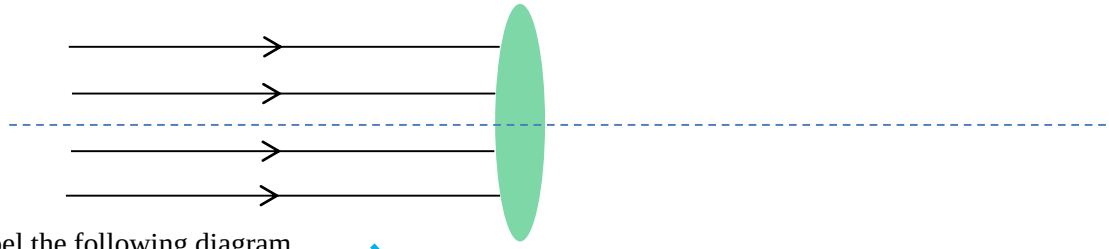
**Shedding Light on Lenses** Name: _____

PART A

1. There are two types of lenses: _____ and _____.

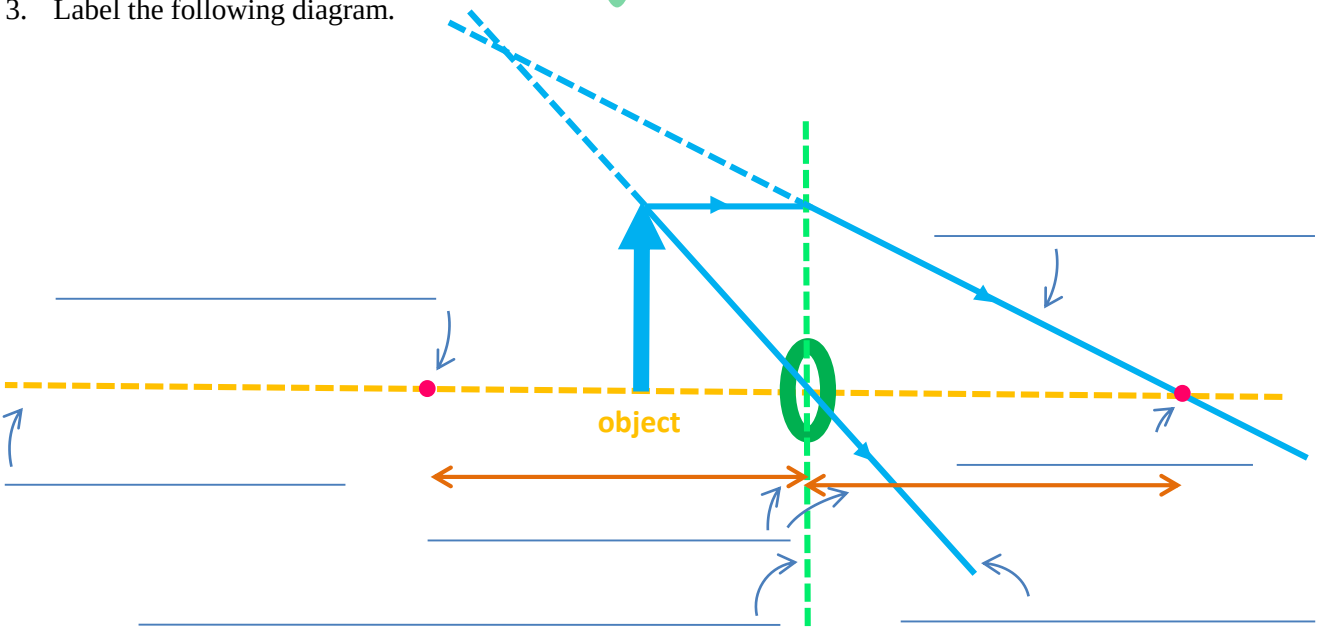
PART B

2. Sketch the path that the four light rays will take after they pass through the convex lens. Mark in the lens's focal point.



