1) viscosity & kinematic viscosity. Determination of viscosity of capillary tube viscometer.

viscosity :-

Flow properties of simple liquid is expressed in terms of viscosity. viscosity is the index of resistance of a liquid to flow. The higher the viscosity of liquid the greater is resistance to flow.

$$\text{viscosity} = \eta = \frac{F}{G}$$

co-efficient of viscosity is defined as force per unit area reqd to maintain unit difference in velocity b/w 2 parallel lines.

kinematic viscosity :-

It's defined as viscosity (η) divided by the density (ρ) of the liquid, viscosity is expressed in terms of kinematic viscosity. In the official pharmacopoeias I.P, B.P, USP, and National formulatory. It's Mathematically expressed as,

$$\text{kinematic viscosity} = \frac{\eta}{\rho}$$

unit of kinematic viscosity is stokes (S) & centistokes (CS)

Capillary viscometer :-

ostwald viscometer is used to define the viscosity of the Newtonian fluid. Both dynamic & kinematic viscosities can be obtained.

Principle - when liquid flows by gravity the time required for liquid to pass b/w 2 marks A & B through a vertical capillary tube is determined.

$$\eta_1 = \frac{\rho_1 t_1}{\rho_2 t_2} \eta_2$$

ρ_1 = density of unknown liquid

t_1 = time of flow unknown liquid

ρ_2 = density of the known liquid

t_2 = time of flow of known liquid

Derivation :- Poiseuille's law expresses the following relationship of flow of the liquid through capillary tube viscometer

$$\eta = \frac{\pi r^4 t \Delta P}{8 l v}$$

η = viscosity of the liquid, Poise

(2) 2102KOOS

$$\rightarrow n_1 = \frac{P_1 t_1}{P_2 t_2} t_2.$$

$$\rightarrow \frac{n_1}{P_1} = \frac{P_1 t_1 n_2}{P_2 t_2} \times \frac{1}{P_1}$$

$$\rightarrow = \frac{t_1 n_2}{P_2 t_2} = \frac{t_1}{t_2} \times \text{kinematic viscosity.}$$

Applications :-

→ ostwald's viscometer is used for formulation & evaluation of pharmaceutical dispersion systems.

→ dispersions b/w colloids, dilute suspensions, emulsions, etc it is official in IP for the evaluation of liquid paraffin.

→ light liquid paraffin & dextran 40 injection.

→ The study of flow of liquids through a capillary tube when the liquid of circulation of the blood.

4) write about plastic & elastic deformation, thixotropy in formulations. Add a note on Haeckel equation.

r = radius of inside capillary.

t = time of flow, sec.

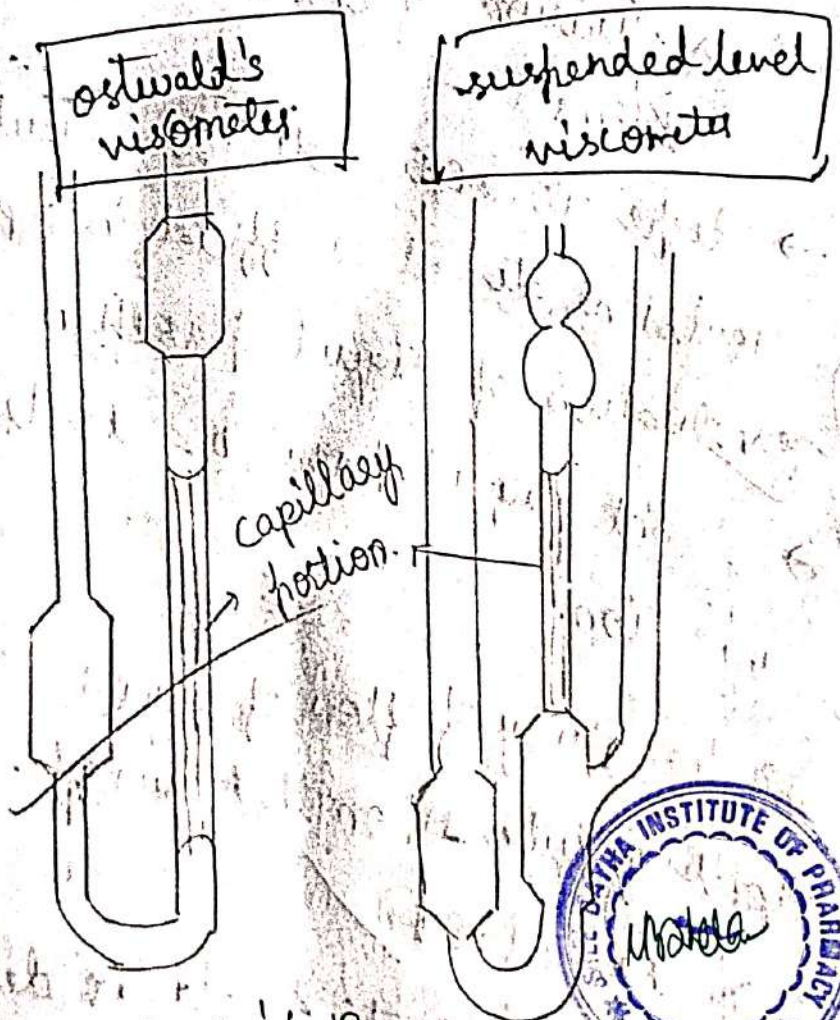
ΔP = Pressure head, dy/cm^2.

l = length of capillary.

v = volume of liquid flowing.

$$\eta = Kt\Delta P.$$

The accelaration due to gravity is constant and levels in capillary tube can be made constant by taking accurately measured identical volume of liquids.



$$\rightarrow \eta = K' t_1 \rho_1$$

$$\rightarrow \eta_1 = K' t_1 \rho_1$$

$$\rightarrow \eta_2 = K' t_2 \rho_2$$

r = radius of the inside capillary

Elastic deforation:-

Elastic deforation:- The consistency flow for elastic deforation is the permanent distortion that occurs when a material is subjected to tensile, compressive, buckle and bend or twist.

Elastic deformation:- Elasticity is the ability of a body to resist a distorting influence & to return to it's original shape and size when that influence or force is removed.

Thixotropy in formulations:-

Thixotropic behaviour exhibited by plastic and pseudoplastic systems:

The phenomena of thixotropy can be observed by observing the constructing consistency curves. The rate of shear is progressively increased, and stress is measured using instrument

when this reading give a curves the rate of is reduced gradually the down curve b is obtained. In Non-newtonian fluid the the down curve is displaced by giving thixotropic curves.

⇒ thixotropic gel-sol-gel transformation.

At Rest → multipoint contacts → Gel state

↓ Rapid process

on shear → consists Breakdown → sol state

↓ Not instantaneous.

set aside → Particle Contacts due to Brownian motion. → Gel state

a) the rate of shear increased / decreased.

b) the length of time during which a sample is subjected to any one rate of the shear. The previous sample has effect of rheologic properties of the thixotropic systems.

Haeckels equation:-

Applied pressure.

$$\ln[1/1-D] = KP + A$$

D = Density

P = Pressure

K = constant related to powder

→ The variations in volume with applied pressure are defined by way of numerous equations among which haeckel theory is most vital. Heckel measured that decline in the voids follows the first order kinetics connection with applied pressure - For compression of method Haecked has suggested this equation.