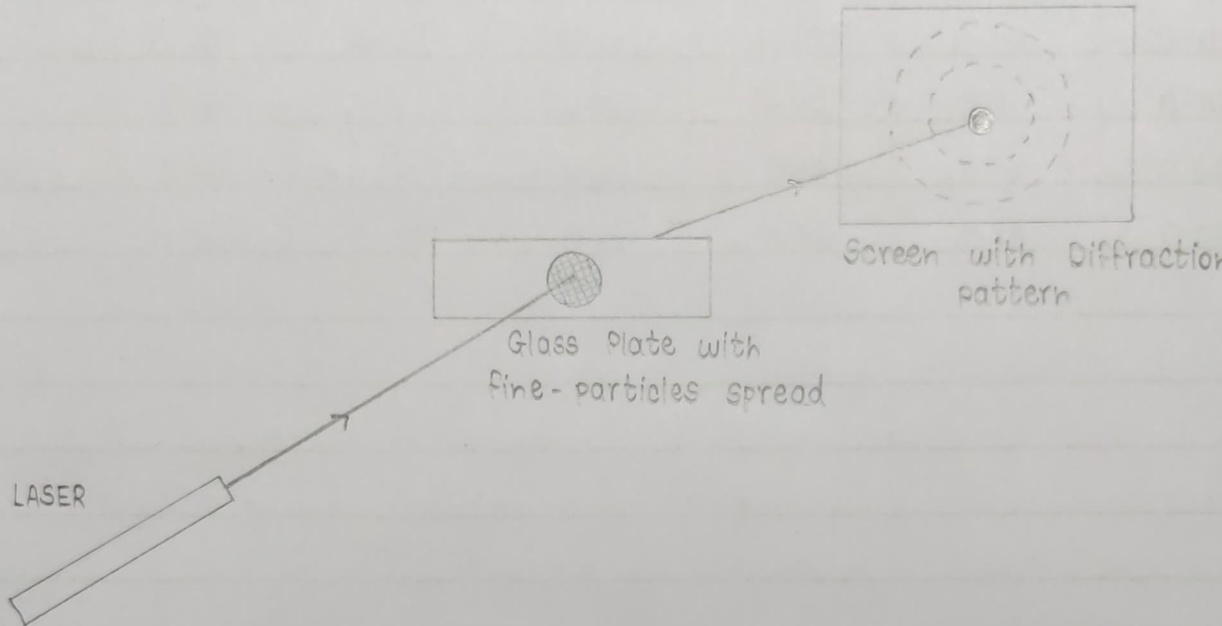
DIAGRAM ⟹



OBSERVATION ⟹

Wavelength of laser light (λ) = 6328 $\mathring{A}$.

TABLE : Determination of particle size :

Sr. No.	Distance (D)	Diffraction order (n)	Radius of dark ring (r_n)	Particle size (2a)
	cm		cm	μm
1.	15	1	1.3	8.90787
		2	2.6	8.90787
2.	20	1	1.7	9.08254
		2	3.5	8.82304
3.	25	1	2.2	8.77290

PARTICLE SIZE DETERMINATION USING LASER.

AIM ⟹

To determine the size of micro particles using laser.

APPARATUS REQUIRED ⟹

Fine micro-particles having nearly same size (say lycopodium powder), a glass plate (say microscopic slide), diode, laser and a screen.

PRINCIPLE ⟹

When laser is passed through a glass plate on which fine particles of nearly uniform size are spread, due to diffraction circular rings are observed. From the measurement of radii of the observed rings, we can calculate the size of the particles. Since, for diffraction to occur size of the obstacle must be comparable with wavelength, only for extremely fine particles of micron or still lesser dimension, diffraction pattern can be obtained.

Diffraction is very often referred to as the bending of the waves around an obstacle. When a circular obstacle is illuminated by a coherent collinated beam such as laser light, due to diffraction circular rings are obtained. If 'r' is the radius of the first dark ring and 'D' is the distance between the obstacle and screen on which the diffraction is obtained then,

		2	4.4	8.77290
			MEAN ⟶	8.877856

CALCULATION ⟹

1) $2a = \frac{1.22 \times n\lambda D}{r_n}$

$= \frac{1.22 \times 1 \times 6328 \times 15}{1.3} = 89078.7\,A^\circ = 8.90787\ \mu m.$

2) $2a = \frac{1.22 \times n\lambda D}{r_n}$

$= \frac{1.22 \times 2 \times 6328 \times 15}{2.6} = 89078.7\,A^\circ = 8.90787\ \mu m$

3) $2a = \frac{1.22 \times n\lambda D}{r_n}$

$= \frac{1.22 \times 1 \times 6328 \times 20}{1.7} = 90825.4\,A^\circ = 9.08254\ \mu m$

4) $2a = \frac{1.22 \times n\lambda D}{r_n}$

$= \frac{1.22 \times 2 \times 6328 \times 20}{3.5} = 88230.4\,A^\circ = 8.82304\ \mu m$

5) $2a = \frac{1.22 \times n\lambda D}{r_n}$

$= \frac{1.22 \times 1 \times 6328 \times 25}{2.2} = 87729.09\,A^\circ = 8.772909\ \mu m$

$$\tan\theta = \frac{r}{D}$$

Since, 'θ' is very small in this eæperiment:

$$\therefore \tan\theta \approx \theta = \frac{r}{D}$$

According to the theory, the diameter 1a' of the circular obstacle is given by:

$$2a = \frac{1.22 \times n \times \lambda \times D}{r_n}$$

where,

r_n = radius of the n^{th} order dark ring (m)

D = distance between the obstacle and the screen (m)

λ = wavelength of the laser light (A°)

RESULT ⟹

The average size of the particles measured using laser = 8.877856 μm.

Teacher's Signature