EXERCISE # 1

A. Very Short Answer Type Questions

- Q.1 What is the maximum angle of refraction when a ray of light is refracted from glass into air ?
- Q.2 What should be the position of an object relative to biconvex lens so that this lens behaves like a magnifying glass?
- **Q.3** Can the absolute refractive index of a medium be less than unity?
- Q.4 To a fish under water viewing obliquely a fisherman standing on the bank of a lake, does the man look taller or shorter than what actually he is?
- Q.5 Does the apparent depth of a tank of water change if viewed obliquely? If so, does the apparent depth increase or decrease?
- **Q.6** A substance has critical angle of 45° for yellow light. What is its refractive index?
- Q.7 What is critical angle for a material of refractive index $\sqrt{2}$?
- **Q.8** A ray of light is incident normally on a glass slab. What is the angle of refraction?
- Q.9 What is the power of the combination of a convex lens and a concave lens of the same focal length?
- Q.10 How is power of a lens related to its focal length?

Q.11 Define critical angle for total internal reflection.

B. Short Answer Type Questions

- Q.12 Explain the shining of an air bubble in water.
- Q.13 For the same angle of incidence, the angles of refraction in media P, Q and R are 35°, 25°,15° respectively, In which medium will the velocity of light be minimum ?
- Q.14 Define focus and principal focus of a lens.
- Q.15 A virtual image, we always say, cannot be caught on a screen. Yet when we 'see' a virtual image, we are obviously bringing it on to the 'screen' i.e., retina of our eye. Is there a contradiction?
- **Q.16** A convex lens is held in water. What would be the change in the focal length ?
- Q.17 Why goggles (Sun glasses) have zero power even though their surfaces are curved?
- Q.18 The lens shown in fig. is made of two different materials. A point objects is placed on the principal axis of this lens. How many images will be obtained?



Q.19 Refer to fig. (a), (b) and (c). Give relationship between μ_1 and μ_2 in each case.

μ1	μ1	μ1
μ_2	μ ₂	μ_2
(a)	(b)	(c)

- **Q.20** Images formed by totally reflected light are brighter than the images formed by ordinary reflected light. why ?
- **Q.21** Can light travelling from air to glass suffer total internal reflection? Justify your answer.
- **Q.22** What are the five general features of the image formed by a plane mirror ?

Long Answer Type Questions

- **Q.23** (a) What is total internal reflection? How is critical angle related to refractive index?
 - (b) A ray of light while travelling from a denser to a rarer medium undergoes total internal reflection. Derive the expression for the critical angle in terms of the speed of light in the respective media.
- Q.24 Discuss in detail refraction at (i) convex surface (ii) concave surface.
- Q.25 Derive lens formula for a thin lens.
- **Q.26** What is critical angle? Give one application of total internal reflection.
- Q.27 State Snell's law of refraction.
- **Q.28** What is meant by power of a lens? What is one dioptre ?

D. Numerical Problem

Q.29 The speed of light in air is 3×10^8 m/s. Calculate the speed of light in glass given that the refractive index of glass is 1.5.

- **Q.30** The refractive index of water with respect to air is 4/3. Calculate the refractive index of air with respect to water.
- **Q.31** The refractive index of glass is 3/2. What is the critical angle for the glass-water surface?
- **Q.32** A ray of light travelling in air falls on the surface of a glass slab at an angle of incidence 45°. Find the angle made by the refracted ray with the normal within the slab where refractive index for glass is 3/2.
- Q.33 A ray of light travelling in air is incident on the surface of a transparent material of refractive index $\sqrt{3}$. If the angle of refraction is 30°, calculate the angle of incidence.
- Q.34 Focal length of a convex lens is 50 cm. Calculate its power.
- **Q.35** A point object is placed at a distance of 12 cm from a convex lens on its principal axis. Its image is formed 18 cm from the lens on the other side. Calculate the focal length of the lens.
- Q.36 An object is placed at a distance of 20 cm from a concave lens on its principal axis. If the focal length of the lens is 20 cm, find the position of the image.
- Q.37 A beam of light incident parallel to the principal axis of a concave lens appears to diverge from a point 20 cm behind the lens after refraction through the lens. Calculate the power of the lens.
- **Q.38** A pin 2 cm long is placed at a distance of 16 cm from a convex lens of focal length 12 cm perpendicular to the principal axis. Find the position, nature and size of the image.
- **Q.39** A convex lens of focal length 20 cm and a concave lens of focal length 12.5 cm are placed in contact having the same principal axis. Calculate the power of the combined lens.
- **Q.40** Two thin lenses of power +3.5D and -2.5D are placed in contact. Find the power and focal length of the lens combination.

