

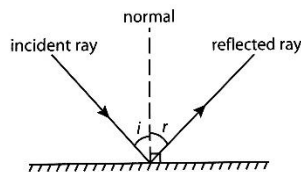
FOCUS 1 - Reflection of Light

- Reflection is the bouncing of light as it hits upon a surface.

■ Laws of Reflection

1st Law of Reflection

The incident ray, the reflected ray and the normal to the reflecting surface all lie in the same plane.

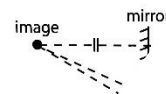


2nd Law of Reflection

The

■ Mirrors

- An image formed in a plane mirror is
 1. laterally inverted,
 2. upright,
 3. at the same distance from the mirror as the object,
 4. the same size as the object,



Hello,

You have made a very important and right decision to look at this sample learning material created by Calvin Kong, a former MOE Senior Teacher in Physics with more than a decade of experience, also trained under the [Research for Better Teaching, Inc.](#) (Massachusetts) and [New Teacher Centre](#) (California).

It is not difficult to figure out why is Calvin Kong's 2-paged Summary the favourite among most of his students. It contains all necessary content of 1 chapter, kept within the space of an A4 paper. Imagine the entire syllabus compressed into 22 sheets of paper.

- speed of light in vacuum c to the speed of light in the medium v . The RI is also equal to the ratio of the sine of angle of incidence i to the sine of angle of refraction r of light travelling from vacuum into the medium.

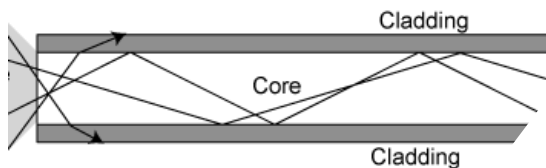
$$n = \frac{c}{v} = \frac{\sin i}{\sin r}$$

- The medium with a larger RI is said to be optically denser. When light travels into an optically denser medium, it bends towards the normal.

3. Total Internal Reflection

- When light travels from a denser medium into a less dense medium, it bends away from the normal. When the angle of incidence is greater than the critical angle c , total internal reflection occurs.
- The relationship between the critical angle c and the RI of the two media is given by:
- The following are the conditions for total internal reflection to occur:
 1. Light must travel from a denser medium to a less dense medium.
 2. The angle of incidence must be greater than the critical angle.

- One application of TIR is optical fibres. Optical fibres are made up of a core of glass or plastic with high RI, coated by another material of lower RI. Light travels along a fibre by total internal reflection at the boundary.
- In the communication industry, optical fibres can carry laser light which carries information such as telephone conversations, computer data and television pictures.
- Advantages of using optical fibres:
 - they can carry light round bends and in places where it would be difficult or dangerous to supply electricity (e.g. under the sea)
 - they can carry information over great distances at high speed.
 - they can carry more information than a copper wire cable.



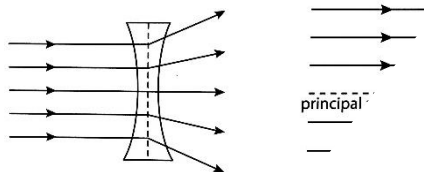
FOCUS 3 – Refraction by Thin Lenses

- A lens is a piece of clear plastic or glass with curved surfaces.

Types of Lenses

Diverging (Concave) Lens

- A Diverging Lens is thinner in the middle.
- A parallel beam of light that passes through a diverging lens will spread out (diverge).



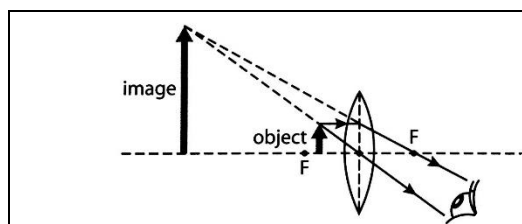
Converging (Convex) Lens

- A Converging Lens is thicker in the middle.
- A parallel beam of light that pass through converging lens will meet (converge) at
- Terminology:
 - Optical Center (C) is the center of the lens.
 - Principal Axis is a line through the optical center of the lens and is perpendicular to the centre of curvature.
 - When rays of light are traveling parallel and close to the principal axis pass through the lens, they converge at a point called the principal focus, F.
 - Focal Length (f) is the distance between the principal focus (F) and the optical center.

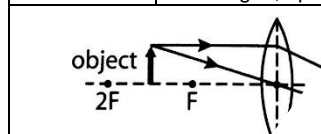
Ray Diagrams for Lenses

Construction Rules for Ray Diagram

- Path I - A ray through the optical center will not be deviated.
- Path II - A ray parallel to the principal axis is refracted by the lens so that it passes through the principal focus, F.
- Path III - A ray through F is refracted by the lens so that it becomes parallel to the principal axis.



Position of Object	Description
Between lens and F	Image is formed behind the lens. It is enlarged, upright and virtual.



Position of Object	Description
Between F and 2F	Image is formed on the opposite side of the lens. It is inverted and smaller than the object.