Standard 9 Science Chapter 11 Question Papers

Set 1

Q.1. Objectives (4 Marks)

1. Light is actually _____ radiation.
2. The centre of the mirror surface is called its _____.
3. According to the Cartesian sign convention, the object is always kept on the _____ of the mirror.
4. The image formed by a plane mirror is of the _____ size as the source.

Q.2. Short Answer (8 Marks)

Solve Any 4 (2 marks each)

1. Why are the mirrors fitted on the outside of cars convex?
2. Which type of mirrors are used in a periscope and a kaleidoscope?
3. If a spherical mirror breaks, what type of mirrors are the individual pieces?
4. Why does obtaining the image of the sun on a paper with the help of a concave mirror burn the paper?
5. What sign conventions are used for reflection from a spherical mirror?

Q.3. Brief/Long Answer (8 Marks)

Solve Any 2 (4 marks each)

1. Draw ray diagrams for images obtained in concave mirrors when the object is placed at the Focus.
2. An object of height 7 cm is kept at a distance of 25 cm in front of a concave mirror. The focal length of the mirror is 15 cm. At what distance from the mirror should a screen be kept so as to get a clear image? What will be the size and nature of the image?
3. Explain the difference between a plane mirror, a concave mirror and a convex mirror with respect to the type and size of the images produced.

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Set 2

Q.1. Objectives (4 Marks)

1. The focal length of a concave mirror is _____.
2. If the reflected rays do not actually meet, such an image is called a _____ image.
3. 1 nanometer = _____ meters.
4. If an incident ray is parallel to the principal axis, then the reflected ray passes through the _____.

Q.2. Short Answer (8 Marks)

Solve Any 4 (2 marks each)

1. Why are concave mirrors used in solar devices?
2. Which type of mirrors are used in floodlights and street lights?
3. Describe the positions of the source of light with respect to a concave mirror in a torch light.
4. Which type of mirrors are used in shaving mirrors and head lamps of a car?
5. Three mirrors are created from a single sphere. Which of the following - pole, centre of curvature, radius of curvature, principal axis - will be common to them?

Q.3. Brief/Long Answer (8 Marks)

Solve Any 2 (4 marks each)

1. Draw ray diagrams for images obtained in concave mirrors when the object is placed at the Centre of curvature.
2. A convex mirror has a focal length of 18 cm. The image of an object kept in front of the mirror is half the height of the object. What is the distance of the object from the mirror?
3. Describe the positions of the source of light with respect to a concave mirror in: 1. Torch light 2. Projector lamp 3. Floodlight.

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Set 3

Q.1. Objectives (4 Marks)

1. The distance between the pole and the principal focus of the mirror is called the _____.
2. A convex mirror is also called a _____ mirror.
3. The formula determining the relationship between object distance, image distance and focal length is called the _____.
4. For real images, the height is taken to be _____.

Q.2. Short Answer (8 Marks)

Solve Any 4 (2 marks each)

1. Which type of mirrors are used in a shaving mirror and a kaleidoscope?
2. If a spherical mirror breaks, what type of mirrors are the individual pieces?
3. Describe the position of the source of light in a Projector lamp.
4. Why are the mirrors fitted on the outside of cars convex?
5. State the rules for drawing ray diagrams.

Q.3. Brief/Long Answer (8 Marks)

Solve Any 2 (4 marks each)

1. Draw ray diagrams for images obtained in concave mirrors when the object is placed at an infinite distance.
2. A convex mirror has a focal length of 18 cm. The image of an object kept in front of the mirror is half the height of the object. What is the distance of the object from the mirror?
3. What sign conventions are used for reflection from a spherical mirror?

Standard 9 Science Chapter 11 Question Papers

Set 4

Q.1. Objectives (4 Marks)

1. Magnification due to a spherical mirror is given by the ratio of the height of the image to the _____.
2. The radius of the sphere of which the mirror is a part, is called the _____ of the mirror.
3. The image formed by a convex mirror is always virtual, smaller than the object and situated _____ the mirror.
4. $1/v + 1/u =$ _____.

