CHAPTER - C

OPTICAL INSTRUMENTS

Date Planned : __ / __ / __	Daily Tutorial Sheet - 1	Expected Duration : 90 Min
Actual Date of Attempt : __ / __ / __	Level - 1	Exact Duration :_____

1. The near and far points of a woman are 30 cm and 180 cm. Find the power of lens she should use while reading at 25 cm.

(A) $1.5\ D$ **(B)** $-\frac{2}{3}D$ **(C)** $\frac{2}{3}D$ **(D)** $2\ D$

2. In previous problem, by using the lens on the eye and what maximum distance is clearly visible?

(A) 53 cm **(B)** 81.82 cm **(C)** 40.8 cm **(D)** 20.3 cm

3. The image formed by an objective of a compound microscope is :

(A) virtual and diminished **(B)** real and diminished

(C) real and enlarged **(D)** virtual and enlarged

4. The largest telescope in the world has a reflector with an aperture 200" to get:

(A) The least spherical aberration **(B)** High resolving power

(C) Low dispersive power **(D)** High accommodating power

5. The resolution limit of the eye is 1 minute. At a distance x km from the eye, two persons stand with a lateral separation of 3 metre. For the two persons to be just resolved by the naked eye, x should be:

(A) 10 km **(B)** 15 km **(C)** 20 km **(D)** 30 km

6. The distance between the eye lens and cross-wires in Ramsden's eye-piece which has a field lens of focal length 1.2 cm is:

(A) 1.1 cm **(B)** 1.2 cm **(C)** 2.2 cm **(D)** 2.4 cm

7. In a terrestrial telescope the focal length of erecting lens is 2 cm. The length of the telescope is 96 cm. If the magnifying power of the telescope is 10, then the focal lengths of eye-piece and objective are respectively:

(A) 8 *cm*, 80 *cm* **(B)** $\frac{96}{11}cm, \frac{960}{11}cm$ **(C)** 6 *cm*, 90 *cm* **(D)** None of these

8. The light gathering power of a camera lens depends on :

(A) its diameter only **(B)** ratio of diameter and focal length

(C) product of focal length and diameter **(D)** wavelength of light used

9. What happens inside optical fibre?

(A) Diffraction **(B)** polarization **(C)** interference **(D)** total internal reflection

10. The optical fibres have an inner core of refractive index n_1 and a cladding of refractive index n_2, such that :

(A) $n_1 = n_2$ **(B)** $n_1 \le n_2$ **(C)** $n_1 < n_2$ **(D)** $n_1 > n_2$

Paragraph for Q, 11-12

In a compound microscope the objective and the eyepiece have focal length of 1 cm and 5 cm respectively and are placed at distance of $\frac{125}{6}$ cm. The compound microscope is adjusted for clear vision.

11. The position of object from objective is:

(A) $\frac{100}{94}$ cm **(B)** $\frac{95}{94}$ cm **(C)** 0.94 cm **(D)** $\frac{100}{47}$ cm

12. The total magnification is:

(A) – 100 **(B)** – 50 **(C)** – 94 **(D)** None of these

13. At Kavalur in India, the astronomers using a telescope whose objective had a diameter of one metre, started using a telescope of diameter 2.54 m. This resulted in:

(A) The increase in the resolving power by 2.54 times for the same λ

(B) The increase in the limiting angle by 2.54 times for the same λ

(C) Decrease in resolving power

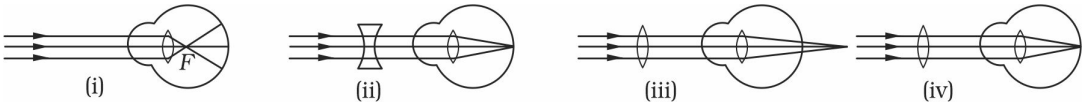
(D) No effect on the limiting angle

14. An astronomical telescope has a large aperture to:

(A) reduce spherical aberration **(B)** have high resolution

(C) increase span of observation **(D)** have low dispersion

15. Identify the wrong description of the figures given below:



(A) (i) represents far – sightedness **(B)** (ii) correction for short-sightedness

(C) (iii) represents short – sightedness **(D)** (iv) correction for far-sightedness

JEE Main (Archive)

1. Wavelength of light used in an optical instrument are $\lambda_1 = 4000\,\text{Å}$ and $\lambda_2 = 5000\,\text{Å}$, then ratio of their respective resolving power (corresponding to λ_1 and λ_2) is : **[2002]**

(A) 16 : 25 **(B)** 9 : 1 **(C)** 4 : 5 **(D)** 5 : 4

2. The aperture of the objective lens of a telescope is made large so as to : **[2002]**

(A) Increase the magnifying power of the telescope is made large so as to

(B) Increase the resolving power of the telescope

(C) Make image aberration less

(D) Focus on distant objects

3. The image formed by an objective of a compound microscope is: **[2003]**

(A) virtual and diminished **(B)** real and diminished

(C) real and enlarged **(D)** virtual and enlarged

4. Two point dots are 1*mm* apart on a black paper. They are viewed by eye of pupil diameter 3 *mm*. approximately, what is the maximum distance at which dots can be resolved by the eye? [Take wavelength of light = 500 *nm*] **[2005]**

(A) 6 *m* **(B)** 3 *m* **(C)** 5 *m* **(D)** 1 *m*

5. This question has Statement-1 and Statement- 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. **[2013]**

Statement-1: Very large size telescope are reflecting telescopes instead of refracting telescopes

Statement-2: It is easier to provide mechanical support to large size mirrors than large size lenses.

