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Light

True/False questions

State whether the following statements are true or false.

1. A plane mirror can form virtual images only.
2. An object is placed in front of a mirror and an image of it is formed at the object itself. The mirror mentioned in question is a convex mirror.
3. A concave mirror can produce both real and virtual images.
4. Light travels faster in glass than in air.
5. For a ray of light, incidenting normally on a plane mirror, the angle of reflection is 180°.
6. A plane mirror produces a magnification of +1.
7. A diminished virtual image can be formed only in concave mirror.
8. The field of view is maximum for convex mirror.
9. An object situated at the principle focus of a concave lens will have its image formed at infinity.
10. Given a point source of light, a convex mirror can produce a parallel beam of light.
11. The ratio of the refractive index of red light to blue light in air is less than unity.
12. A converging lens is used to form an image on a screen. When upper half of the lens is covered by an opaque screen half the image will be formed of decreased intensity.

Fill in the blanks

1. Light wave are ..... waves travelling in vacuum or air with speed of ..... metres per second.
2. For a concave mirror to form a magnified, real image, the object must be placed between its ..... and .....
3. An object is placed in front of a spherical mirror. The image is found to be virtual for all positions of the object. The spherical mirror is .....
4. Two immiscible transparent liquids A and B have 1.2 and 1.5 as their refractive indices (with respect to air). The refractive index of B with respect to A is .....
5. A convex lens is a ..... lens whereas a concave lens is a ..... lens.
6. A concave lens and a convex mirror both form ..... images only.

Objective type questions

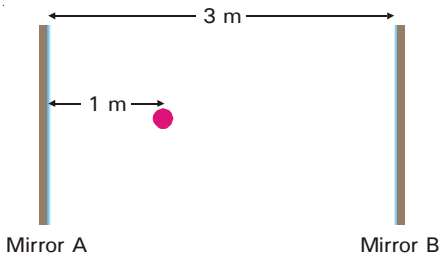
In the following questions, four options are given out of which only one is correct.

1. Light waves
   (1) are mechanical waves
   (2) are electromagnetic waves
   (3) travel with a speed 332 m/s in vacuum
   (4) requires a material medium for their propagation
2. Virtual image of a real object can be formed by
   (1) convex mirror (2) concave mirror
   (3) plane mirror (4) all of these
3. An object is placed at the centre of curvature of a concave mirror. The distance between the object and its image is
   (1) f (2) 0.5 f
   (3) 2f (4) zero
4. The magnification in the image of a real object formed by a spherical mirror is negative. The image is
   (1) real
   (2) virtual
   (3) larger than object
   (4) smaller than object
5. To get a virtual image smaller than the object, one can use
   (1) a convex mirror
   (2) a concave mirror
   (3) either a convex mirror or a concave mirror
   (4) neither a convex mirror nor a concave mirror because the virtual image is always enlarged
6. A lens has positive focal length. Then the lens is
   a. concave b. convex
   c. diverging d. converging
   (1) both a & c (2) both b & d
   (3) both a & d (4) both b & c
7. A concave lens of focal length 15 cm forms a virtual image of a real object. The object distance can be
   (1) 5 cm (2) 15 cm
   (3) 25 cm (4) any value
8. If the refractive index of a transparent slab is 5/3, then the speed of light in the slab will be
   (1) 3×10^8 m/s (2) 2×10^8 m/s
   (3) 1.8×10^8 m/s (4) 1.5×10^8 m/s

9. In order to see complete image of a person of height 1.6 m in a plane mirror, the minimum size of the mirror placed in front should be
(1) 1.6 m (2) 3.2 m
(3) 1.2 m (4) 0.8 m

10. In a museum a child walks towards a large concave mirror. He will see that his real, inverted image
a. goes on increasing in size
b. goes on decreasing in size
c. eventually becomes virtual, erect & magnified
d. eventually becomes virtual, erect & diminished
(1) a only (2) b only
(3) both a & c (4) both b & d

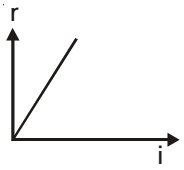
11. If we want to form a three times magnified real image of a real object using a convex lens of focal length 10 cm, the object distance must be
(1) equal to 8 cm
(2) equal to 10 cm
(3) between 10 cm and 20 cm
(4) more than 20 cm

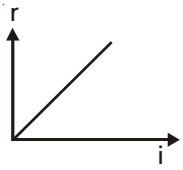
12. 

