13. A ray of light is incidenting normally on a plane mirror. The angle of reflection will be **[MP PET 2000]**

(1) $0°$ (2) $90°$

(3) Will not be reflected (4)None of the above

14. When light wave suffers reflection at the interface from air to glass, the change in phase of the reflected wave is equal to **[CPMT 1991; J & KCET 2004]**

(1) 0 (2) $\frac{\pi}{2}$

(3) π (4) 2π

15. A ray is reflected in turn by three plain mirrors mutually at right angles to each other. The angle between the incident and the reflected rays is **[Roorkee 1995]**

(1) $90°$ (2) $60°$

(3) $180°$ (4) None of these

16. Two plane mirrors are at right angles to each other. A man stands between them and combs his hair with his right hand. In how many of the images will he be seen using his right hand **[MP PMT 1995; UPSEAT 2001]**

(1) None (2) 1

(3) 2 (4) 3

17. When a plane mirror is rotated through an angle θ then the reflected ray turns through the angle 2θ then the size of the image

(1) Is doubled (2) Is halved

(3) Remains the same (4) Becomes infinite

18. A plane mirror produces a magnification of **[MP PET/PMT 1997]**

(1) -1 (2) $+1$

(3) Zero (4) Between 0 and $+\infty$

19. A plane mirror makes an angle of $30°$ with horizontal. If a vertical ray strikes the mirror, find the angle between mirror and reflected ray **[RPET 1997]**

(1) $30°$ (2) $45°$

(3) $60°$ (4) $90°$

20. A watch shows time as $3:25$ when seen through a mirror, time appeared will be **[RPMT 1997; JIPMER 2001, 02]**

(1) $8:35$ (2) $9:35$

(3) $7:35$ (4) $8:25$

21. If an observer is walking away from the plane mirror with $6 m/sec$ Then the velocity of the image with respect to observer will be

(1) $6 m/sec$ (2) $-6 m/sec$

(3) $12 m/sec$ (4) $3 m/sec$

22. A man runs towards mirror at a speed of $15 m/s$. What is the speed of his image

(1) 7.5 m/s (2) 15 m/s

(3) 30 m/s (4) 45 m/s

23. A small object is placed 10 cm infront of a plane mirror. If you stand behind the object 30 cm from the mirror and look at its image, the distance focused for your eye will be **[KCET (Engg.) 2001]**

(1) 60 cm (2) 20 cm

(3) 40 cm (4) 80 cm

24. An object is at a distance of 0.5 m in front of a plane mirror. Distance between the object and image is **[CPMT 2002]**

(1) 0.5 m (2) 1 m

(3) 0.25 m (4) 1.5 m

25. A man runs towards a mirror at a speed 15 m/s The speed of the image relative to the man is **[Kerala PET**

(1) 15 ms^{-1} (2) 30 ms^{-1}

(3) 35 ms^{-1} (4) 20 ms^{-1}

26. The light reflected by a plane mirror may form a real image **[KCET (Engg. & Med.) 2002]**

(1) If the rays incident on the mirror are diverging

(2) If the rays incident on the mirror are converging

(3) If the object is placed very close to the mirror

(4) Under no circumstances

27. Two plane mirrors are inclined at an angle of 72^0. The number of images of a point object placed between them will be [KCET (Engg. & Med.)1999; BCECE 2003]

(1) 2 (2) 3

(3) 4 (4) 5

28. To get three images of a single object, one should have two plane mirrors at an angle of

(1) 30° (2) 60°

(3) 90° (4) 150°

29. A man of length h requires a mirror, to see his own complete image of length at least equal to

(1) $\frac{h}{4}$ (2) $\frac{h}{3}$

(3) $\frac{h}{2}$ (4) h

30. Two plane mirrors are at $45°$ to each other. If an object is placed between them, then the number of images will be [MP PMT 2003]

(1) 5 (2) 9

(3) 7 (4) 8

31. A man having height 6 m. He observes image of 2 m height erect, then mirror used is

(1) Concave (2) Convex

(3) Plane (4) None of these

32. A light beam is being reflected by using two mirrors, as in a periscope used in submarines. If one of the mirrors rotates by an angle θ, the reflected light will deviate from its original path by the angle [UPSEAT 2004]

(1) 2θ (2) 0^o

(3) θ (4) 4θ

33. Focal length of a plane mirror is

(1) Zero (2) Infinite

(3) Very less (4) Indefinite

34. A ray of light is incident at 50° on the middle of one of the two mirrors arranged at an angle of 60° between them. The ray then touches the second mirror, get reflected back to the first mirror, making an angle of incidence of [MP PET 2005]

(1) 50° (2) 60°

(3) 70° (4) 80°

Spherical Mirror

1. A convex mirror of focal length f forms an image which is $\frac{1}{n}$ times the object. The distance of the object from the mirror is [AIEEE 2003]

(1) $(n-1)f$ (2) $\left(\frac{n-1}{n}\right)f$

(3) $\left(\frac{n+1}{n}\right)f$ (4) $(n+1)f$

2. A diminished virtual image can be formed only in [MP PET 2003]

[MP PMT 2002]

(a) Plane mirror (2) A concave mirror

(3) A convex mirror (4) Concave-parabolic mirror

3. Which of the following could not produce a virtual image

(1) Plane mirror

(2) Convex mirror

(3) Concave mirror

(4) All the above can produce a virtual image [BCECE 2004]

4. An object $5cm$ tall is placed $1m$ from a concave spherical mirror which has a radius of curvature of $20cm$ The size of the image is

(1) $0.11cm$ (2) $0.50cm$

(3) $0.55cm$ (4) $0.60cm$

5. The focal length of a concave mirror is $50cm$ Where an object be placed so that its image is two times and inverted

(1) 75 cm (2) 72 cm

(3) 63 cm (4) 50 cm [RPMT 2000]

6. An object of size $7.5cm$ is placed in front of a convex mirror of radius of curvature $25cm$ at a distance of $40cm$ The size of the image should be

