NCERT Exemplar Solutions for Class 6 Science
Chapter 11: Light

Multiple Choice Questions

1. Observe the picture given in fig 11.1 carefully.

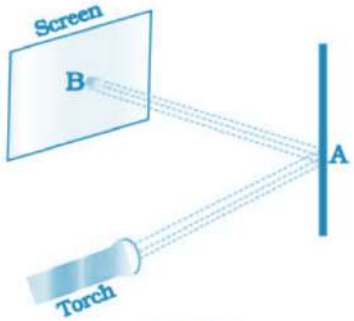


Fig. 11.1

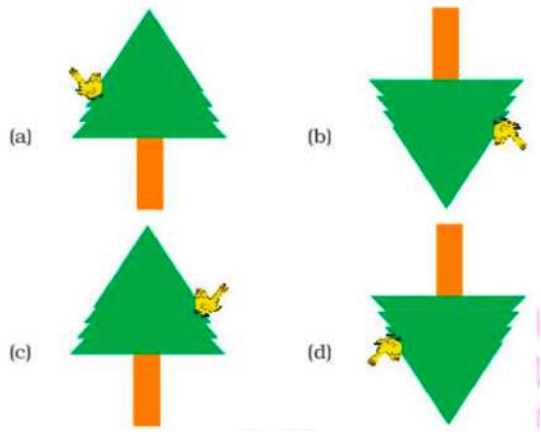
A patch of light is obtained at B, when the torch is lighted as shown. Which of the following is kept at position A to get this patch of light?

(a) A lens
(b) A glass sheet
(c) A mirror
(d) A sheet of white paper

Solution: (c) Mirror

Explanation: Only a mirror can reflect light rays and change their direction effectively. When light from the torch hits the mirror at position A, it reflects and creates a patch of light at point B on the screen. Other materials like glass sheets or white paper cannot redirect light in this manner to create a focused patch.

2. A student observes a tree given in figure through a pinhole camera. Which of the diagrams given in figures (a) to (d) depicts the image seen by her correctly?



Solution: (b) Option (b) depicts the image seen by the student correctly
Explanation: In a pinhole camera, the image formed is always inverted (upside down) with lateral inversion. This happens because light travels in straight lines, and rays from the top of the object form the bottom of the image, while rays from the bottom form the top of the image.

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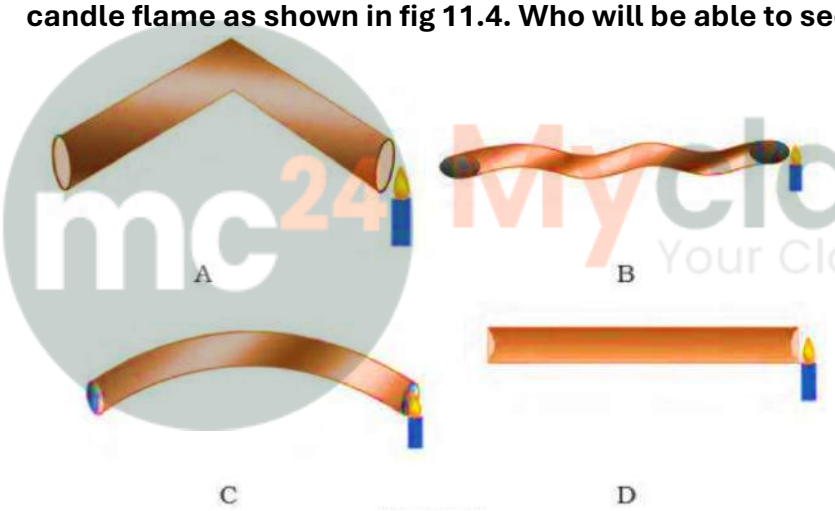
3. Four students A, B, C and D looked through pipes of different shapes to see a candle flame as shown in fig 11.4. Who will be able to see the candle flame clearly?



