Name _____

**Chapter 22 Ray Diagrams Practice Worksheet**

A ray diagram helps you see where the image produced by a lens appears. The components of the diagram include the lens, the principal axis, the focal point, the object, and three lines drawn from the tip of the object and through the lens. These light rays meet at a point and intersect on the other side of the lens. Where the light rays meet indicates where the image of the object appears. In other words, a ray diagram helps you determine where an image produced by a lens will form and shows whether the image is upside down or right side up.

Steps to drawing a ray diagram:
- Draw a lens and show the principal axis.
- Draw a line that shows the plane of the lens.
- Make a dot at the focal point of the lens on the right and left sides of the lens.
- Place an arrow (pointing upward and perpendicular ot the principle axis) at 4 cm on the left side of the lens.
- **Line 1:** draw a line from the tip of the arrow that is parallel to the principal axis on the left, and that goes through the focal point on the right of the lens.
- **Line 2:** draw a line from the tip of the arrow that goes through the center of the lens (where the plane and the principal axis cross).
- **Line 3:** draw a line from the tip of the arrow that goes through the focal point on the left side of the lens, through the lens, and parallel to the principal axis on the right side of the lens.
- Lines 1, 2, and 3 converge on the right side of the lens where the tip of the image of the arrow appears.
- The image is upside down compared with the object.
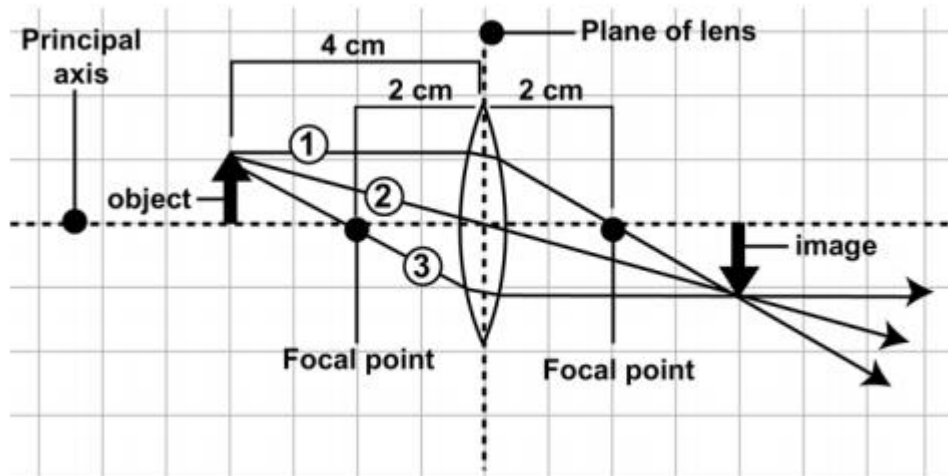
1. A lens has a focal length of 4 cm. An object is placed 8 cm to the left of the lens. Trace the rays and predict where the image will form. Is the image bigger, smaller, or inverted as compared with the object?
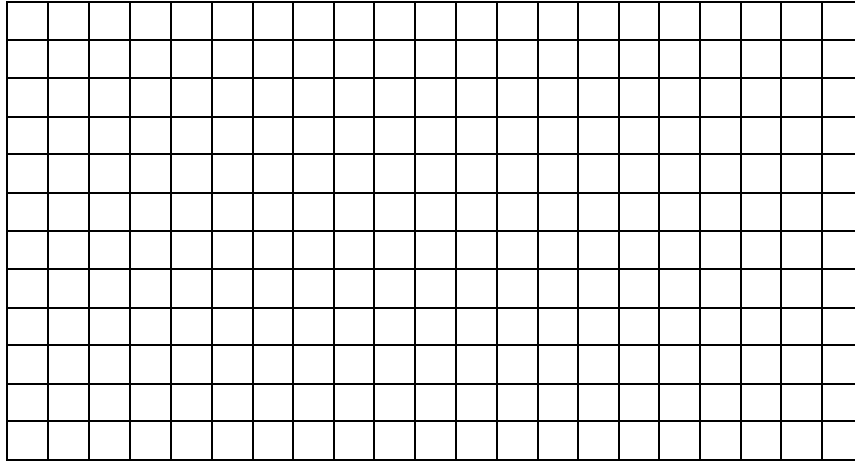
2. An arrow is placed at 3 cm to the left of a converging lens. The image appears at 3 cm to the right of the lens. What is the focal length of this lens? (HINT: Place a dot to the right of the lens where the image of the tip of the arrow will appear. You will only be able to draw lines 1 and 2. Where does line 1 cross the principal axis if the image appears at 3cm?
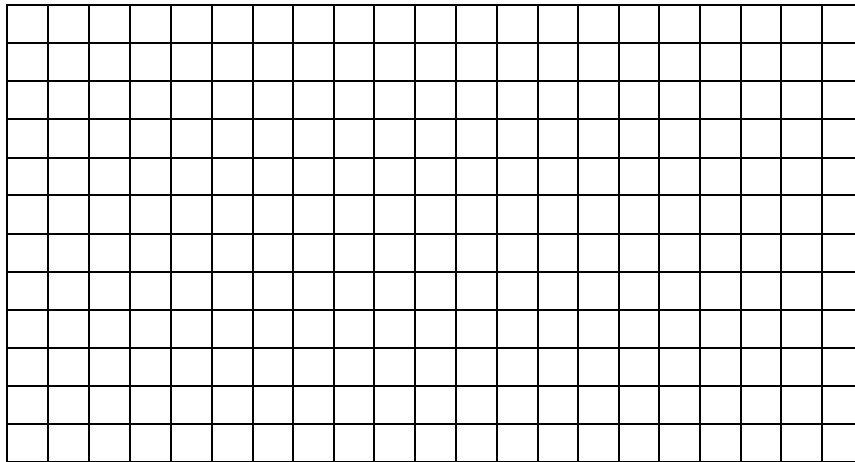
3. What happens when an object is placed at a distance from the lens that is less than the focal length? Use the term *virtual image* in your answer.