(1) $2.3cm$ (2) $1.78cm$

(3) $1cm$ (4) $0.8cm$

7. The field of view is maximum for

(1) Plane mirror (2) Concave mirror
(3) Convex mirror (4) Cylindrical mirror

8. The focal length of a concave mirror is f and the distance from the object to the principle focus is x. The ratio of the size of the image to the size of the object is **[Kerala PET 2005]**

(1) $\frac{f+x}{f}$ (2) $\frac{f}{x}$
(3) $\sqrt{\frac{f}{x}}$ (4) $\frac{f^2}{x^2}$

9. A convex mirror is used to form the image of an object. Then which of the following statements is wrong **[CPMT 1973]**

(1) The image lies between the pole and the focus
(2) The image is diminished in size
(3) The image is erect
(4) The image is real

10. Given a point source of light, which of the following can produce a parallel beam of light **[CPMT 1974; KCET 2005]**

(1) Convex mirror
(2) Concave mirror
(3) Concave lens
(4) Two plane mirrors inclined at an angle of 90°

11. The image formed by a convex mirror of focal length $30cm$ is a quarter of the size of the object. The distance of the object from the mirror is

(1) $30cm$ (2) $90cm$
(3) $120cm$ (4) $60cm$

12. A boy stands straight infront of a mirror at a distance of $30cm$ away from it. He sees his erect image whose height is $\frac{1}{5}th$ of his real height. The mirror he is using is **[MP PMT 1993]**

(1) Plane mirror (2) Convex mirror
(3) Concave mirror (4) Plano-convex mirror

13. A person sees his virtual image by holding a mirror very close to the face. When he moves the mirror away from his face, the image becomes inverted. What type of mirror he is using

(1) Plane mirror (2) Convex mirror
(3) Concave mirror (4) None of these

14. Which one of the following statements is true

(1) An object situated at the principle focus of a concave lens will have its image formed at infinity
(2) Concave mirror can give diminished virtual image
(3) Given a point source of light, a convex mirror can produce a parallel beam of light
(4) The virtual image formed in a plane mirror can be photographed

15. The relation between the linear magnification m, the object distance u and the focal length f is

(1) $m=\frac{f-u}{f}$ (2) $m=\frac{f}{f-u}$
(3) $m=\frac{f+u}{f}$ (4) $m=\frac{f}{f+u}$

16. While using an electric bulb, the reflection for street lighting should be from

(1) Concave mirror (2) Convex mirror
(3) Cylindrical mirror (4) Parabolic mirror

17. A concave mirror is used to focus the image of a flower on a nearby well $120cm$ from the flower. If a lateral magnification of 16 is desired, the distance of the flower from the mirror should be **[MP PET 1986]**

(1) $8cm$ (2) $12cm$
(3) $80cm$ (4) $120cm$

18. A virtual image larger than the object can be obtained by **[MP PMT 1986]**

(1) Concave mirror (2) Convex mirror
(3) Plane mirror (4) Concave lens

19. An object is placed $40cm$ from a concave mirror of focal length $20cm$ The image formed is **[MP PET 1986; MP PMT/PET 1998]**

(1) Real, inverted and same in size

(2) Real, inverted and smaller

(3) Virtual, erect and larger

(4) Virtual, erect and smaller

20. A virtual image three times the size of the object is obtained with a concave mirror of radius of curvature $36cm$ The distance of the object from the mirror is **[MP PET 1986]**

(1) $5cm$ (2) $12cm$

(3) $10cm$ (4) $20cm$

21. Radius of curvature of concave mirror is $40cm$ and the size of image is twice as that of object, then the object distance is **[AFMC 1995]**

(1) $60cm$ (2) $20cm$

(3) $40cm$ (4) $30cm$

22. All of the following statements are correct except **[Manipal MEE 1995]**

(1) The magnification produced by a convex mirror is always less than one

(2) A virtual, erect, same-sized image can be obtained using a plane mirror

(3) A virtual, erect, magnified image can be formed using a concave mirror

(4) A real, inverted, same-sized image can be formed using a convex mirror

23. If an object is placed $10cm$ infront of a concave mirror of focal length $20cm$, the image will be **[MP PMT 1995]**

(1) Diminished, upright, virtual

(2) Enlarged, upright, virtual

(3) Diminished, inverted, real

(4) Enlarged, upright, real

24. Which of the following form(s) a virtual and erect image for all positions of the object

(1) Convex lens (2) Concave lens

(3) Convex mirror (4) Concave mirror

25. A convex mirror has a focal length f. A real object is placed at a distance f in front of it from the pole produces an image at

(1) Infinity (2) f

(3) $f/2$ (4) $2f$

26. An object $1cm$ tall is placed $4cm$ infront of a mirror. In order to produce an upright image of $3cm$ height one needs a **[SCRA 1994]**

(1) Convex mirror of radius of curvature $12cm$

(2) Concave mirror of radius of curvature $12cm$

(3) Concave mirror of radius of curvature $4cm$

(4) Plane mirror of height $12cm$

27. Match List I with List II and select the correct answer using the codes given below the lists :

List I (Position of the object)	**List II** (Magnification)
(I) An object is placed at focus before a convex mirror	(1) Magnification is $-\infty$
(II) An object is placed at centre of curvature before a concave mirror	(2) Magnification is 0.5
(III) An object is placed at focus before a concave mirror	(3) Magnification is $+1$
(IV) An object is placed at centre of curvature before a convex mirror	(4) Magnification is -1
	(E) Magnification is 0.33

Codes :

(1) I-B, II-D, III-A, IV-E (2) I-A, II-D, III-C, IV-B

(3) I-C, II-B, III-A, IV-E (4) I-B, II-E, III-D, IV-C

28. A concave mirror gives an image three times as large as the object placed at a distance of $20cm$ **[MP PET 1996]**

from it. For the image to be real, the focal length should be

[SCRA 1998; JIPMER 2000]

