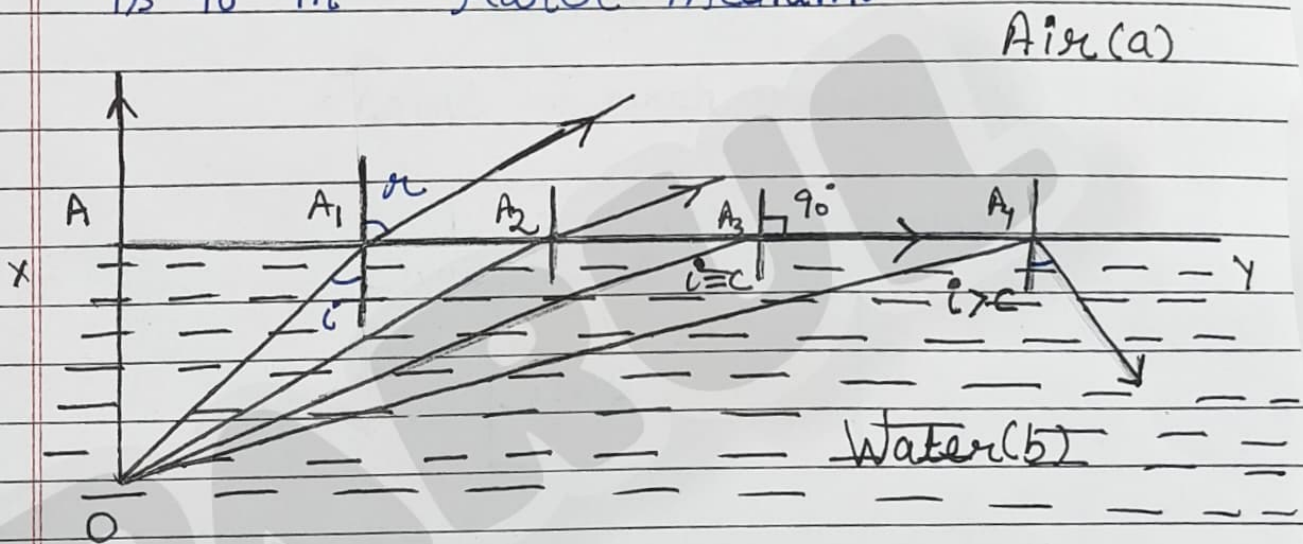


Total Internal Reflection

Phenomenon of reflection of light in denser medium when a ray of light travels in a denser medium at an angle greater than critical angle.

- → Critical Angle - It is that angle of incidence in denser medium for which angle of refraction is 90° in rarer medium.



- → Conditions for T.I.R

1. Ray should travel from denser to rarer medium.
2. Angle of Incidence $>$ Critical angle

- → Relation between Refractive index & critical angle

According to Snell's law

When light travel from denser to rarer medium

$$\mu_a = \frac{\sin i}{\sin r}$$

When $i = C$, $r = 90^\circ$

$$\mu_a = \frac{\sin C}{\sin 90^\circ} = \sin C$$

(a) Denser to Rarer = $\sin C$

Rarer to denser = $\frac{1}{\sin C}$

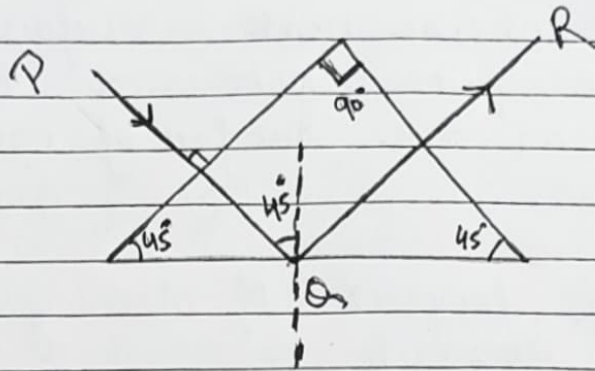
$$\mu_d = \frac{1}{\sin C}$$

• Practical Applications of Total Internal Reflection

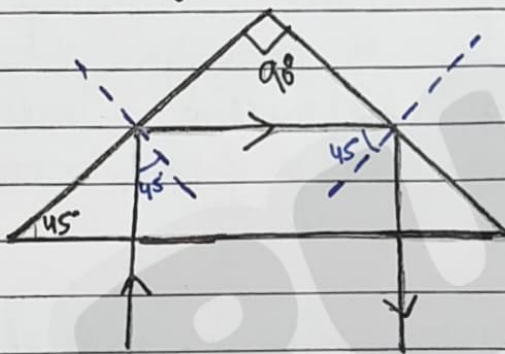
1. Totally reflecting Prisms - An Isosceles right angled glass prism having angles 45° - 45° - 90° can be used to deviate a ray of light through 90° or 180° making use of phenomenon of T.I.R.

