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**Assignment – I**

1. Find the focal length of a convex mirror of radius of curvature 1m.
2. An object 4 cm in size is placed at a distance of 25 cm from a concave mirror of focal length 15 cm. Find the position, nature and height of the image.
3. A converging mirror forms a real image of height 4 cm, of an object of height 1 cm placed 20 cm away from the mirror. Calculate the image distance. What is the focal length of the mirror ?
4. The image formed by a convex mirror of focal length 20 cm is a quarter of the object. What is the distance of the object from the mirror ?
5. An arrow 2.5 cm high is placed at a distance of 25 cm from a diverging mirror of focal length 20 cm. Find the nature, position and size of the image formed.
6. Focal length of a convex mirror is 50 cm. What is its radius of curvature ?
7. Radius of curvature of a concave mirror is 25 cm. What is its focal length ?
8. A concave mirror produces 10 cm long image of an object of height 2 cm. What is the magnification produced ?
9. An object 1 cm high is held near a concave mirror of magnification 10. How tall will be the image ?
10. Find the size, nature and position of image formed by a concave mirror, when an object of size 1 cm is placed at a distance of 15 cm. Given focal length of mirror is 10 cm.
11. An object 2 cm high is placed at a distance of 16 cm from a concave mirror, which produces 3 cm high inverted image. What is the focal length of the mirror? Also, find the position of the image.
12. An erect image 3 times the size of the object is obtained with a concave mirror of radius of curvature 36 cm. What is the position of the object ?
13. A 2.5 cm candle is placed 12 cm away from a convex mirror of focal length 30 cm. Give the location of the image.
14. An object is placed in front of a concave mirror of focal length 20 cm. The image formed is 3 times the size of the object. Calculate two possible distances of the object from the mirror ?
15. A concave mirror produces a real image 10 mm tall, of an object 2.5 mm tall placed at 5 cm from the mirror. Calculate focal length of the mirror and the position of the image ?
16. An object is placed at a large distance in front of a convex mirror of radius of curvature 40 cm. How far is the image behind the mirror ?

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1. An object is placed 15 cm from a convex mirror of radius of curvature 90 cm. Calculate position of the image and its magnification.
2. The image formed by a convex mirror of focal length 30 cm is a quarter of the object. What is the distance of the object from the mirror ?
3. When an object is placed at a distance of 60 cm from a convex spherical mirror, the magnification produced is 1/2. Where should the object be placed to get a magnification of 1/3 ?
4. An object is placed 18 cm in front of a spherical mirror. If the image is formed at 4 cm to the right of the mirror, calculate its focal length. Is the mirror convex or concave? What is the nature of the image? What is the radius of curvature of the mirror ?
5. A convex mirror used for rear view on an automobile has a radius of curvature of 3 m. If a bus is located at 5 m from this mirror, find the position, nature and magnification of the image.

**Answers**

1. 0.5 m 2. – 37.5 cm , real & inverted , - 6 cm 3. – 80 cm , – 16 cm 4. – 60 cm

5. 11.1 cm , virtual and erect , 1.11 cm 6. 100 cm 7. 12.5 cm 8. 5 9. 10 cm

10. 2 cm , real and inverted , – 30 cm 11. – 9.6 cm , – 24 cm 12. – 12 cm 13. 8.6 cm

