Revision Notes for Class 12 Physics

Chapter 9 – Ray Optics and Optical Instruments

Reflection of Light

This section from Chapter 9 Physics Ray Optics Class 12 Notes will help students to revise their understanding regarding the reflection of light. Accordingly, essential concepts such as deviation, laws of reflection have been discussed in detail. Reflection by a plane surface and a plane mirror has been explained in Ray Optics Class 12 Notes with the help of diagrams.

Spherical Mirrors

Students can strengthen their understanding of spherical mirrors after going through this section in the Class 12 Physics Chapter 9 Notes. A simplified explanation of the following terms have been provided under this section in Ray Optics Notes Class 12 PDF:

- Centre of curvature.
- Normal.
- Radius of curvature.
- Pole of mirror.
- Principal axis.

Concepts such as paraxial rays have also been discussed in this segment from Ray Optics And Optical Instruments Class 12 Notes with the help of ray diagrams. A step by step explanation has also been provided on mirror formula and magnification that will enable you to revise them at a glance before examination.

Sign Convention:

In Class 12 Physics Chapter 9, "Ray Optics and Optical Instruments," the sign convention is very important for solving problems involving lenses and mirrors. Given below is an easy explanation.

For Lenses:

- **Focal Length (f):** Positive for convex lenses (converging) and negative for concave lenses (diverging).
- **Object Distance (u):** Always taken as negative because the object is placed to the left of the lens.
- **Image Distance (v):** Positive if the image is formed on the right side of the lens (real image) and negative if on the left side (virtual image).

For Mirrors:

- **Focal Length (f):** Positive for concave mirrors (converging) and negative for convex mirrors (diverging).
- **Object Distance (u):** Always taken as negative because the object is placed in front of the mirror.
- **Image Distance (v):** Positive if the image is real (formed on the same side as the reflected rays) and negative if virtual (formed behind the mirror).

These conventions help ensure consistency and accuracy in calculations involving optical systems.

Focal Length of Spherical Mirrors:

The focal length is the distance between the mirror's surface and its focal point, where parallel rays of light converge or appear to diverge from. For spherical mirrors, which include both concave and convex mirrors, the focal length helps determine how they form images.

Concave Mirrors: These mirrors curve inward and have a focal point in front of the mirror. The focal length is positive, and the mirror converges light rays to a point.

Convex Mirrors: These mirrors curve outward and have a focal point behind the mirror. The focal length is negative, and the mirror diverges light rays, making them appear to spread out from the focal point.

Mirror Formula: The mirror formula connects the focal length of a mirror with the distances of the object and the image from the mirror. The formula is:

$$\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$$

where f is the focal length, v is the image distance, and u is the object distance.

Refraction of Light

Within this section of Ray Optics And Optical Instruments Class 12 Notes, the following topics have been explained in a detailed manner so that students can comprehend them quickly:

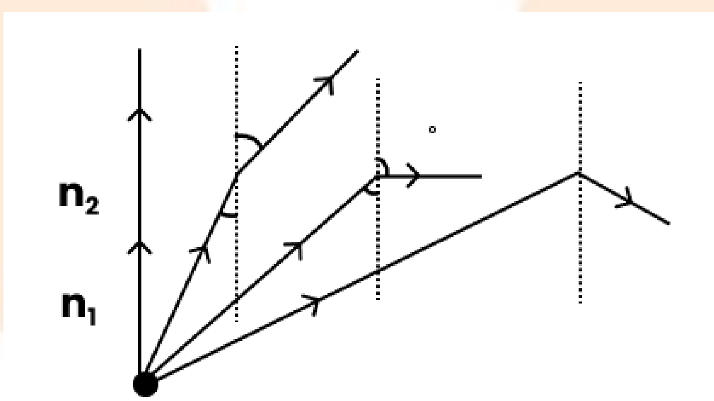
- Reflective index.
- Law of Refraction or Snell's law.
- Refraction through a curved surface.

- Total internal reflection.
- Double refraction from a plane surface.
- Single refraction from a plane surface.
- The relation between object distance and image distance refraction.
- Linear magnification for spherical refracting surfaces.

Furthermore, derivations of equations for each of the above terms are also provided in Class 12 Physics Chapter 9 Notes, which will help you to understand these concepts thoroughly.