- Q.41 An illuminated slit is kept at a distance of 40 cm in front of a convex lens of focal length 15 cm. Find the position of the screen to obtain the image.
- **Q.42** A ray incident at a slab at angle 10° as shown in figure. Find angle of emergent θ .



EXERCISE # 2

Single Correct Answer type Questions

Q.1 How will the image formed by a convex lens be affected, if the central portion of the lens is wrapped in black paper, as shown in the fig.



- (A) No image will be formed
- (B) Full image will be formed but it is less bright
- (C) Full image will be formed but without the central portion
- (D) Two images will be formed, one due to each exposed half.
- Q.2 The critical angle for light going from medium X into medium Y is θ. The speed of light in medium X is υ. The speed of light in medium Y is-

(A) υ (1 – cos θ)	(B) $\upsilon/\cos\theta$
(C) $\upsilon \cos \theta$	(D) $\upsilon/\sin\theta$

Q.3 One surface of a lens is convex and the other is concave. If the radii of curvature are r_1 and r_2 respectively, the lens will be convex, if-

(A) $r_1 > r_2$	(B) $r_1 = r_2$
(C) $r_1 < r_2$	(D) $r_1 = 1/r_2$

Q.4 An object is immersed in a fluid. In order that the object becomes invisible, it should

- (A) behave as a perfect reflector
- (B) absorb all light falling on it
- (C) have refractive index one
- (D) have refractive index exactly matching with that of the surrounding fluid.
- Q.5 R.I. of glass w.r.t. air is $\frac{3}{2}$, then the R.I. of air w.r.t. glass is-

(A)
$$\frac{3}{4}$$
 (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) 3

- Q.6 Refractive index of glass with respect to air is 1.5 and refractive index of water with respect to air is $\frac{4}{3}$. What will be the refractive index of glass with respect to water ? (A) 1 (B) 1.5 (C) 1.125 (D) -10
- Q.7 The refractive index of a medium depends upon-
 - (A) Nature of material of the medium
 - (B) Optical density of the medium
 - (C) Wavelength of light
 - (D) All of these
- Q.8 If refractive index of water w.r.t. air is $\frac{4}{3}$, then refractive index of air w.r.t. water will be-

(A)
$$4 \times 3$$
 (B) $\frac{3}{4}$ (C) $\sqrt{\frac{4}{3}}$ (D) $\sqrt{\frac{3}{4}}$

- Q.9 A ray of light is incident normally on a rectangular piece of glass. The value of angle of refraction will be(A) 180° (B) 90° (C) 45° (D) 0°
- **Q.10** What is the angle of deviation ?
 - (A) Angle between the reflected ray and incident ray
 - (B) Angle between the reflected ray and refracted ray
 - (C) Angle between the incident ray and refracted ray
 - (D) angle between the incident ray and emergent ray
- Q.11 The speed of light in vacuum is 3.0×10^8 m/s. If the refractive index of a transparent liquid is 4/3, then the speed of light in the liquid is-

