TOPIC WISE MULTIPLE CHOICE QUESTIONS

10.1 LEAST DISTANCE OF DISTINCT VISION

(1) The minimum distance from the eye at which an object appears to be distinct is called

(a) infinite point **(b)** least distance of fuzzy vision
(c) least distance of distinct vision **(d)** none of these

(2) The least distance of distinct vision for the normal eye is **LHR-2016 (G-II)**

(a) 25cm **(b)** 2.5cm
(c) 15cm **(d)** 20cm

(3) The least distance of distinct vision

(a) decreases with age **(b)** increases with age
(c) no change **(d)** none of these

(4) A human eye acts like

(a) mirror **(b)** lens
(c) laser **(d)** all of these

(5) Far point for the human eye is

(a) 10cm **(b)** 25cm
(c) 20cm **(d)** infinity

10.2 MAGNIFYING POWER AND RESOLVING POWER OF OPTICAL INSTRUMENTS

(6) Product of number of rulings "N" and the order of diffraction "m" is equal to: **LHR-2019 (G-II)**

(a) Resolving power **(b)** Magnification
(c) Near point **(d)** Magnifying power

(7) Rayleigh formula for resolving power **SGD-2016 (G-I)**

(a) $R = 1.22\lambda / D$ **(b)** $R = 1.22D / \lambda$
(c) $R = D / 1.22\lambda$ **(d)** $R = \lambda / 1.22D$

(8) The ratio of the angles subtended by the image as seen through the optical device to that subtended by the object at the unaided eye is called

(a) linear magnification **(b)** least distance of distinct vision
(c) angular magnification **(d)** near point

(9) The power of lens is measured in

(a) joule **(b)** diopter
(c) watt **(d)** meters

(10) Unit of magnification

(a) meter **(b)** diopter
(c) cm **(d)** no unit

(11) To increase the resolving power of lens

(a) increase λ and D
(b) increase λ and decrease D
(c) decrease λ and increase D
(d) decrease λ and D

(12) The resolving power of diffraction grating is defined as

(a) $\frac{\lambda}{\Delta\lambda}$
(b) $\frac{\Delta\lambda}{\lambda}$
(c) $\frac{\lambda_1 - \lambda_2}{\lambda}$
(d) $\frac{\lambda_2 - \lambda_1}{\Delta\lambda}$

(13) The ratio of the size of the image to the size of object is called

(a) magnification
(b) angular magnification
(c) classification
(d) linear classification

(14) When an object is viewed at a shorter distance, the image on the retina of the eye is

(a) smaller
(b) greater
(c) unchanged
(d) remain same

(15) The resolving power of an optical instrument can be expressed

(a) $R = \frac{1}{\alpha_{min}}$
(b) $R = \alpha_{max}$
(c) $R = \alpha_{res}$
(d) $R = \alpha$

(16) Magnification of a lens is negative when the image is

(a) real and inverted
(b) real and erected
(c) virtual and inverted
(d) virtual and erect

(17) Wavelength of light used in an optical instrument are λ_1= 4000 Å and λ_2 = 5000 Å, then ratio of their respective resolving powers (corresponding to λ_1 and λ_2) is

(a) 16 : 25
(b) 9 : 1
(c) 4 : 5
(d) 5 : 4

(18) When the image is real and inverted the magnification of the lens is

(a) positive
(b) neutral
(c) negative
(d) virtual

(19) The smaller value of α_{min} ___________ is the resolving power.

(a) smaller
(b) greater
(c) zero
(d) none of these

(20) A magnifying glass has a focal length of 15 cm. If the near point of the eye is 25 cm from the eye the angular magnification of the glass is about:

(a) 0.067
(b) 0.33
(c) 2.7
(d) 1.7

(21) A good optical device should have

(a) high magnification power and high resolving power
(b) Low magnification power and high resolving power
(c) Low magnification power and Low resolving power
(d) high magnifications power and low resolving power

10.3 SIMPLE MICROSCOPE

(22) The magnifying power of convex lens of focal length 10cm is: GRW-2019 (G-I)