(1) $10\,cm$ (2) $15\,cm$

(3) $20\,cm$ (4) $30\,cm$

29. The minimum distance between the object and its real image for concave mirror is

(1) f (2) $2f$

(3) $4f$ (4) Zero

30. An object is placed at $20\,cm$ from a convex mirror of focal length $10\,cm$ The image formed by the mirror is

[JIPMER 1999]

(1) Real and at $20\,cm$ from the mirror

(2) Virtual and at $20\,cm$ from the mirror

(3) Virtual and at $20/3\,cm$ from the mirror

(4) Real and at $20/3\,cm$ from the mirror

31. A point object is placed at a distance of $10\,cm$ and its real image is formed at a distance of $20\,cm$ from a concave mirror. If the object is moved by $0.1\,cm$ towards the mirror, the image will shift by about [MP PMT 2000]

(1) $0.4\,cm$ away from the mirror

(2) $0.4\,cm$ towards the mirror

(3) $0.8\,cm$ away from the mirror

(4) $0.8\,cm$ towards the mirror

32. Under which of the following conditions will a convex mirror of focal length f produce an image that is erect, diminished and virtual

(1) Only when $2f > u > f$ (2) Only when $u = f$

(3) Only when $u < f$ (4) Always

33. The focal length of a convex mirror is 20 *cm* its radius of curvature will be

(1) 10 *cm* (2) 20 *cm*

(3) 30 *cm* (4) 40 *cm*

34. A concave mirror of focal length 15 *cm* forms an image having twice the linear dimensions of the object. The position of the object when the image is virtual will be

(1) 22.5 *cm* (2) 7.5 *cm*

(3) 30 *cm* (4) 45 *cm*

35. A point object is placed at a distance of 30 *cm* from a convex mirror of focal length 30*cm.* The image will form at

[JIPMER 2002]

(1) Infinity

(2) Focus [RPMT 1999]

(3) Pole

(4) 15 *cm* behind the mirror

36. An object 2.5 *cm* high is placed at a distance of 10 *cm* from a concave mirror of radius of curvature 30 *cm* The size of the image is

(1) 9.2 *cm* (2) 10.5 *cm*

(3) 5.6 *cm* (4) 7.5 *cm*

37. For a real object, which of the following can produced a real image [Orissa JEE 2003]

(1) Plane mirror (2) Concave lens

(3) Convex mirror (4) Concave mirror

38. An object of length 6 *cm* is placed on the principle axis of a concave mirror of focal length f at a distance of $4f$. The length of the image will be [MP PET 2003]

(1) 2 *cm* (2) 12 *cm*

(3) 4 *cm* (4) 1.2 *cm*

39. Convergence of concave mirror can be decreased by dipping in

(1) Water (2) Oil

(3) Both (4) None of these

40. What will be the height of image when an object of 2 *mm* is placed on the axis of a convex mirror at a distance 20 *cm* of radius of curvature 40 *cm*? [AMU (Engg.) 2001] [Orissa PMT 2004]

(1) 20 *mm* (2) 10 *mm*

(3) 6 *mm* (4) 1 *mm*

41. Image formed by a concave mirror of focal length 6 *cm*, is 3 times of the object, then the distance of object from mirror is [MP PMT 2001]

[RPMT 2000]

(1) – 4 *cm* (2) 8 *cm*

(3) 6 *cm* (4) 12 *cm*

42. A concave mirror of focal length f (in air) is immersed in water ($\mu = 4/3$). The focal length of the mirror in water will be

(1) f (2) $\frac{4}{3}f$

(3) $\frac{3}{4}f$ (4) $\frac{7}{3}f$

Refraction of Light at Plane Surfaces

1. To an observer on the earth the stars appear to twinkle. This can be ascribed to
[CPMT 1972, 74; AFMC 1995]

(1) The fact that stars do not emit light continuously

(2) Frequent absorption of star light by their own atmosphere

(3) Frequent absorption of star light by the earth's atmosphere

(4) The refractive index fluctuations in the earth's atmosphere

2. The ratio of the refractive index of red light to blue light in air is [CPMT 1978]

(1) Less than unity

(2) Equal to unity

(3) Greater than unity

(4) Less as well as greater than unity depending upon the experimental arrangement

3. The refractive index of a piece of transparent quartz is the greatest for
[MP PET 1985, 94]

(1) Red light (2) Violet light

(3) Green light (4) Yellow light

4. The refractive index of a certain glass is 1.5 for light whose wavelength in vacuum is 6000 Å. The wavelength of this light when it passes through glass is
[NCERT 1979; CBSE PMT 1993; MP PET 1985, 89]

(1) 4000 Å (2) 6000 Å

(3) 9000 Å (4) 15000 Å

5. When light travels from one medium to the other of which the refractive index is different, then which of the following will change
[MP PMT 1986; AMU 2001; BVP 2003]

(1) Frequency, wavelength and velocity

(2) Frequency and wavelength

(3) Frequency and velocity

(4) Wavelength and velocity

6. A light wave has a frequency of 4×10^{14} Hz and a wavelength of 5×10^{-7} meters in a medium. The refractive index of the medium is
[MP PMT 1989]

(1) 1.5 (2) 1.33

(3) 1.0 (4) 0.66

7. How much water should be filled in a container 21 *cm* in height, so that it appears half filled when viewed from the top of the container (given that ${}_a\mu_\omega = 4/3$)
[MP PMT 1989]

(1) 8.0 *cm* (2) 10.5 *cm*

(3) 12.0 *cm* (4) None of the above

8. Light of different colours propagates through air

(1) With the velocity of air

(2) With different velocities

(3) With the velocity of sound

(4) Having the equal velocities

9. Monochromatic light is refracted from air into the glass of refractive index μ. The ratio of the wavelength of incident and refracted waves is
[JIPMER 2000; MP PMT 1996, 2003]