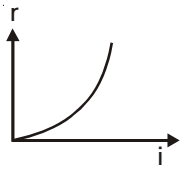
Let an object be placed between two plane mirrors A and B, parallel to each other, as shown above. Then the distance (in m) of the first three images formed in the mirror A measured from the mirror A will be
(1) 2, 6, 8 (2) 1, 4, 10
(3) 1, 5, 7 (4) 4, 8, 10

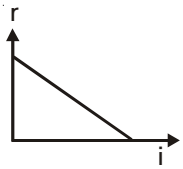
13. A concave mirror produces a real image of same size as that of the object when placed at a distance of 20 cm from it. At what distance from the mirror should the object be placed so that the image becomes twice the size of the object?
(1) 10 cm (2) 15 cm
(3) 20 cm (4) 30 cm

14. Which of the following correctly represents graphical relation between angle of incidence (i) and angle of reflection (r) for a mirror?

(1) 

(2) 

(3) 

(4) 

15. A convex mirror of focal length f (in air) is immersed in a liquid of refractive index 1.5. The focal length of the mirror in liquid
(1) becomes 1.5 times
(2) becomes 0.67 times
(3) becomes infinite
(4) remains same

16. A ray of light incident on a plane mirror gets deviated after reflection rays by 60°. The angle of incidence is
(1) 30° (2) 60°
(3) 90° (4) 15°

17. A convex mirror has a radius of curvature 10 cm. Magnification of an object placed 10 cm from it will be
(1) 0.2 (2) 0.5
(3) 1 (4) 0.33

18. The minimum distance between an object and its real image formed by a convex lens of focal length f is
(1) f (2) 2f
(3) 3f (4) 4f

19. Rays are converging towards the centre of curvature of a convex mirror of radius of curvature R. The distance between the image formed and the pole is
(1) R (2) $<R$
(3) 0.5 R (4) $>R$

20. An object of size 1 mm is placed perpendicular to the principal axis of a concave mirror. The distance of the object from the mirror equals twice the focal length. The size of the image will be
(1) 0.5 mm (2) 1.5 mm
(3) 1 mm (4) 2 mm

21. According to Cartesian convention, the object distance for a virtual object and image distance for a virtual image in case of a spherical mirror are
(1) negative, negative (2) negative, positive
(3) positive, negative (4) positive, positive

22. The relation "focal length is half the radius of curvature" is applicable to
(1) concave mirrors (2) plane mirrors
(3) concave lenses (4) all of these

23. A ray of light which retrace its path after reflection from a concave mirror is
(1) that which passes through the focus
(2) that which passes through centre of curvature
(3) that which passes through the pole
(4) that which is parallel to the principal axis

24. A ray of light upon emerging from a glass slab
(1) goes without deviating from its path
(2) deviates away from the normal
(3) deviates towards the normal
(4) retraces its path

25. A lens has a power of +0.25 D. It is
(1) a concave lens of focal length 5 m
(2) a convex lens of focal length 5 cm
(3) a convex lens of focal length 4 m
(4) a concave lens of focal length 4 m

26. If you want to see your full image and minimum size of the plane mirror is used, the lower end of the mirror should be at a height
(1) equal to your height
(2) equal to half of your height.
(3) equal to less than half of your height
(4) which depends upon your distance from the mIrror

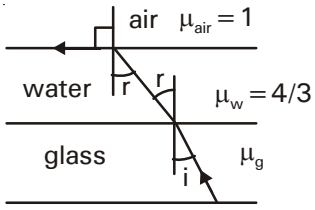
27. An object A is placed at a distance d_1 in front of a plane mirror. If a person standing directly behind the object at a distance d_2 from the mirror wants to photograph the image, the camera should be focused at a distance
(1) $2d_1$ (2) $2d_2$
(3) $d_1 + d_2$ (4) $2d_1 + d_2$

