

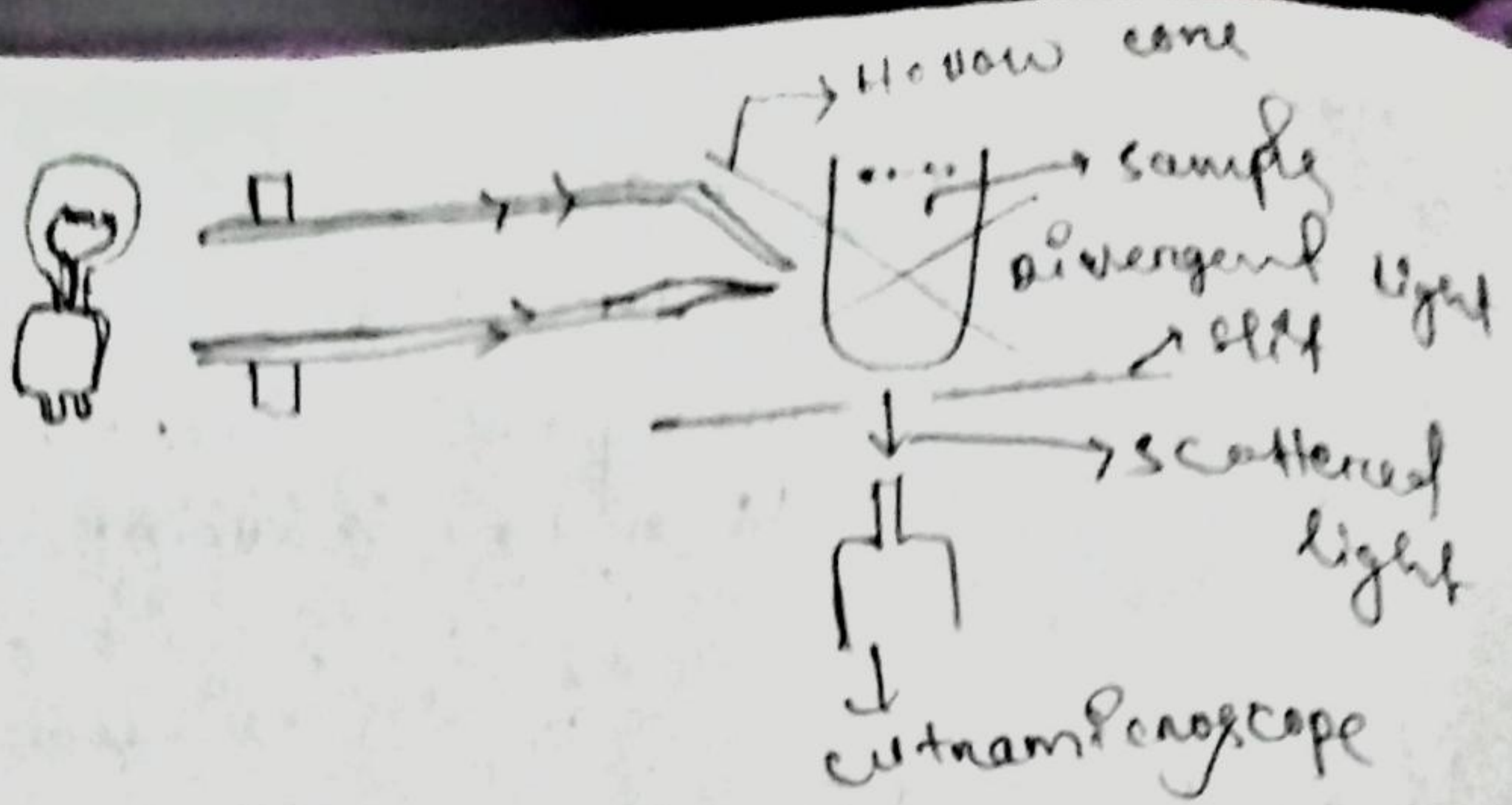
Optical properties of colloids  
→ study of optical properties of colloids helps in obtaining information regarding the shape, size, molecular weight of the colloids.

### Light microscope:

→ light microscope uses visible light as its source. It can dissolve the particles with the size range of  $2000 \text{ \AA}$ . But the colloidal particles are not coming in this range hence light microscope is little used for the determination of optical properties.

### Ultramicroscope:

→ it is used to observe Tyndall effect or particles with light. When an intense narrow beam of light is passed through the colloidal dispersion, the path is visible due to scattering of light. The beam is most visible when viewed against a dark background perpendicular to incident beam.



## Principle

- The working principle of the instrument is shown in the figure about a condenser produces a hollow cylinder of light.
- It converges <sup>into</sup> a hollow cone to focus on the sample.
  - The sample is placed at the apex of the cone.
  - The light passing through the sample diverges in all directions and pass through all directions.
  - Some of the scattered light can be entered into the objective of the lens which can be visible as light spots against dark background.

## Electron microscope:

- Particle size, shape & structure can be determined by using electron microscope.
- Here the radiation source is a beam of high energy electrons having wavelength

0.1 A.  
The e-microscope has high resolution power and it can also be photographed of actual particles.

\* Turbidity:  
Turbidity is used to estimate the concentration of dispersed particle and the molecular weight of the solute.  
The principle behind this can be explained by spectrophotometric analysis.

Spectrophotometer  
It measures the intensity transmitted light in the direction of incident light which can be explained by the formula i.e.

$$\text{Formula} = \frac{I}{I_0} = e^{-2l}$$

where  $I_0$  = intensity of incident light  
 $I$  = intensity of transmitted light

$2l$  = Turbidity  
 $l$  = length of sample path which is 1 cm

Light scattering

when beam of light strikes on particle it polarise the atoms, molecule in it and induces the dipole in the particle.  
The dipole.

⇒ The scattering of light propagates in all directions and this phenomenon is called light scattering

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Principle

When light source having a wavelength higher than the dimension of the particle we then the turbidity or measured from the scattered light by viewing it at particular angle.

→ This equation is  $\tau = \frac{16\pi}{3} R_{90}$  (Rayleigh Ratio)

$$R_{90} = \frac{I_{\pi}^2}{I_0}$$

where,  $I_0$  = ~~scat~~ intensity of scattered light

$I$  = intensity of incident light

$r$  = distance from the scattered light to the point of observation

$\tau$  = Turbidity

⇒ The molecular mass of the dispersion the relationship with turbidity which can be explained by Debye equation i.e.

$$\frac{HC}{\tau} = \frac{1}{M} + 2Bc$$

where,  $C$  = concentration of solute

$M$  = Average molecular weight of the  
colloids

$k_B$  = Interaction constant of the  
solute-system

$H$  = A constant for a particular  
system.