(a) 7
(b) 9.6
(c) 3.5
(d) 11

(23) The magnifying power of a magnifying glass is: **BWP-2019 (G-I)**

(a) $1-\frac{d}{f}$ **(b)** $1-\frac{f}{d}$

(c) $\frac{f}{d}$ **(d)** $\frac{d}{f}+1$

(24) The magnification of a convex lens of focal length 5cm is equal to **MTN-2018 (G-I)**

(a) $\frac{1}{5}$ **(b)** 5

(c) 6 **(d)** 25

(25) The magnifying power of a simple microscope is **BWP-2016 (G-I)**

(a) $M=1+\frac{f}{d}$ **(b)** $M=1+\frac{d}{f}$

(c) $M=1+\frac{1}{f}$ **(d)** $M=1+df$

(26) If a convex lens is used as a magnifying glass, which lens will give higher magnification that has **DGK-2016 (G-I)**

(a) short size **(b)** long focal length

(c) large size **(d)** short focal length

(27) Watch makers uses

(a) convex lens **(b)** concave lens

(c) plano-concave lens **(d)** mirror

(28) Focal length of convex lens will be maximum for

(a) blue light **(b)** red light

(c) green light **(d)** yellow light

(29) If the image is at the least distance of the distinct vision then

(a) q = d **(b)** q= 1/d

(c) 1/q = d **(d)** q – d = 1

(30) In a simple microscope, if final image is located at infinity then its magnifying power is

(a) $\frac{25}{f}$ (b) $\frac{25}{D}$ (c) $\frac{f}{25}$ (d) $1+\frac{25}{f}$

(31) If the object is 5mm high and image is 2cm high then the magnification is

(a) 4 **(b)** 1

(c) 2 **(d)** 10

(32) For a lens of high magnification the focal length should be

(a) large **(b)** small

(c) of any size **(d)** none of these

(33) If f = 5cm then the magnification of the simple microscope will be

(a) M = 4 **(b)** M = 6

(c) M = 5 **(d)** M = 2

(34) In magnifying glass, the object is placed at

(a) Focus (b) Between f and 2f

(c) Beyond 2f (d) Between lens and f

(35) The magnifying power of a magnifying glass of focal length of 25cm will be

(a) 5 **(b)** 2

(c) 6 **(d)** 0

(36) **When beam of white light falls perpendicularly on a plane of glass then the angle of refraction will be**

(a) 90^o **(b)** 60^o
(c) $0°$ **(d)** 180^o

(37) **The image formed by the simple microscope is**

(a) inverted and real **(b)** erect and virtual
(c) real and erect **(d)** inverted and magnified

(38) **If f = 50cm and the final image is formed at d = 25 cm, the magnifying power of simple microscope:**

(a) 5 **(b)** 3/2
(c) 0 **(d)** 1

10.4 COMPOUND MICROSCOPE

(39) **The focal length of the objective used in compound microscope**

(a) large **(b)** small
(c) same as eyepiece **(d)** none of these

(40) **The magnifying power of compound microscope**

(a) $M = \frac{q}{p}(1 + df_e)$ **(b)** $M = \frac{q}{p}\left(1 + \frac{d}{f_e}\right)$

(c) $M = \frac{q}{p}\left(1 + \frac{f_e}{d}\right)$ **(d)** $M = \frac{p}{q}\left(1 + \frac{d}{f_e}\right)$

(41) **The image formed by the eyepiece of compound microscope is**

(a) real and inverted **(b)** real and erect
(c) virtual and erect **(d)** virtual and inverted

(42) **The resolving power of a compound microscope depends upon**

(a) the refractive index of the medium in which object is placed
(b) diameter of objective
(c) width of objective lens
(d) nature of lens

(43) **The angular magnification of the compound microscope is defined by**

(a) $\frac{\tan\theta_o}{\tan\theta_e}$ **(b)** $\frac{\tan\theta_e}{\tan\theta_o}$

(c) $\tan\theta_e \times \tan\theta_o$ **(d)** $\frac{1}{\tan\theta_e \times \tan\theta_o}$

