

Physics II

Chapter 23

Spring 2018

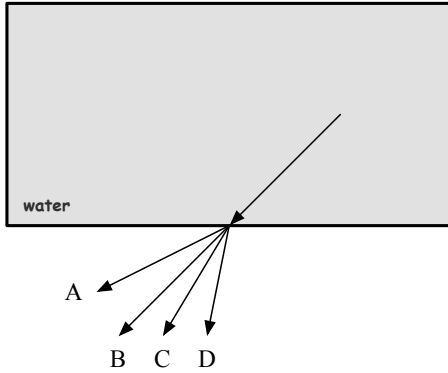
IMPORTANT: Except for multiple-choice questions, you will receive no credit if you show only an answer, even if the answer is correct. Always show in the space on your answer sheet some sketches, words, or equations which clearly justify your answer. Show the equations you use and the values substituted into them whenever equations are necessary. If you go from a formula directly to an answer without showing the values used, you will lose points. Points will also be deducted for missing or erroneous units.

Each individual answer is weighted roughly evenly throughout the exam.

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} \quad n_1 \sin \theta_1 = n_2 \sin \theta_2 \quad \frac{h_i}{h_o} = \frac{d_i}{d_o}$$

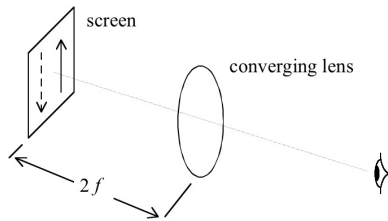
Name _____

1. **T / F** The angle of incidence equals the angle of reflection for all mirrors, even curved ones.



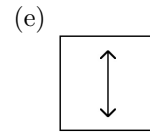
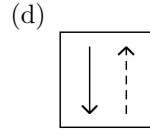
2. Which of the labeled rays above could be the ray that refracts as it passes from water to air?

- (a) A
(b) B
(c) C
(d) D



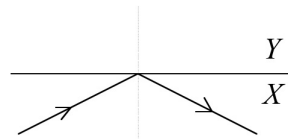
3. Two arrows are drawn as shown on a screen, placed at a distance $2f$ from a converging lens of focal length f . Which of the following diagrams correctly represents the image seen when the screen is viewed through the lens?

- (a)
- (b)
- (c)

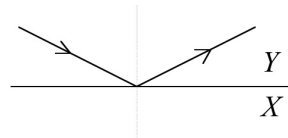


4. Light travels between two media X and Y. If the refractive index of X is greater than the refractive index of Y, which of the following is/is a possible ray diagram(s)?

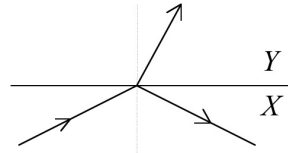
(1)



(2)



(3)

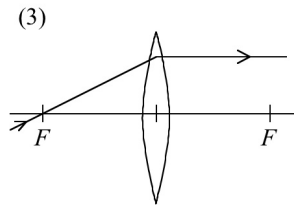
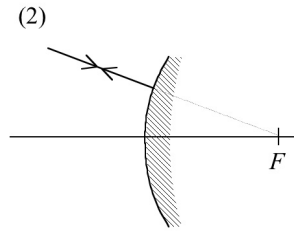
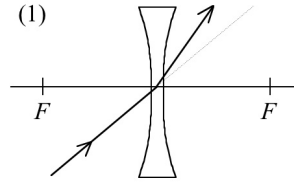


- (a) (1), (2) and (3)
(b) (1) and (2) only
(c) (2) and (3) only
(d) (1) only
(e) (3) only

5. The speed of light in a certain material is 1.6×10^8 m/s. Find the critical angle for that material and air. (Speed of light in air = 3×10^8 m/s)

- (a) 28.1°
(b) 32.2°
(c) 41.8°
(d) 48.0°
(e) 57.8°

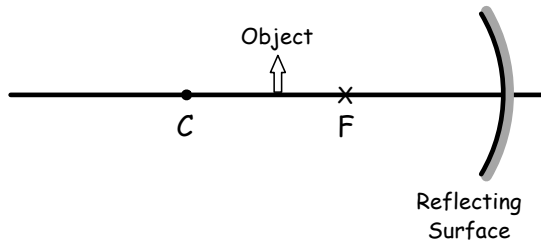
6. Which of the following ray diagrams is/are correct? (F is the focus of the corresponding optical instrument.)



