Physicsaholics

DPP – 1 (Optical Instruments)

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Q 1. When the length of a microscope tube increases, its magnifying power :
(a) Decreases (b) Increases
(c) Does not change (d) May decrease or increase

Q 2. The focal lengths of the objective and the eyepiece of the telescope are 225 cm and 5 cm respectively.Maximum magnifying power of the telescope will be
(a) 49 (b) 54
(c) 35 (d) 60

Q 3. A magnifying glass is made of a combination of convergent lens of power +20 diopters and a divergent lens of power −4 diopters. If the least distance of distinct vision is 25cm, Maximum magnifying power is:
(a) 3 (b) 4
(c) 5 (d) 7

Q 4. The image of an object is formed at the least distance of distinct vision from the lens of a simple microscope of focal length 2.5 cm. Its magnifying power is:
(a) 2.5 (b) 5
(c) 10 (d) 11

Q 5. A convex lens of focal length 5 cm is used as a simple microscope. The image is formed at the least distance of distinct vision. Calculated the angular magnification.
(a) 6 (b) 5
(c) 0.5 (d) 4

Q 6. The length of the tube of a microscope is 10 cm. The focal lengths of the objective and eye lenses are 0.5 cm and 1 cm respectively. The magnifying power of the microscope when the image is at far point, is about
(a) 5 (b) 23
(c) 166 (d) 500

Q 7. The diameter of human eye lens is 2mm. What should be the minimum separation between two points situated at 50m from eye, to resolve them. Take wavelength of light =5000Å.
(a) 1.25 cm (b) 2.35 cm
(c) 1.525 cm (d) 2.15 cm

Q 8. The diameter of the objective of the telescope is 0.1 meter and wavelength of light is 6000 Å. Its resolving power would be approximately
(a) 7.32×10^{-6} rad (b) 1.36×10^{6} rad
(c) 7.32×10^{-5} rad (d) 1.36×10^{5} rad

Q 9. For a total magnification of 175 from a compound microscope, the magnification produced by objective is 7. What should be the magnification produced by eye piece?
(a) 25 (b) 7
(c) 175×7 (d) none of these

Q 10. The magnification produced by the objective lens is 25 and magnifying power of eyepiece is 6 in a compound microscope. The magnifying power of this microscope is
(a) 19 (b) 31
(c) 150 (d) $\sqrt{150}$

Q 11. The objective lens of a compound microscope produces magnification of 10. In order to get an overall magnifying power of 100 when image is formed at 25 cm from the eye, the focal length of the eye lens should be
(a) 4 cm (b) 10 cm
(c) $\frac{25}{9}$ cm (d) 9 cm

Q 12. A far sighted person has a near point of 60cm. What power lens should be used for eye glasses such that the person can be read this book at a distance of 25 cm.
(a) 2.33 D (b) 1.66 D
(c) 3.22 D (d) 4.55 D

Q 13. A person wants to read a book placed at 20cm, whereas near point of his eye is 30cm. Calculate the power of the lens required.
(a) 1.67 D (b) 1.33 D
(c) 1.98 D (d) 2.15 D

Q 14. A person can see clearly only up to a distance of 25cm. He wants to read a book placed at a distance of 50cm. What kind of lens does he require for his spectacles and what must be its power ?
(a) Concave, −1.0 D (b) Convex, +1.5 D
(c) Concave, −2.0 D (d) Convex, +2.0D