(a) A
(b) B
(c) C
(d) D
Solution: (d) D
Explanation: Light travels in a straight line. Only student D has a straight pipe that allows light from the candle flame to travel directly to their eye without obstruction. The curved or bent pipes used by students A, B, and C will block the light path, preventing them from seeing the flame clearly.

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4. Which of the following is/are not always necessary to observe a shadow?
(a) Sun
(b) Screen

(c) Source of light
(d) Opaque object
Solution: (a) Sun
Explanation: While the Sun is a source of light, it is not always necessary to observe a shadow. Any source of light (like a torch, bulb, candle, etc.) can create shadows. The Sun is just one example of a light source, but shadows can be formed using any artificial or natural light source.

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5. Paheli observed the shadow of a tree at 8:00 a.m., 12:00 noon and 3:00 p.m. Which of the following statements is closest to her observation about the shape and size of the shadow?
(a) The shape of the shadow of the tree changes but the size remains the same.
(b) The size of the shadow of the tree changes but the shape remains the same.
(c) Both the size and shape of the shadow of the tree change.
(d) Neither the shape nor the size of the shadow changes.
Solution: (c) Both the size and shape of the shadow of the tree change.
Explanation: As the Sun moves across the sky throughout the day, its position relative to the tree changes continuously. This causes both the length and direction of the shadow to change, resulting in variations in both size and shape. At noon, shadows are shortest, while in early morning and late afternoon, they are longer.

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6. Which of the following can never form a circular shadow?
(a) A ball
(b) A flat disc
(c) A shoe box
(d) An ice cream cone
Solution: (c) A shoe box
Explanation: A shoe box has a rectangular or square cross-section. No matter how light falls on it, the shadow will always have straight edges and angular corners, never forming a perfect circle. In contrast, a ball, flat disc, and ice cream cone can all form circular shadows under appropriate lighting conditions.

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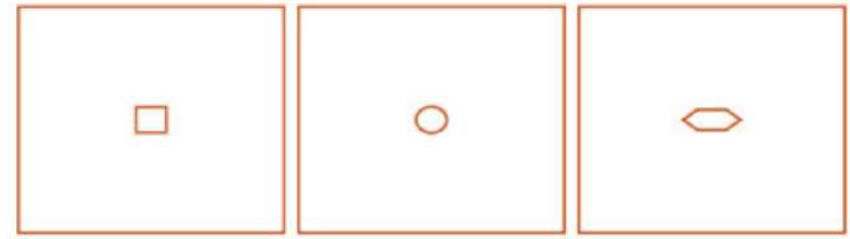
7. Two students while sitting across a table looked down on to its top surface. They noticed that they could see their own and each other's image. The table top is likely to be made of:
(a) Unpolished wood
(b) Red stone
(c) Glass sheet
(d) Wood top covered with cloth
Solution: (c) Glass sheet
Explanation: Only a smooth, reflective surface like a glass sheet can clearly reflect light to form visible images. Glass has a smooth surface that can act like a mirror, allowing the students to see their reflections. Unpolished wood, stone, or cloth surfaces are too rough to create clear reflections.

Very Short Answer Questions

8. You have 3 opaque strips with very small holes of different shapes as shown in fig 11.5. If you obtain an image of the sun on a wall through these holes, will the image formed by these holes be the same or different?



Solution: All three opaque strips will form the **same image** of the sun.
Explanation: When the holes are very small, they act as pinholes regardless of their shape. In pinhole cameras, the shape of the pinhole does not affect the final image - it only affects the brightness. The image of the sun will always be circular (matching the sun's shape) and inverted, regardless of whether the pinhole is square, circular, or oval-shaped.