(1) $1:\mu$ (2) $1:\mu^2$

(3) $\mu:1$ (4) 1 : 1

10. A monochromatic beam of light passes from a denser medium into a rarer medium. As a result
[CPMT 1972]

(1) Its velocity increases (2)Its velocity decreases

(3) Its frequency decreases (4)Its wavelength decreases

11. Refractive index for a material for infrared light is
[CPMT 1984]

(1) Equal to that of ultraviolet light

(2) Less than for ultraviolet light

(3) Equal to that for red colour of light

(4) Greater than that for ultraviolet light

12. The index of refraction of diamond is 2.0, velocity of light in diamond in *cm/second* is approximately

[CPMT 1975; MNR 1987; UPSEAT 2000]

(1) 6×10^{10} (2) 3.0×10^{10}

(3) 2×10^{10} (4) 1.5×10^{10}

13. A beam of light propagating in medium A with index of refraction n (1) passes across an interface into medium B with index of refraction $n(2)$. The angle of incidence is greater than the angle of refraction; $v(1)$ and $v(2)$ denotes the speed of light in A and B. Then which of the following is true

(1) $v(1) > v(2)$ and $n(1) > n(2)$

(2) $v(1) > v(2)$ and $n(1) < n(2)$

(3) $v(1) < v(2)$ and $n(1) > n(2)$

(4) $v(1) < v(2)$ and $n(1) < n(2)$

14. A rectangular tank of depth 8 meter is full of water ($\mu = 4/3$), the bottom is seen at the depth

[MP PMT 1987]

(1) 6 *m* (2) 8/3 *m*

(3) 8 *cm* (4) 10 *cm*

15. A vessel of depth 2d *cm* is half filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2. The apparent depth of the vessel seen perpendicularly is **[SCRA 1994]**

(1) $d\left(\frac{\mu_1\mu_2}{\mu_1+\mu_2}\right)$ (2) $d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$

(3) $2d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$ (4) $2d\left(\frac{1}{\mu_1\mu_2}\right)$

16. A beam of light is converging towards a point I on a screen. A plane glass plate whose thickness in the direction of the beam = t, refractive index = μ, is introduced in the path of the beam. The convergence point is shifted by

[MNR 1987]

(1) $t\left(1-\frac{1}{\mu}\right)$ away (2) $t\left(1+\frac{1}{\mu}\right)$ away

(3) $t\left(1-\frac{1}{\mu}\right)$ nearer (4) $t\left(1+\frac{1}{\mu}\right)$ nearer

17. Light travels through a glass plate of thickness t and having refractive index n. If c is the velocity of light in vacuum, the time taken by the light to travel this thickness of glass is

[NCERT 1976; MP PET 1994; CBSE PMT 1996; KCET 1994; MP PMT 1999, 2001]

(1) $\frac{t}{nc}$ (2) tnc

(3) $\frac{nt}{c}$ (4) $\frac{tc}{n}$

18. When a light wave goes from air into water, the quality that remains unchanged is its

[AMU 1995; MNR 1985, 95; KCET 1993; CPMT 1990, 97; MP PET 1991, 2000, 02; UPSEAT 1999, 2000; AFMC 1993, 98, 2003; RPET 1996, 2000, 03; RPMT 1999, 2000; DCE 2001; BHU 2001]

(1) Speed (2) Amplitude

(3) Frequency (4) Wavelength

19. Light takes 8 *min* 20 *sec* to reach from sun on the earth. If the whole atmosphere is filled with water, the light will take the time ($_a\mu_w = 4/3$)

(1) 8 *min* 20 *sec* (2) 8 *min*

(3) 6 *min* 11 *sec* (4) 11 *min* 6 *sec*

20. The length of the optical path of two media in contact of length d_1 and d_2 of refractive indices μ_1 and μ_2 respectively, is

(1) $\mu_1 d_1 + \mu_2 d_2$ (2) $\mu_1 d_2 + \mu_2 d_1$

(3) $\frac{d_1 d_2}{\mu_1\mu_2}$ (4) $\frac{d_1 + d_2}{\mu_1\mu_2}$

21. Immiscible transparent liquids A, B, C, D and E are placed in a rectangular container of glass with the liquids making layers according to their densities. The refractive index of the liquids are shown in the adjoining diagram. The container is illuminated from the side and a small piece of glass having refractive index 1.61 is gently dropped into the liquid layer. The glass piece as it descends downwards will not be visible in **[CPMT 1986]**

A	1.51
B	1.53
C	1.61
D	1.52
E	1.65

(1) Liquid *A* and *B* only

(2) Liquid *C* only

(3) Liquid *D* and *E* only

(4) Liquid *A*, *B*, *D* and *E*

22. The refractive indices of glass and water *w.r.t.* air are 3/2 and 4/3 respectively. The refractive index of glass *w.r.t.* water will be

[MNR 1990; JIPMER 1997, 2000; MP PET 2000]

(1) 8/9 (2) 9/8

(3) 7/6 (4) None of these

23. If $_i\mu_j$ represents refractive index when a light ray goes from medium *i* to medium *j*, then the product $_2\mu_1 \times {}_3\mu_2 \times {}_4\mu_3$ is equal to

[CBSE PMT 1990]

(1) $_3\mu_1$ (2) $_3\mu_2$

(3) $\frac{1}{{}_1\mu_4}$ (4) $_4\mu_2$

24. The wavelength of light diminishes μ times ($\mu = 1.33$ for water) in a medium. A diver from inside water looks at an object whose natural colour is green. He sees the object as

[CPMT 1990; MNR 1998]

(1) Green (2) Blue

(3) Yellow (4) Red

25. Ray optics fails when

(1) The size of the obstacle is 5 *cm*

(2) The size of the obstacle is 3 *cm*

(3) The size of the obstacle is less than the wavelength of light

(4) (1) and (2) both

26. When light travels from air to water and from water to glass, again from glass to CO_2 gas and finally through air. The relation between their refractive indices will be given by