PART C

3. Label the following diagram.

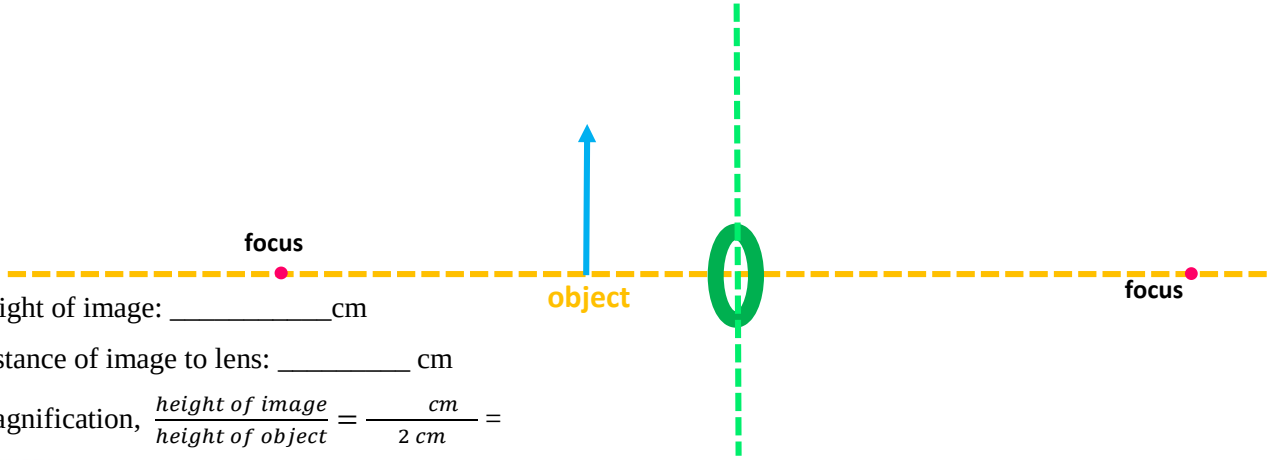



4. (a) On the diagram above **mark in the position of the image** that an observer would see.
   (b) The height of the image is approximately _____cm.
   (c) The image is approximately _____ cm from the lens.
   (d) The focal length, f, of the lens in the diagram above is _____ cm.
   (e) The magnification of the object is $\frac{height\ of\ image}{height\ of\ object} = \frac{\_\_\_\_\_\ cm}{cm} =$

   (Note: magnification does not have units)

5. When an object is close to a convex lens (specifically, when it's closer than the lens's focal point), the image produced is _____ and _____.

6. **Skill-Building Exercise:** A 2cm tall object is 2cm away from a convex lens of focal length 6cm. Use two reference rays to determine the height of the image, its position and the magnification produced.




height of image: _____cm

distance of image to lens: _____ cm

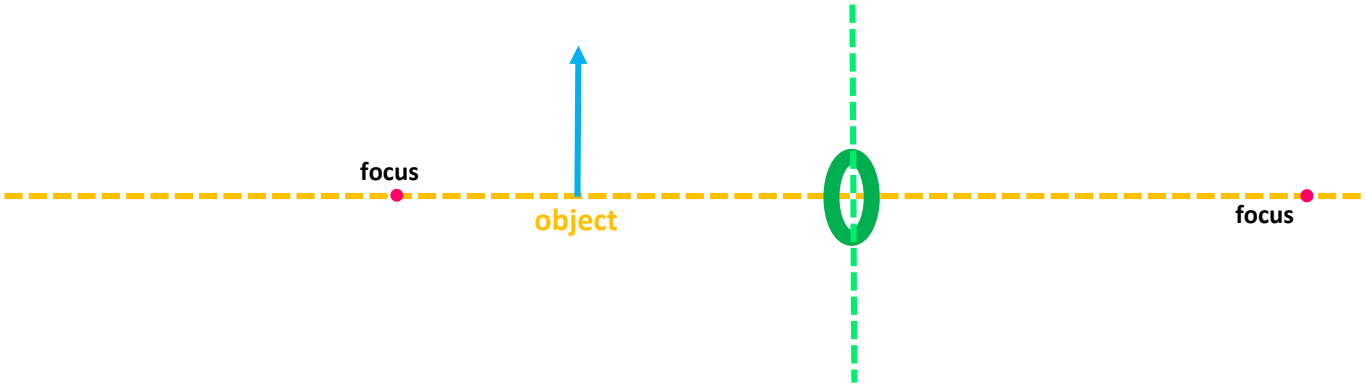
magnification, $\frac{height\ of\ image}{height\ of\ object} = \frac{\_\_\_\_\_\ cm}{2\ cm} =$