28. Indicate the only correct statement.
(1) The image formed by a convex mirror can be taken on the screen.
(2) A convex mirror can produce a parallel beam of light from a light bulb
(3) The image of a virtual object placed at the focus of a convex mirror will be formed at infinity.
(4) A concave mirror can form a diminished virtual image of a real object

29. Focal length of a concave mirror is f and distance from the object to the principal focus is x. The distance of image from the focus will be
(1) $\frac{f}{x}$ (2) $\frac{f^2}{x}$
(3) $\frac{f}{x^2}$ (4) $f + x$

30. A concave mirror of focal length 15 cm produces a virtual image 4 times as large as an object placed infront of it. The object distance is
(1) 10 cm (2) 12 cm
(3) 11.25 cm (4) 12.5 cm

31. A glass prism when immersed in a liquid of refractive index 1.6 almost disappears. The refractive index of the material of the prism is
(1) < 1.6 (2) > 1.6
(3) 1.6 (4) zero

32. 

A ray of light is incident at the glass water interface at an angle 'i', it emerges finally parallel to the surface of water, then value of μ_g will be
(1) (4/3)sin i (2) 1/sin i
(3) 4/3 (4) (1/3) sin i

33. The frequency of light wave in a material is 2×10^{14}Hz and wavelength is 5000 Å. The refractive index of material is
(1) 1.5 (2) 3
(3) 1.33 (4) 1.4

34. The ratio of thickness of two glass slabs P and Q is 5:3, If light takes equal time in passing through them, then refractive index of P with respect to Q will be
(1) 5 : 3 (2) 3 : 5
(3) $\sqrt{5} : \sqrt{3}$ (4) $\sqrt{3} : \sqrt{5}$

35. The refractive indices of glass and water with respect to air are 3/2 amd 4/3 respectively. Then the refractive index of glass with respect to water is
(1) $\frac{9}{8}$ (2) $\frac{8}{9}$
(3) 2 (4) 0.5

36. A convex lens of focal length 30cm produces 5 times magnified real image of an object. What is the object distance ?
(1) 36 cm (2) 25 cm
(3) 30 cm (4) 150 cm

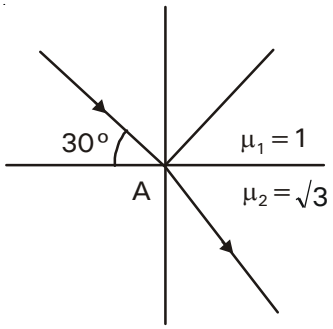
37. A 2cm tall object is placed 15cm in front of a concave mirror of focal length 10cm. What is the size and nature of the image?
(1) 4cm, real (2) 4cm, virtual
(3) 1cm, real (4) none of these

38. A focal length of a lens is 10cm. What is power of lens ?
(1) 15 D (2) 0.1 D
(3) 20 D (4) 10 D

39. Two lenses of power $+15$D and -3D are placed in contact. The power of the combination is

(1) 12 D (2) 18 D
(3) -12 D (4) -18 D

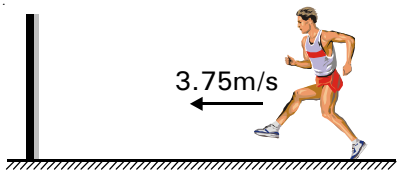
40. A beam of monochromatic light reflects and refracts at point A, as shown in the diagram. Find the angle of refraction at point A



(1) 60° (2) 45°
(3) 30° (4) none of these

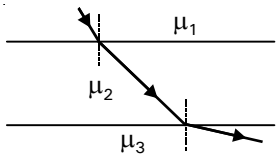
41. Which of the following statements is false?

(1) A plane mirror produces a magnification of $+1$
(2) Focal length of a plane mirror is infinite
(3) For a man of height h, to see his own complete image, a mirror of height at least equal to 0.5 h is required
(4) For a ray of light, incidenting normally on a plane mirror, the angle of reflection is 180°

42. 

