# SHORT QUESTIONS

**10.1 What do you understand by linear magnification and angular magnification? Explain how a convex lens is used as a magnifier?**

**Ans.** **Linear Magnification:** It is defined as the ratio of the size of image to the size of object. Mathematically

$$M = \frac{I}{O} = \frac{q}{p}$$

**Angular Magnification:** It is the ratio of the angle subtended by the image as seen through the optical instrument to the angle subtended by the object at the unaided eye.

$$M = \frac{\beta}{\alpha}$$

Both linear and angular magnification has no unit.

**A Convex lens as a Magnifier:** A convex lens of short focal length can be used as magnifying glass because when an object is placed between lens and focus then the image formed is erect, virtual and very much magnified.

**10.2 Explain the difference between angular magnification and resolving power of an optical instrument. What limits the magnification of an optical instrument?**

**Ans.** Angular magnification means how large or magnified image is formed by the instrument but resolving power is its ability to provide the minor details of an object under examination. The magnification of an optical instrument is limited due to defects in the lenses. Such as chromatic and spherical aberrations.

**10.3 Why would it be advantageous to use blue light with a compound microscope?**

**Ans.** We know that the expression for resolving power is:

$$R \propto \frac{1}{\alpha_{min.}}$$

Here, $$\alpha_{min.} = 1.22\frac{\lambda}{D}$$

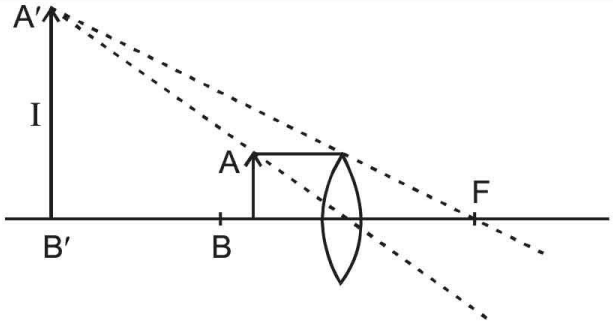
From this equation we see that resolving power is inversely proportional to $\alpha_{min.}$ and $\alpha_{min.}$ depends upon wavelength and diameter of lens. As blue light has short wavelength therefore it will produce less diffraction and resolving power of compound microscope will increase.

**10.4 One can buy a cheap microscope for use by the children. The images seen in such a microscope have coloured edges. Why is this so?**

**Ans.** It is due to the defect of lenses known as chromatic aberrations. This is because of the prism like formation of the lens in which all rays of white light cannot meet at a single point therefore image is not sharp and has coloured edges.

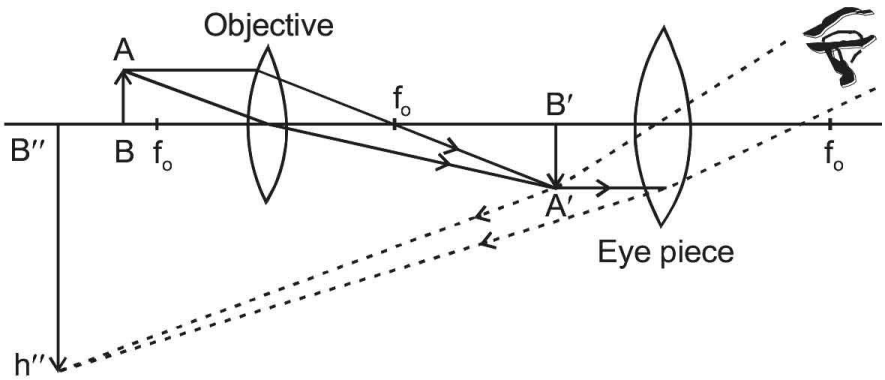
**10.5 Describe with the help of diagram, how (a) a single biconvex lens can be used as a magnifying glass. (b) biconvex lenses can be arranged to form a microscope.**

**Ans.** (a) Ray diagram of a biconvex lens used as magnifying glass:




**Simple microscope or magnifying glass**

(b) Ray diagram of two biconvex lens arranged to make microscope.