- (a) (1), (2) and (3)
- (b) (1) and (2) only
- (c) (2) and (3) only
- (d) (1) only
- (e) (3) only

7. The index of refraction of plexiglass is about 1.5. The critical angle for plexiglass in air is most nearly

- (a) 42°
- (b) 30°
- (c) 60°
- (d) 52°
- (e) 48°

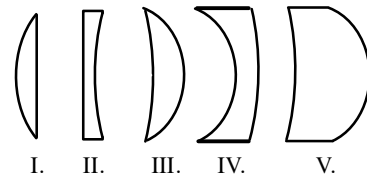


8. An object is placed as shown in the figure above. The center of curvature C and the focus F of the reflecting surface are indicated. As compared with the object, the image formed by the reflecting surface is

- (a) erect and larger
- (b) erect and the same size
- (c) erect and smaller
- (d) inverted and larger
- (e) inverted and smaller

9. An object is placed 0.30 meter from a lens of focal length -0.15 meter. The image is

- (a) inverted, real, and 0.30 meter from the lens on the opposite side from the object.
- (b) upright, virtual, and 0.30 meter from the lens on the opposite side from the object.
- (c) upright, real, and 0.10 meter from the lens on the same side as the object.
- (d) upright, virtual, and 0.10 meter from the lens on the opposite side from the object.
- (e) inverted, real, and 0.10 meter from the lens on the same side as the object.



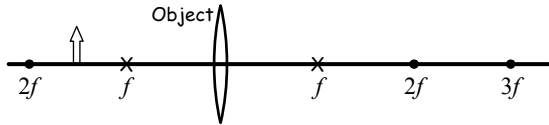
10. Which three of the glass lenses above, when placed in air, will cause parallel rays of light to diverge?

- (a) I, II, and III
- (b) I, III, and V
- (c) I, IV, and V
- (d) II, III, and IV
- (e) II and IV

11. If the object distance for a converging thin lens is more than twice the focal length of the lens, the image is

- (a) virtual and erect.

- (b) larger than the object.
 (c) located inside the focal point.
 (d) located at a distance more than $2f$ from the lens.
 (e) located at a distance less than $2f$ from the lens.
12. A concave mirror with a radius of curvature of 1.0 m is used to collect light from a distant star. The distance between the mirror and the image of the star is most nearly
- (a) 0.25 m
 (b) 0.50 m
 (c) 0.75 m
 (d) 1.0 m
 (e) 2.0 m



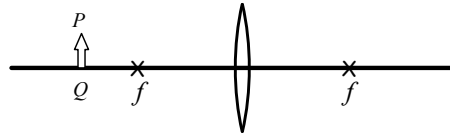
13. An object is placed at a distance of $1.5f$ from a convex lens of focal length f , as shown above. What type of image will be formed and what is its size relative to the object?

| | Type | Size |
|-----|---------|-----------|
| (a) | Virtual | Larger |
| (b) | Virtual | Same Size |
| (c) | Virtual | Smaller |
| (d) | Real | Larger |
| (e) | Real | Smaller |

14. An object is placed 8.0 cm from a convex thin lens of focal length 2.0 cm on its principle axis. The distance of the image from the lens is most nearly
- (a) 0.4 cm
 (b) 0.8 cm
 (c) 1.6 cm
 (d) 2.0 cm
 (e) 2.7 cm

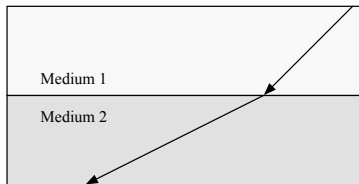
15. A large lens is used to create an image of a light bulb on a screen. If the left half of the lens is covered with an opaque card, which of the following occurs?
- (a) The left half of the image disappears.
 (b) The right half of the image disappears.
 (c) The image becomes blurred.
 (d) The image becomes dimmer.
 (e) No image the light bulb will form.