(A) Statement-1: is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1: is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1.

(C) Statement-1: is true, Statement-2 is false.

(D) Statement-1: is false, Statement-2 is true.

6. The diameter of objective lens of microscope makes an angle 2β at the focus of the microscope. Further, the medium between the object and the lens is an oil of refractive index n. Then the resolving power of microscope. **[2014]**

(A) Increases with decreasing value of n

(B) Increases with decreasing value of β

(C) Increases with increasing value of $n\sin 2\beta$

(D) Increases with increasing value of $\dfrac{1}{n\sin 2\beta}$

7. In a compound microscope the focal length of objective lens is 1.2 cm and focal length of eye piece is 3.0 cm. When object is kept at 1.25 cm in front of objective, the final image is formed at infinity. Magnifying power of the compound microscopes should be : **[2014]**

(A) 150 **(B)** 100 **(C)** 400 **(D)** 200

8. The focal lengths of objective lens and eye lens of a Galilean Telescope are respectively 30 cm and 3.0 cm. Telescope produces virtual, erecrt image of an object situated far away from it at least distance of distinct vision from the eye lens. In this condition, the Magnifying Power of the Galilean Telescope should. **[2014]**

(A) +11.2 **(B)** –11.2 **(C)** –8.8 **(D)** +8.8

9. Assuming human pupil to have a radius of 0.25 *cm* and a comfortable viewing distance of 25 *cm*, the minimum separation between two objects that human eye can resolve at 500 *nm* wavelength is : **[2015]**

(A) $30\,\mu m$ **(B)** $100\,\mu m$ **(C)** $300\,\mu m$ **(D)** $1\,\mu m$

10. A telescope has an objective lens of focal length 150 *cm* and an eyepiece of focal length 5 *cm*. If a 50 *m* tall tower at a distance of 1 *km* is observed through this telescope in normal setting, in normal setting the angle formed by the image of the tower is θ, then θ, then θ is closed to : **[2015]**

(A) 60° **(B)** 15° **(C)** 1° **(D)** 30°

11. An observer looks at a distant tree of height 10 *m* with a telescope of magnifying power of 20. To observer the tree appears. **[2016]**

(A) 10 times taller **(B)** 10 times nearer **(C)** 20 times taller **(D)** 20 times nearer

12. In an electron microscope, the resolution that can be achieved is of the order of the wavelength of electrons used. To resolve a width of $7.5\times10^{-12}m$, the minimum electron energy required is close to:

(A) 1 keV **(B)** 25 keV **(C)** 500 keV **(D)** 100 keV **[2019]**

13. The eye can be regarded as a single refracting surface. The radius of curvature of the surface is equal to that of cornea (7.8mm). This surface separates two media of refractive indices 1 and 1.34. Calculate the distance from the refracting surface at which a parallel beam of light will come to focus. **[2019]**

(A) 4.0 cm **(B)** 3.1 cm **(C)** 2 cm **(D)** 1 cm

14. Calculate the limit of resolution of a telescope objective having a diameter of 200 cm, if it has to detect light of wavelength 500 nm coming from a star. **[2019]**

(A) 305×10^{-9} radian **(B)** 457.5×10^{-9} radian

(C) 152.5×10^{-9} radian **(D)** 610×10^{-9} radian

15. Diameter of the objective lens of a telescope is 250 *cm*. For light of wavelength 600 *nm* coming from a distant object, the limit of resolution of the telescope is close to: **[2019]**

(A) $1.5\times10^{-7}rad$ **(B)** $2.0\times10^{-7}rad$ **(C)** $4.5\times10^{-7}rad$ **(D)** $3.0\times10^{-7}rad$

16. The value of numerical aperature of the objective lens of a microscope is 1.25. If light of wavelength 5000 Å is used, the minimum separation between two points, to be seen as distinct, will be: **[2019]**

(A) 0.24 μm **(B)** 0.12 μm **(C)** 0.38 μm **(D)** 0.48 μm

17. If we need a magnification of 375 from a compound microscope of tube length 150 mm and an objective of focal length 5 mm, the focal length of the eyepiece, should be close to: **[2020]**

(A) 2 mm **(B)** 12 mm **(C)** 33 mm **(D)** 22 mm

18. The aperture diameter of a telescope is 5 m. The separation between the moon and the earth is $4\times10^{5}km$. With light of wavelength of 5500 Å , the minimum separation between objects on the surface of moon, so that they are just resolved, is close to : **[2020]**

(A) 60 m **(B)** 20 m **(C)** 600 m **(D)** 200 m

19. The magnifying power of a telescope with tube length $60cm$ is 5. What is the focal length of its eye piece ? **[2020]**

(A) 40 cm **(B)** 20 cm **(C)** 10 cm **(D)** 30 cm

20. In a compound microscope, the magnified virtual image is formed at a distance of 25 cm from the eye-piece. The focal length of its objective lens is 1 cm. If the magnification is 100 and the tube length of the microscope is 20 cm, then the focal length of the eye-piece lens (in cm) is _____. **[2020]**

21. A compound microscope consists of an objective lens of focal length 1cm and an eye piece of focal length 5 cm with a separation of 10 cm. The distance between an object and the objective lens, at which the strain on the eye is minimum is $\frac{n}{40}$ cm. The value of n is_____. **[2020]**