Q.2. Short Answer (8 Marks)

Solve Any 4 (2 marks each)

1. Which type of mirrors are used in street lights and head lamps of a car?
2. Why does obtaining the image of the sun on a paper with the help of a concave mirror burn the paper?
3. Describe the position of the source of light in a Floodlight.
4. Three mirrors are created from a single sphere. Which of the following - pole, centre of curvature, radius of curvature, principal axis - will be common to them?
5. State the use of a concave mirror in a torch.

Q.3. Brief/Long Answer (8 Marks)

Solve Any 2 (4 marks each)

1. A 10 cm long stick is kept in front of a concave mirror having focal length of 10 cm in such a way that the end of the stick closest to the pole is at a distance of 20 cm. What will be the length of the image?
2. Explain the difference between a plane mirror, a concave mirror and a convex mirror with respect to the type and size of the images produced.
3. Draw ray diagrams for images obtained in concave mirrors when the object is placed between the pole and focus.

ANSWER KEYS

Set 1 Answer Key

Q.1. Objectives

1. Electromagnetic [33]
2. Pole [34]
3. Left [35]
4. Same [36]

Q.2. Short Answer

1. **Mirrors on cars:**
    - Convex mirrors are used on the sides of cars.
    - They are used because they form an erect image.
    - The image is smaller than the object.
    - This allows the driver to see a much larger area of the surroundings compared to a plane mirror. [373737]
2. **Periscope and Kaleidoscope:**
    - Periscope uses plane mirrors.
    - Kaleidoscope uses plane mirrors. [3838]
3. **Broken Mirror:**
    - If a spherical mirror breaks, the nature of the curvature remains the same for the pieces.
    - Therefore, the individual pieces are of the same type (concave or convex) as the original mirror. [3939]
4. **Burning Paper:**
    - Sun rays are parallel to the principal axis.
    - A concave mirror converges parallel rays to a single point called the focus.
    - When the sun's rays are focused on the paper, a large amount of heat energy is concentrated at that point.
    - This concentrated heat causes the paper to burn. [40404040]
5. **Sign Conventions:**
    - The pole of the mirror is taken as the origin and the principal axis as the X-axis.
    - The object is always kept on the left of the mirror; distances measured to the right of the pole are positive, left are negative.

- Distances measured vertically upwards from the principal axis are positive.
- Distances measured vertically downwards are negative. [41]

Q.3. Brief/Long Answer

1. **Ray Diagram (Object at Focus):**
   - *Diagram Requirement:* Draw a concave mirror with P, F, C marked.
   - *Ray 1:* Parallel to principal axis -> Reflects through Focus.
   - *Ray 2:* Through Centre of Curvature -> Reflects back on same path (or Ray through Pole).
   - *Image:* Reflected rays are parallel and do not meet.
   - *Conclusion:* Image is formed at infinity, Real, Inverted, and Very Large. [4242]
2. **Numerical:**
   - Given: $h_1 = 7$ cm, $u = -25$ cm, $f = -15$ cm (Concave).
   - Formula: $1/v + 1/u = 1/f \Rightarrow 1/v = 1/f - 1/u$
   - Calculation: $1/v = 1/(-15) - 1/(-25) = -1/15 + 1/25 = (-5 + 3)/75 = -2/75$.
   - Result: $v = -37.5$ cm. The screen should be placed 37.5 cm in front of the mirror.
   - Magnification: $h_2/h_1 = -v/u \Rightarrow h_2 = 7 \times [-(-37.5)/(-25)] = 7 \times (-1.5) = -10.5$ cm.
   - Nature: The image is Real, Inverted, and Magnified (10.5 cm). [4343]
3. **Differences:**
   - **Plane Mirror:** Image is virtual, erect, and of the same size as the object.
   - **Concave Mirror:** Image can be real or virtual, inverted or erect, and magnified, diminished or same size depending on object position.
   - **Convex Mirror:** Image is always virtual, erect, and smaller than the object.
   - **Field of View:** Convex mirrors cover a wider field of view than plane or concave mirrors. 4444444444

