THE STORY OF LIGHT

Understanding How We See the World

Light is Necessary to See Objects



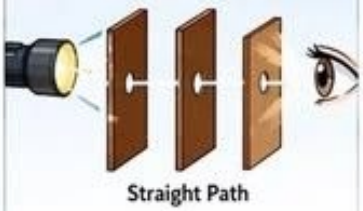
No light → No vision

Objects are Visible due to Reflection of Light



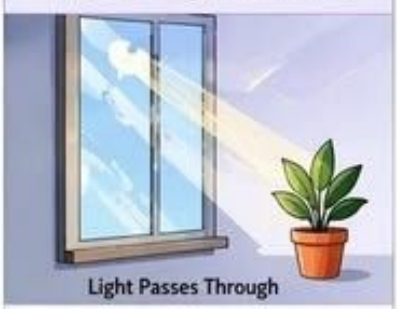
Objects reflect light

Light Travels in Straight Line



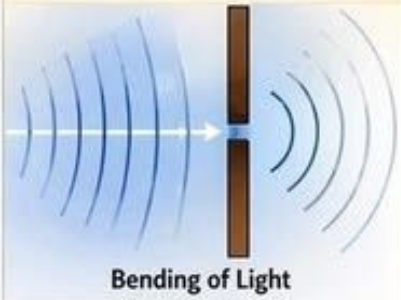
Light travels straight

Transparent Materials Allow Light to Pass



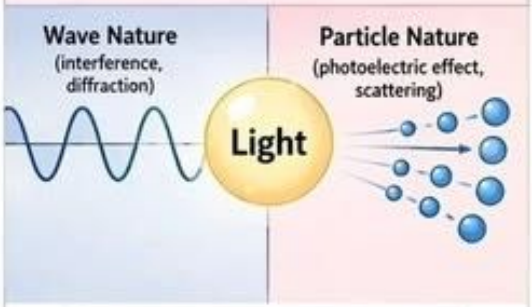
Allow light to pass

Diffraction Shows Bending of Light



Small object → Bending (diffraction)

Light Has Dual Nature (Wave + Particle)



Light = wave + particle

Optical Phenomena Include Rainbow, Mirrors, etc.



KEY TAKEAWAYS



No light → no vision

Objects reflect light

Light travels straight

Shadow proves straight path

Small object → bending (diffraction)

Light = wave + particle

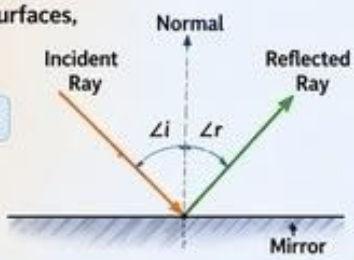
REFLECTION OF LIGHT

Light bounces back from a surface. This is called reflection.

LAWS OF REFLECTION

These laws are true for all reflecting surfaces, including spherical surfaces.

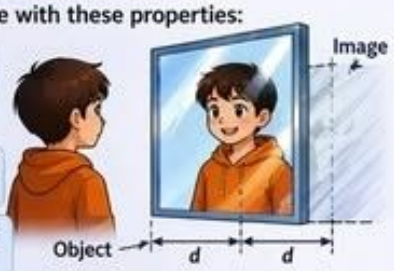
1. The angle of incidence is equal to the angle of reflection. $\angle i = \angle r$
2. The incident ray, the normal, and the reflected ray all lie in the same plane.



PLANE MIRROR AND ITS IMAGE

A plane mirror forms an image with these properties:

- Virtual and erect
- Same size as the object
- As far behind the mirror as the object is in front
- Laterally inverted (left appears as right)



ACTIVITY 9.1: THE SHINING SPOON



Take a large shining spoon. View your face in its curved surface. Do you get the image? Is it smaller or larger?



Move the spoon slowly away from your face. Observe the image. How does it change?



Reverse the spoon and repeat the activity. How does the image look now?



Compare the characteristics of the images on the two surfaces.

The curved surface of a shining spoon acts like a curved mirror.

WHAT IS A SPHERICAL MIRROR?