Total Internal Reflection

When light moves from a denser medium (like glass) to a less dense medium (like air) and hits the boundary at an angle greater than a specific angle called the critical angle, it reflects completely back into the denser medium. This is known as Total Internal Reflection. It only happens if the angle at which the light hits the boundary is greater than this critical angle (i.e., the angle of incidence is greater than the critical angle).



Lens

After going through this section from Ray Optics Class 12 Notes, students will learn to distinguish between a thin lens and a standard lens. Some of the main terms related to lens have been explained in a simplified way to aid you in your revision process. These terms include:

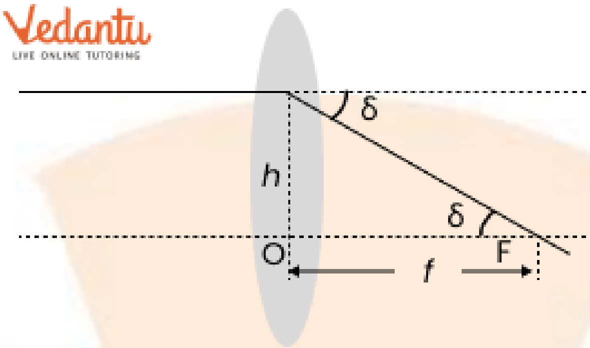
- Centre of curvature.
- Radius of Curvature.
- Principal Axis.
- Optical centre.
- Principal foci.
- First principal focus F_1.
- Second principal F_2.
- Focal Length.

Apart from these terms, crucial concepts such as lens maker's formula and lens formula, silvering of lens, a combination of lens, cutting of lens etc. have also been discussed in brief in Ray Optics Notes Class 12 PDF.

Power of lens:

- A lens with a positive power (convex lens) converges light and brings it to a point.
- A lens with a negative power (concave lens) diverges light and spreads it out.
- The greater the magnitude of the power, the stronger the lens's ability to bend light.

Formula for Power of a Lens: $P=\frac{1}{f}$, where P is the power of the lens in diopters, and f is the focal length of the lens in metres.



Combination of thin lenses in contact:

In Class 12 Physics Chapter 9, “Ray Optics and Optical Instruments,” the topic of "Combination of Thin Lenses in Contact" deals with how to handle multiple lenses placed together without any gap between them. When lenses are in contact, they work together to form a single optical system.

To find the effective focal length of the combined lenses, you use the following formula:

$$\frac{1}{f_{\text{effective}}}=\frac{1}{f_1}+\frac{1}{f_2}+\frac{1}{f_3}+\ldots$$

where $f_{\text{effective}}$ is the focal length of the combination, and $f_1, f_2,\ f_3, \ldots$ are the focal lengths of the individual lenses. This formula helps you determine how the lenses together will focus light and form images.

Prism

This section from Ray Optics And Optical Instruments Class 12 Notes covers the features of a Prism, its importance and various formulae applicable to it. Furthermore, students can also recapitulate their knowledge of multiple theories like dispersion and deviation of light by a prism, condition of no emergence, dispersive power which has been explained in a simple and straightforward way along with equations.

Optical Instruments

We use several optical instruments in our day to day lives which have been developed after applying the properties of reflection, refraction, dispersion etc. A brief discussion on the workings of these instruments has been given in Ray Optics And Optical Instruments Class 12 Notes. Some of the devices include:

Eye

Our eyes contain an array of interconnected nerve fibres and cells that can sense the intensity of light and colour. For instance, the retina contains nerve cells like rods and cones, which receives the light, converts it to electrical signals and sends it to the brain via the optic nerves. Furthermore, the ciliary muscles help in modifying the shape and focal length of the lens present in an eye.

Simple Microscope

A simple microscope which is also known as a magnifying glass is made of a converging lens which has a small focal length. Consequently, when it is held close to the eye magnified, an erect and virtual image is formed. On the other hand, a compound microscope has two converging lenses, an eyepiece with moderate focal length and large aperture, objective lens of small focal length and short aperture.

Magnifying Power (M): $M = \frac{D}{F} \times \frac{L}{F_o}$

Where D is the diameter of the objective lens, F is the focal length of the objective lens, L is the distance between the objective and eyepiece lenses, and F_o is the focal length of the eyepiece.

Telescope

This device is used to observe objects which are far away. However, a telescope has an objective lens of large aperture and considerable focal length and eye lens that with a small aperture and focal length.

Angular Magnification (M): M = $\frac{F_o}{F_e}$

Where F_o is the focal length of the objective lens and $F_e F$ e is the focal length of the eyepiece lens.