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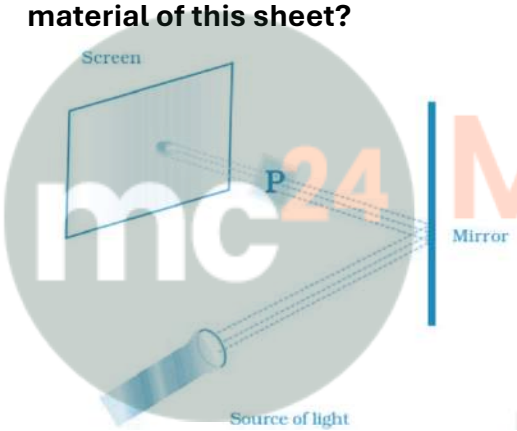
9. Observe the picture given in fig 11.6. A sheet of some material is placed at position 'P', still the patch of light is obtained on the screen. What is the type of material of this sheet?



Solution: The sheet at position P must be made of **transparent material**.
Explanation: Since light is still reaching the screen and forming a patch even after placing the sheet at position P, the material must allow light to pass through it. Only transparent materials like clear glass, clear plastic, or cellophane allow light to pass through with minimal obstruction.

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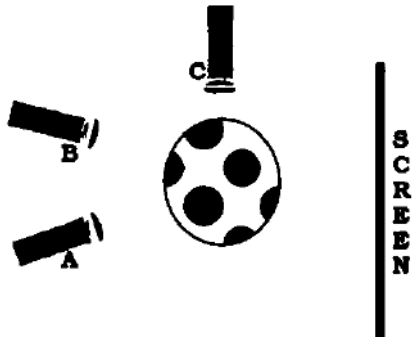
10. Three torches A, B and C shown in fig. are switched on one by one. The light from which of the torches will not form a shadow of the ball on the screen?



Solution: The light from **torch C** will not form a shadow of the ball on the screen.
Explanation: Light travels in straight lines. Torch C is positioned parallel to the screen, meaning its light rays run alongside the screen rather than hitting it. Since the light doesn't fall on the screen, no shadow can be formed there. Torches A and B can create shadows because their light reaches the screen.

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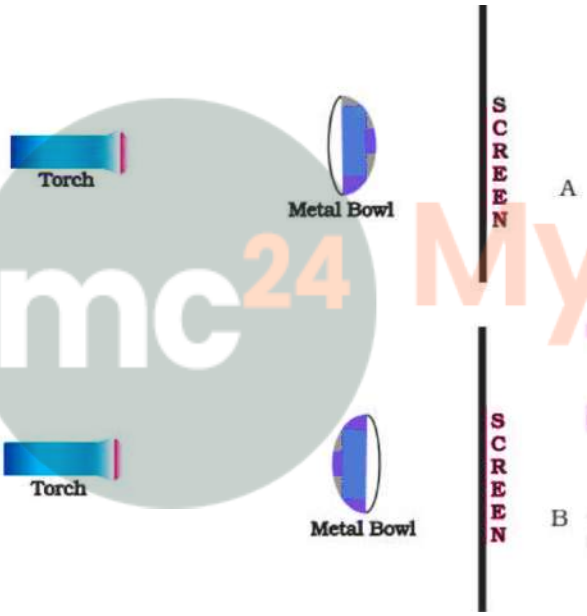
11. Look at the given figure. Will there be any difference in the shadow formed on the screen in A and B?



Solution: No, the shadows formed on screens A and B will be the same.
Explanation: Both setups have the same torch, metal bowl (object), and screen arrangement. The distance and relative positions appear identical, so the size, shape, and intensity of the shadows will be the same in both cases.

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12. Correct the following statements:
(i) The colour of the shadow of an object depends on its colour of the object.
(ii) Transparent objects allow light to pass through them partially.
Solution: (i) Corrected statement: The colour of the shadow does not depend on the colour of the object. Shadows are usually dark or black because they are areas where light is blocked.
(ii) Corrected statement: Transparent objects allow most of the light to pass through them completely. Translucent objects allow light to pass through them partially.