(1) $_an_w \times {}_wn_{gl} \times {}_{gl}n_{gas} \times {}_{gas}n_a = 1$

(2) $_an_w \times {}_wn_{gl} \times {}_{gas}n_{gl} \times {}_{gl}n_a = 1$

(3) $_an_w \times {}_wn_{gl} \times {}_{gl}n_{gas} = 1$

(4) There is no such relation

27. For a colour of light the wavelength for air is 6000 $\mathring{A}$ and in water the wavelength is 4500 $\mathring{A}$. Then the speed of light in water will be

(1) $5. \times 10^{14}\ m/s$ (2) $2.25 \times 10^8\ m/s$

(3) $4.0 \times 10^8\ m/s$ (4) Zero

28. A ray of light travelling inside a rectangular glass block of refractive index $\sqrt{2}$ is incident on the glass–air surface at an angle of incidence of 45°. The refractive index of air is 1. Under these conditions the ray **[CPMT 1972]**

(1) Will emerge into the air without any deviation

(2) Will be reflected back into the glass

(3) Will be absorbed

(4) Will emerge into the air with an angle of refraction equal to 90°

29. If ε_0 and μ_0 are respectively, the electric permittivity and the magnetic permeability of free space, ε and μ the corresponding quantities in a medium, the refractive index of the medium is

[IIT-JEE 1982; MP PET 1995; CBSE PMT 1997]

(1) $\sqrt{\frac{\mu\varepsilon}{\mu_0\varepsilon_0}}$ (2) $\frac{\mu\,\varepsilon}{\mu_0\varepsilon_0}$

(3) $\sqrt{\frac{\mu_0\varepsilon_0}{\mu\varepsilon}}$ (4) $\sqrt{\frac{\mu\mu_0}{\varepsilon\,\varepsilon_0}}$

30. A beam of monochromatic blue light of wavelength 4200Å in air travels in water ($\mu = 4/3$). Its wavelength in water will be

[MNR 1991; UPSEAT 2000]

(1) 2800 $\mathring{A}$ (2) 5600 $\mathring{A}$

(3) 3150 $\mathring{A}$ (4) 4000 $\mathring{A}$

31. If μ_0 be the relative permeability and K_0 the dielectric constant of a medium, its refractive index is given by

[MNR 1995]

(1) $\frac{1}{\sqrt{\mu_0 K_0}}$ (2) $\frac{1}{\mu_0 K_0}$

(3) $\sqrt{\mu_0 K_0}$ (4) $\mu_0 K_0$

32. If the speed of light in vacuum is C *m*/sec, then the velocity of light in a medium of refractive index 1.5

[NCERT 1977; MP PMT 1984; CPMT 2002]

(1) Is $1.5 \times C$ (2) Is C

(3) Is $\frac{C}{1.5}$ (4) Can have any velocity

33. In the adjoining diagram, a wavefront AB, moving in air is incident on a plane glass surface XY. Its position CD after refraction through a glass slab is shown also along with the normals drawn at A and D. The refractive index of glass with respect to air ($\mu = 1$) will be equal to

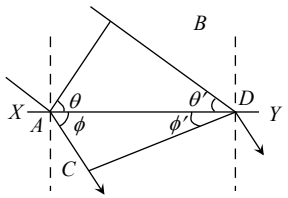
[CPMT 1988; DPMT 1999]

(1) $\frac{\sin\theta}{\sin\theta'}$

(2) $\frac{\sin\theta}{\sin\phi'}$

(3) $\frac{\sin\phi'}{\sin\theta}$

(4) $\frac{AB}{CD}$



34. When light enters from air to water, then its

[MP PMT 1994; MP PET 1996]

(1) Frequency increases and speed decreases

(2) Frequency is same but the wavelength is smaller in water than in air

(3) Frequency is same but the wavelength in water is greater than in air

(4) Frequency decreases and wavelength is smaller in water than in air

35. On a glass plate a light wave is incident at an angle of 60°. If the reflected and the refracted waves are mutually perpendicular, the refractive index of material is

[MP PMT 1994; Haryana CEE 1996; KCET 1994; 2000]

(1) $\frac{\sqrt{3}}{2}$ (2) $\sqrt{3}$

(3) $\frac{3}{2}$ (4) $\frac{1}{\sqrt{3}}$

36. Refractive index of glass is $\frac{3}{2}$ and refractive index of water is $\frac{4}{3}$. If the speed of light in glass is 2.00×10^8 m/s, the speed in water will be

[MP PMT 1994; RPMT 1997]

(1) 2.67×10^8 *m/s* (2) 2.25×10^8 *m/s*

(3) 1.78×10^8 *m/s* (4) 1.50×10^8 *m/s*

37. Monochromatic light of frequency 5×10^{14} *Hz* travelling in vacuum enters a medium of refractive index 1.5. Its wavelength in the medium is

[MP PET/ PMT 1995; Pb. PET 2003]

(1) 4000 *Å* (2) 5000 *Å*

(3) 6000 *Å* (4) 5500 *Å*

38. Light of wavelength is 7200 Å in air. It has a wavelength in glass ($\mu = 1.5$) equal to

[DCE 1999]

(1) 7200 *Å* (2) 4800 *Å*

(3) 10800 *Å* (4) 7201.5 *Å*

39. Which of the following is *not* a correct statement

[MP PET 1997]

(1) The wavelength of red light is greater than the wavelength of green light

(2) The wavelength of blue light is smaller than the wavelength of orange light

(3) The frequency of green light is greater than the frequency of blue light

(4) The frequency of violet light is greater than the frequency of blue light

40. Which of the following is a *correct* relation **[MP PET 1997]**

(1) ${}_a\mu_r = {}_a\mu_w \times {}_r\mu_\omega$ (2) ${}_a\mu_r \times {}_r\mu_w = {}_w\mu_a$

(3) ${}_a\mu_r \times {}_r\mu_a = 0$ (4) ${}_a\mu_r / {}_w\mu_r = {}_a\mu_w$

41. The time taken by sunlight to cross a 5 *mm* thick glass plate ($\mu = 3/2$) is**[MP PMT/PET 1998; BHU 2005]**

(1) 0.25×10^{-10} *s* (2) 0.167×10^{-7} *s*

(3) 2.5×10^{-10} *s* (4) 1.0×10^{-10} *s*

42. The distance travelled by light in glass (refractive index =1.5) in a nanosecond will be

[MP PET 1999]