(44) **For higher magnification which of the following instrument is used**

(a) optical fiber **(b)** compound microscope
(c) collimator **(d)** LED

(45) **The diverging lens of compound microscope is**

(a) eyepiece **(b)** objective
(c) eye **(d)** none of these

(46) **The magnifying power of compound microscope is given by the relation**

(a) $M_o - M_e$ **(b)** $M_o \times M_e$
(c) $M_o + M_e$ **(d)** M_o/M_e

(47) The magnification of two lenses of compound microscope are 2 and 5 then magnifying power of microscope is

(a) 7 **(b)** 3
(c) 10 **(d)** 20

(48) The compound microscope is based on the principle of

(a) reflection **(b)** refraction
(c) both a & b **(d)** none of these

(49) In a compound microscope magnification produced by objective is 5 and that produced by eye piece is 50, the total magnification produced by the microscope is

(a) 250 times **(b)** 10 times
(c) 25 times **(d)** 100 times

10.3 ASTRONOMICAL TELESCOPE

(50) If $f_o = 100cm$; $f_e = 5cm$ length and magnifying power of an astronomical telescope is:

LHR-2019 (G-I)

(a) 0.05cm ; 20 **(b)** 95 cm ; 20
(c) 20cm ; 500 **(d)** 105 cm ; 20

(51) Magnifying power of telescope is: **LHR 2015(G-II)**

(a) $\frac{f_e}{f_o}$ **(b)** $\frac{f_o}{f_e}$
(c) $f_e f_o$ **(d)** $\frac{1}{f_e f_o}$

(52) For formal adjustment what is the length of astronomical telescope of focal lengths of objective and eye-piece are 100 and 20 cm respectively. **DGK-2018 (G-I)**

(a) 100 cm **(b)** 20 cm
(c) 5 cm **(d)** 120 cm

(53) If focal length of objective and eye piece is 0.5 m and 10 cm respectively then magnifying power of telescope will be **SWL-2017**

(a) 5 **(b)** 0.5
(c) 10 **(d)** 20

(54) The final image seen from the astronomical telescope

(a) real, erect and enlarged **(b)** real, inverted and enlarged
(c) virtual, inverted and enlarged **(d)** virtual, erect and enlarged

(55) In astronomical telescope the image formed by eyepiece is

(a) real **(b)** virtual
(c) neither real nor virtual **(d)** none of these

(56) A simple astronomical telescope consists of

(a) two concave lenses **(b)** two convex lenses
(c) one concave and one convex lens **(d)** two plano-concave lens

(57) The rays after refraction through the eye piece will become parallel and the final image appears to be formed at

(a) f **(b)** 2f
(c) between f and 2f **(d)** infinity

(58) 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 eyepiece
(d) the diameter of the objective lens

(59) For normal adjustment the distance between the objective and eye-piece of a telescope is
(a) $f_o + f_e$ **(b)** $f_o - f_e$
(c) $f_e - f_o$ **(d)** none of these

(60) In simple astronomical telescope the focal length of objective is
(a) less than eyepiece **(b)** greater than eye piece
(c) equal to eyepiece **(d)** none of these

(61) In astronomical telescope, if the focal lengths of objective and eye piece is 35 cm and 5cm respectively, then its length for normal adjustment is
(a) 40cm **(b)** 35cm
(c) 4.5cm **(d)** 3.5cm

(62) A good telescope used by astronomers has an objective of
(a) long focal length and small aperture **(b)** small focal length and large aperture
(c) long focal length and of large aperture **(d)** small focal length and small aperture

(63) The focal length of the objective of telescope (f_o) can be expressed as
(a) $\frac{M}{f_e}$ **(b)** $\frac{f_e}{M}$
(c) $M \times f_e$ **(d)** $\frac{1}{Mf_e}$

10.6 SPECTROMETER

(64) Which is not the essential component of a spectrometer? (FSD 2015)
(a) collimator **(b)** telescope
(c) turntable (d) microscope

(65) An optical device used to study spectra from different sources of light is called
(a) micrometer **(b)** spectrometer
(c) collimator **(d)** telescope

(66) Spectrometer consists of
(a) four parts **(b)** three parts
(c) five parts **(d)** two parts

(67) In spectrometer the function of collimator is to produce
(a) parallel beam of light **(b)** converging beam of light
(c) diverging beam of light **(d)** all of these