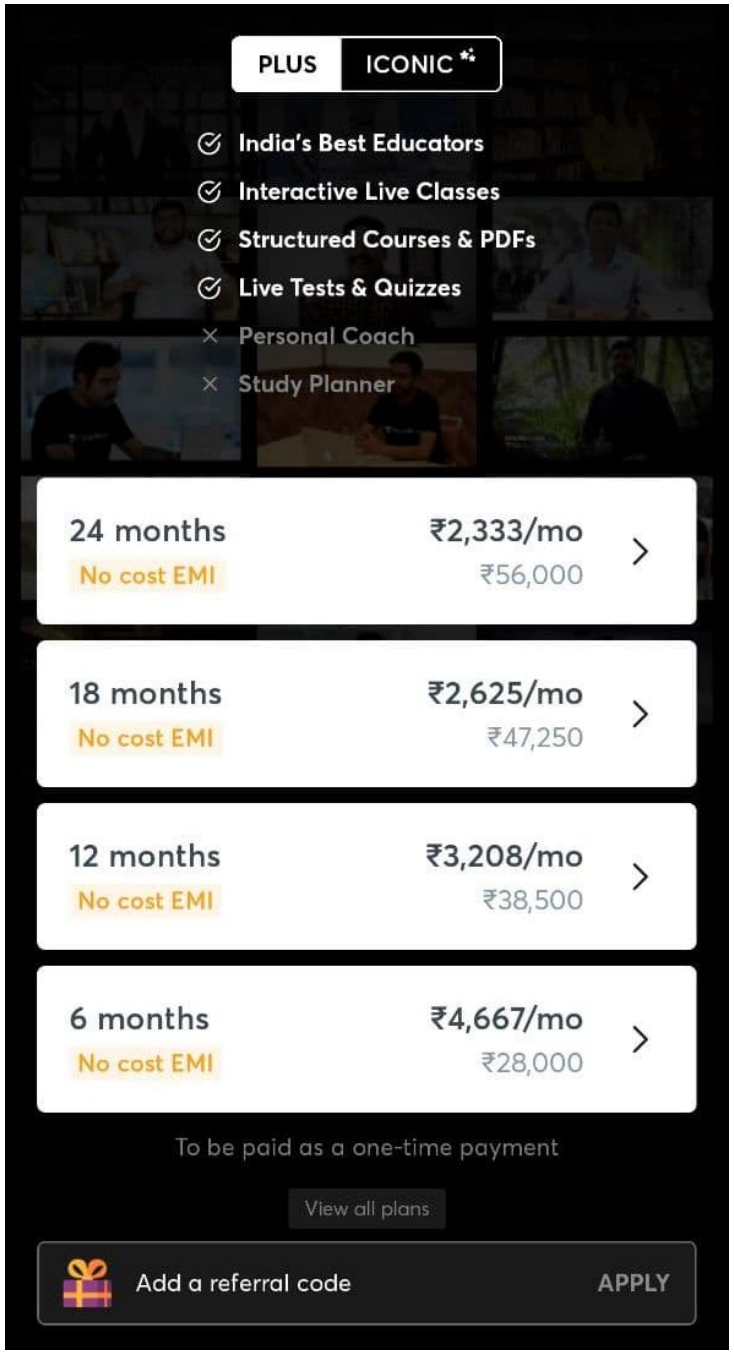
Q 15. A man can not see clearly an object kept beyond 100cm. What should be focal length of the lens used in spectacles to see an object properly.
(a) 100 cm (b) −100 cm
(c) 75 cm (d) −75 cm

Q 16. In an electron microscope the accelerating voltage is increased to 4 times, The resolving power of microscope will become
(a) Doubled
(b) Halved
(c) Quadrupled
(d) Tripled

Q 17. In a compound microscope focal length of objective is 1 cm and that of eyepiece is 5 cm. Object is placed at distance 1.2 cm from objective. Length of microscope for maximum magnifying power is nearly
(a) 10 cm
(b) 12 cm
(c) 11 cm
(d) 9 cm

Answer Key

Q.1 a	**Q.2 b**	**Q.3 c**	**Q.4 d**	**Q.5 a**
Q.6 d	**Q.7 c**	**Q.8 d**	**Q.9 a**	**Q.10 c**
Q.11 c	**Q.12 a**	**Q.13 a**	**Q.14 c**	**Q.15 b**
Q.16 a	**Q.17 a**			