For the next two items



16. An object PQ is located to the left of a convex lens having focal points F , as shown in the diagram above. The image formed by the lens is
- (a) real, inverted, and smaller than the object.
 (b) real, inverted, and larger than the object.
 (c) real, upright, and larger than the object.
 (d) virtual, upright, and larger than the object.
 (e) virtual, upright, and smaller than the object.
17. The image of object PQ would be visible to an observer in which position or positions listed below?
- I. to the left of the lens, looking to the right
 II. to the right of the lens, looking to the left
 III. to the left of the lens, looking to the left
- (a) I only
 (b) II only
 (c) III only
 (d) I and II only
 (e) I, II, and III
18. The image of an object formed by a flat mirror is always

- (a) larger than the object.
 - (b) smaller than the object.
 - (c) the same size as the object.
 - (d) independent of the size of the object.
19. The radius of curvature of a spherical mirror is equal to _____ the focal length of its curvature.
- (a) 4 times
 - (b) 2 times
 - (c) $\frac{1}{2}$
 - (d) the square root of
20. Using a cheaper spherical mirror instead of a parabolic mirror introduces which undesirable feature of images?
- (a) spherical aberration
 - (b) mirages
 - (c) chromatic aberration
 - (d) scattering
24. What will be the location of the image will you see when using this lens as a magnifying glass for the bug?
- (a) real and magnified
 - (b) virtual and magnified
 - (c) real and diminished
 - (d) virtual and diminished
- (a) on your side of the lens
 - (b) on the other side of the lens from you



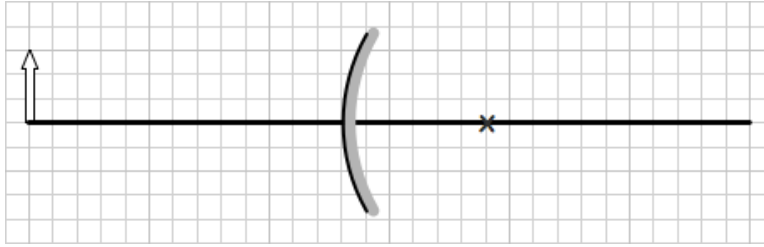
21. Which of the two media shown above has the greater index of refraction?
- (a) Medium 1
 - (b) Medium 2
 - (c) This cannot be determined from the diagram.

For the next three items

You want to examine a bug with a magnifying glass.

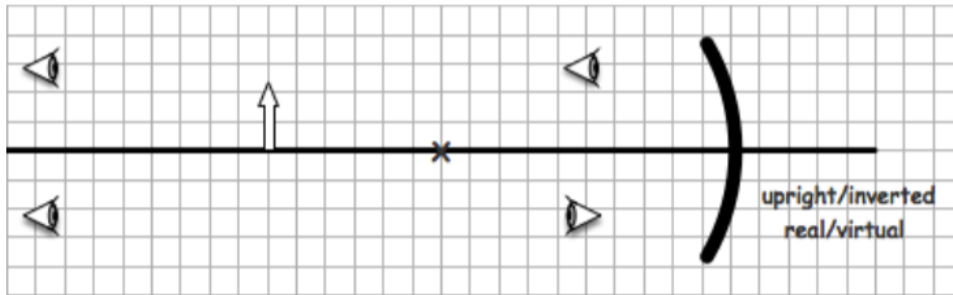
22. What kind of lens must one use and where must the object, the bug, be placed relative to the lens and its focus?
- | | <u>Type</u> | <u>Object Location</u> |
|-----|-------------|----------------------------------|
| (a) | Concave | Closer to lens than the focus |
| (b) | Concave | Farther from lens than the focus |
| (c) | Convex | Closer to lens than the focus |
| (d) | Convex | Farther from lens than the focus |
| (e) | Concave | At the focus |