4. Of the diagrams below, which one correctly illustrates how light rays come off an object? Explain your answer.

| All directions | Only one direction | All directions, corkscrew pathways |
|:---:|:---:|:---:|
| A. | B. | C. |
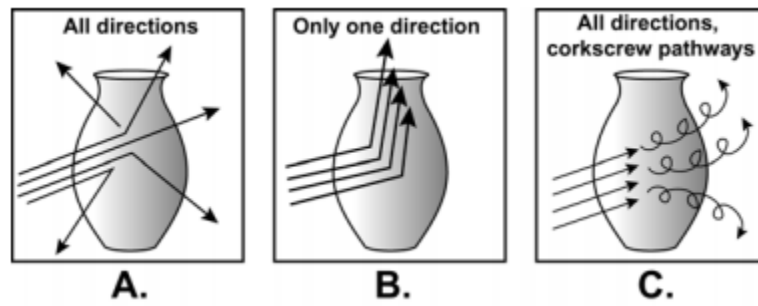
5. Of the diagrams below, which one correctly illustrates how a light ray enters and exits a piece of thick glass?

**Light through thick glass**

| A. | B. | C. |
|:---:|:---:|:---:|
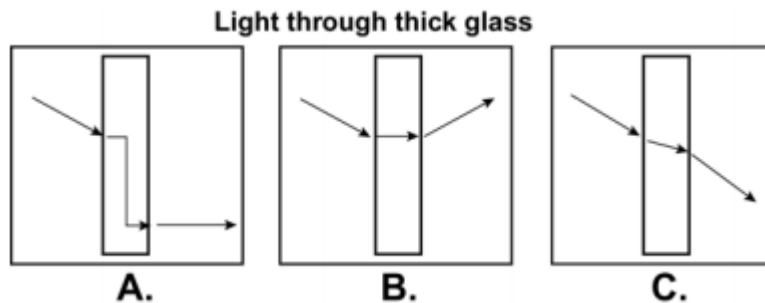
In your own words, explain what happens to light as it enters glass from the air and then exits glass back into the air. Why does this happen? Use the term *refraction* in your answer.

6. Of the diagrams below, which one correctly illustrates how parallel light rays enter and exit a converging lens? Explain your answer.

| A. | B. | C. |
|:---:|:---:|:---:|
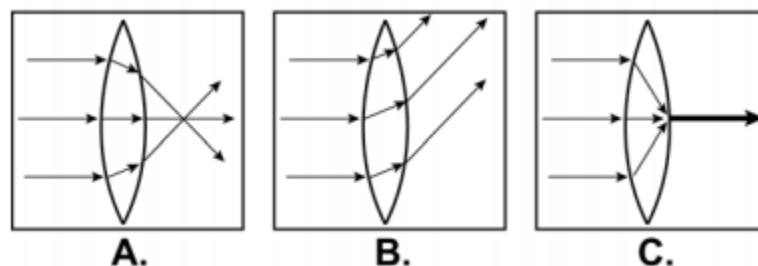
7. Draw a diagram of a converging lens that has a focal length of 10 cm. In your diagram, show three parallel lines entering the lens and exiting the lens. Show the light rays passing through the focal point of the lens. Be detailed in your diagram and provide labels.