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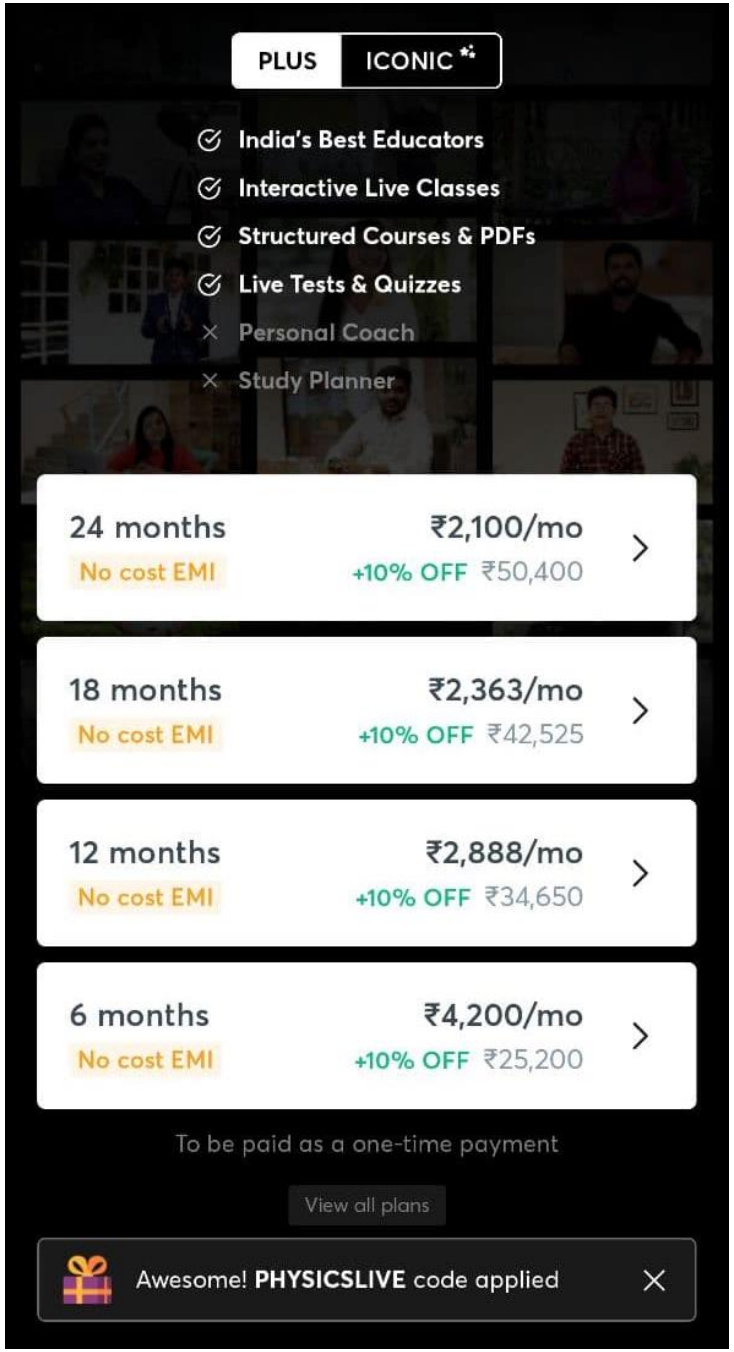


Written Solution

DPP -1 Optical Instruments

By Physicsaholics Team

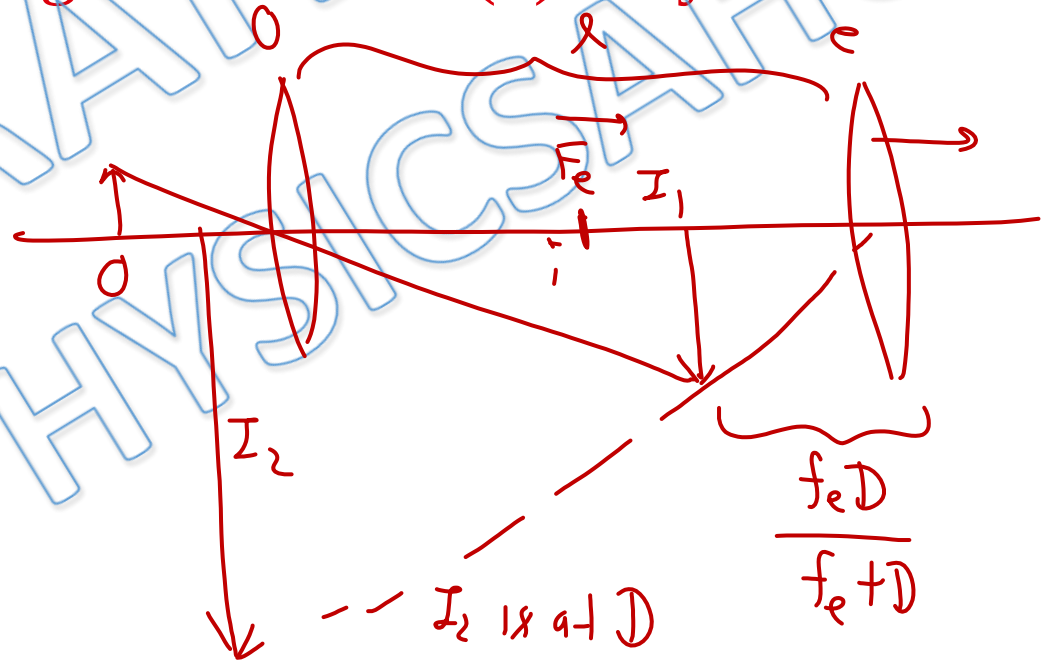
Q.1) When the length of a microscope tube increases, its magnifying power :