A spherical mirror has a reflecting surface that forms part of a sphere.

There are two types:



Concave Mirror
Reflecting surface is curved inward.

Convex Mirror
Reflecting surface is curved outward.

HOW IMAGES CHANGE ON CURVED MIRRORS

The size and nature of the image depend on the type of mirror and the distance of the object from it.

CONCAVE MIRROR



Close
Larger Image

At Medium Distance
Same Size Image

Far Away
Smaller Image

CONVEX MIRROR



Close
Smaller, Erect Image

Far Away
Smaller, Erect Image

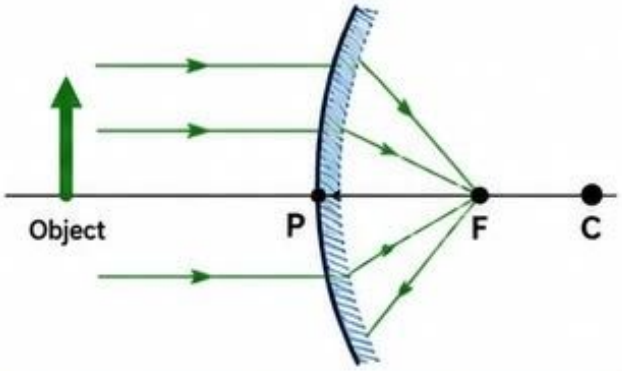
Reflection helps us see images, instruments, and even ourselves!

DIFFERENCE BETWEEN CONVERGENT & DIVERGENT MIRROR

CONVERGENT MIRROR

(CONCAVE MIRROR)

Rays meet at focus (F)

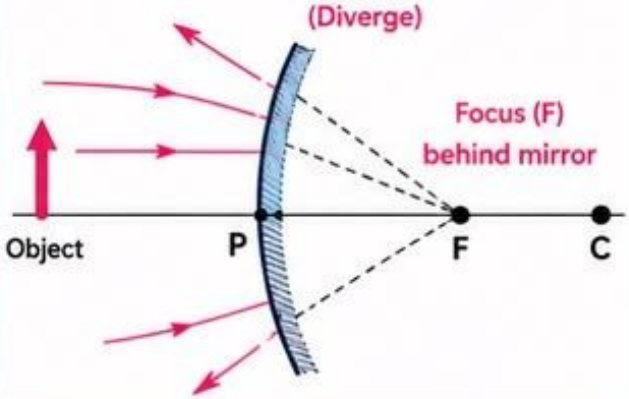


VS

DIVERGENT MIRROR

(CONVEX MIRROR)

Rays spread out (Diverge)



Concave mirror (curved inward)	**TYPE OF MIRROR**	Convex mirror (curved outward)
Light rays converge and meet at one point.	**BEHAVIOUR OF RAYS**	Light rays diverge (spread out) after reflection.
Real focus in front of mirror.	**FOCUS**	Virtual focus behind mirror.
Can form real and inverted image or virtual and erect image.	**IMAGE FORMED**	Always forms virtual, erect and diminished image.
Image can be formed in front of the mirror or behind the mirror.	**POSITION OF IMAGE**	Image is always formed behind the mirror.
Curved inward reflecting surface.	**SURFACE SHAPE**	Curved outward reflecting surface.
Used in shaving mirror, dentist mirror, headlights, solar cookers, telescopes.	**USES**	Used as rear-view mirror in vehicles, safety mirrors, security mirrors.
Examples: Shaving mirror, make-up mirror, dentist mirror, torch reflector, telescope.	**EXAMPLES**	Examples: Rear-view mirror of vehicles, security mirror in shops, traffic mirrors.