Explanation: Shadows are formed by the absence of light, not by the color of the object blocking the light. Transparent materials like clear glass allow nearly all light to pass through, while translucent materials like frosted glass allow only some light to pass through.

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13. Suggest a situation where we obtain more than one shadow of an object at a time.

Solution: We can obtain multiple shadows when **more than one light source** illuminates the same object simultaneously.

Examples:

- In a cricket stadium with multiple floodlights, players cast several shadows in different directions
- In a room with multiple lamps or bulbs switched on
- During outdoor events with stage lighting using several spotlights
- In photography studios with multiple light sources

Explanation: Each light source creates its own shadow of the object. When multiple light sources are present, each one creates a separate shadow, resulting in multiple shadows of the same object.

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14. On a sunny day, does a bird or an aeroplane flying high in the sky cast its shadow on the ground? Under what circumstances can we see their shadow on the ground?

Solution: No, a bird or aeroplane flying high in the sky cannot cast a visible shadow on the ground.

Explanation: Objects flying at high altitudes are too far from the ground for their shadows to be clearly visible. The shadow becomes very faint and diffused due to the large distance.

Circumstances where we can see their shadows:

- When they fly very close to the ground (low altitude)
- When they fly over smooth, light-colored surfaces like snow or sand
- During specific times when the sun angle is optimal
- When they are large enough (like low-flying aircraft)

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15. You are given a transparent glass sheet. Suggest any two ways to make it translucent without breaking it.

Solution: Two ways to make a transparent glass sheet translucent:

(i) Apply materials to the surface:

- Apply oil, grease, or butter on the glass surface
- Paste butter paper, wax paper, or frosted tape on it
- Apply soap solution or toothpaste

(ii) Roughen the surface:

- Rub the glass surface with sandpaper or abrasive material
- Use steel wool to create fine scratches on the surface
- Apply etching cream (with adult supervision)

Explanation: These methods work by either creating a rough surface that scatters light or by adding a layer that partially blocks light transmission, converting the transparent glass into translucent material.

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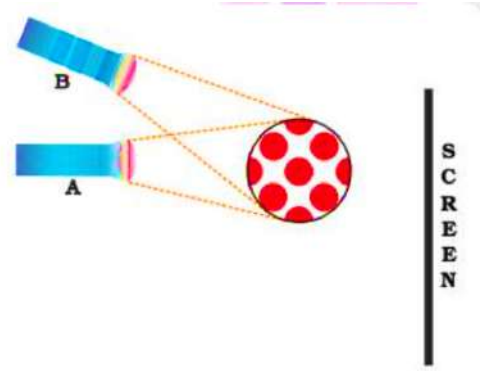
16. A torch is placed at two different positions A and B, one by one, as shown in fig 11.9. Match the position of the torch and shape of the shadow of the ball.



Solution: A → a (Position A forms shadow 'a')
B → b (Position B forms shadow 'b')
Explanation: The position of the light source directly affects the shadow's shape and size. When the torch is at position A (closer and at a different angle), it creates shadow 'a'. When moved to position B, the changed angle and distance result in shadow 'b' with different characteristics.

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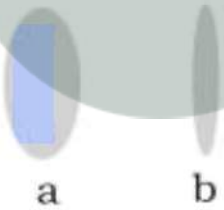
17. A student covered a torch with red cellophane sheet to obtain red light. Using the red light she obtains a shadow of an opaque object. She repeats this activity with green and blue light. Will the colour of the light affect the shadow? Explain.



Solution: No, the colour of light will not affect the shadow.
Explanation: Shadows are formed when an opaque object blocks light completely. Since no light reaches the shadow area, the shadow appears dark or black regardless of the original color of the light source. The shadow is simply the absence of light, so it doesn't matter whether the blocked light was red, green, blue, or white.