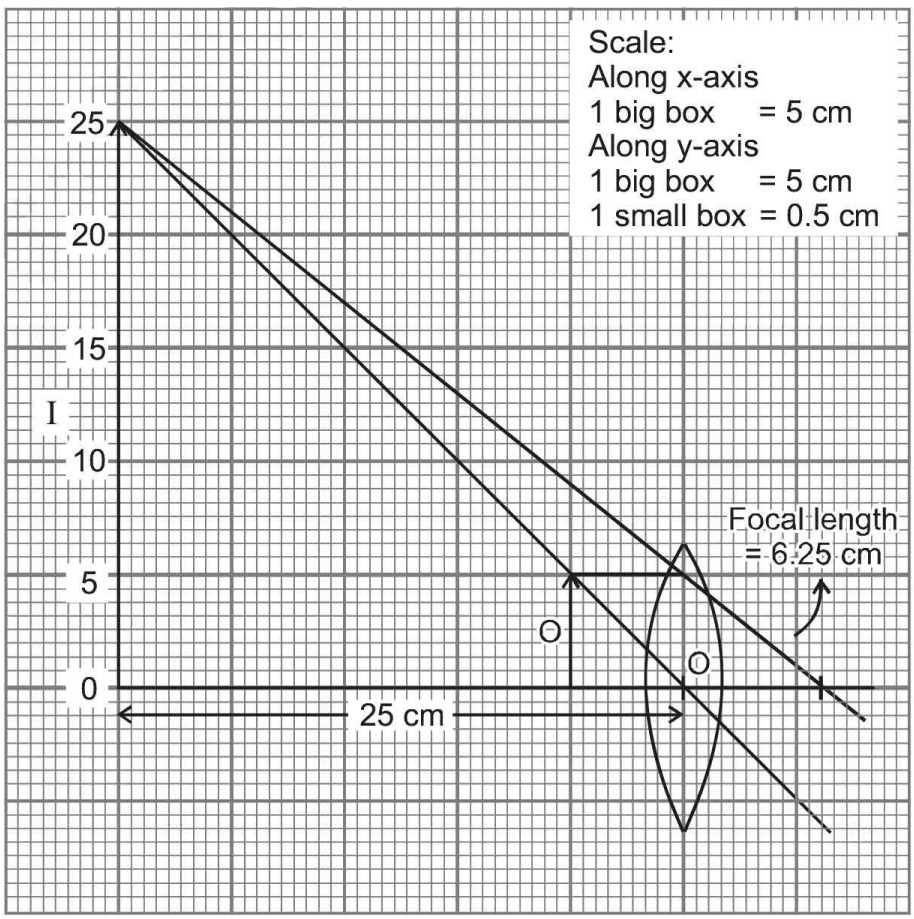



**Compound microscope**

**10.6 If a person were looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens?**

**Ans.** The person will see the full image of the moon if half of the objective lens of a telescope is covered but its brightness is reduced because less light is transmitted through the lens.

**10.7 A magnifying glass gives a five times enlarged image at a distance of 25 cm from the lens. Find, by ray diagram, the focal length of the lens.**



***Data***

Magnification = M = 5

Image distance = q = 25 cm

Focal length of lens = f = ?

***Solution***

By formula

$$M = 1 + \frac{d}{f}$$

$$5 = 1 + \frac{25}{f}$$

$$5 - 1 = \frac{25}{f}$$

$$4f = 25$$

$$f = \frac{25}{4}$$

$$f = 6.2 \text{ cm}$$

**10.8 Identify the correct answer:**

**(i) The resolving power of a compound microscope depends on;**

**(a) The refrective index of the medium in which the object is placed.**

**(b) The diameter of the objective lens.**

**(c) The angle subtended by the objective lens at the object.**

**(d) The position of an observer's eye with regard to the eye lens.**

**(ii) The resolving power of an astronomical telescope depends on:**

**(a) The focal length of the objective lens.**

**(b) The least distance of distinct vision of the observer.**

**(c) The focal length of the eye lens.**

**(d) The diameter of the objective lens.**

**Ans.** (i) The formula for the resolving power of a lens of diameter D is given by

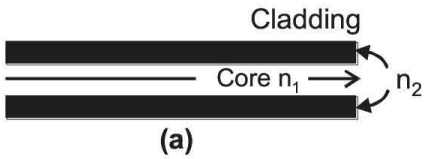
$$R = \frac{D}{1.22\lambda}$$

Hence the resolving power of a lens depends upon the diameter of objective so (b) is correct.

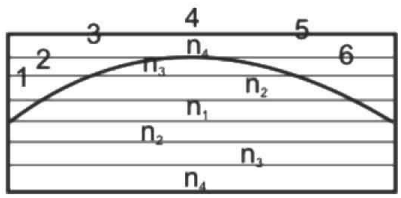
(ii) As we know that the resolving power of an astronomical telescope depends upon the diameter of objective lens so (d) is correct.

**10.9 Draw sketches showing the different light paths through a single-mode and a multimode fibre. Why is the single-mode fibre preferred in telecommunications?**

**Ans.**




(a)




(b)

It has a very thin core of about 5 μm diameter and has a relatively larger cladding. It can carry more than 14 TV channels or 14000 phone calls so it is preferred in telecommunication.

**10.10 How the light signal is transmitted through the optical fibre?**

**Ans.** The light signals are transmitted through the optical fibre on the principle of:

(i) Total internal reflection.

(ii) Continuous refraction.

**10.11 How the power is lost in optical fibre through dispersion? Explain.**

**Ans.** If the source of light signals is not monochromatic then the light will disperse while propagating through the core of the optical fibre into different wavelength so the light of different wavelengths reaches the other end of the fibre at different times and the signal received is distorted. So the power is lost in optical fibre through dispersion.