(1) 45 *cm* (2) 40 *cm*

(3) 30 *cm* (4) 20 *cm*

43. When light is refracted from air into glass

[IIT 1980; CBSE PMT 1992; MP PET 1999; MP PMT 1999; RPMT 1997, 2000, 03; MH CET 2004]

(1) Its wavelength and frequency both increase

(2) Its wavelength increases but frequency remains unchanged

(3) Its wavelength decreases but frequency remains unchanged

(4) Its wavelength and frequency both decrease

44. A mark at the bottom of a liquid appears to rise by 0.1 m. The depth of the liquid is 1 m. The refractive index of the liquid is

[CPMT 1999]

(1) 1.33 (2) $\frac{9}{10}$

(3) $\frac{10}{9}$ (2) 1.5

45. A man standing in a swimming pool looks at a stone lying at the bottom. The depth of the swimming pool is h. At what distance from the surface of water is the image of the stone formed (Line of vision is normal; Refractive index of water is n)

[KCET 1994]

(1) h / n (2) n / h

(3) h (4) hn

46. On heating a liquid, the refractive index generally

[KCET 1994]

(1) Decreases

(2) Increases or decreases depending on the rate of heating

(3) Does not change

(4) Increases

47. If $\hat{i}$ denotes a unit vector along incident light ray, $\hat{r}$ a unit vector along refracted ray into a medium of refractive index μ and $\hat{n}$ unit vector normal to boundary of medium directed towards incident medium, then law of refraction is

[EAMCET (Engg.) 1995]

(1) $\hat{i}.\hat{n} = \mu(\hat{r}.\hat{n})$ (2) $\hat{i}\times\hat{n} = \mu(\hat{n}\times\hat{r})$

(3) $\hat{i}\times\hat{n} = \mu(\hat{r}\times\hat{n})$ (4) $\mu(\hat{i}\times\hat{n}) = \hat{r}\times\hat{n}$

48. The bottom of a container filled with liquid appear slightly raised because of

[RPMT 1997]

(1) Refraction (2) Interference

(3) Diffraction (4) Reflection

49. The speed of light in air is $3\times10^8\ m/s$. What will be its speed in diamond whose refractive index is 2.4

[KCET 1993]

(1) $3\times10^8\ m/s$ (2) 332 m/s

(3) $1.25\times10^8\ m/s$ (4) $7.2\times10^8\ m/s$

50. Time taken by the sunlight to pass through a window of thickness 4 mm whose refractive index is 1.5 is

[CBSE PMT 1993]

(1) $2\times10^{-8}\ sec$ (2) $2\times10^8\ sec$

(3) $2\times10^{-11}\ sec$ (4) $2\times10^{11}\ sec$

51. Ray optics is valid, when characteristic dimensions are

[CBSE PMT 1994; CPMT 2001]

(1) Of the same order as the wavelength of light

(2) Much smaller than the wavelength of light

(3) Of the order of one millimetre

(4) Much larger than the wavelength of light

52. The refractive index of water is 1.33. What will be the speed of light in water **[CBSE PMT 1996; KCET 1998]**

(1) $3\times10^8\ m/s$ (2) $2.25\times10^8\ m/s$

(3) $4\times10^8\ m/s$ (4) $1.33\times10^8\ m/s$

53. The time required to pass the light through a glass slab of 2 mm thick is ($\mu_{glass} = 1.5$) **[AFMC 1997; MH CET 2002, 04]**

(1) $10^{-5}\ s$ (2) $10^{-11}\ s$

(3) $10^{-9}\ s$ (4) $10^{-13}\ s$

54. The refractive index of water with respect to air is 4 / 3 and the refractive index of glass with respect to air is 3/2. The refractive index of water with respect to glass is

[BHU 1997; JIPMER 2000]

(1) $\frac{9}{8}$ (2) $\frac{8}{9}$

(3) $\frac{1}{2}$ (4)2

55. Electromagnetic radiation of frequency n, wavelength λ, travelling with velocity v in air, enters a glass slab of refractive index μ. The

frequency, wavelength and velocity of light in the glass slab will be respectively [CBSE PMT 1997]

(1) $\frac{n}{\mu}, \frac{\lambda}{\mu}, \frac{v}{\mu}$ (2) $n, \frac{\lambda}{\mu}, \frac{v}{\mu}$

(3) $n, \lambda, \frac{v}{\mu}$ (4) $\frac{n}{\mu}, \frac{\lambda}{\mu}, v$

56. What is the time taken (in *seconds*) to cross a glass of thickness 4 *mm* and $\mu = 3$ by light [BHU 1998; Pb. PMT 1999, 2001; MH CET 2000; MP PET 2001]

(1) 4×10^{-11} (2) 2×10^{-11}

(3) 16×10^{-11} (4) 8×10^{-10}

57. A plane glass slab is kept over various coloured letters, the letter which appears least raised is [J & K CET 2004; BHU 1998, 05]

(1) Blue (2) Violet

(3) Green (4) Red

58. A ray of light is incident on the surface of separation of a medium at an angle 45° and is refracted in the medium at an angle 30°. What will be the velocity of light in the medium [AFMC 1998; MH CET (Med.) 1999]

(1) 1.96×10^8 *m/s* (2) 2.12×10^8 *m/s*

(3) 3.18×10^8 *m/s* (4) 3.33×18^8 *m/s*

59. Absolute refractive indices of glass and water are $\frac{3}{2}$ and $\frac{4}{3}$. The ratio of velocity of light in glass and water will be [UPSEAT 1999]

(1) 4 : 3 (2) 8 : 7

(3) 8 : 9 (4) 3 : 4

60. The ratio of thickness of plates of two transparent mediums *A* and *B* is 6 : 4. If light takes equal time in passing through them, then refractive index of *B* with respect to *A* will be [UPSEAT 1999]