(a) Decreases

(b) Increases

(c) Does not change

(d) May decrease or increase



Q.2) The focal lengths of the objective and the eyepiece of the telescope are 225 cm and 5 cm respectively.Maximum magnifying power of the telescope will be

(a) 49 (b) 54

(c) 35 (d) 60

$$m = \frac{f_o}{f_e}\left(1 + \frac{f_e}{D}\right)$$

$$= \frac{225}{5}\left(1 + \frac{5}{25}\right)$$

$$= 45\left(1 + \frac{1}{5}\right)$$

$$= 45 + 9$$

$$= 54$$

Q.3) A magnifying glass is made of a combination of convergent lens of power +20 diopters and a divergent lens of power −4 diopters. If the least distance of distinct vision is 25cm, Maximum magnifying power is:

(a) 3 (b) 4

(c) 5 (d) 7

$P = P_1 + P_2$

$P = \frac{1}{f} = 20 - 4 = 16$

$m_{max} = 1 + \frac{D}{f}$

$= 1 + DP$

$= 1 + \frac{1}{4} \times 16$

$= 5$

Q.4) The image of an object is formed at the least distance of distinct vision from the lens of a simple microscope of focal length 2.5 cm. Its magnifying power is:

(a) 2.5 (b) 5

(c) 10 (d) 11

$$M_{max} = 1 + \frac{D}{f}$$

$$= 1 + \frac{25}{2.5}$$

$$= 11$$

Q.5) A convex lens of focal length 5 cm is used as a simple microscope. The image is formed at the least distance of distinct vision. Calculated the angular magnification.

(a) 6

(b) 5

(c) 0.5

(d) 4

$$m_{max} = 1 + \frac{D}{f}$$

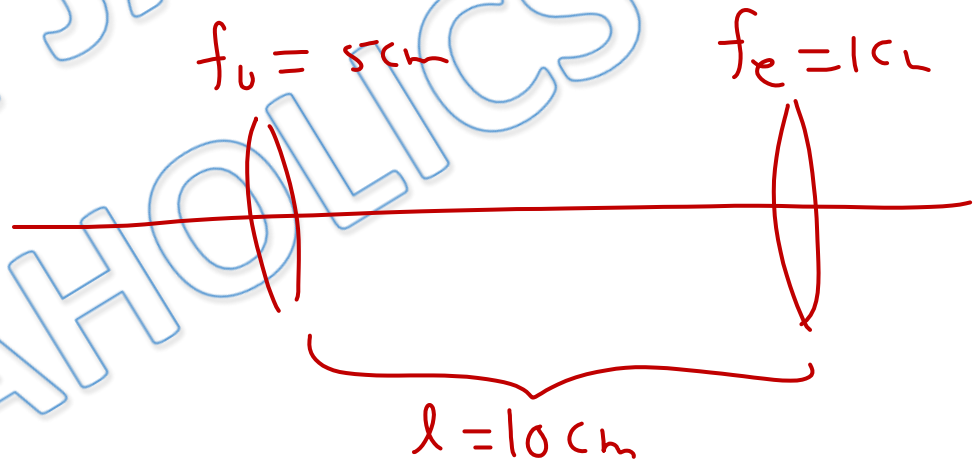
$$= 1 + \frac{25}{5}$$

$$= 6$$

Q.6) The length of the tube of a microscope is 10 cm. The focal lengths of the objective and eye lenses are 0.5 cm and 1 cm respectively. The magnifying power of the microscope when the image is at far point, is about