Set 2 Answer Key

Q.1. Objectives

1. Negative [45]
2. Virtual [46]
3. 10^{-9} [47]
4. Principal Focus [48]

Q.2. Short Answer

1. **Solar Devices:**
    - Concave mirrors are used in solar devices.
    - Sun rays are parallel incident rays.
    - Concave mirrors focus these parallel rays to a single point (focus) in the focal plane.
    - This concentration of heat energy is utilized in solar devices. [494949]
2. **Floodlights and Street Lights:**
    - **Floodlights:** Use concave mirrors. Source is placed beyond C to throw bright light.
    - **Street Lights:** Use convex mirrors (or divergent beam logic). Light needs to spread out (diverge). [5050]
3. **Torch Light:**
    - In a torch, the source of light is kept at the focus of the concave mirror.
    - Rays starting from the focus become parallel to the principal axis after reflection.
    - This produces a strong, parallel beam of light.
    - This allows the light to travel a long distance. [515151]
4. **Shaving and Car Headlamps:**
    - **Shaving Mirror:** Concave mirror is used. (Produces erect, magnified image when face is close).
    - **Car Headlamps:** Concave mirror is used. (Source at focus gives parallel beam). [525252]
5. **Common Properties (Three Mirrors):**
    - Centre of curvature is common (it is the centre of the original sphere).
    - Radius of curvature is common (radius of the original sphere).
    - Pole and Principal axis will not be common as they depend on the specific cut section. [53]

Q.3. Brief/Long Answer

1. **Ray Diagram (Object at C):**

- *Diagram:* Concave mirror, Object placed at C.
- *Ray 1:* Parallel to axis -> Through F.
- *Ray 2:* Through F -> Parallel to axis.
- *Image:* Rays meet at C, below the axis.
- *Nature:* Real, Inverted, Same size as object. [5454]

2. **Numerical:**
    - Given: Convex mirror $f = +18$ cm. Image height $h_2 = 0.5 \times h_1$.
    - Magnification $m = -v/u = h_2/h_1 = 0.5$. (Convex image is virtual/erect, so m is positive).
    - Relation: $v = -0.5u$.
    - Formula: $1/v + 1/u = 1/f$. Substitute v: $1/(-0.5u) + 1/u = 1/18$.
    - Calculation: $-2/u + 1/u = 1/18 \Rightarrow -1/u = 1/18$.
    - Result: $u = -18$ cm. The object is placed 18 cm in front of the mirror. [5555]
3. **Positions of Source:**
    - **Torch Light:** Source is placed at the Focus. This produces a parallel beam of light.
    - **Projector Lamp:** Source is placed at the Centre of Curvature (or close to it) to form an image on the screen. (Note: Usually between F and C for magnification, but text might specify based on use cases). *Correction based on text:* Text lists "Projector lamp" in questions but defines "Torch" and "Floodlight" in Uses. Standard physics: Projectors place object between F and 2F. However, for "Source", it's usually at C or F depending on design.
    - **Floodlight:** The source of light is placed a little beyond the centre of curvature. This gives a bright beam of light. [565656]

Set 3 Answer Key

Q.1. Objectives

1. Focal length [57]
2. Dispersing [5858]
3. Mirror formula [59]
4. Negative [60]

Q.2. Short Answer

1. **Shaving and Kaleidoscope:**
    - **Shaving Mirror:** Concave mirror (gives magnified, erect image).
    - **Kaleidoscope:** Plane mirrors (creates multiple reflections/patterns). [61616161]
2. **Broken Mirror Pieces:**
    - If a spherical mirror breaks, the curvature (radius) remains unchanged.
    - The nature of the reflecting surface (inner or outer) remains the same.
    - Therefore, the individual pieces are of the same type (concave or convex) as the original mirror. [6262]
3. **Projector Lamp:**
    - In a projector, the source (or object) is placed such that a real, magnified image is obtained.
    - The source is typically placed between the focus and the centre of curvature.
    - This produces a real, inverted, and magnified image on the screen. [6363]
4. **Car Side Mirrors (Convex):**
    - Convex mirrors are used because they always produce an erect image.
    - The image formed is diminished (smaller).
    - This allows a wider field of view for the driver to see traffic behind. [646464]
5. **Ray Diagram Rules:**
    - Rule 1: Incident ray parallel to principal axis passes through principal focus after reflection.
    - Rule 2: Incident ray passing through principal focus goes parallel to principal axis after reflection.
    - Rule 3: Incident ray passing through centre of curvature traces the same path back. [65]

