

Dear Aspirants,

Here are General Knowledge study notes on Optics for CDS exam. Candidates who are going to attempt this exam must read these notes thoroughly in order to understand the topic better and increase their score in the exam.

CDS Study Notes: Optics

Light:

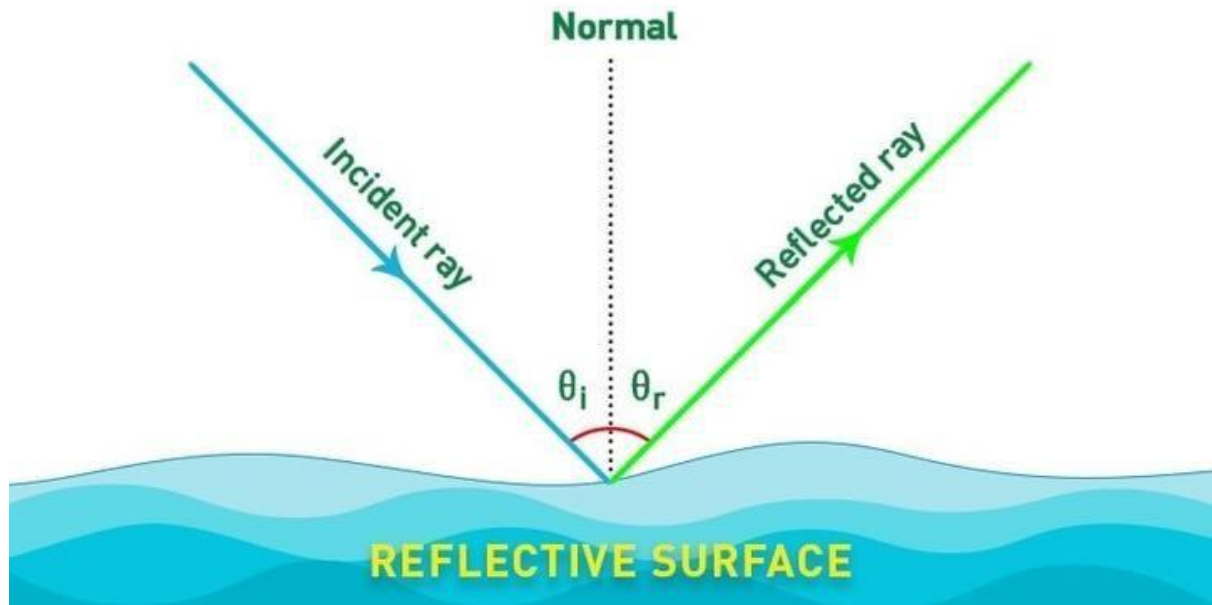
- It is a Transverse Electromagnetic Wave.
- It is a form of energy.
- The speed of light in vacuum is approximately 3×10^8 m/sec.

What happens when light falls on an object:

- The object can absorb all the light and thus will appear completely black.
- The object will transmit the light falling upon itself.
- The object can reflect the light that fall on the surface.

Reflection of light

The bouncing back of light into the same media when it comes in contact with the boundary between two different mediums is called reflection of light.



Laws of Reflection:

1. The angle of incidence is equal to the angle of reflection.
2. The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.

Types of spherical mirrors:

1. Concave mirror:

Used as shaving mirror, vehicle headlights, solar cookers etc.

2. Convex mirror:

Used as rear-view mirrors, sodium reflector lamps etc.

Terms related to spherical mirrors:

- **Center of curvature (c):** The center of the hollow glass sphere of which the mirror is a part
- **Radius of curvature (R):** The radius of the hollow glass sphere of which the mirror is a part
- **Pole (P):** The mid point of the spherical mirror

- **Focus (F):** The point at which the parallel beams of light converge (or seem to converge) after reflection from the mirror
- **Focal length (d):** Half the radius of curvature

Summary of the Images Formed by a Concave and Convex Mirror

Position of object	Position of Image	Size of Image	Nature of Image
Concave Mirror			
At infinity	At Focus F	Highly diminished	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between F and C	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect
Convex Mirror			
At infinity	At focus	Highly diminished	Virtual point size
Anywhere on Principal axis	Between pole & focus	Diminished	Virtual and erect

Refraction of Light

The phenomenon of deviation of the light rays from their path when it travels from one transparent to another is called the reflection of light.

The difference in the speed of light in different media is the reason for the refraction of light.

During refraction of light, the wavelength and the velocity of the light changes while the frequency remains constant.

Laws of Refraction:

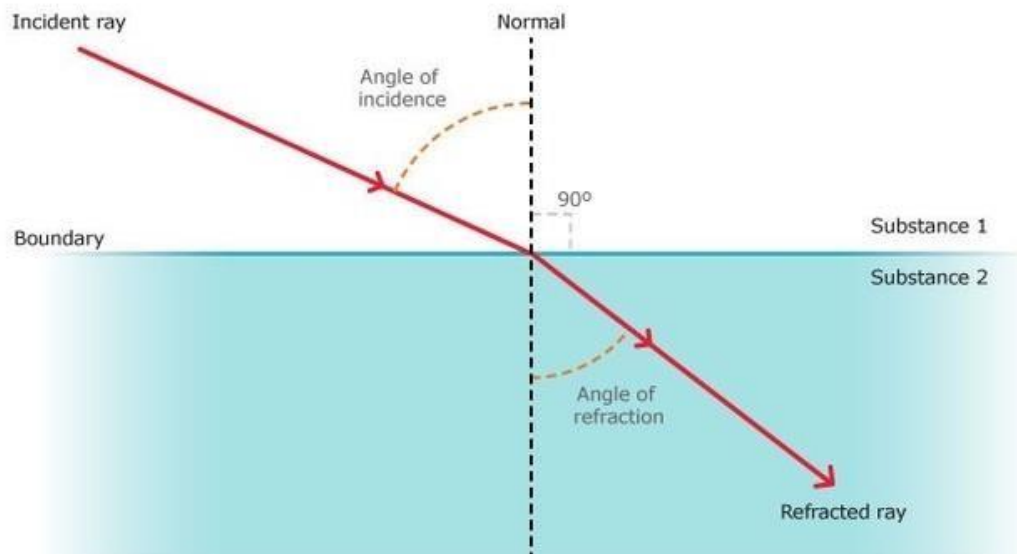
1. The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane.
2. The ratio of sine of the angle of incidence and the sine of the angle of refraction is a constant. This law is called the Snell's Law.

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Refraction of light



Critical Angle:

The angle of incidence in a denser medium for which the angle of refraction in the rarer medium becomes 90 degree is called the critical angle.

Lens

A lens is a transmissive optical device that focuses or disperses a light beam through refraction.

1. Convex lens:

Used in microscopes, magnifying glasses etc.

2. Concave lens:

Used in flashlights, peepholes, binoculars, telescopes etc.

Total Internal Reflection:

When a light ray travelling in the denser medium (to rarer medium) is incident at the interface at an angle which is greater than the critical angle then the light rays are reflected back to the denser medium. This phenomenon is called Total Internal Reflection.

Eg: Shining of the diamond, mirage etc.