EASY TRICK TO REMEMBER

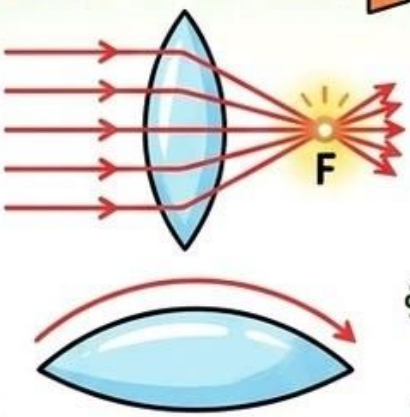
Concave = Convergent
(Rays come together)

Convex = Divergent
(Rays spread apart)

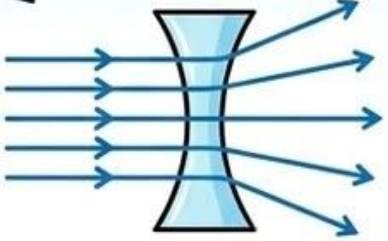
PERFECT FOR CTET / HP TET / OTHER TEACHING EXAMS

SCIENCE FOR KIDS: TYPES OF LENSES

CONVEX LENSES (CONVERGING)

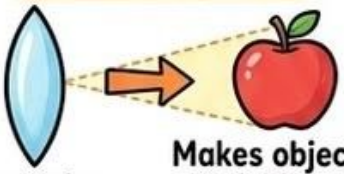


CONCAVE LENSES (DIVERGING)





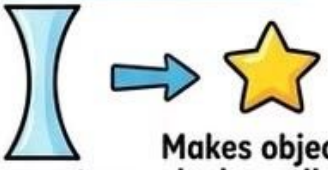
What they do:



Convex Lens

Makes objects look bigger

What they do:



Concave Lens

Makes objects look smaller

Real-Life Examples!



Magnifying



Reading glasses



Telescove



Camera



Binovatlus

Real-Life Examples!



Glasses for nearsightedness



Peephole lenses



Laser pointers



Some complex telescopes



EXPLORE OPTICS!



Dispersion of Light

Definition

- Splitting of white light into its different colours through a prism.

Example



Cause of Dispersion

- Different wavelengths
- Violet bends most
- Red bends least



Spectrum



Band of Colours (Spectrum)

Order of Colours

Violet ~ Indigo ~ Blue ~ Green ~ Yellow ~ Orange ~ Red

Important Points

- White light = **7 Colours**
- Different Wavelengths
- Rainbows in nature



Rainbow Formation



Used in **Spectrometers**



Study of Light

D.A.V PUBLIC SCHOOL, PTPS, PATRATU

SUBJECT: PHYSICS

CHAPTER: LIGHT

CLASS NOTES

→ Reflection of Light: When light falls on a shining surface, there is a change in direction of propagation of light. This phenomenon is called reflection of light.

→ Regular Reflection: When light falls on a smooth surface, the reflection is called regular reflection or plane reflection.

→ Irregular Reflection: When light falls on a rough surface, the reflection is called irregular or diffused reflection.

→ Laws of Reflection:

→ First Law: The incident ray, the normal at the point of incidence and the reflected ray; all lie in the same plane.

→ Second Law: Angle of incidence and angle of reflection are equal.

Physics

→ Formation of Image by Plane Mirror:

- In case of a plane mirror, the image is of the same size as object.
- Image is laterally inverted.
- In case of plane mirror, virtual image is formed.
- The image distance is same as object distance from the plane mirror.

→ Multiple Images: When two or more than two plane mirrors are kept at an angle with each other, multiple images are formed. This property is utilised to make kaleidoscope.

→ Spherical Mirror: When a mirror is a part of a sphere, it is called spherical mirror. Spherical mirrors are of two types:
(a) Concave mirror: When the reflecting surface is on the inside of spherical surface, it is called a concave mirror.
(b) Convex mirror: When the reflecting surface is on the outside of spherical surface, it is called a convex mirror.

→ Terms used in connection with spherical mirror:

→ Centre of curvature: The centre of sphere (of which the mirror is a part) is called centre of curvature of the spherical mirror.

→ Radius of curvature: The radius of sphere (of which the mirror is a part) is called the radius of curvature of the spherical mirror.

→ Pole: The central point of the spherical mirror is called its pole.

→ Principal axis: The line joining the pole to centre of curvature is called the pole of the spherical mirror.

→ Normal: The perpendicular to the mirror; at the point of incidence is called normal.