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18. Is air around us always transparent? Discuss.
Solution: Generally yes, but air is not always completely transparent.
When air is transparent:

- In normal, clear weather conditions
- When there are no pollutants or particles suspended in it
- In clean, indoor environments

When air becomes less transparent:

- During heavy fog or mist (becomes translucent)
- In polluted areas with smog or dust
- During sandstorms or heavy dust
- When thick smoke is present
- During heavy rain or snow

Explanation: The transparency of air depends on the particles suspended in it. Clean air allows us to see clearly, but when particles like water droplets, dust, smoke, or pollutants are present, visibility decreases and air becomes translucent or even opaque.

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19. Three identical towels of red, blue and green colours are hanging on a clothes line in the sun. What would be the colour of shadows of these towels?
Solution: The shadows of all three towels will be **dark or black**, regardless of their colors.
Explanation: The color of the towel does not affect the color of its shadow. Shadows are formed when objects block light, creating areas of darkness. Since shadows represent the absence of light, they appear dark or black, not colored. The red, blue, and green towels all block sunlight equally, so their shadows will all look the same.

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20. Using a pinhole camera a student observes the image of two of his friends, standing in sunlight, wearing yellow and red shirt respectively. What will be the colours of the shirts in the image?
Solution: The colors of the shirts in the image will remain **yellow and red** respectively.
Explanation: A pinhole camera does not change the colors of objects - it only inverts the image (turns it upside down). The yellow shirt will appear yellow and the red shirt will appear red in the image, but both friends will appear inverted (upside down) due to the nature of pinhole camera optics.

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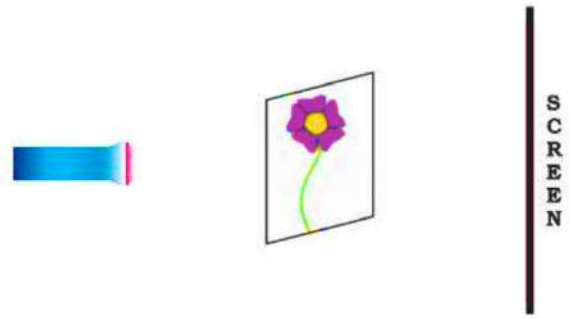
21. In fig 11.11, a flower made of thick coloured paper has been pasted on the transparent glass sheet. What will be the shape and colour of shadow seen on the screen?



Solution: Shape: The shadow will have the shape of the flower along with its stalk.
Color: The shadow will be dark or black in color.
Explanation: The thick colored paper flower is opaque, so it will block light completely and create a shadow that matches its outline - including the flower petals and stalk. Since shadows represent blocked light areas, they appear dark regardless of the original color of the paper flower.

Long Answer Questions

22. A football match is being played at night in a stadium with flood lights ON. You can see the shadow of a football kept at the ground but cannot see its shadow when it is kicked high in the air. Explain.

Solution: This phenomenon occurs due to the **absence of a suitable screen** at height and the **distance factor**.

Why shadow is visible on the ground:

- The ground acts as a screen to receive and display the shadow
- The football is close enough to the ground for a sharp shadow to form
- Multiple floodlights create well-defined shadows on the field surface

Why shadow disappears when the ball is in the air:

- **No screen present:** There is no surface in the air to catch and display the shadow
- **Distance factor:** The higher the ball goes, the farther it gets from any potential screen surface
- **Shadow diffusion:** At greater distances, shadows become larger and more diffused, making them harder to see
- **Multiple light sources:** Stadium floodlights from different angles create overlapping light, reducing shadow contrast

Additional factors:

- The intensity of stadium lighting may wash out faint shadows at height
- The dark sky background makes it impossible to see shadows even if they exist

Conclusion: Shadows need both an object to block light and a screen to display them. In the air, there's no screen, so we cannot observe the football's shadow.

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23. A student had a ball, a screen and a torch in working condition. He tried to form a shadow of the ball on the screen by placing them at different positions. Sometimes the shadow was not obtained. Explain.