(a) 5 (b) 23

(c) 166 (d) 500



$$m = \frac{l}{f_o}\left(\frac{D}{f_e}\right)$$

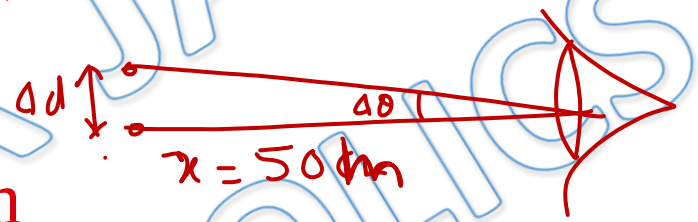
$$= \frac{100}{5} \times \frac{25}{1}$$

$$= 500$$

Q.7) The diameter of human eye lens is 2mm. What should be the minimum separation between two points situated at 50m from eye, to resolve them. Take wavelength of light =5000Å.

$= 5 \times 10^{-7}\ m$

$= 5 \times 10^{-5}\ cm$



(a) 1.25 cm (b) 2.35 cm

(c) ~~1.525~~ cm (d) 2.15 cm

$R = \frac{1}{\Delta\theta} = \frac{b}{1.22\lambda}$

$\Delta d = \frac{1.22\lambda x}{b}$

$= \frac{1.22 \times 5 \times 10^{-5} \times 50 \times 10^{2}}{2 \times 10^{-1}}$

$\frac{x}{\Delta d} = \frac{b}{1.22\lambda}$

$= .61 \times 5 \times 5 \times 10^{-1}$

$= 1.525\ cm$

Q.8) The diameter of the objective of the telescope is 0.1 meter and wavelength of light is 6000 Å. Its resolving power would be approximately

(a) 7.32×10^{-6} rad (b) 1.36×10^{6} rad

(c) 7.32×10^{-5} rad (d) 1.36×10^{5} rad

$$R = \frac{1}{\Delta\theta} = \frac{b}{1.22\lambda} = \frac{0.1}{1.22 \times 6 \times 10^{-7}}$$

$$= \frac{10^{6}}{7.32} = \left(\frac{10}{7.32}\right) \times 10^{5}$$

$$= 1.36 \times 10^{5}$$

Q.9) For a total magnification of 175 from a compound microscope, the magnification produced by objective is 7. What should be the magnification produced by eye piece?

(a) 25

(b) 7

(c) 175×7

(d) none of these

$m = m_o m_e$

$175 = 7\, m_e$

$m_e = 25$

Q.10) The magnification produced by the objective lens is 25 and magnifying power of eyepiece is 6 in a compound microscope. The magnifying power of this microscope is

(a) 19 (b) 31

(c) 150 (d) $\sqrt{150}$

$$m = \left(\frac{v_o}{u_o}\right)\left(\frac{D}{u_e}\right)$$

magnifying power of objective

magnifying power of eyepiece

$= 25 \times 6$

$= 150$

Q.11) The objective lens of a compound microscope produces magnification of 10. In order to get an overall magnifying power of 100 when image is formed at 25 cm from the eye, the focal length of the eye lens should be