7. **Skill-Building Exercise:** The same 2cm tall object is now 3.6cm away from a convex lens of focal length 6cm. Determine the height of the image, its position, and the magnification produced.

height of image: _____cm

distance of image to lens: _____ cm

magnification, $\frac{height\ of\ image}{height\ of\ object} = \frac{\quad cm \quad}{2cm} =$




8. By comparing your ray diagrams from Questions 6 and 7 above, you can tell that, as an object gets further away from a convex lens (and closer to the left focal point), the magnification of the virtual image increases/decreases.
9. Describe the image formed when the object is at the focal point of a convex lens. (Hint: Trick Question!)

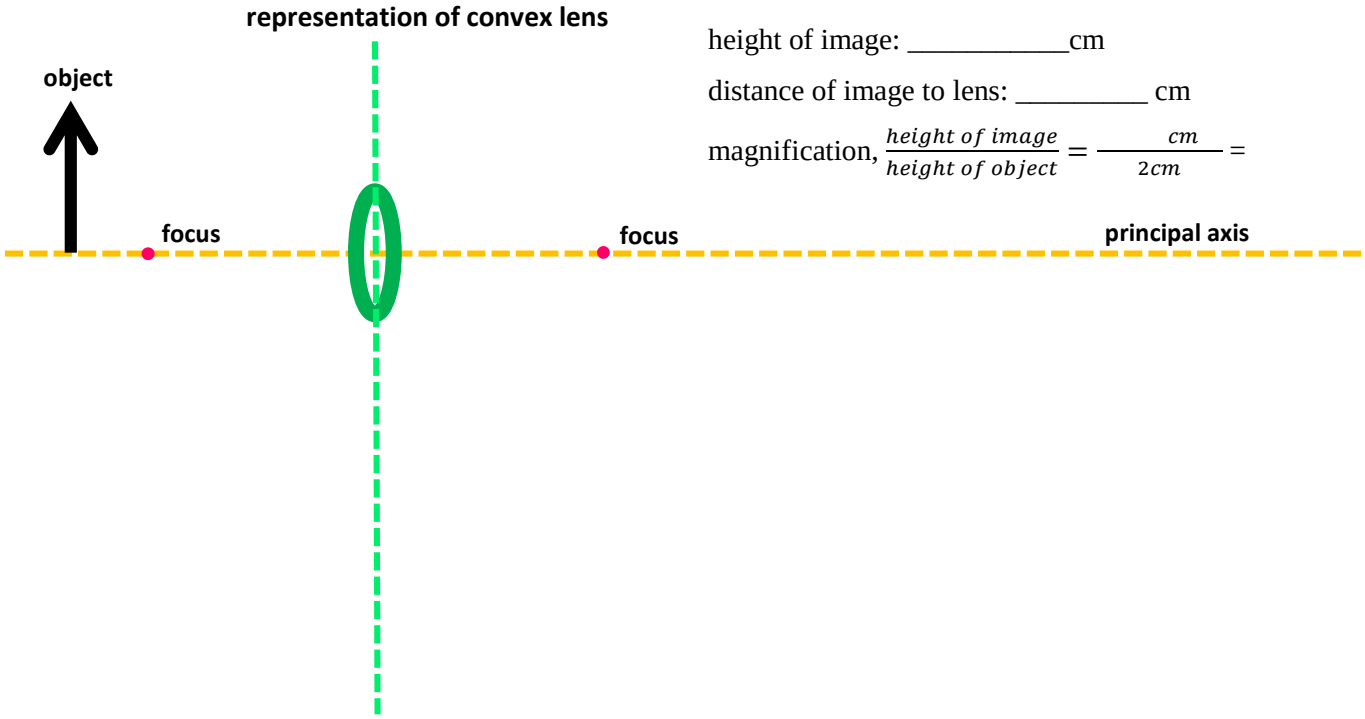
_____

_____

_____

PART D

10. **Skill-Building Exercise:** A 2cm-tall object stands 4cm from a convex lens of focal length 3cm. Using ray diagrams, determine the height of the image, its position, and the magnification produced.




height of image: _____cm

distance of image to lens: _____ cm

magnification, $\frac{height\ of\ image}{height\ of\ object} = \frac{\quad cm \quad}{2cm} =$

11. How does the ray diagram above (in Question 10) relate to a projector?

_____

_____

_____

12. A particular video camera records a movie file at 30 frames per second. What is a frame? What does "30 frames per second" (or 30fps) mean?

