

1: State three uses of concave mirrors.

- **Shaving / Makeup mirrors:** Forms an erect and magnified image when held close (between focus and pole).
- **Headlights & Searchlights:** Placing light source at focus produces a powerful parallel light beam.
- **Dentist's mirrors:** Enables dentists to see an enlarged view of teeth.

2: A convex rear view mirror is preferred over a plane mirror in a car. Why?

- **Wider Field of View:** Curved outwards to offer a much wider field of view than a plane mirror.
- **Erect & Diminished Images:** Consistently forms upright and smaller images of rear traffic for safe driving.

3: Convex lens focus vs Concave lens focus?

- **Convex Lens (Real Focus):** Parallel rays physically intersect at a point after refraction.
- **Concave Lens (Virtual Focus):** Light rays diverge after refraction and only appear to originate from a point when extended backward.

4: Why do we need a shiny surface for reflection?

- **High Reflectivity:** Smooth, shiny surfaces reflect incident light rays in an organized, parallel manner (specular reflection).
- **Prevents Light Loss:** Rough surfaces scatter light (diffuse reflection) and absorb more energy instead of reflecting it back clearly.

5: Converging vs Diverging lenses?

- **Convex Lens (Converging):** Bends incident parallel light rays inward towards the principal axis to meet at a single focal point.
- **Concave Lens (Diverging):** Bends incident parallel light rays outward, spreading them apart.

6: Why are convex lenses used as a magnifying glass?

When an object is placed close to a convex lens (between principal focus and optical centre), it produces a virtual, erect, and magnified image on the same side.

7: What is a spectrum?

A spectrum is the band of seven distinct colors (VIBGYOR: Violet, Indigo, Blue, Green, Yellow, Orange, Red) produced when white light undergoes dispersion (splitting) while passing through a transparent medium like a glass prism.

8: Differences between real and virtual images

Feature	Real Image	Virtual Image
Formation	Light rays actually intersect after reflection or refraction.	Light rays only appear to meet when extended backwards.
Screen Capability	Can be obtained on a screen.	Cannot be obtained on a screen.

Orientation	Always inverted relative to object.	Always erect (upright) relative to object.
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Long Answers (5 Marks) — Chapter 3 Light: Mirrors and Lenses

LA 1: What are the uses of the curved mirrors and lenses?

Uses of Curved Mirrors:

- **Concave Mirrors:** Used in shaving/makeup mirrors (magnified image), car headlights and searchlights (parallel beam), solar furnaces (concentrating heat), and by dentists to inspect teeth.
- **Convex Mirrors:** Used as rear-view mirrors in vehicles to provide a wider field of view, in street light reflectors to spread light over a wider area, and as security mirrors in shops and ATMs.

Uses of Lenses:

- **Convex Lenses:** Used as magnifying glasses, in cameras to focus light on sensors, in eye spectacles to correct hypermetropia (farsightedness), and in microscopes/telescopes.
- **Concave Lenses:** Used in eye spectacles to correct myopia (nearsightedness), in peepholes of doors for a wider view, and in lasers/flashlights to diverge light beams.

LA 2: Show that when seven colours are mixed together then white colour is formed. Explain with the help of an activity?

White light is composed of seven spectral colors (VIBGYOR: Violet, Indigo, Blue, Green, Yellow, Orange, and Red). When these seven colors are mixed rapidly, our eyes synthesize them back into white light due to the persistence of vision. This can be demonstrated using Newton's Colour Disc activity.

Activity: Newton's Colour Disc

- **Materials Required:** A circular cardboard disc, white paper, paints/markers (VIBGYOR colors), and a central pin/spindle.
- **Procedure:** 1. Cut a round circular piece out of cardboard.
2. Divide the circle into seven equal sector segments.
3. Paint each segment with one of the seven colors of the rainbow (Violet, Indigo, Blue, Green, Yellow, Orange, Red).
4. Fix a central pin or small stick through the center of the disc so it can spin freely.
- **Observation:** When the disc is rotated slowly, all seven colors are distinctly visible. However, when the disc is spun rapidly, the individual colors blend together, and the disc appears off-white or white.
- **Conclusion:** This activity demonstrates that white light is a combination of the seven spectrum colors.

LA 3: Explain the setup used by Newton to obtain a spectrum.

Sir Isaac Newton conducted a famous experiment using a glass prism to show that sunlight consists of seven constituent colors (dispersion of light).

Newton's Experimental Setup:

- **Light Source & Aperture:** Newton allowed a narrow beam of sunlight to enter a dark room through a tiny pinhole in a window shutter.
- **Glass Prism Placement:** He placed a triangular glass prism in the path of the narrow white light beam.
- **Screen & Dispersion:** As white light entered the prism, it bent (refracted) at different angles depending on wavelength. Red light bent the least, while violet light bent the most.

- **Observation:** On a white screen placed on the opposite side of the prism, a colored band of seven colors appeared in the order of VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange, Red). This rainbow-like band is called a spectrum.

Recombination Experiment:

To prove that the prism itself does not color the light, Newton placed a second identical prism in an inverted position behind the first prism. The separated colors recombined into a beam of white light, confirming white light is made of 7 colors.

LA 4: Write the properties of the image formed by a:

(i) Plane Mirror:

- **Virtual and Erect:** The image cannot be caught on a screen and is right-side up.
- **Same Size:** Image height is equal to the object height.
- **Laterally Inverted:** The left side of the object appears as the right side in the image.
- **Equal Distance:** Distance of the image behind the mirror equals the distance of the object in front of it.

(ii) Concave Mirror:

- **Real & Inverted (in most cases):** When object is beyond Focus (F), the image formed is real and inverted.
- **Virtual & Erect (when close):** When object is placed between Focus (F) and Pole (P), the image formed is virtual, erect, and magnified.
- **Variable Size:** Image size can be magnified, diminished, or same size depending on object position.

(iii) Convex Mirror:

- **Always Virtual and Erect:** Image cannot be taken on a screen and is always upright.
- **Always Diminished:** Image size is always smaller than the object.
- **Location:** Image is always formed behind the mirror between Pole (P) and Focus (F).

(iv) Concave Lens:

- **Always Virtual and Erect:** Light rays diverge after refraction; image is formed on the same side as the object.
- **Always Diminished:** Image size is always smaller than the object.
- **Location:** Formed between Optical Centre (O) and Focus (F).

(v) Convex Lens:

- **Real & Inverted (mostly):** When object is beyond Focus (F), image is real, inverted, and can be projected on a screen.
- **Virtual & Erect (when close):** When object is between Focus (F) and Optical Centre (O), image is virtual, erect, and magnified.
- **Variable Size:** Image can be enlarged, diminished, or same size depending on object distance.