**Reflection and Mirrors Review**

From <http://www.physicsclassroom.com/reviews/refln/reflnprint.cfm>

**Part A: Multiple Choice**

1. Suppose that laser light is approaching a mirror. Then the angle of incidence is gradually increased. If one were to measure the angle between the incident ray and the reflected ray, then it would be observed that this angle approaches the value of \_\_\_\_\_ degrees.

a. 0 b. 90 c. 180 d. 360

2. If you stand three feet in front of a plane mirror, how far away would you see yourself in the mirror?

a. 1.5 ft b. 3.0 ft c. 6.0 ft d. 12.0 ft

3. A concave mirror with a focal length of 10.0 cm creates a real image 30.0 cm away on its principal axis; the corresponding object is located a distance of \_\_\_\_\_ cm from the mirror.

a. 5.0 b. 7.5 c. 15.0 d. 20.0

4. A light bulb is placed along the principal axis and 22.0 cm from the surface of a concave mirror. An image is produced 35.0 cm from the mirror. What is the focal length of the mirror?

a. 13.5 cm b. 28.5 cm c. 59.2 cm d. -59.2 cm

5. A concave mirror has a focal length of 15.0 cm. A virtual image is formed along the principal axis a distance of 10.0 cm from the mirror. The object distance is \_\_\_\_\_ cm.

a. 6.0 b. 10.0 c. 12.4 d. 30.0

6. An object is placed along the principal axis of a convex mirror that has a focal length of -18.0 cm. A virtual image is formed 12.0 cm from the mirror. What is the object distance?

a. 7.2 cm b. 15.0 cm c. 36.0 cm d. -36.0 cm

7. If a man's face is 30.0 cm in front of a concave shaving mirror creating an upright image 1.50 times as large as the object, what is the mirror's focal length?

a. 12.0 cm b. 20.0 cm c. 70.0 cm d. 90.0 cm

8. A plane mirror produces images of objects that have an orientation that is \_\_\_\_\_, a size that is \_\_\_\_\_\_\_ (compared to that of the object) and a type that is \_\_\_\_\_.

a. upright, magnified, real

b. upright, reduced, real

c. upright, neither magnified nor reduced, virtual

d. inverted, reduced, real

9. An object is placed along the principal axis of a concave mirror, somewhere between the focal point (F) and the center of curvature (C). This would result in the formation of an image that has an orientation that is \_\_\_\_\_, a size that is \_\_\_\_\_\_\_ (compared to that of the object) and a type that is \_\_\_\_\_.

a. upright, magnified, real b. upright, magnified, virtual

c. inverted, magnified, real d. inverted, reduced, real

10. An object is placed along the principal axis of a concave mirror, somewhere beyond (further away than) the center of curvature (C). This would result in the formation of an image that has an orientation that is \_\_\_\_\_, a size that is \_\_\_\_\_\_\_ (compared to that of the object) and a type that is \_\_\_\_\_.

a. upright, magnified, real b. upright, magnified, virtual

c. inverted, magnified, real d. inverted, reduced, real

11. An object is placed along the principal axis of a concave mirror, somewhere in front of the focal point (F). This would result in the formation of an image that has an orientation that is \_\_\_\_\_, a size that is \_\_\_\_\_\_\_ (compared to that of the object) and a type that is \_\_\_\_\_.

a. upright, magnified, real b. upright, magnified, virtual

c. inverted, magnified, real d. inverted, reduced, real

12. An object is placed along the principal axis of a convex mirror, somewhere in front of the focal point (F). This would result in the formation of an image that has an orientation that is \_\_\_\_\_, a size that is \_\_\_\_\_\_\_ (compared to that of the object) and a type that is \_\_\_\_\_.

a. upright, reduced, real b. upright, reduced, virtual

c. upright, magnified, real d. inverted, reduced, virtual

13. In precision optical equipment, parabolic mirrors are often preferred over spherical mirrors. This is because parabolic mirrors reduce the problems associated with \_\_\_\_\_.

a. mirages b. dispersion of light

c. chromatic aberration d. spherical aberration

14. A plane mirror image possesses the characteristics of being \_\_\_\_.

a. real and upright. b. real and inverted.

c. virtual and upright. d. virtual and inverted.

15. Images produced by plane mirrors have an image distance that depends upon \_\_\_\_\_.

a. the wavelength of light used for viewing.

b. the distance from the object to the mirror.

c. the distance of both the observer and the object to the mirror.

16. In the *Mirror, Mirror, On the Wall* lab, a plane mirror is secured to a vertical wall. A student views herself in mirror. The amount of mirror that is needed to view her entire image \_\_\_\_\_.

a. is roughly equal to her height

b. is roughly equal to one-half of her height

c. is dependent upon the distance that she stands from the mirror

d. is dependent upon both her height and the distance that she stands from the mirror

17. A concave mirror image will \_\_\_\_.

a. will always be real b. will always be virtual

c. be either real or virtual d. will always be magnified

18. A convex mirror image \_\_\_\_.

a. will always be real. b. will always be virtual.

c. may be either real or virtual. d. will always be magnified.