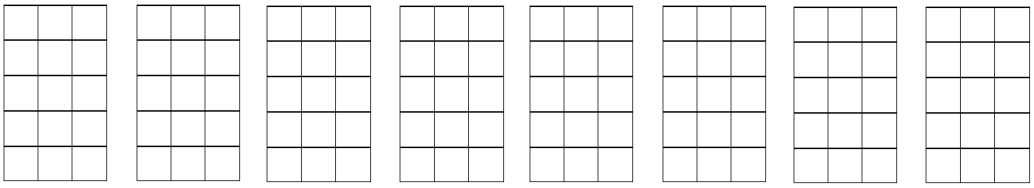
_____

_____

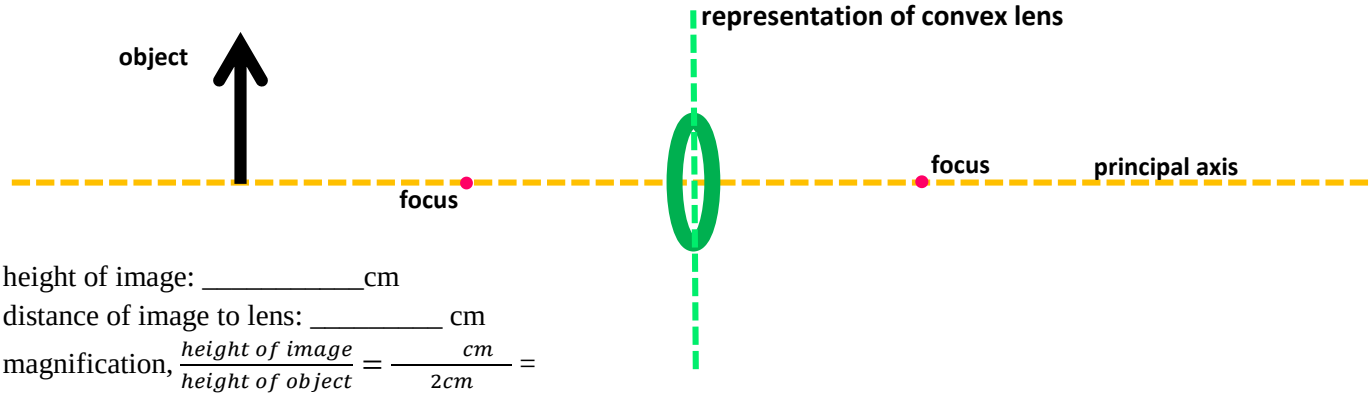
_____

13. If each square in the grids below was a micromirror in a Digital Micromirror Device (a DMD), shade the appropriate square to produce the letters required. Try both "black on white" and "white on black".

E F H J P T U Y



14. **Skill-Building Exercise:** A 2cm-tall object stands 6cm from a convex lens of focal length 3cm. Determine the height of the image, its position, and the magnification produced.

