Viva voce on Resolving Power of Telescope

Q. 1. What do you mean by resolving power and resolution limit?
Ans. It is an ability of an instrument to distinguish the two close objects separately. The minimum distance between two close objects that can be resolved by an instrument is termed as resolution limit. Resolving power is reciprocal to resolution limit. Lower the limit, higher will be the resolving power of an instrument.

Q.2. What do you mean by chromatic resolving power?
Ans. The chromatic resolving power of an instrument is its ability to separate and distinguish between two spectral lines whose wavelengths are very close. Smaller the wavelength interval at a particular wavelength that can be separated, the greater is the resolving power. If a source emits two close wavelengths λ and $(\lambda + d\lambda)$, the resolving power is mathematically defined as the ratio $(\lambda/d\lambda)$, provided the wavelength interval $d\lambda$ can be just separated at the wavelength λ.

Q. 3. What do you mean by geometrical resolving power of telesope?
Ans. The resolving power or geometrical resolving power of a telescope is defined as the reciprocal of the smallest angle subtended at the objective by two distinct points which can be just seen as separate through the telescope.

Q. 4. On what factors does the resolving power of a telescope depend?
Ans. The resolving power of a telescope is given by

$RP = \frac{1}{d\theta} = \frac{a}{\lambda} = \frac{D}{d}$, for rectangular aperture and $RP = \frac{1}{d\theta} = \frac{a}{1.22\lambda}$ for circular aperture

Resolving power is directly proportional to diameter of objective lens and inversely proportional to λ. i.e., a telescope with large diameter of objective lens has higher resolving power. (here D distance between objective and source, d: separation between slits)

Q. 5. For which colour of light, the resolving power of telescope will be large?
Ans. For blue colour of light.

Q. 6. Why are the telescopes fitted with objectives of large diameter?
Ans. To increase the resolving power of telescope.

Q. 7. Does the resolving power of a telescope depend upon the focal length of its objective?
Ans. No.

Q. 8. Does any thing depend on *f*?
Ans. Yes, Magnifying power increases with *f*.

Q. 9. Sometimes an observer gets a higher than the theoretically expected value of resolving power. How do you explain it?
Ans. It is because that Rayleigh criterion is itself quite arbitrary and skilful experimenters can exceed the Rayleigh limit.

Q. 10. Define the magnifying power of the telescope.
Ans. The magnifying power of a telescope is defined as the ratio of angle subtended at the eye by the final image and the angle subtended at the eye by object when viewed at its actual distance.

Q. 11. What is Rayleigh criterion of resolution?
Ans. According to Rayleigh criterion, two point sources are resolvable by an optical instrument when the central maximum in the diffraction pattern of one falls over the first minimum in the diffraction pattern of the other and vice-versa.

Q. 12. What does the term 200 inch written on a telescope indicate?
Ans. This indicate that the diameter of the objective of the telescope is 200 inches.

Q. 13. Which instrument do you used for the determination of slit width?
Ans. Microscope.

Q. 14. What is microscope?
Ans. It is an instrument that increases the visual angle of near small object. i.e. it magnifies the near small objects.

Viva voce on Resolving Power of Telescope

Q. 15. How have you determined the least count of your microscope?

Ans. One centimetre of main scale of microscope is divided in to 20 division and its vernier has 50 divisions thus-

$$Least\ count\ of\ microscope = \frac{value\ of\ 1\ div.\ on\ main\ scale}{number\ of\ divisions\ on\ vernier\ scale}$$

$$Least\ count\ of\ microscope = \frac{1/20}{50} = \frac{1}{1000} = 0.001cm$$

Q. 16. How have you determined the least count of micrometer fitted at slit of telescope?

Ans. We have determined with following formula-

$$Least\ count\ of\ micro = \frac{Pitch}{number\ of\ divisions\ on\ circular\ scale}$$

If pitch is 0.05cm and number of division on circular scale is 50 then

$$Least\ count\ of\ micrometer = \frac{0.05cm}{50} = \frac{1}{1000} = 0.001cm$$

Q. 17. A telescope posses high focal length of objective lens while low focal length of eye lens. A microscope has small focal length of eye lens while high focal length of eye lens. Can a telescope be formed by reverse of microscope?

Ans. No, the length of microscope is greater or equal to the sum of focal lengths while telescope length is less that sum of both focal lengths.

Q. 18. When you focus the illuminated slits, there is two bright lines and few less bright lines. Why this is so?

Ans. This is due to diffraction from double slit.

Q. 19. What is diffraction of light?

Ans. The bending of light beam through sharp edge or corner is called as diffraction.

Q. 20. What is difference between the diffraction fringes and interference fringes?

Ans. In the interference pattern, all the bright fringes have equal intensity while in diffraction pattern, the central fringe have maximum intensity while other fringes on its both side have decreasing intensity.

Q. 21. Which nature of light is proved by diffraction?

Ans. Wave nature of light, because the linear propagation of light can not results light in geometrical shadow region.

Q. 22. On what principle do you explain the diffraction?

Ans. The diffraction can be explained on the principle of zone plate.

Q. 23. What is zone plate?

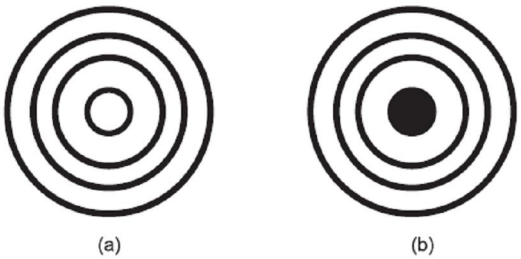
Ans. It is device which has different focal lengths.

A zone plate is a specially constructed screen such that light is obstructed from every alternate zone. It can be designed so as to cut off light due to the even numbered zones or that due to the odd numbered zones. To Construct a zone plate, concentric circles are drawn on white paper such that the radii are proportional to the square roots of the natural numbers. The odd numbered zones (i.e., 1st, 3rd, 5th etc) are covered with black ink and a reduced photograph is taken. The drawing appears as shown in Fig.(b) the negative of the photograph will be as shown in Fig.(a). In the developed negative, the odd zones are transparent to incident light and the even zones will cut off light.

Focal length of zone plate f_n is given by-

$$f_n = \frac{r_n^2}{n\lambda};\ \text{where}\ r_n = \sqrt{bn\lambda}$$

Thus, a zone plate has different foci for different wavelengths, the radius of the nth zone increases with increasing value of λ. B is distance from zone plate to screen.



(a) (b)

Q. 24. What is the essential condition for diffraction?

Ans. The obstacle size should be in order of wavelength of light.