(1) 1.4 (2) 1.5

(3) 1.75 (4) 1.33

61. The refractive index of water and glass with respect to air is 1.3 and 1.5 respectively. Then the refractive index of glass with respect to water is [MH CET (Med.) 1999]

(1) $\frac{2.6}{1.5}$ (2) $\frac{1.5}{2.6}$

(3) $\frac{1.3}{1.5}$ (4) $\frac{1.5}{1.3}$

62. A tank is filled with benzene to a height of 120 *mm*. The apparent depth of a needle lying at a bottom of the tank is measured by a microscope to be 80 *mm*. The refractive index of benzene is [Pb. PMT 1999]

(1) 1.5 (2) 2.5

(3) 3.5 (4) 4.5

63. Each quarter of a vessel of depth *H* is filled with liquids of the refractive indices n_1, n_2, n_3 and n_4 from the bottom respectively. The apparent depth of the vessel when looked normally is [AMU (Engg.) 2000]

(1) $\frac{H(n_1 + n_2 + n_3 + n_4)}{4}$ (2) $\frac{H\left(\frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3} + \frac{1}{n_4}\right)}{4}$

(3) $\frac{(n_1 + n_2 + n_3 + n_4)}{4H}$ (4) $\frac{H\left(\frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3} + \frac{1}{n_4}\right)}{2}$

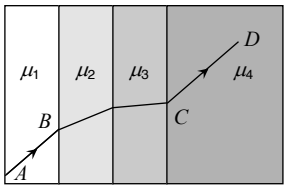
64. A ray of light passes through four transparent media with refractive indices $\mu_1 . \mu_2 \mu_3$, and μ_4 as shown in the figure. The surfaces of all media are parallel. If the emergent ray *CD* is parallel to the incident ray *AB*, we must have [IIT-JEE (Screening) 2001]

(1) $\mu_1 = \mu_2$

(2) $\mu_2 = \mu_3$

(3) $\mu_3 = \mu_4$

(4) $\mu_4 = \mu_1$



65. The reason of seeing the Sun a little before the sunrise is [MP PMT 2001; Orissa JEE 2003]

(1) Reflection of the light (2) Refraction of the light

(3) Scattering of the light (4) Dispersion of the light

66. An under water swimmer is at a depth of 12 *m* below the surface of water. A bird is at a height of 18 *m* from the surface of water, directly above his eyes. For the swimmer the bird appears to be at a distance from the surface

of water equal to (Refractive Index of water is 4/3)

[KCET (Engg.) 2001]

(1) 24 *m* (2) 12 *m*

(3) 18 *m* (4) 9 *m*

67. The optical path of a monochromatic light is same if it goes through 4.0 *cm* of glass or 4.5 *cm* of water. If the refractive index of glass is 1.53, the refractive index of the water is

[UPSEAT 2002]

(1) 1.30 (2) 1.36

(3) 1.42 (4) 1.46

68. Which of the following statement is true [Orissa JEE 2002]

(1) Velocity of light is constant in all media

(2) Velocity of light in vacuum is maximum

(3) Velocity of light is same in all reference frames

(4) Laws of nature have identical form in all reference frames

69. A ray of light is incident on a transparent glass slab of refractive index 1.62. The reflected and the refracted rays are mutually perpendicular. The angle of incidence is

[MP PET 2002]

(1) 58.3^o (2) 50^o

(3) 35^o (4) 30^o

70. A microscope is focussed on a coin lying at the bottom of a beaker. The microscope is now raised up by 1 *cm*. To what depth should the water be poured into the beaker so that coin is again in focus ? (Refractive index of water is $\frac{4}{3}$)

[BHU 2003]

(1) 1 *cm* (2) $\frac{4}{3}$ *cm*

(3) 3 *cm* (4) 4 *cm*

71. Velocity of light in glass whose refractive index with respect to air is 1.5 is 2×10^8 *m/s* and in certain liquid the velocity of light found to be 2.5×10^8 *m/s*. The refractive index of the liquid with respect to air is [CPMT 1978; MP PET/PMT 1988]

(1) 0.64 (2) 0.80

(3) 1.20 (4) 1.44

72. Stars are twinkling due to

[CPMT 1997]

(1) Diffraction (2) Reflection

(3) Refraction (4) Scattering

73. A thin oil layer floats on water. A ray of light making an angle of incidence of 40° shines on oil layer. The angle of refraction of light ray in water is ($\mu_{oil} = 1.45, \mu_{water} = 1.33$)

[MP PMT 1993]

(1) 36 .1° (2) 44.5°

(3) 26. 8° (4) 28.9°

74. An object is immersed in a fluid. In order that the object becomes invisible, it should

[AIIMS 2004]

(1) Behave as a perfect reflector

(2) Absorb all light falling on it

(3) Have refractive index one

(4) Have refractive index exactly matching with that of the surrounding fluid

75. When light travels from glass to air, the incident angle is θ_1 and the refracted angle is θ_2. The true relation is

[Orissa PMT 2004]

(1) $\theta_1 = \theta_2$ (2) $\theta_1 < \theta_2$

(3) $\theta_1 > \theta_2$ (4) Not predictable

76. Velocity of light in a medium is $1.5 \times 10^8 m/s$. Its refractive index will be [Pb. PET 2000]

(1) 8 (2) 6

(3) 4 (4) 2

77. The frequency of a light ray is $6 \times 10^{14} Hz$. Its frequency when it propagates in a medium of refractive index 1.5, will be

[MP PMT 2000; DPMT 2003; Pb PMT 2003; MH CET 2004]

(1) $1.67 \times 10^{14} Hz$ (2) $9.10 \times 10^{14} Hz$

(3) $6 \times 10^{14} Hz$ (4) $4 \times 10^{14} Hz$

78. The refractive indices of water and glass with respect to air are 1.2 and 1.5 respectively. The refractive index of glass with respect to water is

[Pb. PET 2002]