In the above situation, a person is running towards a mirror kept in vertical position. Velocity of the image relative to the person is

(1) 1.875 m/s (2) zero
(3) 7.5 m/s (4) 3.75 m/s

43. 

The figure shows the path of a ray of light as it passes through three different materials with refractive indices μ_1, μ_2 and μ_3. The refractive indices of the material satisfy the relation

(1) $\mu_3 < \mu_2 < \mu_1$ (2) $\mu_3 < \mu_1 < \mu_2$
(3) $\mu_2 < \mu_1 < \mu_3$ (4) $\mu_1 < \mu_3 < \mu_2$

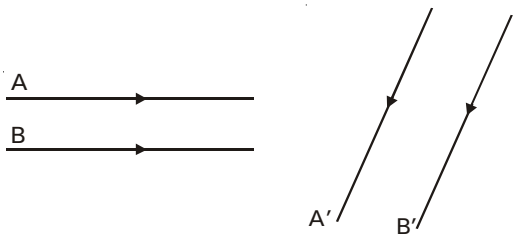
44. When a certain light of wavelength 5400 Å travels from air to another medium, its wavelength decreases by 900 Å. Then speed of light in that medium is

(1) 1.25×10^8 m/s (2) 1.5×10^8 m/s
(3) 2.25×10^8 m/s (4) 2.5×10^8 m/s

45. Light of wavelength 6000 Å in air enters a medium of refractive index 1.5. What will be its frequency in the medium?

(1) 2×10^{14} Hz (2) 3×10^{14} Hz
(3) 5×10^{14} Hz (4) 7×10^{14} Hz

46. Figure shows two rays A and B being reflected by a mirror and going as A′ and B′

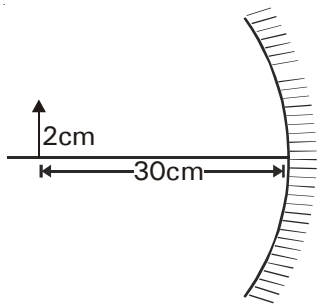


The mirror

(1) is a plane mirror
(2) is convex mirror
(3) is concave mirror
(4) may be any spherical mirror

Passage based questions (47 to 50)

A linear object of height 2 cm is placed at distance 30 cm from pole of the concave mirror of radius of curvature 40 cm



47. The position of image from pole of the mirror is
    (1) 30 cm infront of the mirror
    (2) 60 cm behind the mirror
    (3) 60 cm infront of mirror
    (4) none of these

48. The magnification is
    (1) +2 (2) −2
    (3) +1/2 (4) −1

49. Height of the image is
    (1) 2 cm (2) 4 cm
    (3) 6 cm (4) 1 cm

50. Nature of image formed is
    (1) real and inverted
    (2) virtual and erect
    (3) real and erect
    (4) virtual and inverted

Answers

True / False

1. (F)
2. (F)
3. (T)
4. (F)
5. (F)
6. (T)
7. (F)
8. (T)
9. (F)
10. (F)
11. (T)
12. (F)

Fill in blanks

1. Electromagnetic, 3×10^8
2. f, 2f
3. Convex
4. 1.25
5. converging, diverging
6. virtual, erect and small in size

Objective questions

1. (2)
2. (4)
3. (4)
4. (1)
5. (1)
6. (2)
7. (4)
8. (3)
9. (4)
10. (3)
11. (3)
12. (3)
13. (2)
14. (2)
15. (4)
16. (2)
17. (4)
18. (4)
19. (1)
20. (3)
21. (4)
22. (1)
23. (2)
24. (2)
25. (3)
26. (3)
27. (3)
28. (3)
29. (2)
30. (3)
31. (3)
32. (2)
33. (2)
34. (2)
35. (1)
36. (1)
37. (1)
38. (4)
39. (1)
40. (3)
41. (4)
42. (3)
43. (1)
44. (4)
45. (3)
46. (1)
47. (3)
48. (2)
49. (2)
50. (1)