Solution: Several positioning issues can prevent shadow formation:

1. Screen too far from the ball:

- **Problem:** When the screen is placed too far away, the shadow becomes very large and diffused
- **Result:** The shadow edges become blurred and may not be clearly visible
- **Solution:** Place the screen closer to the ball for a sharper shadow

2. Light source parallel to the screen:

- **Problem:** If the torch beam travels parallel to the screen surface, light doesn't hit the screen
- **Result:** No light reaches the screen, so no shadow can form
- **Solution:** Angle the torch so light falls on the screen

3. Torch too far from the ball:

- **Problem:** Distant light sources create very faint shadows
- **Result:** Insufficient light intensity difference between lit and shadowed areas
- **Solution:** Bring the torch closer to the ball

4. Ball not between torch and screen:

- **Problem:** If the ball is not in the light path between source and screen

- **Result:** Light reaches the screen without obstruction - no shadow
- **Solution:** Ensure proper alignment: torch → ball → screen

5. Inadequate torch intensity:

- **Problem:** Very dim light doesn't create sufficient contrast
- **Result:** Shadow may be too faint to observe
- **Solution:** Use a brighter torch or darken the room

6. Incorrect angles:

- **Problem:** Torch pointed away from the screen-ball setup
- **Result:** Light doesn't illuminate the system properly
- **Solution:** Direct torch toward the ball and screen

Best setup for clear shadows:

- Torch reasonably close to ball (but not too close)
- Ball positioned between torch and screen
- Screen at moderate distance from ball
- Room darkened to improve contrast
- All three components properly aligned

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24. A sheet of plywood, a piece of muslin cloth and that of a transparent glass, all of the same size and shape were placed at A one by one in the arrangement shown in fig 11.12. Will the shadow be formed in each case? If yes, how will the shadow on the screen be different in each case? Give reasons for your answer.

Solution:

Answer: Shadows will be formed in **two out of three cases** - with muslin cloth and plywood, but **not with transparent glass**.

Case 1: Plywood Sheet

Shadow formed: Yes

Shadow characteristics: Dark, sharp, and well-defined shadow

Explanation:

- Plywood is **opaque** - it blocks light completely
- No light passes through it, creating a distinct shadow
- The shadow will have clear, sharp edges
- Shadow color will be dark/black with high contrast against the lit screen

Case 2: Muslin Cloth

Shadow formed: Yes

Shadow characteristics: Light, soft, and less defined shadow

Explanation:

- Muslin cloth is **translucent** - it allows some light to pass through while blocking some
- Partial light transmission creates a lighter shadow than opaque objects
- Shadow edges will be softer and less sharp than plywood's shadow
- The shadow area will be dimmer than surrounding areas but not completely dark
- Some light still reaches the "shadow" area, making it grayish rather than black

Case 3: Transparent Glass

Shadow formed: No (or extremely faint)

Shadow characteristics: No visible shadow or extremely faint outline

Explanation:

- Transparent glass allows **most light to pass through** with minimal obstruction
- Nearly all light rays continue to the screen unblocked
- Any shadow formed would be extremely faint and barely visible
- The screen remains almost uniformly lit
- Only a very slight dimming might occur due to minor light absorption

Summary Comparison:

Material	Type	Shadow Intensity	Shadow Sharpness	Reason
Plywood	Opaque	Very Dark	Very Sharp	Blocks all light
Muslin Cloth	Translucent	Light Gray	Soft edges	Blocks some light
Transparent Glass	Transparent	None/Very faint	No defined edges	Allows most light through

Scientific Principle:

The **amount and clarity of shadow depends on how much light the material blocks**:

- **Opaque materials** → Complete shadow
- **Translucent materials** → Partial shadow
- **Transparent materials** → No visible shadow

This demonstrates the relationship between material properties and light transmission, showing how different materials interact with light in distinct ways.