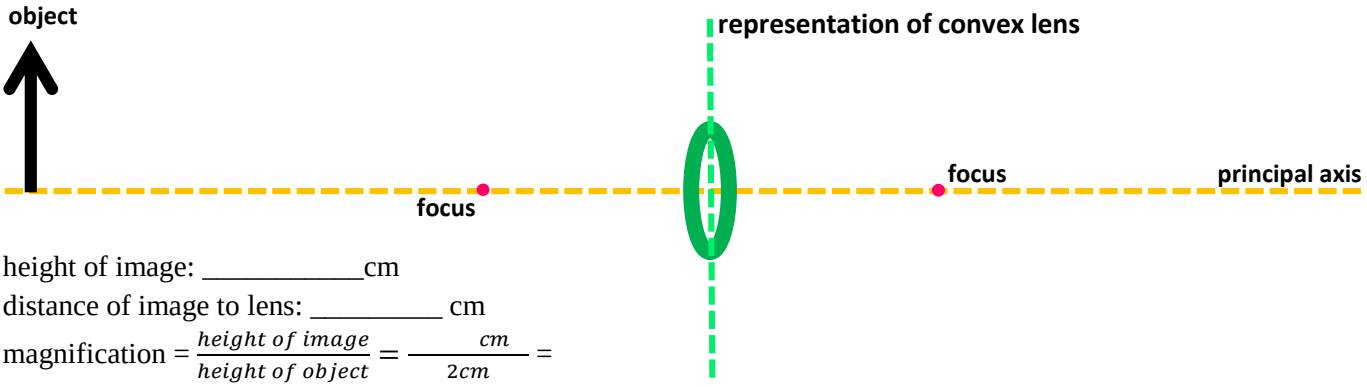



height of image: _____cm

distance of image to lens: _____ cm

magnification, $\frac{height\ of\ image}{height\ of\ object} = \frac{\quad cm}{2cm} =$

15. **Skill-Building Exercise:** A 2cm-tall object stands 9cm from a convex lens of focal length 3cm. Determine the height of the image, its position, and the magnification produced.



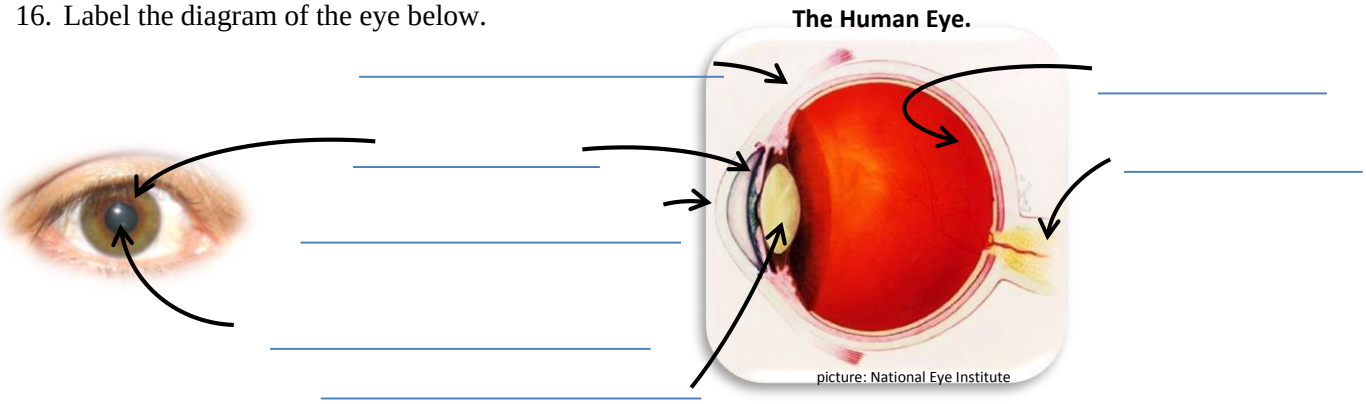

height of image: _____cm

distance of image to lens: _____ cm

magnification = $\frac{height\ of\ image}{height\ of\ object} = \frac{\quad cm}{2cm} =$

