Follow the Rays

Use ray models to connect lens shape, image formation, and technology.

S8P4.g "Develop and use models to demonstrate the effects that lenses have on light (i.e., formation an image) and their possible technological applications."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline every sentence that describes a light-ray path. Circle each phrase that tells where an image forms or seems to form, so you can use ray evidence to predict an image.

How Lenses Build Images

1. Light usually travels in straight lines, but a transparent lens changes its path by refraction. Refraction happens because light changes speed as it moves between air and glass or plastic. A lens is shaped with curved surfaces. In a simple ray model, arrows show light rays entering the lens, bending at each surface, and leaving in new directions. Where the rays meet, or seem to meet, determines the image a viewer sees. The image may be projected onto a screen or viewed through the lens.

2. A convex lens is thicker in the middle than at its edges. Parallel rays, such as rays from a distant object, bend toward one another after passing through it. They can meet on the far side at a focal point. A screen placed where rays meet can receive a real image. This image is upside down because rays from the top and bottom of the object cross. Cameras use a convex lens to form a real image on a sensor, which records the light pattern.

3. A concave lens is thinner in the middle than at its edges. It spreads incoming parallel rays apart. The rays do not actually meet after the lens, but backward extensions of the rays seem to meet on the incoming side. This creates an upright, smaller virtual image that cannot be projected onto a screen. Eyeglasses can use concave lenses to help some people see distant objects clearly. Door viewers also use lens systems to show a wide area, while microscopes combine lenses to make tiny nearby objects appear larger.

2 ANSWER WITH EVIDENCE

Use the passage

1. A camera points at a distant object. Use the ray model to explain why the sensor is placed on the far side of its convex lens.

2. Compare the paths of parallel rays through a convex lens and a concave lens.

3. Why can a screen receive an image from the convex lens described in the passage but not from the concave lens?

4. A door viewer needs to show a wide area without making a screen image. Which type of lens model best fits this use, and what image would its rays produce?

3 YOUR TURN

Your own words

Create two labeled ray models in the panels. In Panel 1, model a camera using a convex lens. In Panel 2, model eyeglasses using a concave lens. Include an object arrow, lens, at least two light rays with arrows, the image location, and labels for real or virtual. Then write one sentence comparing whether each image can be projected onto a screen.

ANSWER KEY

Follow the Rays

GRADE 8 · S8P4.g

PART 1 · READ AND MARK

Underline every sentence that describes a light-ray path. Circle each phrase that tells where an image forms or seems to form, so you can use ray evidence to predict an image. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	A camera points at a distant object. Use the ray model to explain why the sensor is placed on the far side of its convex lens.	**A convex lens bends parallel rays toward one another. The rays meet on the far side, so a sensor there can receive the real image.**
2	Compare the paths of parallel rays through a convex lens and a concave lens.	**A convex lens bends parallel rays toward one another so they can meet on the far side. A concave lens spreads parallel rays apart, and their backward extensions seem to meet on the incoming side.**
3	Why can a screen receive an image from the convex lens described in the passage but not from the concave lens?	**After a convex lens, rays actually meet, forming a real image that can be projected onto a screen. After a concave lens, rays do not actually meet, so its virtual image cannot be projected.**
4	A door viewer needs to show a wide area without making a screen image. Which type of lens model best fits this use, and what image would its rays produce?	**A concave lens model fits. Its rays spread apart and form an upright, smaller virtual image that cannot be projected onto a screen.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: Draw an upright object arrow to the left of a convex lens. Draw two rays that bend toward each other, cross on a sensor to the right, and form an inverted real image. Panel 2: Draw an upright distant-object arrow to the left of a concave lens. Draw two rays that spread apart, then draw dashed backward extensions meeting on the left to show an upright, smaller virtual image. A camera sensor receives a real image, but the concave-lens virtual image cannot be projected onto a screen.

Accept accurate ray models with arrows showing refraction, a convex lens that converges rays to a real image, and a concave lens that diverges rays to a virtual image. Image size and exact ray angles may vary if the required image orientation, location, and projection claim are correct.