(68) A fixed metallic tube with a convex lens at one end of the spectrometer is called
(a) telescope **(b)** microscope
(c) collimator **(d)** periscope

(69) The grating placed on the turn table which is capable of rotating about
(a) horizontal axis **(b)** vertical axis
(c) both a & b **(d)** in all direction

(70) A circular scale of the spectrometer, graduated in
(a) 180° **(b)** 90°
(c) half degree **(d)** 360°

(71) The resolving power of spectrometer of "N" number of rulings is expressed as
(a) R = N + m **(b)** $R = \frac{m}{N}$
(c) R = N×m **(d)** none of these

10.7 SPEED OF LIGHT

(72) In Michelson's experiment, the angle subtended by a side of the eight sided mirror is: **FSD-2017**

(a) $\frac{\pi}{8}$ rad **(b)** $\frac{\pi}{4}$ rad

(c) $\frac{\pi}{2}$ rad **(d)**

(73) Who was the first person to make attempt to measure the speed of light

(a) Michelson **(b)** Galileo

(c) Einstein **(d)** Newton

(74) The speed of light in materials other than vacuum is always

(a) greater than c **(b)** less than c

(c) equal to c **(d)** none of these

(75) Michelson's formula for the speed of light is

(a) $c = \frac{16f}{d}$ **(b)** $c = \frac{16d}{f}$

(c) $c = 16fd$ **(d)** $c = \frac{fd}{16}$

(76) The speed of light in the medium of refractive index of 1.5 is

(a) $2 \times 10^8 ms^{-1}$ (b) $3 \times 10^8 ms^{-1}$

(c) $0.5 \times 10^8 ms^{-1}$ (d) $1.5 \times 10^8 ms^{-1}$

(77) The speed of light in vacuum is

(a) $3 \times 10^5 kms^{-1}$ **(b)** $3 \times 10^{-8} ms^{-1}$

(c) $3 \times 10^8 kms^{-1}$ **(d)** $3 \times 10^6 ms^{-1}$

(78) The speed of light in air

(a) very less than in vacuum **(b)** very greater than in vacuum

(c) nearly equal to in vacuum **(d)** zero

(79) The speed of light in diamond is $1.5 \times 10^8 ms^{-1}$ its refractive index w.r.t to air is

(a) 1 **(b)** 3

(c) 1.5 **(d)** 2

10.8 INTRODUCTION OF FIBRE OPTICS

(80) Information carrying capacity of fibre optics is known as

LHR-2016 (G-I), LHR-2018 (G-II)

(a) semiconductor **(b)** band length

(c) bandwidth **(d)** laser

(81) Photo phone was invented by

(a) Graham Bell **(b)** Alexander Fleming

(c) Galileo **(d)** Abu Ali Sena

(82) The practical use of services of optical fibre is

(a) telecommunication

(b) word processing

(c) image transmission and receiving equipment

(d) all of these

(83) Which light can travel faster through the optical fibre

(a) infra red **(b)** ultraviolet

(c) visible **(d)** none of these

(84) Characteristic of optical fibre is
(a) much thinner **(b)** light weight
(c) extremely wide bandwidth **(d)** all of these

(85) Graham Bell was able to transmit a voice message via
(a) microscope **(b)** periscope
(c) beam of light **(d)** telescope

(86) The detector used in photo phone is made of
(a) selenium **(b)** copper
(c) curie **(d)** aluminum

(87) With respect to efficiency an optical fibre of diameter 6mm, can replace the bundle of
(a) copper of 7.62cm **(b)** aluminum wire of 7.62cm
(c) copper of 6.72cm **(d)** aluminum wire of 6.34cm

10.9 FIBRE OPTIC PRINCIPLES

(88) If the speed of light in vacuum is c, then its velocity in a medium of refractive index 1.3 is: **LHR-2017 (G-II)**
(a) 1.3c **(b)** $\frac{1.3}{c}$
(c) $\frac{c}{1.3}$ **(d) c**

(89) Critical angle is that incident angle in denser medium for which angle of refraction is **(GRW 2014)**
(a) 0° **(b)** 45°
(c) 180° **(d)** 90°