23. What kind of image will you see when using this lens as a magnifying glass for the bug?



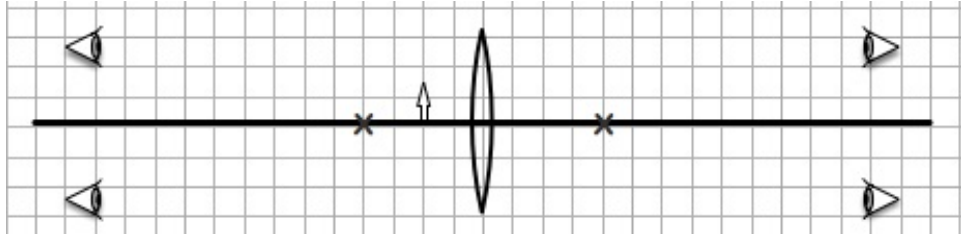
25. An object is placed 39 cm from a convex mirror that has a focal length of 18 cm as shown above.
- Sketch a ray diagram to locate the image that the mirror forms.
 - Calculate the location of the image.

- Is the image a **real image** or a **virtual image**? **Circle one.**
- Is the image **upright** or **inverted**? **Circle one.**
- Sketch on the diagram an “eye” at a location at which an observer could view the image.



26. An object is placed 16 cm from a concave mirror that has a focal length of 10 cm as shown above.
- Sketch a ray diagram to locate the image that the mirror forms.
 - Calculate the location of the image.

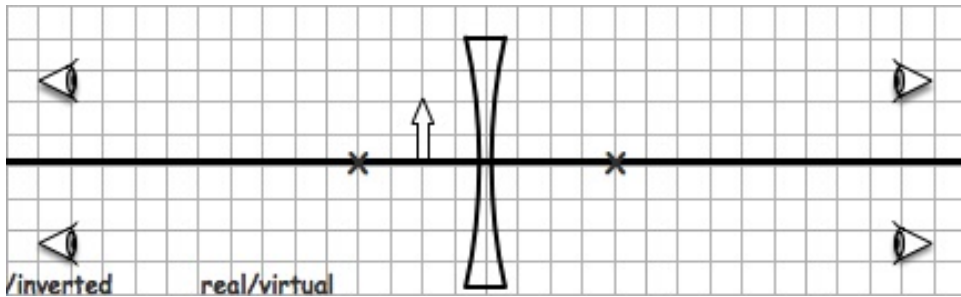
- Is the image a **real image** or a **virtual image**? **Circle one.**
- Is the image **upright** or **inverted**? **Circle one.**
- Sketch on the diagram an “eye” at a location at which an observer could view the image.



27. An object is placed 8 cm from a convex lens that has a focal length of 16 cm as shown above.

- (a) Sketch a ray diagram to locate the image that the mirror forms.
- (b) Calculate the location of the image.

- (c) Is the image a **real image** or a **virtual image**? **Circle one.**
- (d) Is the image **upright** or **inverted**? **Circle one.**
- (e) Sketch on the diagram an “eye” at a location at which an observer could view the image.



28. An object is placed 10 cm from a concave lens that has a focal length of -20 cm as shown above.

- (a) Sketch a ray diagram to locate the image that the mirror forms.
- (b) Calculate the location of the image.

- (c) Is the image a **real image** or a **virtual image**? **Circle one.**
- (d) Is the image **upright** or **inverted**? **Circle one.**
- (e) Circle on the diagram an “eye” at a location at which an observer could view the image.