(a) 4 cm (b) 10 cm

(c) $\frac{25}{9}$ cm (d) 9 cm

$$m = \left(\frac{v_o}{u_o}\right)\left(1 + \frac{D}{f_e}\right)$$

$$10 = 10\left(1 + \frac{25}{f_e}\right)$$

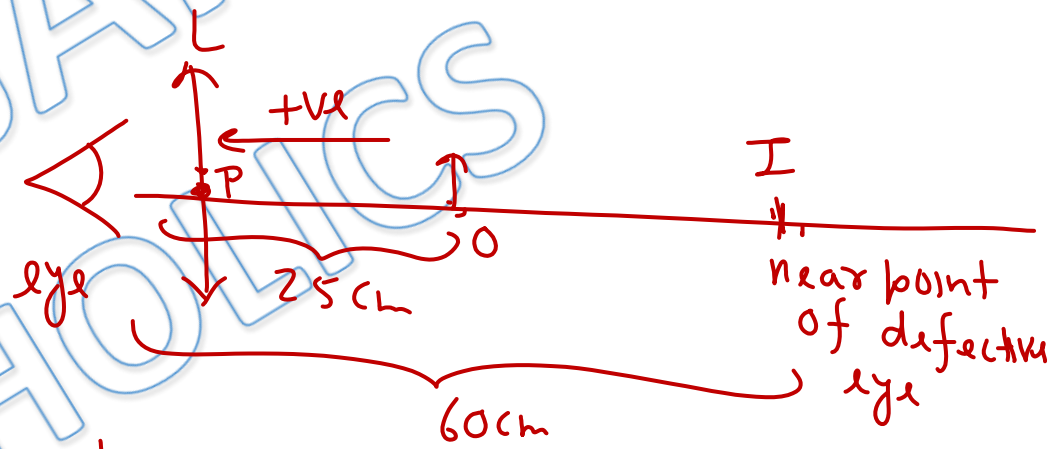
$$\frac{25}{f_e} = 9$$

$$f_e = \frac{25}{9}\ \text{cm}$$

Q.12) A far sighted person has a near point of 60cm. What power lens should be used for eye glasses such that the person can be read this book at a distance of 25 cm.

(a) 2.33 D (b) 1.66 D

(c) 3.22 D (d) 4.55 D



$$P = \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

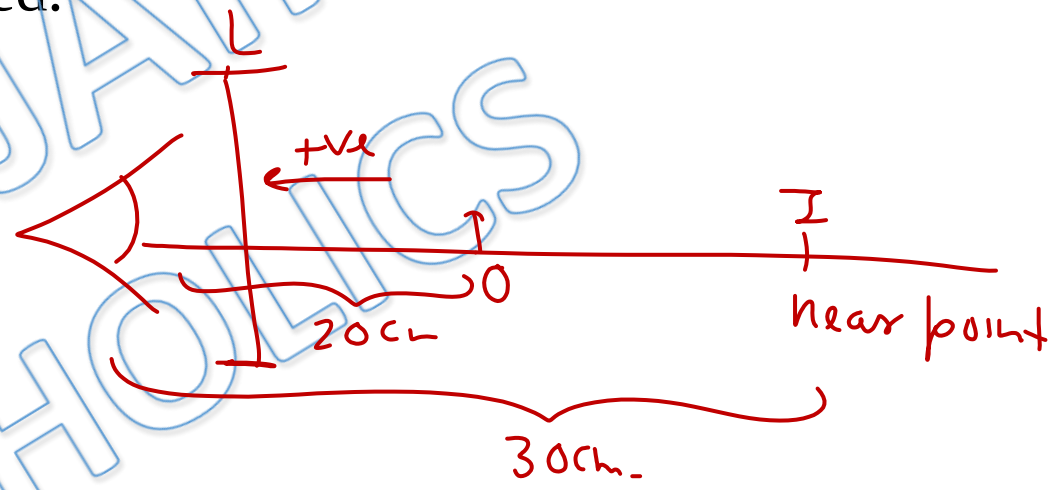
$$= \frac{100}{-60} - \frac{100}{-25} = 4 - \frac{5}{3} = \frac{7}{3}$$

$$= 2.33\,D$$

Q.13) A person wants to read a book placed at 20cm, whereas near point of his eye is 30cm. Calculate the power of the lens required.