19. Rays of light that are traveling parallel to the principal axis of a concave mirror will reflect off the mirror and converge\_\_\_\_.

a. at the focal point

b. at the center of curvature

c. on the opposite side of the mirror

d. Nonsense! Concave mirrors would not converge parallel rays of light

20. Right angle mirrors produce three images of objects. Which of the following statements is/are true of the middle image?

1. The middle image is the same size as the object.
2. The middle image is the same distance from the mirror as the object.
3. The middle image will exhibit left-right reversal relative to the object.
4. The middle image is a real image.
5. The middle image is an upright image.
6. The magnification of the middle image is -1.
7. When sighting at the middle image, light will reflect twice prior to reaching one's eye.

21. Two plane mirrors are attached to form a dual mirror system with an adjustable angle. As the angle between the mirrors increases, the number of images \_\_\_\_\_.

a. increases b. decreases c. remains the same

22. Which of the following statements is/are true of a virtual image?

a. Virtual images are always located behind the mirror.

b. Virtual images can be either upright or inverted.

c. Virtual images can be magnified in size, reduced in size or the same size as the object.

d. Virtual images can be formed by concave, convex, and plane mirrors.

e. Virtual images are not real; thus you could never see them when sighting in a mirror.

f. Virtual images result when the reflected light rays diverge.

g. Virtual images can be projected onto a sheet of paper.

23. Which of the following statements is/are true of a real image?

1. Real images are always located behind the mirror.
2. Real images can be either upright or inverted.
3. Real images can be magnified in size, reduced in size or the same size as the object.
4. Real images can be formed by concave, convex, and plane mirrors.
5. Real images are not virtual; thus you could never see them when sighting in a mirror.
6. Real images result when the reflected light rays diverge.
7. Real images can be projected onto a sheet of paper.

24. Which of the following situations would always result in an image that is magnified in size?

a. Concave mirror: di > 0 and do < di

b. Convex mirror: do > 0

c. Plane Mirror: do > 0

d. Concave Mirror: do> R

e. Concave Mirror: do< f

f. Concave Mirror: do> f and do < R

25. Which of the following situations would always result in an image that is upright?

1. Concave mirror: di > 0 and do < di
2. Convex mirror: do > 0
3. Plane Mirror: do > 0
4. Concave Mirror: do> R
5. Concave Mirror: do< f
6. Concave Mirror: do> f and do < R

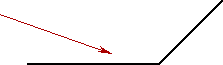
26. **TRUE** or **FALSE**:

Virtual images formed by mirrors are always upright images.

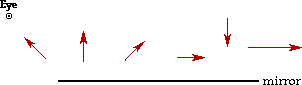
a. True b. False

**Part B: Diagramming**

27. On the diagram below, sketch the path the light ray would take as it travels.



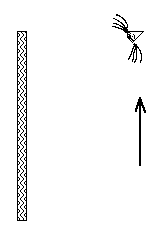
28. Locate the images of the objects below and state which images can be seen by the eye.



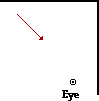
29. Locate all of the images formed by the mirror systems below.



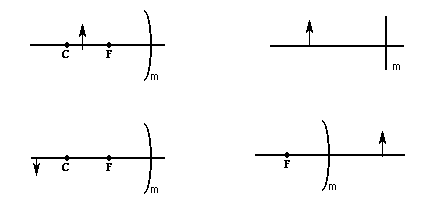
30. Consider the following object in front of a plane mirror. Construct a ray diagram to show how light travels from the object (arrow) to the mirror and ultimately to the eye; then indicate the portion of the mirror needed in order for the eye to view the image.



31. For the right angle mirror below, draw in the secondary (or middle) image and show how light travels from the middle image to the eye.



32. Construct ray diagrams to show where the images of the following objects are located. Dray in the complete image and describe its characteristics (real or virtual, enlarged or reduced in size, inverted or upright). (NOTE: review the ray diagrams for all possible objects locations for each device.)



**Part C: Calculations and Explanations**

33. Distinguish between diffuse and regular (specular) reflection in terms of both cause and result.

34. Write the formulae that show the relationship between image distance, object distance and focal length, and the magnification of an object/image.

35. Fill in the blanks below for the problem-solving rules:

Focal lengths, object and image distances are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if they are on the reflective side of the mirror. Object and image heights are positive if they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the principle axis.

36. What is the focal length of a mirror that gives an image 3.00 meters away when an object is placed 150. cm from it?

37. Where is the image located when an object is placed 60.0 cm from a mirror that has a focal length of 20.0 cm?

38. How far would an object need to be placed from a mirror of focal length 10.0 cm if it is to produce an image that is 20.0 cm BEHIND the mirror?

39. A mirror with a focal length of -100.0 cm is used to form an image. An object is placed 50.0 cm in front of the mirror.

a. Where is the image located?

b. What type of mirror is being used in this problem?

40. An object is placed 20.0 cm from a mirror of focal length 10.0 cm. The object is 5.00 cm tall. Where is the image located? How tall is the image?

41. A 20.0 cm tall object produces a 40.0 cm tall real image when placed in front of a curved mirror with a focal length of 50.0 cm. Determine the place that the object must be located to produce this image.

42. A mirror is used to produce a virtual image that is 5.00 times bigger than the object. If the focal length of the mirror is 100. cm, where will the image be located?