→ Focus: In case of a concave mirror, light rays coming from infinity converge at a point after reflection. In case of a

convex mirror, light rays coming from infinity appear to be diverging from a point after reflection. This point is called the focus of the mirror. Focal length is half of the radius of curvature for a spherical mirror.
So, f = r/2
Laws of Reflection and Spherical Mirrors

→ Laws of reflection are obeyed in spherical mirrors as well. Following are the important points in case of spherical mirror:
(a) A ray; parallel to the principal axis; passes through the focus of the mirror or appears to diverge from the focus; after reflection.
(b) A ray; directed towards the focus of the mirror; comes out as parallel to the principal axis after reflection.
(c) A ray; directed towards the centre of curvature; retraces its path after reflection.
Table

→ Uses of Concave Mirror:

- As reflector in headlights and flashlights.
- By ENT specialists, to throw a beam of light inside ear.
- By dentists, to see enlarged image of the tooth.
- By hairdresser, to see enlarged image of the face.

→ Uses of Convex Mirror:

- At hairpin bends, so that a driver can see the vehicles coming from other side of the bend.
- As rear view mirror in vehicles.

→ Mirror: A surface with one polished surface and another reflecting surface.

Physics

→ Normal: Perpendicular to the reflecting surface at the point of incidence.

→ Incident ray: The light ray falling on a surface.

→ Diverging mirror: Convex mirror is also known as diverging mirror.

→ Kaleidoscope: A device which shows beautiful patterns because of multiple images.

SELF ASSESMENT QUESTION

Section A: Very Short Answer Questions (1 Mark Each)

1. What is light?
2. Name the natural source of light nearest to Earth.
3. What is meant by reflection of light?
4. Define a ray of light.
5. What is a beam of light?
6. What is regular reflection?
7. What is irregular (diffused) reflection?
8. What is an incident ray?
9. What is a reflected ray?
10. What is the normal in reflection?
11. State the first law of reflection.
12. State the second law of reflection.
13. What is a plane mirror?

14. What is lateral inversion?
15. Why can we see our image in a mirror?
16. What is a spherical mirror?
17. Name the two types of spherical mirrors.
18. What is a concave mirror?
19. What is a convex mirror?
20. What is a lens?

Section B: Short Answer Questions (2 Marks Each)

21. Differentiate between luminous and non-luminous objects with examples.
22. Explain reflection of light with a neat diagram.
23. Write any two differences between regular and irregular reflection.
24. Why is a polished surface a good reflector of light?
25. Define angle of incidence and angle of reflection.
26. Why are objects visible during daytime?
27. Explain lateral inversion with an example.
28. Why is the word "AMBULANCE" written in reverse on ambulances?
29. Give any two uses of plane mirrors.
30. What is a spherical mirror? Name its types.
31. Write two uses of concave mirrors.
32. Write two uses of convex mirrors.

33. What is a lens? Name its types.

34. Differentiate between a convex lens and a concave lens.

35. Write two uses of convex lenses.

Section C: Long Answer Questions (3 Marks Each)

36. Explain the laws of reflection of light.

37. Draw and explain regular reflection.

38. Draw and explain irregular reflection.

39. Describe image formation by a plane mirror.

40. Explain the characteristics of an image formed by a plane mirror.

41. Describe the uses of concave mirrors in daily life.

42. Explain why convex mirrors are used as rear-view mirrors in vehicles.

43. Describe the structure and uses of convex lenses.

44. Describe the structure and uses of concave lenses.

45. Explain the process of dispersion of light.

Section D: Competency-Based and Application-Based Questions

46. A student shines a torch on a smooth mirror and then on a rough wall. The mirror produces a clear reflection, while the wall does not. Explain why.

47. Rahul stands 2 m in front of a plane mirror. How far is his image from the mirror? Explain your answer.

48. During driving, a driver uses a convex mirror instead of a plane mirror. Why is a convex mirror preferred?

49. After rain, a rainbow appears in the sky. Which property of light is responsible for this phenomenon? Explain briefly.

50. Sir Isaac Newton passed a beam of sunlight through a glass prism and observed seven colours. What is this phenomenon called? Name the seven colours obtained.