

## Rectilinear Propagation of Light

### A. Fill in the Blanks

1. The property of light traveling in a \_\_\_\_\_ line is called rectilinear propagation.
2. A/An \_\_\_\_\_ object is required to form a distinct shadow.
3. The completely dark region of a shadow, where no light reaches, is called the \_\_\_\_\_.
4. A \_\_\_\_\_ eclipse occurs when the Earth comes between the Sun and the Moon.
5. The image formed in a pinhole camera is real and \_\_\_\_\_.

### B. Match the Following;

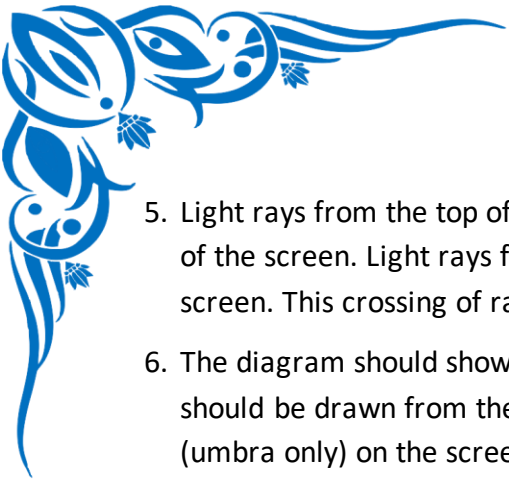
Match the animal or structure in Column A with its correct respiratory organ or method in Column B.

Column A	Column B
1. Umbra	A. The principle that light travels in a straight line.
2. Pinhole Camera	B. Occurs when the Moon blocks our view of the Sun.
3. Opaque	C. The darkest, central part of a shadow.
4. Rectilinear Propagation	D. An object that completely blocks light.
5. Solar Eclipse	E. A simple device that forms an inverted image.

### C. Practice Problems

Think a little deeper about the concepts you've learned.

1. A shadow is formed when an opaque object blocks the path of light. Since light travels in a straight line, it cannot go around the object, creating a dark area (shadow) on the surface behind it.
2. Your shadow is the shortest at noon when the sun is directly overhead. It is the longest in the early morning and late evening when the sun is low on the horizon.
3. The umbra is the central, darkest part of a shadow where the light source is completely blocked. The penumbra is the outer, fainter part of the shadow where the light source is only partially blocked.
4. A pinhole camera is a light-proof box with a tiny hole on one side and a screen (like tracing paper) on the opposite side. Light from an object travel in straight lines through the pinhole and forms an inverted (upside-down) image on the screen.



5. Light rays from the top of an object travel in a straight line through the pinhole and land on the bottom of the screen. Light rays from the bottom of the object travel in a straight line and land on the top of the screen. This crossing of rays causes the image to be inverted.
6. The diagram should show a point source of light, an opaque object, and a screen. Straight lines (rays) should be drawn from the light source, grazing the edges of the object, to form a sharp, dark shadow (umbra only) on the screen.
7. The diagram should show a large (extended) light source, an opaque object, and a screen. Rays from the top and bottom of the light source should be drawn grazing the object's edges. This will create a central dark umbra and a surrounding lighter penumbra on the screen.
8. If the pinhole were made much larger, the image would become blurry and less sharp. This is because a large hole acts like many pinholes close together, creating many overlapping images, which results in a bright but fuzzy patch of light.
9. A solar eclipse occurs when the Moon passes between the Sun and Earth. The Moon casts a shadow onto Earth, blocking the Sun's light.
10. A lunar eclipse occurs when the Earth passes directly between the Sun and the Moon. The Earth casts a shadow on the Moon, making it appear dim or reddish.

#### **D. Warm-up Questions**

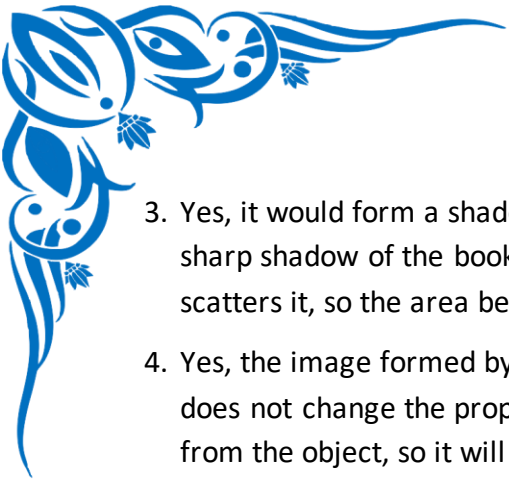
**Answer these quick questions to get your brain working!**

1. The principle states that in a uniform, transparent medium, light travels in a straight line.
2. A beam of light from a flashlight; the formation of shadows; rays of sunlight coming through clouds.
3. A "ray of light" is the straight-line path along which light energy travels. It is represented by a line with an arrow.
4. Because light travels in straight lines and cannot bend around the wall. The wall is an opaque object that blocks the light.
5. Opaque.

#### **E. Challenge Questions**

**Apply your knowledge to solve these tricky questions.**

1. You would see two separate, inverted images of the object on the screen, one formed by each pinhole. Each pinhole acts as an independent image-forming device.
2. Yes, but not in a uniform medium. Light can bend when it passes from one medium to another (refraction) or in a medium where the density changes gradually (like Earth's atmosphere). For the scope of Grade 7, the key principle is that it travels straight in a uniform medium.



3. Yes, it would form a shadow, but it would be very faint and fuzzy (less defined) compared to the dark, sharp shadow of the book. This is because the translucent glass allows some light to pass through and scatters it, so the area behind it is not completely dark.
4. Yes, the image formed by a pinhole camera has color. The pinhole simply allows light to pass through; it does not change the properties (like color) of the light itself. The image is formed by the actual light from the object, so it will have the same colors as the object.

## F. Word Problems & Application

**Read the scenarios and apply your scientific knowledge.**

1. The Sun is the source of light. The position of the Sun in the sky changes throughout the day. In the morning and evening, the Sun is low, so the light rays hit the flagpole at an angle, casting a long shadow. At noon, the Sun is nearly overhead, so the light rays are more direct, casting a very short shadow. This happens because the light travels in a straight line from the Sun, past the flagpole, to the ground.
2. The photographer should move the camera farther away from the tree. As the camera moves away, the angle of light rays from the top and bottom of the tree becomes smaller, allowing the entire image to fit on the small screen inside the camera.
3. Even during a total eclipse, the Sun's powerful corona (outer atmosphere) is visible. Furthermore, during the partial phases, intense ultraviolet and infrared radiation from the uncovered parts of the Sun can travel in straight lines to your eyes and cause permanent retinal damage, even if it doesn't feel bright.
4. The beam of light from the lighthouse is seen as a distinct, straight line traveling across the sky and sea. It doesn't curve or bend. The beam is visible because the light scatters off particles (water vapor, dust) in the air, revealing its straight path.
5. The projector is a light source. The people, seats, and other objects in the theater are opaque and block the light, casting shadows. The beam of light is visible because tiny dust particles in the air scatter the light, making its straight path from the projector to the screen visible, perfectly demonstrating rectilinear propagation.

## G. True or False

1. Light cannot bend around large obstacles; it travels in straight lines. \_\_\_\_\_
2. A pinhole camera forms a real and inverted image. \_\_\_\_\_
3. The umbra is the darkest part of a shadow. \_\_\_\_\_
4. Translucent objects form faint or indistinct shadows because they block some light but allow some to pass through. \_\_\_\_\_