CBSE 12th PHYSICS – RAY OPTICS AND OPTICAL INSTRUMENTS

REVISION TEST -1 Total Marks - 25

SHORT TYPE 1 QUESTIONS **Marks 3 x 2 =6**

1. A ray of monochromatic light passes through an equilateral glass prism in such a way that the angle of incidence is equal to the angle of emergence and each of these angles is 3/4 times the angle of the prism. Determine the angle of deviation and the refractive index of the glass prism.

2. Show that the least possible distance between an object and its real image in a convex lens is 4f, where f is the focal length of the lens.

3. In an astronomical telescope in normal adjustment a straight black line of length L is drawn on the objective lens. The eyepiece forms a real image of this line whose length is l. What is the angular magnification of the telescope?

SHORT TYPE 2 QUESTIONS **Marks 2 x 4=8**

4. **Read the following paragraph and answer the questions that follow.**

Types of Lenses and their combination

A convex or converging lens is thicker at the centre than at the edges. It converges a beam of light on refraction through it. It has a real focus. Convex lens is of three types: Double convex lens, Plano convex lens and Concavo-convex lens.

Concave lens is thinner at the centre than at the edges. It diverges a beam of light on refraction through it. It has a virtual focus. Concave lenses are of three types: Double concave lens, Plano concave lens and Convexo-concave lens.

When two thin lenses of focal lengths f_1 and f_2 are placed in contact with each other along their common principal axis, then the two lens system is regarded as a single lens of focal length *f* and

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

If several thin lenses of focal length f_1, f_2, ... f_n are placed in contact, then the effective focal length of the combination is given by

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + ... + \frac{1}{f_n}$$

and in terms of power, we can write

$$P = P_1 + P_2 + ... + P_n$$

The value of focal length and power of a lens must be used with proper sign consideration.

i. Two thin lenses are kept coaxially in contact with each other and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, the focal length of the other would be

(a) -26.7cm (b) 60cm (c) 80cm (d) 30cm

ii. A spherical air bubble is embedded in a piece of glass. For a ray of light passing through the bubble, it behaves like a

(a) converging lens
(b) diverging lens
(c) mirror
(d) thin plane sheet of glass

iii. Lens generally used in magnifying glass is

(a) single concave lens
(b) single convex lens
(c) combination of convex lens of lower power and concave lens of lower focal length
(d) Planoconcave lens

iv. The magnification of an image by a convex lens is positive only when the object is placed

(a) at its focus F
(b) between F and 2F
(c) at 2F
(d) between F and optical centre

5. Draw a ray diagram for the formation of image of a point object by a thin double convex lens having radii of curvature R_1 and R_2. Hence derive lens maker's formula. A converging lens has a focal length of 10 cm in air. It is made of a material of refractive index 1.6. If it is immersed in a liquid of refractive index 1.3, find its new focal length.

LONG TYPE QUESTIONS **Marks -2 x 5 =10**

6. a) A giant refracting telescope at an observatory has an objective lens of focal length 15 m. If an eyepiece of focal length 1.0 cm is used, what is angular magnification of the telescope in normal adjustment?

b) If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is 3.48×10^6 m, and the radius of lunar orbit is 3.8×10^8 m.

7. A compound microscope consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 15 cm. How far from the objective should an object be placed in order to obtain the final image at

a) the least distance of distinct vision (25 cm) and
b) infinity? What is the magnifying power of the microscope in each case?