(90) The ratio $\frac{c}{v}$ is equal to: **MTN-2019 (G-II)**
(a) Critical angle **(b)** Total reflection
(c) Refractive index **(d)** Angle of refraction

(91) For glass air boundary, the value of critical angle is: **SWL-2016 (G-I)**
(a) 41.4° **(b)** 41.6°
(c) 41.8° **(d)** 42.2°

(92) Snell's law is expressed as
(a) $\sin\theta_c = \frac{1}{n_2 n_1}$ **(b)** $n_1 \sin\theta_1 = n_2 \sin\theta_2$
(c) $\frac{n_1 \sin\theta_1}{n_2 \sin\theta_2} = 0$ **(d)** $\frac{n_2 \sin\theta_2}{n_1 \sin\theta_1} = 0$

(93) Cladding is the layer of lower refractive index over central core of
(a) small refractive index **(b)** high refractive index
(c) zero refractive index **(d)** none of these

(94) When the light enters in the glass, there is no change in its
(a) velocity **(b)** wavelength
(c) frequency **(d)** direction

(95) The main drawback of multimode step index fibre is
(a) quality of fibre **(b)** size of cable
(c) dispersion of signal **(d)** amount of data

(96) For the protection, the optical fibre is covered with
(a) glass jacket **(b)** copper jacket
(c) plastic jacket **(d)** rubber jacket

(97) When a ray passes through the denser medium to the rarer medium the refracting ray
(a) bends towards the normal **(b)** bends away from the normal
(c) moves along to the normal **(d)** none of these

(98) Now a days, a new type of optical fibre is used in which the central core has
(a) high density **(b)** low density
(c) low refractive index **(d)** zero refractive index

(99) To obey the phenomenon of total internal reflection, the angle of incidence of ray
(a) should be greater than critical angle **(b)** should be less than critical angle
(c)should be equal to critical angle **(d)** should be zero

(100) A ray which passes through the rigid rod (glass rod) and parallel to the axis of rigid rod is called
(a) reflected ray **(b)** axial ray
(c) no-axial ray **(d)** X-rays

(101) The optical fibre whose density gradually decreases towards its periphery is called
(a) single mode step index fibre **(b)** multimode graded index fibre
(c) multimode step index fibre **(d)** single graded step index fibre

(102) Snell's law helps to find
(a) frequency of light **(b)** wavelength of light
(c) refractive index of any material **(d)** none of these

(103) When $\theta_2 = 90°$ and $\theta_1 = \theta_C$ then Snell's law becomes
(a) $\sin\theta_c = n_1 n_2$ **(b)** $\sin\theta_c = \frac{n_1}{n_2}$
(c) $\sin\theta_c = \frac{n_2}{n_1}$ **(d)** $\sin\theta_c = \frac{1}{n_1 n_2}$

ANSWER KEYS

(Topic Wise Multiple Choice Questions)

1	c	16	d	31	a	46	b	61	a	76	a	91	c
2	a	17	d	32	b	47	c	62	c	77	a	92	b
3	b	18	a	33	b	48	b	63	c	78	c	93	b
4	b	19	b	34	d	49	a	64	d	79	d	94	c
5	d	20	c	35	b	50	d	65	b	80	c	95	c
6	a	21	a	36	c	51	b	66	b	81	a	96	c
7	c	22	c	37	b	52	d	67	a	82	d	97	b
8	c	23	d	38	c	53	a	68	c	83	a	98	a
9	b	24	c	39	c	54	c	69	b	84	d	99	a
10	d	25	d	40	c	55	b	70	c	85	c	100	b
11	c	26	d	41	d	56	b	71	c	86	a	101	b
12	a	27	a	42	b	57	d	72	b	87	a	102	c
13	a	28	b	43	b	58	d	73	b	88	c	103	c
14	b	29	a	44	b	59	a	74	b	89	d		
15	a	30	a	45	a	60	b	75	c	90	c		

SHORT QUESTIONS

(From Textbook Exercise)

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

SGD-14(G-II), RWP-14(G-I), MTN-15(G-I), FSD-15(G-I), MIRPUR (AJK)15, MTN-16 (G-I), BWP-17 (G-II), LHR-18 (G-I), FSD-19 (G-I), GRW-19 (G-II), LHR-19 (G-I)

Ans: Linear Magnification:

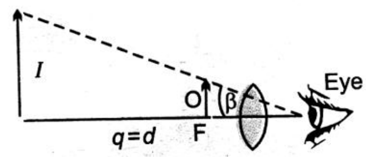
The ratio of size of image to the size of object is called linear magnification.