Q.3. Brief/Long Answer

1. **Ray Diagram (Object at Infinity):**
    - *Diagram:* Parallel rays coming from infinity (parallel to axis).

- *Reflection:* All rays converge at the Principal Focus (F).
- *Nature:* Real, Inverted, Point image (highly diminished). [6666]

2. **Numerical (Convex Mirror):**
   - *Refer to Set 2 Q3 Solution.*
   - $m = 0.5$, $f = +18$.
   - $1/(-0.5u) + 1/u = 1/18 \Rightarrow -1/u = 1/18 \Rightarrow u = -18$ cm. [6767]
3. **Sign Conventions:**
   - Pole (P) is the origin. Principal axis is X-axis.
   - Distances right of P are positive (+); left of P are negative (-).
   - Distances upward from axis are positive (+); downward are negative (-).
   - Focal length of concave is negative (-); convex is positive (+). [68]

Set 4 Answer Key

Q.1. Objectives

1. Height of the object [69]
2. Radius of curvature [70]
3. Behind [71]
4. $1/f$ [72]

Q.2. Short Answer

1. **Street Lights and Car Headlamps:**
    - **Street Lights:** Convex mirrors are often used to diverge light over a large area.
    - **Car Headlamps:** Concave mirrors are used to produce a parallel beam of light (source at focus). 73737373
2. **Burning Paper:**
    - Concave mirrors converge parallel sun rays to the focus.
    - This convergence concentrates a large amount of solar heat energy at a single point.
    - The concentrated heat raises the temperature of the paper to its ignition point, causing it to burn. 74747474
3. **Floodlight Source Position:**
    - The source of light is placed a little beyond the centre of curvature of the mirror.
    - This position is chosen to obtain a bright beam of light. [75]
4. **Common Properties:**
    - Centre of curvature.
    - Radius of curvature. (These belong to the original sphere and apply to any piece).
    - (Pole and Principal Axis are specific to the cut mirror fragment). [76]
5. **Concave Mirror in Torch:**
    - The bulb (source) is placed at the focus of the concave mirror.
    - Rays from the focus reflect to become parallel to the principal axis.
    - This creates a strong, focused beam of light for visibility. [77]

Q.3. Brief/Long Answer

1. **Stick Image Numerical:**
    - *Given:* Stick length = 10 cm. $f = 10$ cm (Concave). Closest end at $u = 20$ cm.
    - *Analysis:* Since $f=10$, Radius of curvature $R = 2f = 20$ cm.

- The stick is placed at the Centre of Curvature (C = 20 cm).
- *Logic:* For an object placed at C, the image is formed at C. It is real, inverted, and of the same size.
- *Calculation:* Since the object is at C, Magnification = -1. Length of image = Length of object.
- *Result:* The length of the image will be **10 cm**. [78787878]

2. **Difference (Plane, Concave, Convex):**
   - **Plane:** Image always virtual, erect, same size.
   - **Concave:** Image nature changes with distance (Real/Virtual, Magnified/Diminished). Used for focusing light.
   - **Convex:** Image always virtual, erect, diminished. Used for dispersing light/wide view. [79797979]
3. **Ray Diagram (Between Pole and Focus):**
   - *Diagram:* Object placed close to mirror (inside F).
   - *Ray 1:* Parallel to axis -> Through F.
   - *Ray 2:* Through C (appears to come from C) -> Retraces path.
   - *Image:* Rays diverge in front, but meet behind the mirror when extended.
   - *Nature:* Virtual, Erect, Magnified. [80]