PART E

16. Label the diagram of the eye below.



17. What is the role of the iris? Draw some diagrams to aid your explanation.

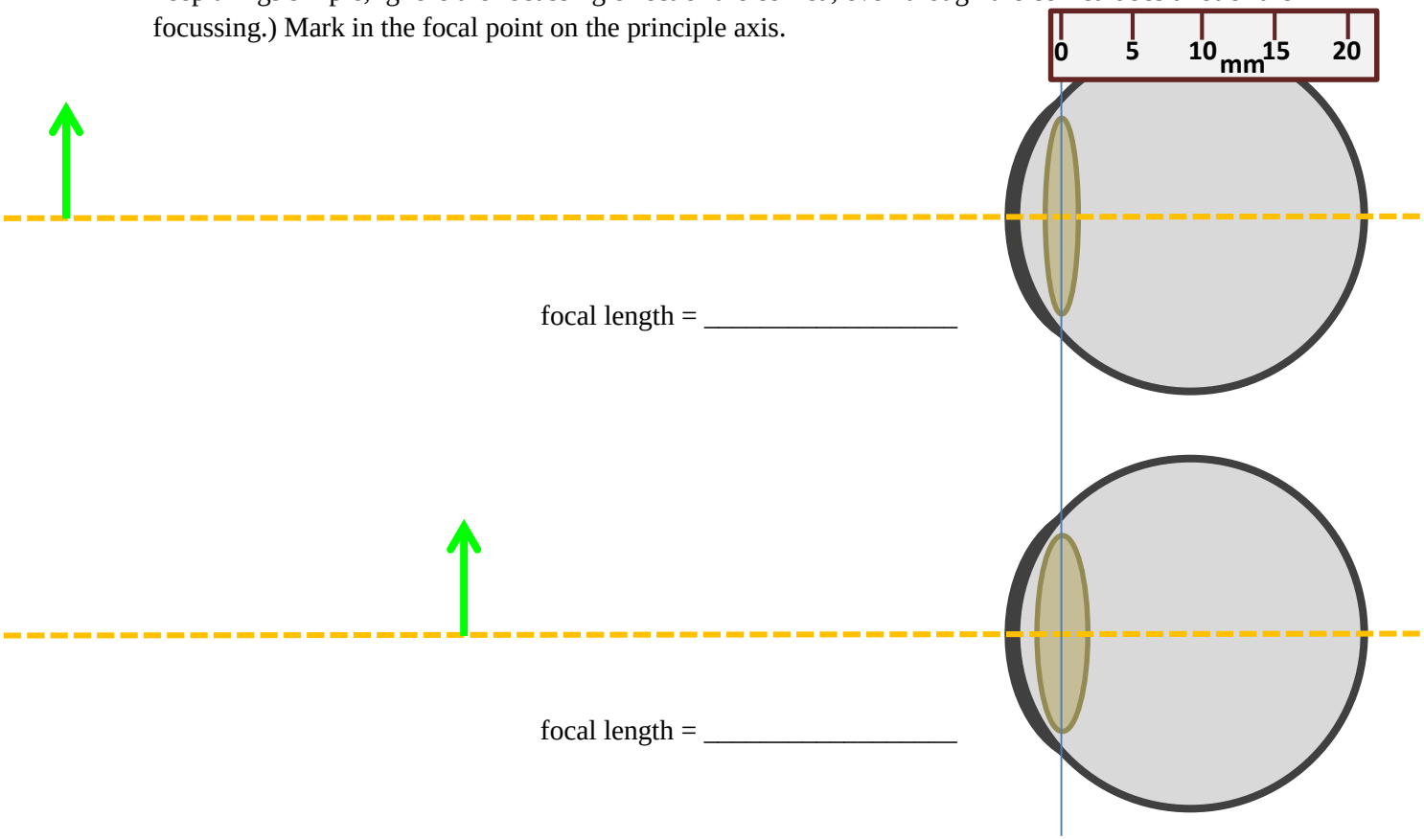
_____

_____

_____

18. (a) When you are looking at something up close, your lens has to thicken up / thin out in order to produce a focussed image on the retina.
(b) When you then look at something far away, your lens has to thicken up / thin out in order to produce a focussed image on the retina.

19. A typical human eyeball has a diameter of about 25mm. By drawing the second reference ray first, and then drawing the first reference ray, determine on the 2:1 scale diagrams below
(a) the position on the retina of the arrow's image and; (b) the approximate focal length of the lens. (To keep things simple, ignore the focussing effect of the cornea, even though the cornea does a lot of the focussing.) Mark in the focal point on the principle axis.




focal length = _____



focal length = _____

20. Using a ruler, find the near point of each of your eyes. (Most students will have a smaller near point than that of the presenter.) Left eye's near point: _____; Right eye's near point: _____

