

Fluidity (ϕ)

The term fluidity is the reciprocal of viscosity that means

$$\phi = \frac{1}{\eta}$$

Kinematic viscosity

it is defined as the viscosity divided by the density of the liquid so

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

→ The unit of kinematic viscosity is Stokes
or centistokes

→ In S.I system kinematic viscosity is expressed as $\frac{m^2}{sec}$

Q. A sample of nutrient fluid is analysed by applying a shear stress of 4000 dyne/cm² & the rate of shear is found to be 2000

then calculate the value of viscosity & fluidity

$$\text{viscosity } (\eta) = \eta \cdot v$$

$$4000 = \eta \cdot 200$$

$$\eta = \frac{4000}{200}$$

$$= 20 \text{ poise} = \frac{20}{100} \text{ dyne}$$

$$\text{fluidity } (\phi) = \frac{1}{\eta}$$

$$= \frac{1}{20}$$

$$= 0.05 \frac{\text{cm}^2 \cdot \text{sec}}{\text{dyne}}$$

Q.2 A viscosity of acetone is found to be 0.313 poise at 25°C at density 0.788 gm/cm³ of the kinematic viscosity.

Given

$$\text{kin. viscosity} = \frac{\eta}{\rho}$$

$$* 0.313 \text{ poise}$$

$$= 0.313 \times 10^{-3} \text{ N.s/m}^2$$

$$* 0.788 \text{ g/cm}^3$$

$$= 0.788 \times 10^{-3} \text{ kg/m}^3$$

kin. viscosity:

$$\frac{0.313 \times 10^{-3}}{0.788 \times 10^{-3}}$$

$$= 0.397 \text{ N.s/m}^2 \cdot \text{kg}$$

Relative viscosity:

Relative viscosity i.e. η_r is the ratio of viscosity of the dispersion (η) with respect to the solvent (η_0)
→ mathematically it can be expressed as

$$\text{Relative viscosity } (\eta_r) = \frac{\eta}{\eta_0}$$

Specific viscosity:

Specific viscosity i.e. η_{sp} is defined as the relative increase in the viscosity of the dispersion over the solvent alone.
→ it can be expressed in mathematically i.e.

$$\text{Specific viscosity } (\eta_{sp}) = \frac{\eta - \eta_0}{\eta_0}$$

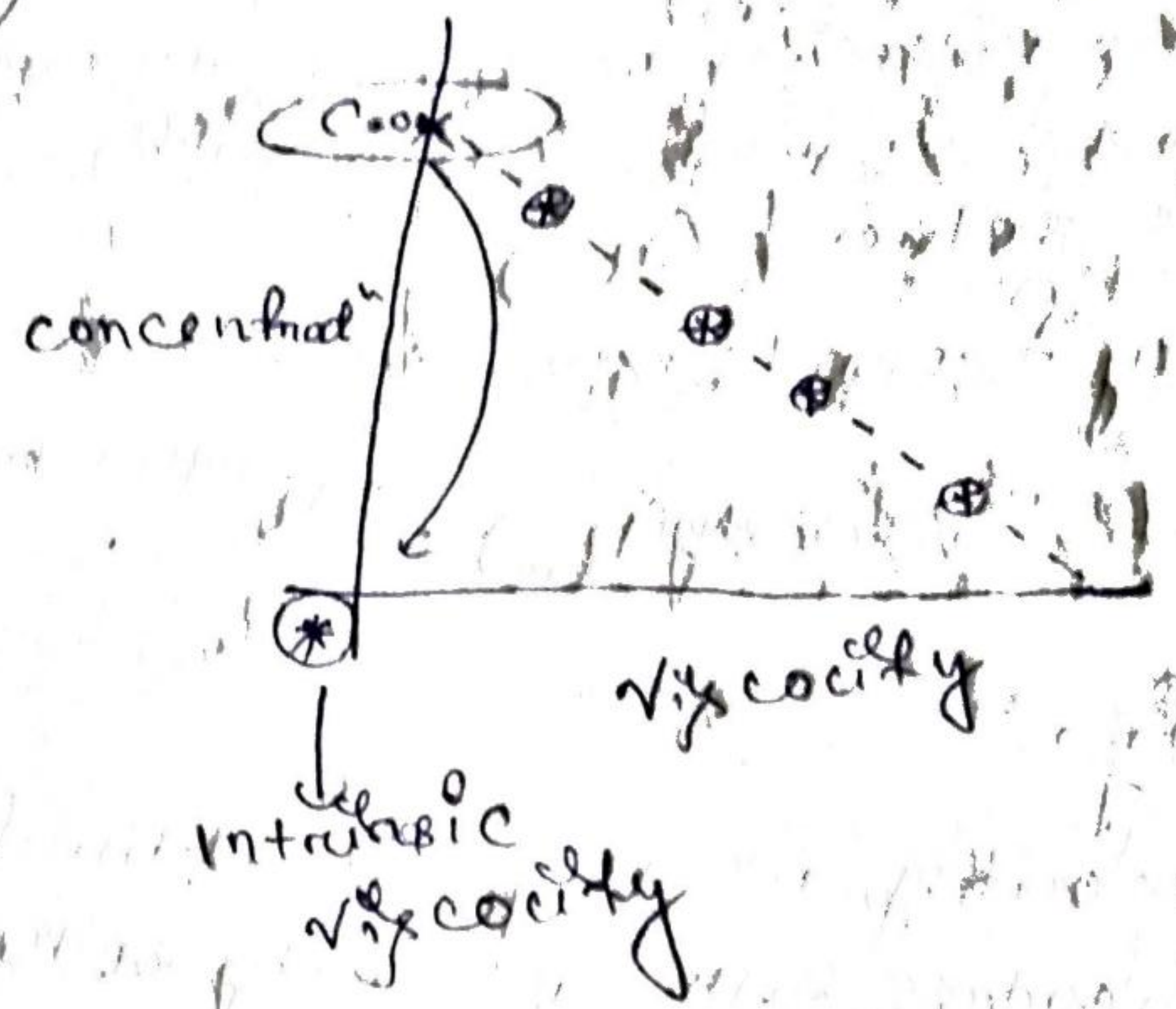
Reduced viscosity:

It is defined as the ratio specific viscosity to the concentration.
→ it is mathematically expressed as $\eta_{red} = \frac{\eta_{sp}}{c}$

Intrinsic viscosity:

When the reduced viscosity is determined at various concentrations of a substance and the results are plotted, the resulting line can be extra plotted to $c=0$ to obtain the intercept.
→ From the intercept value is known as intrinsic viscosity.

Q.3



Q.3 Pure viscosity of water & chloroform at 25°C are 0.8904 pps & 0.563 centipoise wt. is the relative viscosity of water & chloroform
 → $\frac{\eta_{chloroform}}{\eta_{water}}$ viscosity of chloroform = 0.563×10^{-3} pascal sec
 viscosity of H_2O = 0.8904×10^{-3} pascal sec

$$\text{Relative viscosity} = \frac{\eta}{\eta_0}$$

$$= \frac{0.563 \times 10^{-3} \text{ pascal sec}}{0.8904 \times 10^{-3}}$$

$$= \frac{0.563 \times 10^{-3}}{0.8904} \text{ pascal sec}$$

$$= 0.6323 \text{ pascal sec}$$

Q.4

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The viscosity of H₂O at 25°C is 0.8904 cP
the viscosity of 2% w/v solution of methyl
cellulose is 100 cP calculate the relative
viscosity, specific viscosity & reduced
viscosity.

Given

viscosity of H₂O = 0.8904×10^{-3} pascal sec
viscosity of dispersion 2% w/v methyl cellulose
solution = 100×10^{-3} pascal sec.

$$\text{Relative viscosity} = \frac{\eta}{\eta_0}$$

$$= \frac{100 \times 10^{-3}}{0.8904 \times 10^{-3}} \text{ pascal sec}$$

$$= \frac{100}{0.8904} \text{ pascal sec}$$

$$= 112.309$$

$$\text{specific viscosity} = \frac{\eta - \eta_0}{\eta_0}$$

(η_{sp})

$$= \frac{100 \times 10^{-3} - 0.8904}{0.8904 \times 10^{-3}}$$

$$= 111.309$$

$$\text{Reduced viscosity} = \frac{\eta_{sp}}{C} = 55.655$$

(η_{red})

Q.5) The viscosity of H_2O is 0.8904 cP.
 viscosity of 5% w/w starch solution is 89 cP.
 Calculate relative viscosity, specific & reduced
 viscosity.

Ans Relative viscosity (η_r) = $\frac{\eta}{\eta_0}$

$$= \frac{89 \times 10^{-3}}{0.8904 \times 10^{-3}}$$

$$= 98.955$$

Specific viscosity (η_{sp}) = $\frac{\eta - \eta_0}{\eta_0}$

$$= \frac{89 \times 10^{-3} - 0.8904 \times 10^{-3}}{0.8904 \times 10^{-3}}$$

$$= \frac{(89 - 0.8904) \times 10^{-3}}{0.8904 \times 10^{-3}}$$

$$= 98.955$$

Reduced viscosity (η_{red}) = $\frac{\eta_{sp}}{C}$

$$= \frac{\eta_{sp}}{5} = 19.791$$