An object can be placed at several locations to the left of a *converging* lens. (Refer to the ray tracing worksheet on p. 1.)

1. Far away..
2. Just outside *F*.
3. On *F*.
4. Just inside *F*.
5. Very close to the lens .

11. Rank the sizes of the *real* images (if any) produced by this converging lens, from smallest to largest. Indicate ties, if any. (You may not need to use all the blank spaces below).

_____ _____ _____ _____ _____

(smallest) (largest)

12. List the *inverted* images (if any) produced by this converging lens:

Case(s) with an inverted image: _____.

13. Rank the sizes of the *virtual* images (if any) produced by this converging lens, from smallest to largest. Indicate ties, if any. (You may not need to use all the blank spaces below).

_____ _____ _____ _____ _____

(smallest) (largest)

14. List the *upright* images (if any) produced by this converging lens:

Case(s) with an upright image: _____.

15. Identify the case(s) (if any) where no image (real or virtual) is produced by this converging lens. Briefly explain why *no* image was produced.

Case(s) with no image: _____.

Explanation:

An object can be placed at several locations to the left of a *diverging* lens. (Refer to the ray tracing worksheet on p. 2.)

6. Far away..
7. Just outside *F*.
8. On *F*.
9. Just inside *F*.
10. Very close to the lens .

16. Rank the sizes of the *real* images (if any) produced by this diverging lens, from smallest to largest. Indicate ties, if any. (You may not need to use all the blank spaces below).

_____ _____ _____ _____ _____
(smallest) (largest)

17. List the *inverted* images (if any) produced by this diverging lens:

Case(s) with an inverted image: _____.

18. Rank the sizes of the *virtual* images (if any) produced by this diverging lens, from smallest to largest. Indicate ties, if any. (You may not need to use all the blank spaces below).

_____ _____ _____ _____ _____
(smallest) (largest)

19. List the *upright* images (if any) produced by this converging lens:

Case(s) with an upright image: _____.

20. Identify the case(s) (if any) where *no* image (real or virtual) is produced by this diverging lens. Briefly explain why no image was produced.

Case(s) with no image: _____.

Explanation:

21. Placing an object _____ to the left of a *converging* lens would produce a $\begin{bmatrix}\text{real}\\\text{virtual}\end{bmatrix}$ image with the greatest magnification.

(A) out at ∞.
(B) just outside the focal point.
(C) just inside the focal point.
(D) almost next to the lens.
(E) (Unsure/guessing/lost/help!)

22. Placing an object _____ to the left of a *diverging* lens would produce a virtual image with the greatest magnification.

(A) out at ∞.
(B) just outside the focal point.
(C) just inside the focal point.
(D) almost next to the lens.
(E) (Unsure/guessing/lost/help!)

The following Physics 205B students have certain eyesight conditions.

(A) nominal vision.
(B) myopia.
(C) hyperopia.
(D) presbyopia.

23. Indicate which students (if any) are able to clearly focus on objects out as far as ∞.

Student(s):

24. Indicate which students (if any) are able to clearly focus on objects as close as 0.25 m.

Student(s):

25. A Physics 205B student with $\left|\begin{matrix}\text{myopia}\\ \text{hyperopia}\\ \text{presbyopia}\end{matrix}\right|$ should be prescribed a _____ contact lens.

(A) converging.
(B) diverging.
(C) (Unsure/guessing/lost/help!)

26. When a contact lens is used to correct for $\left|\begin{matrix}\text{myopia}\\ \text{hyperopia}\\ \text{presbyopia}\end{matrix}\right|$, the object for the eye is an intermediate virtual image produced by the contact lens. This intermediate virtual image is located:

(A) at ∞.
(B) 0.25 m from the eye.
(C) at the uncorrected far point of the eye.
(D) at the uncorrected near point of the eye.
(E) (Unsure/guessing/lost/help!)

27. As an object is brought closer to an unaided eye, the angular size of the object:

(A) increases.
(B) decreases.
(C) remains the same size.
(D) (Unsure/guessing/lost/help!)

28. In general, a magnifying glass should be a converging lens with a focal length _____ to be useful.

(A) more than 0.25 m.
(B) exactly 0.25 m.
(C) less than 0.25 m.
(D) (Unsure/guessing/lost/help!)

29. When a converging lens is used as a magnifying glass, the object for the relaxed, unaccommodated eye is an intermediate virtual image produced by the converging lens. This intermediate virtual image is located at:

(A) ∞.
(B) the original object.
(C) the focal point of the lens.
(D) the near point of the eye (0.25 m).
(E) (Unsure/guessing/lost/help!)

30. Two converging lenses used as magnifying glasses are labeled with their angular magnifications, "2×" and "4×" (*i.e.*, $M = +2$ and $M = +4$, respectively). The _____ magnifying glass has the longer focal length.
(A) "2×".
(B) "4×".
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

31. An object held _____ in front of a magnifying glass with a focal length of +4.0 cm will produce a virtual image with a larger angular size.
(A) 2.0 cm.
(B) 4.0 cm.
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

32. A $\left\lfloor \begin{matrix} \text{microscope} \\ \text{telescope} \end{matrix} \right\rfloor$ should have a _____ focal length objective lens and a _____ focal length eyepiece lens in order to maximize its angular magnification.
(A) short; short.
(B) short; long.
(C) long; short.
(D) long; long.
(E) (Unsure/guessing/lost/help!)

33. The $\left\lfloor \begin{matrix} \text{objective} \\ \text{eyepiece} \end{matrix} \right\rfloor$ lens of a $\left\lfloor \begin{matrix} \text{microscope} \\ \text{telescope} \end{matrix} \right\rfloor$ produces a:
(A) real image between the objective lens and eyepiece lens.
(B) real image in front of the objective lens.
(C) virtual image between the objective lens and eyepiece lens.
(D) virtual image in front of the objective lens.
(E) (Unsure/guessing/lost/help!)

Five different focal length converging lenses can be selected to make optical instruments:

(A) f_A = +50 cm.
(B) f_B = +20 cm.
(C) f_C = +10 cm.
(D) f_D = +2.0 cm.
(E) f_E = +1.0 cm.

34. Indicate which two lenses should be selected for an objective and eyepiece to construct a telescope with the greatest angular magnification.

Objective: _____.
Eyepiece: _____.

35. For the above telescope, determine the angular magnification, and the resulting distance between the objective and eyepiece.

M = _____×.
L = _____ cm.

36. Indicate which two lenses should be selected for the objective and eyepiece to obtain the greatest angular magnification, in a microscope already constructed with a distance of 12 cm between the objective and eyepiece.

Objective: _____.
Eyepiece: _____.

37. For the above microscope, determine the angular magnification resulting from this choice objective and eyepiece.

M = _____×.

Equations and constants:

$$\frac{1}{d_o}+\frac{1}{d_i}=\frac{1}{f};\ m=\frac{h_i}{h_o}=-\frac{d_i}{d_o};\ P=\frac{1}{f};\ \frac{1}{f_{total}}=\frac{1}{f_1}+\frac{1}{f_2};\ M\approx\frac{N}{f};\ M\approx-\frac{(L-f_e)N}{f_o f_e};\ M\approx-\frac{f_o}{f_e}.$$