(1) 0.6 (2) 0.8

(3) 1.25 (4) 1.75

79. The wavelength of sodium light in air is 5890 *Å*. The velocity of light in air is $3 \times 10^8 ms^{-1}$. The

wavelength of light in a glass of refractive index 1.6 would be close to

[DCE 2003]

(1) 5890 $\mathring{A}$ (2) 3681 $\mathring{A}$

(3) 9424 $\mathring{A}$ (4) 15078 $\mathring{A}$

80. The mean distance of sun from the earth is 1.5×10^8 Km (nearly). The time taken by the light to reach earth from the sun is

[Pb. PET 2003]

(1) 0.12 *min* (2) 8.33 *min*

(3) 12.5 *min* (4) 6.25 *min*

81. Refractive index of air is 1.0003. The correct thickness of air column which will have one more wavelength of yellow light (6000 Å) than in the same thickness in vacuum is

[RPMT 1995]

(1) 2 *mm* (2) 2 *cm*

(3) 2 *m* (4) 2 *km*

82. The wavelength of light in air and some other medium are respectively λ_a and λ_m. The refractive index of medium is

[RPMT 2003]

(1) λ_a / λ_m (2) λ_m / λ_a

(3) $\lambda_a \times \lambda_m$ (4) None of these

83. An astronaut in a spaceship see the outer space as

[CPMT 1990, MP PMT 1991; JIPMER 1997]

(1) White (2) Black

(3) Blue (4) Red

84. Speed of light is maximum in

[CPMT 1990; MP PMT 1994; AFMC 1996]

(1) Water (2) Air

(3) Glass (4) Diamond

85. Which one of the following statements is correct

[KCET 1994]

(1) In vacuum, the speed of light depends upon frequency

(2) In vacuum, the speed of light does not depend upon frequency

(3) In vacuum, the speed of light is independent of frequency and wavelength

(4) In vacuum, the speed of light depends upon wavelength

86. If the wavelength of light in vacuum be λ, the wavelength in a medium of refractive index n will be

[UPSEAT 2001; MP PET 2001]

(1) $n\lambda$ (2) $\frac{\lambda}{n}$

(3) $\frac{\lambda}{n^2}$ (4) $n^2\lambda$

87. In vacuum the speed of light depends upon [MP PMT 2001]

(1) Frequency

(2) Wave length

(3) Velocity of the source of light

(4) None of these

88. A transparent cube of 15 *cm* edge contains a small air bubble. Its apparent depth when viewed through one face is 6 *cm* and when viewed through the opposite face is 4 *cm*. Then the refractive index of the material of the cube is

[CPMT 2004; MP PMT 2005]

(1) 2.0 (2) 2.5

(3) 1.6 (4) 1.5

89. A glass slab of thickness 3 *cm* and refractive index 3/2 is placed on ink mark on a piece of paper. For a person looking at the mark at a distance 5.0 *cm* above it, the distance of the mark will appear to be [Kerala PMT 2005]

(1) 3.0 *cm* (2) 4.0 *cm*

(3) 4.5 *cm* (4) 5.0 *cm*

90. A fish at a depth of 12 *cm* in water is viewed by an observer on the bank of a lake. To what height the image of the fish is raised.

[MP PET 2005]

(1) 9 *cm* (2) 12 *cm*

(3) 3.8 *cm* (4) 3 *cm*

Total Internal Reflection

1. A cut diamond sparkles because of its

[NCERT 1974; RPET 1996; AFMC 2005]

(1) Hardness

(2) High refractive index

(3) Emission of light by the diamond

(4) Absorption of light by the diamond

2. A diver in a swimming pool wants to signal his distress to a person lying on the edge of the pool by flashing his water proof flash light

[NCERT 1972]

(1) He must direct the beam vertically upwards

(2) He has to direct the beam horizontally

(3) He has to direct the beam at an angle to the vertical which is slightly less than the critical angle of incidence for total internal reflection

(4) He has to direct the beam at an angle to the vertical which is slightly more than the critical angle of incidence for the total internal reflection

3. Finger prints on a piece of paper may be detected by sprinkling fluorescent powder on the paper and then looking it into

[MP PET/PMT 1988]

(1) Mercury light (2) Sunlight

(3) Infrared light (4) Ultraviolet light

4. Critical angle of light passing from glass to air is minimum for

[NCERT 1975; RPMT 1999; MP PMT 2002]

(1) Red (2) Green

(3) Yellow (4) Violet

5. The wavelength of light in two liquids 'x' and 'y' is 3500 Å and 7000 Å, then the critical angle of x relative to y will be

(1) 60° (2) 45°

(3) 30° (4) 15°

6. A fish is a little away below the surface of a lake. If the critical angle is 49°, then the fish could see things above the water surface within an angular range of θ^o where

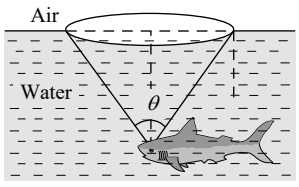
[MP PMT 1986]

(1) $\theta = 49^o$

(2) $\theta = 90^o$

(3) $\theta = 98^o$

(4) $\theta = 24\frac{1^o}{2}$



7. If the critical angle for total internal reflection from a medium to vacuum is 30°, the velocity of light in the medium is

[CPMT 1972; MH CET 2000; KCET 2000; BCECE 2003; RPMT 2003]

(1) 3×10^8 *m/s* (2) 1.5×10^8 *m/s*

(3) 6×10^8 *m/s* (4) $\sqrt{3}\times10^8$ *m/s*

8. A ray of light is incident at an angle i from denser to rare medium. The reflected and the refracted rays are mutually perpendicular. The angle of reflection and the angle of refraction are respectively r and r', then the critical angle will be

[IIT-JEE 1983; MP PET 1995; CBSE PMT 1996; MP PMT 1985, 99; Pb. PET 2002]

(1) $\sin^{-1}(\sin r)$

(2) $\sin^{-1}(\tan r')$

(3) $\sin^{-1}(\tan i)$

(4) $\tan^{-1}(\sin i)$