So, M = I / O

Angular Magnification:

The ratio of angle subtended by the image as seen through optical device to that subtended by the object at unaided eye. So, M = β / α

Convex lens as Magnifier:



When an object is placed with in the principle focus of a convex lens then a highly magnified, virtual and erect image is formed at the same side of the lens. In this way the convex lens behaves as magnifier.

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

LHR-14(G-I), MTN-15(G-I), DGK-16 (G-I)

Ans:

ANGULAR MAGNIFICATION	RESOLVING POWER
• Angular magnification simply increases the apparent size of the image of an object when seen through an optical device.	• The resolving power of an optical instrument is its ability to reveal the minor details of an object under examination.
• It can be made as large as we wish by using lenses of suitable focal lengths.	• It is the minimum angle between two point sources that allow the images to be resolved as two distinct spots of light rather than one.

Limited magnification:

Due to spherical and chromatic aberration the magnification of an optical instrument is limited and details of the object cannot be seen clearly. The magnification alone is of no use unless we can see the details of the objects distinctly.

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

FDR-12, FDR-13, GRW-12, LHR-13(G-I), GRW-13(G-I), SGD-14(G-II), RWP-14(G-I), GRW-14(G-I), LHR-14(G-II), SGD-15(G-I), DGK-15(G-I), MTN-15(G-II), RWP-15 (G-I), LHR-15 (G-I) & (G-II), MTN-16 (G-II), RWP-16 (G-I), LHR-16 (G-I), FSD-17, SWL-18, LHR-18 (G-I), FSD-18, SWL-19, RWP-19 (G-I), FSD-19 (G-I), MTN-19 (G-I), SWL-19, BWP-19 (G-II)

Ans: A wider objective and use of blue light of shorter wavelength produces less diffraction and increase its resolving power. Hence, it allows more details to be seen.

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?

LHR-12, GRW-12, GRW-13(G-I), GRW-14(G-II), SGD-16 (G-I) & (G-II), LHR-18 (G-II), MTN-19 (G-II)

In chromatic aberration, the lens behaves as a prism. When light passes through lens then all wave lengths are not focused at one point. Due to chromatic aberration of the lens the image seen in cheap microscopes have colored edges.

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

LHR-12, GRW-14(G-I), FSD-14(G-I), BWP-15(G-I), RWP-15(G-I), GRW-15(G-I), RWP-16 (G-I), BWP-17 (G-I), LHR-17 (G-I), DGK-18 (G-I), BWP-19 (G-I)

Ans: If the objective lens is half covered then there is no effect on the size of image but the brightness of the image is reduced, because intensity of light depends upon diameter of the objective lens.

TOPIC WISE SHORT QUESTIONS

10.1 LEAST DISTANCE OF DISTINCT VISION

(1) Define Least Distance of Distinct vision. How it is affected with increase of age?

Ans: The minimum distance from the eye at which an object appears to be distinct is called the least distance of distinct vision or near point.

Approximate near points of the normal eye of different ages are given below.

Age (years)	Near Point (cm)
10	10
20	12
30	15
40	25
50	40
60	100

10.2 MAGNIFYING POWER & RESOLVING POWER OF OPTICAL INSTRUMENTS

(2) Write down Raleigh expression for resolving power is lens. BWP-2012, 2019 (G-II)

Ans: Raleigh showed that for light of wavelength *l* through a lens of diameter D, the resolving power is given by

$$R=\frac{1}{\propto_{min}}=\frac{D}{1.22\lambda}$$

$$\propto_{min}=1.22\frac{\lambda}{D}$$

The smaller the value of μ_{min}, greater is the resolving power.

10.3 SIMPLE MICROSCOPE

(3) Why is the convex lens of small focal length preferred for a magnifying glass?

Ans: We know that $M=1+\frac{d}{f}$.