(a) To deviate a ray of light through 90°

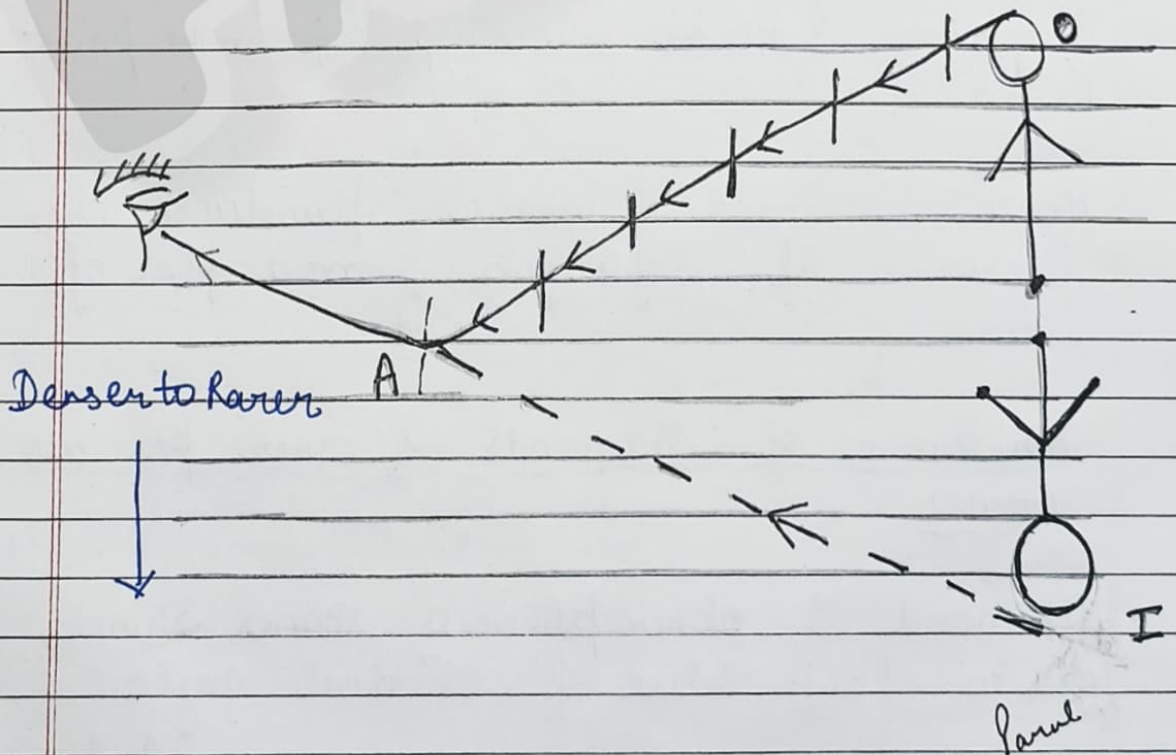
Prism



(b) To deviate a ray of light through 180°



2. Mirage - (It is an optical illusion observed in deserts on a hot day



- * Due to intense heat surface of earth becomes quite hot and temp of air near the surface of earth is maximum.
- * Temp of layers of air goes on decreasing as one goes up.
- * A ray of light travelling from point O of a tree through air of gradually decreasing refractive index therefore gets refracted away from normal.
- * At a layer when angle of incidence becomes greater than the critical angle, total internal reflection takes place.
- * When ray reaches the eye of observer it appears to be coming from the point I.

Hence inverted image produces the impression of reflection from a pool of water.

3. Brilliance of diamonds & other precious stones

- Diamond & other precious stones shines due to low value of critical angle

- Due to low value of critical angle a diamond can be cut so as to have a large no. of faces
- So a ray of light on entering the diamond from a face undergoes a series of total internal reflections, till the angle of incidence inside the diamond remains greater than the critical angle.

Optical fibres: In 1870, John Tyndall demonstrated that light could be made to follow curved path. Light follows curved path as it suffers a total internal reflection.

- Optical fibres are used to transmit light from one place to other along curved path

