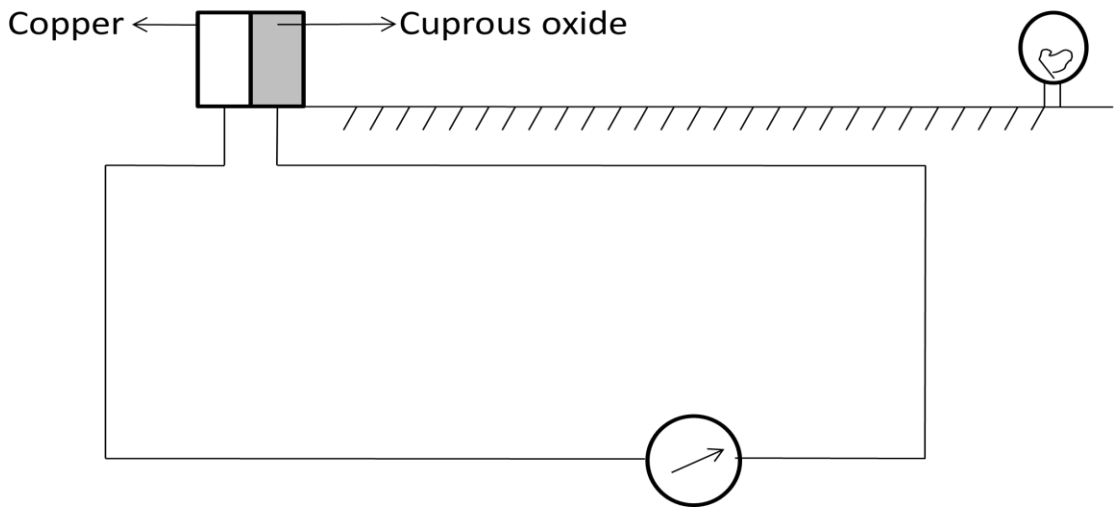
Experiment No.1
Inverse square law

Aim and Objective: To verify inverse square law for intensity of light.

Apparatus: Source of light, photocell, ammeter, metre scale, etc.

Diagram:

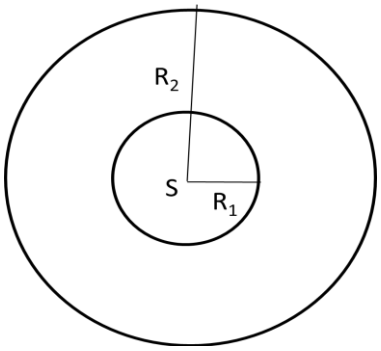


Outcome: To relate the intensity of light and distance of detector from source.

Theoretical background:

Inverse square law-Intensity of illumination at any point is inversely proportional to square of distance between the point and source.

Consider a point source S emitting light in all directions. Let f be the luminous flux (amount of light emitted per unit time.) Consider two spherical surfaces A and B of radii $R_1$and R_2 respectively.



The illumination I_1(Energy received per unit time and area) at any point on the surface A is given by.

$$I_{I=} \quad \frac{f}{\text{Area of A}} = \frac{f}{4\pi R_1^2} \quad \text{----- - - - - - -} \quad \text{---- (1)}$$

Similarly I_2 for surface B

$$I_2 = \frac{f}{4\pi R_2^2} \quad - \quad \text{---------- (2)}$$

Dividing (1) by (2)

$$\frac{I_1}{I_2} = \frac{R_2^2}{R_1^2}$$

$$\text{OR} \quad I \propto \frac{1}{R^2}$$

This is known as inverse square law.

Photo cell: In photocell light energy is converted into electrical energy. When light is incident on it, it emits photoelectrons, that are passed in external circuit and give current. This photocurrent is proportional to number of photons incident on photocell. i.e. intensity of illumination .

Experimentation:

A source is placed at different distances from the photocell and current in ammeter is measured and graph of current (I) vs $1/d^2$ is plotted. The current is directly proportional to intensity of light.

$$I \propto L$$

d is the distance between source and cell $\mathbf{I \propto L \propto 1/d^2}$

So graph of I vs $1/d^2$ is straight line.

Observation Table

Obs No	Distance between source & cell d (cm)	Current (I) μA	d^2	$1/d^2$	Id^2 $\mu A\ cm^2$
1					
2					
3					
4					
5					
6					

Calculations:

Result and Discussion:

1. **Id^2 = - -- ---- - - - - - - - μA cm^2 By calculation**
2. **Id^2 = - -- ---- - - - - - - - μA cm^2 By graph**

Id^2--- **constant**

This verifies inverse square law.

Conclusion:

Questions –

1 State inverse square law and lamberts cosine law.
2 Define i) lumen ii) phot iii) lux iv) brightness
3 State principle used in photocell.
4 Name different photo cells .