It is clear from the formula that convex lens of small focal length has high magnification. Therefore it is preferred.

(4) What is the principle of the working of a simple microscope?

Ans: In simple microscope, we should place the object within the focal length. So we can obtain an erect, virtual and magnified image at the least distance of distinct vision.

(5) Find the magnifying power of a convex lens of 10cm focal length. **LHR-2013**

Ans: Focal length of lens = f = 10cm
Least distance = d = 25cm
The magnification of lens is

$$M = 1 + \frac{d}{f} = 1 + \frac{25}{10} = 1 + 2.5 = 3.5$$

(6) What is simple microscope? Write down the equation for its magnifying power. **LHR-2014**

Ans: It consists of a single convex lens of short focal length.
If an object is placed inside the focal point of a convex lens, then a virtual and magnified image is formed at least distance of distinct vision.
The magnification of lens is

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

(7) Find the magnifying power of convex lens of 25 cm focal length act as a magnifying glass. **SWL-2017**

Ans: The magnification of lens is

$$M = 1 + \frac{d}{f} = 1 + \frac{25}{25}$$

$$= 1 + 1 = 2$$

10.4 COMPOUND MICROSCOPE

(8) What is the normal adjustment of compound microscope?

Ans: In the normal adjustment of compound microscope, the eye piece is positioned so that the final image is formed at the near point of eye i.e. at a distance d.

(9) Define compound microscope? Write the names of its different parts?

Ans: Compound microscope is used whenever high magnification is desired. It consists of two convex lenses, an object lens of very short focal length and an eye – piece of comparatively longer focal length.

(10) What is the principle of working of a compound microscope?

Ans: The image formed by the objective lens must be within the focal length of the eye piece. Then a virtual, inverted, and magnified image is obtained.

(11) Why objective of short focal length is preferred in microscope?

Ans: The magnification of microscope can be expressed as $M = \frac{L}{f_o}\left(1 + \frac{d}{f_e}\right)$

It is clear from the above relation $\left(M \propto \frac{1}{f_o}\right)$ that smaller the focal length greater will be magnifying power. Therefore, to increase the magnification of microscope an objective of short focal length is used.

(12) In a compound microscope magnifications of objective and eyepiece are 5 and 50 respectively. What is the total magnification of microscope?

Ans: Magnification produced by objective $M_1 = 5$
Magnification produced by eye piece $M_2 = 50$
Total Magnification M =?

$$M = M_1 \times M_2$$
$$= 5 \times 50$$
$$M = 250$$

10.5 ASTRONOMICAL TELESCOPE

(13) What is the condition for the normal adjustment of the Telescope?

Ans: If the image of the object formed by the objective lies at the focus of both the objective and the eye piece. Then final image is appeared to be formed at infinity. This is the condition for normal adjustment.

(14) What is the length of Telescope in its normal adjustment?

Ans: The length of the Telescope is the distance between the objective and eye piece of a Telescope. In normal adjustment it is $f_o + f_e$.

(15) The objective of a telescope is of 20cm and eye piece of 5.0cm focal length. What is magnifying power and length of telescope?

Ans. f_o = 20cm

fe = 5.0cm

M = ?

L = ?

$$M = \frac{f_o}{f_e}$$

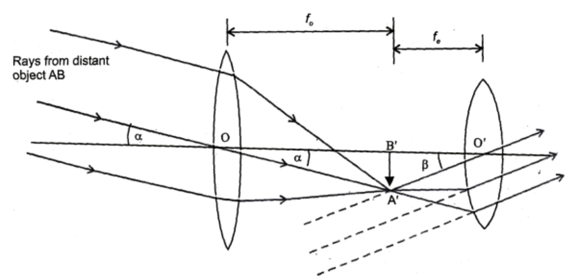
$$M = \frac{20}{5} = 4$$

L = f_o + fe

= 20 + 5 = 25 cm

(16) Draw the ray diagram of astronomical telescope.

Ans:



(17) What are the problems, having a high magnifying power in Astronomical telescope? **SWL-2014**

Ans: Besides having a high magnifying power another problem which confronts the astronomers while designing a telescope to see the distant planets and stars is that they would like to gather as much light from the object as possible. This difficulty is overcome by using the objective of large aperture so that it collects a great amount of light from the astronomical objects. Thus a good telescope has an objective of long focal length and large aperture.