21. What is accommodation (when it comes to focussing)?

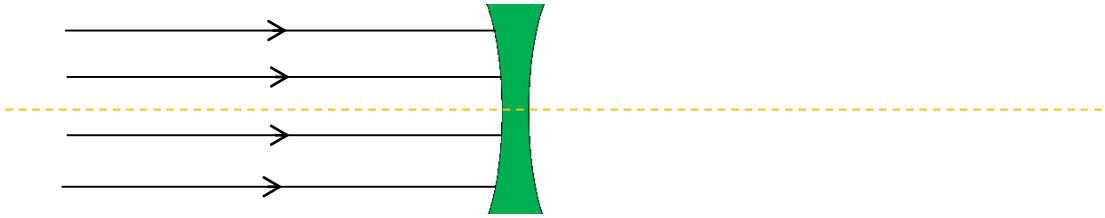
_____

_____

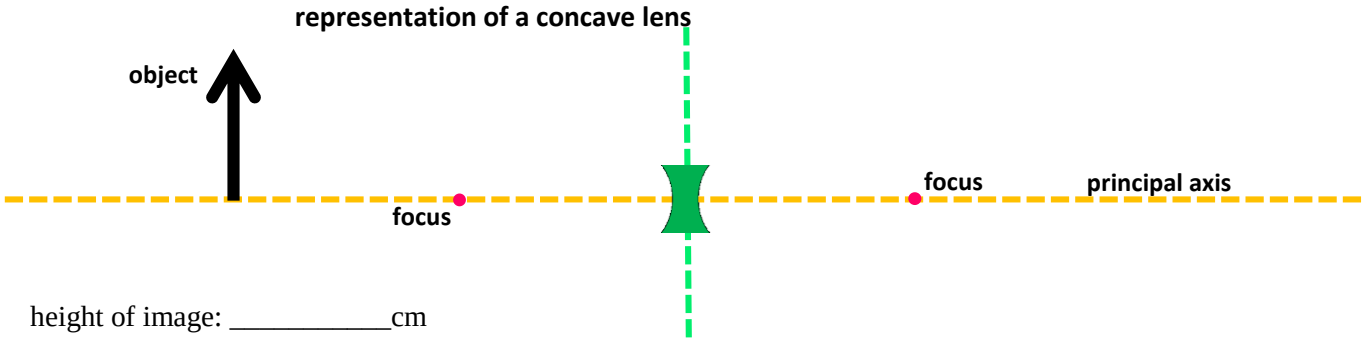
_____

PART F

22. Sketch the path that the four light rays will take after they pass through the concave lens. Mark in the lens's virtual focus. (Hint: You may need to mark in the virtual focus first)



23. A 2cm-tall object stands 6cm from a concave lens of focal length 3cm. Determine the height of the image, its position, and the magnification produced.




height of image: _____cm

distance of image to lens: _____ cm

magnification = $\frac{height\ of\ image}{height\ of\ object} = \frac{\quad cm}{2cm}$ =

**PART G**

24. Describe what short sightedness is.

_____

_____

25. Describe what long sightedness is.

_____

_____

26. What kind of glasses are worn by short sighted people? _____
Draw a diagram to show why.

27. What kind of glasses are worn by long sighted people? _____
Draw a diagram to show why.

28. Why is it fairly common for people to become long sighted as they get older?

_____

_____

_____

29. What is laser eye surgery?

_____

_____

_____

**Shedding Light on Lenses: Bonus Feature 1 – Slow Motion, Fast Motion, Chick Flicks and Hobbitses.**
Name: _____

1. What is time-lapse photography?
   _____
   _____
   _____
2. What is stop-motion?
   _____
   _____
   _____
3. From ordinary video footage, slow motion can easily be created with the right kind of software. How is high-quality slow motion achieved?
   _____
   _____
   _____

4. Create a short movie using stop motion. You can move little figures around, or use modelling clay, or have drawings appear on a piece of paper.
   Some Hints:
   - You will need to use a tripod, so that the camera's position can be controlled.
   - If you want something to "move" at a constant speed (in the finished product), you will have to move it a constant amount between shots. Otherwise, it will appear to jerk forward and then slow down suddenly.
   - Try to keep the lighting constant.
   - To get, say, 10 frames per second, you will have to play each photo (frame) for 1/10 of a second. At this rate, 50 frames will last 5 seconds.