(A) 2.25×10^8 m/s (B) 3×10^8 m/s (C) 4×10^8 m/s (D) 4.33×10^8 m/s

- Q.12 A swimming pool appears to be 2m deep. Its actual depth is (μ for water = 1.33)-(A) 2.66 m (B) 2 m (C) 2.34 (D) 2.54 m
- Q.13 To get a real and inverted image of the same size as that of the object the object should be placed in front of the convex lens at-(A) F
 (B) 2F
 (C) between F and 2F
 - (D) away from 2F, where F is focus
- Q.14 A spherical mirror and a spherical lens each have focal length of -10 cm. The mirror and lens are(A) both convex
 (B) both concave
 (C) mirror is convex and lens is concave
 (D) mirror is concave and lens is convex
- Q.15 The power of a lens having focal length 50 cm is-

- (A) $\frac{1}{2}$ D (B) 2D (C) 3D (D) 0.2 D
- Q.16 The focal length of a lens of power -2.0 D is-(A) -2.0 m (B) 0.2 m (C) -0.5 m (D) 0.5 m
- Q.17Two lenses of power + 5D and -5D are
placed in close contact. The focal length of
the combination is-
(A) Zero
(B) ∞
(C) Zero or ∞
(D) None of these
- Q.18 A student needs a lens of power -2.0 diopter to correct his distant vision. The focal length of the given lens is-(A) +50 cm (B) -50 cm (C) 100 cm (D) -100 cm
- Q.19 Focal length of coloured goggles (Without number) is(A) zero
 (B) infinity
 (C) between zero and infinity
 (D) None of these
- Q.20 Where should an object be placed so that a real and inverted image of very large size is obtained, using a convex lens?
 (A) At the focus (B) At 2F
 (C) Between F and 2F (D) Beyond 2F
 Q.21 A convex lens is –
 (A) Thicker at the middle, thinner at the edges
 - (A) Indeer at the middle, thinner at the edges
 (B) Diverging
 (C) Thicker at the edges thinner in the middle
 (D) Of uniform thickness everywhere
- Q.22 A glass rod of refractive index 1.42 is immersed in kerosene. The refractive index of kerosene is 1.42. Then the rod will-(A) appear bent
 (B) appear raised above the liquid
 (C) become invisible
 - (D) none of the above
- Q.23 The power of a lens whose focal length is 25 cm is-(A) 4 Diopter (B) 25 Diopter

	·)
(C) 0.04 Diopter (E	D) 2.5 Diopter

- **Q.24** A thin lens is made with a material having refractive index $\mu = 1.5$. Both the sides are convex. It is dipped in water ($\mu = 1.33$). It will behave like-
 - (A) convergent lens (B) a divergent lens
 - (C) a rectangular slab (D) a prism
- Q.25 Choose the correct option-
 - (A) If the final rays are converging, we have a real image
 - (B) If the incident rays are converging, we have a real image
 - (C) If the image is virtual, the corresponding object is called a virtual object
 - (D) The image of a virtual object is called a virtual image
- Q.26 A convex lens forms a real image of a point object placed on its principal axis. If the upper half of the lens is painted black.(A) the image will be shifted backward
 - (B) the image will not be shifted
 - (C) the intensity of the image will decrease
 - (D) both (B) and (C)
- Q.27 The minimum distance between an object and its real image formed by a convex lens of focal length f is-(A) f (B) 2f (C) 3f (D) 4f

ANSWER KEY

EXERCISE-1

29. 2×10^8 m/s	30. 3/4	31. 42°	32. 28°	33. 60°	34. + 2D
35. 7.2 cm	36. 10 cm on the same	me side of lens	37. –5D		

38. At 48 cm from the lens on the other side. Image is real, inverted and of size 6 cm.

39. -8D **40.** + 1D, 100 cm **41.** 24 cm **42.** $\theta = 10^{\circ}$

EXERCISE-2

Ques	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	В	D	С	D	В	С	D	В	D	D	А	А	В	В	В
Ques	16	17	18	19	20	21	22	23	24	25	26	27		,	
Ans	С	В	В	В	А	А	С	А	А	А	D	D			