(18) An astronomical telescope of long focal length and large aperture is considered to be a good telescope. Why? **DGK-2018 (G-II)**

Ans: Magnifying power of the telescope $= M = \frac{f_o}{f_e}$

We know that diameter of lens is directly proportional to focal length of lens. For Large aperture of objective lens, focal length will also be large, that is why magnification of astronomical telescope will be high.

10.6 SPECTROMETER

(19) What is a collimator?

Ans: It consists of a fixed metallic tube with a convex lens at one end and an adjustable slit that can slide in and out of the tube at the other end, when the slit is just at the focus of the convex lens, the ray of light coming out of the lens become parallel. For this reason it is called a collimator.

(20) Name the three essential components of a spectrometer?

Ans: The essential components of a spectrometer are
(i) collimator
(ii) turn table
(iii) telescope

(21) What is spectrometer used for?

Ans: **i)** It is used to study spectra from different sources of light
ii) It is used to study, the deviation of light by a glass prism.
iii) It is used to measure the refractive index of the material of the prism.
iv) It is used to measure the wave length of the light by diffraction grating.

10.7 SPEED OF LIGHT

(22) Write a briefly note on Michelson's experiment arrangement to calculate the speed of light, and write down its formula.

Ans: An eight-sided polished mirror M is mounted on the shaft of a motor whose velocity can be varied. Suppose the mirror is stationary in the position shown in the figure. A beam of light from the face 1 of the mirror M falls at the plane mirror m placed at a distance d from M. The beam is reflected back from the mirror m and falls on the face 3 of the mirror M. On reflection from face 3, it enters the telescope.
Speed of light is calculated by following formula

$$c = 16\ f\ d$$

10.8 INTRODUCTION TO FIBRE OPTICS

(23) What is the advantage of light as transmission carrier over radio wave carrier?

Ans: The use of light as a transmission carrier wave in fiber optics has several advantages over radio wave carriers such as a much wider bandwidth capability and immunity from electromagnetic interference.

10.9 FIBRE OPTIC PRINCIPLES

(24) Define total internal reflection.

Ans: **Total Internal Reflection**
When the angle of incidence in denser medium becomes greater than critical angle, the incident ray is reflected in the same medium, which is called total internal reflection.

(25) Define Refractive index?

Ans: The index of refraction is merely the ratio of the speed of light c in vacuum to the speed of light in that material.

Mathematically, $n = \frac{c}{v}$

(26) What is Snell's Law?

Ans: The ratio of angle of incidence to the angle of refraction is equal to ratio of indices of the mediums,

$$\mathbf{n_1 Sin\theta_1 = n_2 Sin\theta_2}$$

(27) What is cladding?

Ans: A layer lying above the inner glass core is called cladding. Cladding has low density and therefore low refractive index than the inner glass core.

(28) Define critical Angle?

Ans: Critical Angle:

Critical angle is the angle of incidence in the denser medium for which the angle of refraction in the rare medium is equal to 90^o.

According to Snells law

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\theta_1 = \theta_c , \theta_2 = 90^o$$

$$n_1 \sin\theta_c = n_2 \sin 90^o$$

$$sin_c = \frac{n_2}{n_1}$$

$$\theta_c = sin^{-1}\left(\frac{n_2}{n_1}\right)$$

(29) Calculate the critical angle for glass-air boundary, if refractive index of glass is 1.5 and the ray of light is passing from glass to air. **BWP-2017 (G-II)**

Ans: According to Snells law

$$n_1 \sin \theta_1 = n_2 \sin\theta_2$$

$$\theta_1 = \theta_c , \theta_2 = 90^o$$

$$n_1 \sin\theta_c = n_2 \sin 90^o$$

$$\sin\theta_c = \frac{n_2}{n_1}$$

$$\theta_c = sin^{-1}\left(\frac{n_2}{n_1}\right)$$

Refractive index of glass = $n_1 = 1.5$

Refractive index of air = $n_2 = 1$

$$\theta_c = sin^{-1}\left(\frac{1}{1.5}\right) = 41.8°$$