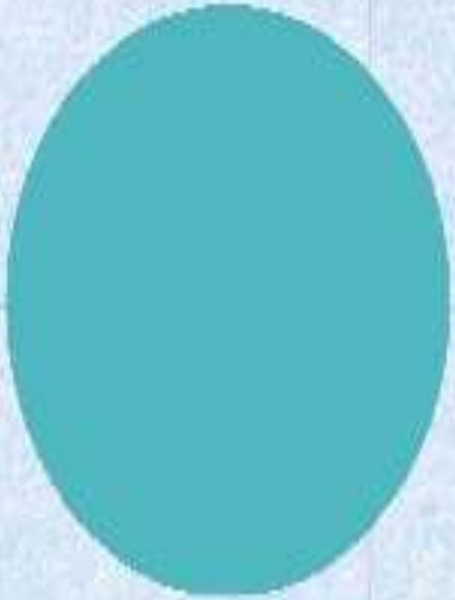
COMPOSITION:-





BASE

- ✓Principle constituent
- ✓A metallic oxide
- ✓Makes the paint film opaque.
- ✓Possesses binding properties which helps reduce shrinkage cracks on drying.
- ✓E.g.,:- white lead, red lead, zinc white, aluminium powder, iron oxide etc.,



VEHICLE

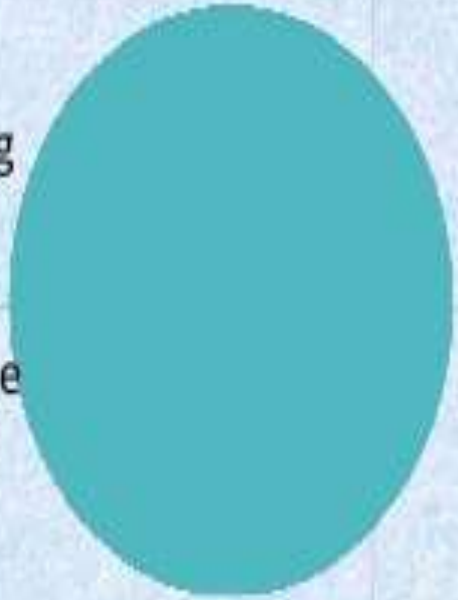
- ✓ Also known as binder.
- ✓ Vehicle is an oil to which the base is mixed.
- ✓ Holds all constituents of paint.
- ✓ Helps spread it over the surface to be painted.
- ✓ Imparts durability, toughness & water proofness to paint film & resistance to weathering and gloss.
- ✓ E.g., :- linseed oil, nut oil, poppy oil & tung oil

PIGMENTS

- ✓Used to hide the surface imperfections.
- ✓To impart the desired colour.
- ✓Improves the impermeability & enhances resistance to weathering.
- ✓Finely ground mineral, organic substances or metal powders.
- ✓Affect the flow characteristics making it possible to paint vertical & uneven surfaces smoothly.

SOLVENTS

- ✓ Oils used to tin the paints, increase the spread.
- ✓ Also, known as thinners.
- ✓ They make paints of workable consistency & evaporate during drying of the film.
- ✓ It makes paint thinner and hence increases the coverage. It helps in spreading paint uniformly over the surface Terpentine and neptha are commonly used thinners. After paint applied, thinner evaporates and paint dries.
- ✓ Eg.,:- petroleum, spirit, naptha, turpentine oil.
- ✓ Most commonly used turpentine because of its high solvent power, excellent flattening properties.

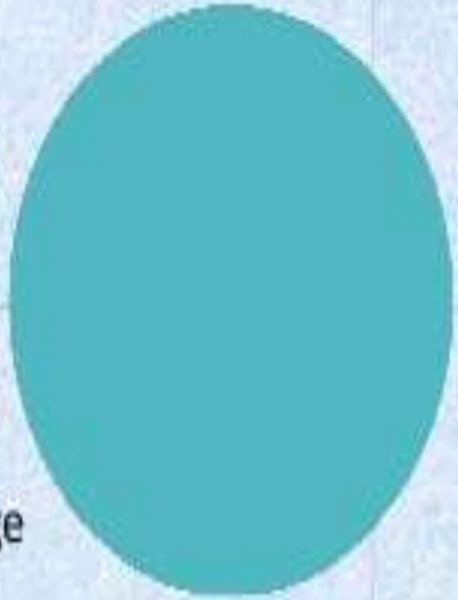


DRIERS

- ✓ Also, known as plasticizers.
- ✓ Are chemicals added to paint for specific purposes.
- ✓ These are the compounds of metal like lead, manganese, cobalt.
- ✓ The function of a drier is to absorb oxygen from the air and supply it to the vehicle for hardening. The drier should not be added until the paint is about to be used.
- ✓ E.g., as catalyst for accelerating the drying of vehicle.
- ✓ Quantity of drier is limited to 8%.
- ✓ Excess affects the elasticity of paint leading to flaking failure.
- ✓ Red lead is the best for primary coat over steel &metal work.
- ✓ It produces extremely hard & tough film, almost impervious to air & moisture.
- ✓ The cost of zinc & lead chromates is high.
- ✓ E.g.,:- letharge, lead acetate, red lead, manganese dioxide, cobalt, zinc.

ADULTERANTS

- ✓ These bring down the overall cost, reduce the weight and increase the durability.
- ✓ Adulterants also help to reduce cracking of dry paint and sometimes help to keep the pigment in suspension.
- ✓ Barium sulphate, calcium carbonate, magnesium silicate and silica are but a few examples. The best adulterant is barium sulphate.
- ✓ Silica is used only in the undercoats so as to take the advantage of its roughness in development of bond with the next coat.



PROPERTIES OF AN IDEAL PAINT

- ✓ It should be possible to apply easily and freely.
- ✓ It should dry in reasonable time.
- ✓ It should form hard and durable surface.
- ✓ It should not be harmful to the health of workers.
- ✓ It should not be easily affected by atmosphere.
- ✓ It should possess attractive and pleasing appearance.
- ✓ It should form a thin film of uniform nature i.e., it should not crack.
- ✓ It should possess good spreading power.
- ✓ It should be cheap.