14. – 40/3 cm , – 80/3 cm 15. – 4 cm , – 20 cm 16. 20 cm 17. 11.25 cm , 0.75

18. – 90 cm 19. – 120 cm 20. 5.14 cm , convex , erect and virtual , 10.28 cm

21. 1.15 m at the back of mirror , virtual , erect , 0.23

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**Assignment – II**

1. Light travels through water with a speed of 2.25 x 108 m/s. What is the refractive index of water? Given speed of light in vacuum = 3 x 108 m/s.
2. Light travels from a rarer medium 1 to a denser medium 2. The angle of incidence and reflection are respectively 45˚ and 30˚. Calculate the refractive index of second medium with respect to the first medium.
3. In problem 2, what is the refractive index of medium 1 with respect to medium 2.
4. A pond of depth 20 cm is filled with water of refractive index 4/3. Calculate apparent depth of the tank when viewed normally.
5. How much time will light take to cross 2 mm thick glass pane if refractive index of glass is 3/2.
6. Calculate speed of light in water of refractive index 4/3. Given speed of light in air = 3 x 108 m/s.
7. A ray of light passes form air to glass (n = 1.5) at an angle of 30˚. Calculate the angle of refraction.
8. A ray of light is incident on a glass slab at an angle of 45˚. If refractive index of glass be 1.6, what is the angle of refraction ?
9. The refractive index of diamond is 2.47 and that of glass is 1.51. How much faster does light travel in glass than in diamond ?
10. The refractive index of glycerine is 1.46. What is the speed of light in air if its speed in glycerine is 2.05 x 108m/s ?
11. The refractive index of glass is 1.6 and that of diamond is 2.4. Calculate refractive index of diamond with respect to glass.
12. In the above problem, what is the refractive index of glass with respect to diamond ?
13. A ray of light is travelling from glass to air. The angle of incidence in glass is 35˚ and angle of refraction in air is 60˚. What is the refractive index of glass with respect to air ?
14. A ray of light is travelling from air to water. What is the angle of incidence in air, if angle of refraction in water is 41˚? Take refractive index of water = 1.32.
15. A water tank appears to be 4 m deep when viewed from the top. If refractive index of water is 4/3, what is the actual depth of the tank ?
16. What is the real depth of a swimming pool when its bottom appears to be raised by 1 m? Given refractive index of water is 4/3.
17. A jar 15 cm long is filled with a transparent liquid. When viewed from the top, its bottom appears to be 12 cm below. What is the refractive index of the liquid ?

**Answers**

1. 1.33 2. = 1.414 3. 0.707 4. 15 cm 5. 10 – 11 s 6. 2.25 x 108 m/s

7. 19.47˚ 8. 26.2˚ 9. 1.635 times 10. 2.99 x 108 m/s 11. 1.5 12. 0.67

13. 1.51 14. 60˚ 15. 5.3 m 16. 4 m 17. 1.25

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**Assignment – III**

1. A 2 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 10 cm. The distance of the object from the lens is 15cm. Find the nature, position and size of the image. Also, find its magnification.
2. A concave lens has focal length of 15 cm. At what distance should an object from the lens be placed so that it forms an image at 10 cm from the lens? Also, find the magnification of the lens.
3. A concave lens of focal length 25 cm and a convex lens of focal length 20 cm are placed in contact with each other. What is the power of this combination? Also, calculate focal length of the combination.
4. A convex lens of focal length 20 cm is placed in contact with a concave lens of focal length 10 cm. What is the focal length and power of the combination?
5. The image obtained with a convex lens is erect and its length is 4 times the length of the object. If the focal length of the lens is 20 cm, calculate the object and image distances.
6. A needle placed 45 cm from a lens forms an image on the screen placed 90 cm on the other side of the lens. Identify the type of the lens and determine its focal length. What is the size of the image if the size of needle is 5 cm?
7. Calculate the distance at which an object should be placed in front of a convex lens of focal length 10 cm to obtain an image of double its size.
8. The image of a needle placed 10 cm from a lens is formed on a wall 20 cm on the other side of the lens. Find focal length of the lens and size of image formed, if the size of object needle is 2.5 cm.
9. An object is placed at a distance of 50 cm from a concave lens of focal length 30 cm. Find the nature and position of the image.
10. An object of height 2 cm is placed at a distance of 15 cm in front of concave lens of power – 10 diopter. Find the size of the image.
11. A thin lens has a focal length of – 25 cm. What is the power of the lens? Is it convex or concave ?
12. The power of lens is 2.5 D. What is its focal length ?
13. A convergent lens of power 8 D is combined with a divergent lens of power – 10 D. Calculate focal length of the combination.
14. A concave lens is kept in contact with a convex lens of focal length 20 cm. The combination works as a converging lens of focal length 100 cm. Calculate power of concave lens.
15. Find the focal length and nature of lens which should be placed in contact with a lens of focal length 10 cm so that the power of the combination becomes 5 diopter.

**Answers**

1. 30 cm , real & inverted , – 4 cm , – 2 2. – 30 cm , 1/3 3. 1 D , 1 m 4. – 20 cm , – 5 D

5. – 15 cm , – 60 cm 6. Convex , 30 cm , –10 cm 7. – 5 cm , – 15 cm 8. 6.67 cm , – 5 cm

9. Virtual ; erect , at – 18.7 cm 10. 0.8 cm 11. – 4 D , concave 12. 40 cm

13. – 0.5 m 14. – 4 D 15. – 20 cm , concave

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**Assignment – IV**