(a) 1.67 D (b) 1.33 D

(c) 1.98 D (d) 2.15 D

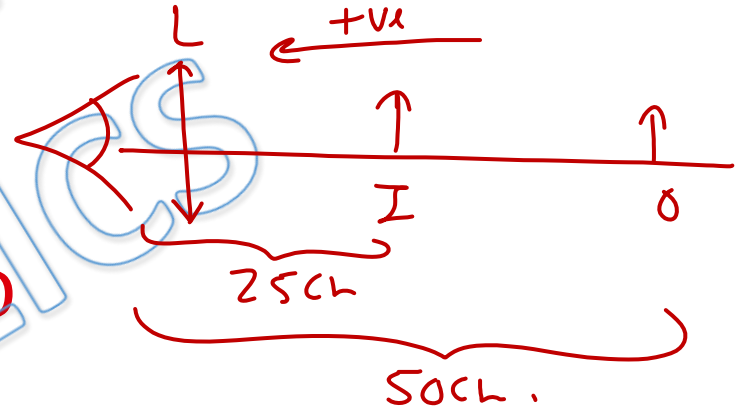


$$P = \frac{1}{V} - \frac{1}{u} = \frac{100}{-30} - \frac{100}{-20}$$

$$= 5^{-} - \frac{10}{3} = 5^{-}/_{3}\ D$$

$$= 1.6(7)\ D.$$

Q.14) A person can see clearly only up to a distance of 25cm. He wants to read a book placed at a distance of 50cm. What kind of lens does he require for his spectacles and what must be its power ?



(a) Concave, −1.0 D

(b) Convex, +1.5 D

(c) Concave, −2.0 D

(d) Convex, +2.0D

$$P = \frac{1}{v} - \frac{1}{u} = \frac{100}{-25} - \frac{100}{-50}$$

$$= 2 - 4 = -2\,D$$

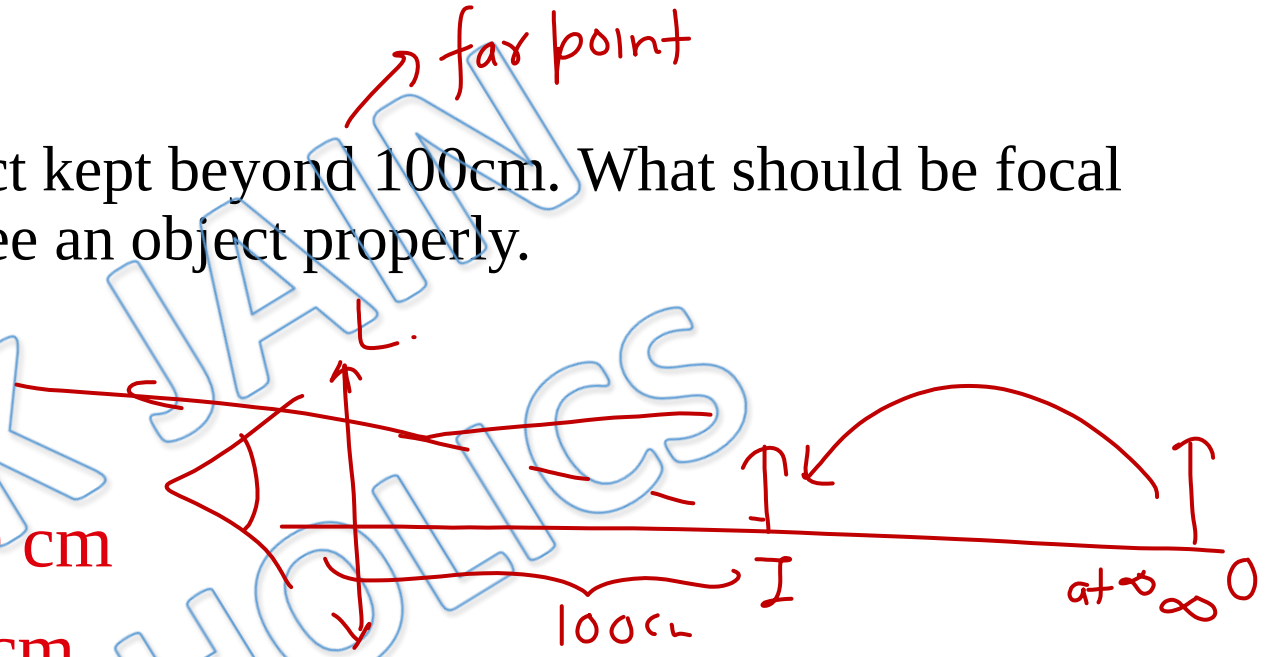
Q.15) A man can not see clearly an object kept beyond 100cm. What should be focal length of the lens used in spectacles to see an object properly.

(a) 100 cm

(b) −100 cm

(c) 75 cm

(d) −75 cm



$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$= \frac{1}{-100} - \frac{1}{-\infty}$$

$$\frac{1}{f} = -\frac{1}{100}$$

$$f = -100\,cm$$

Q.16) In an electron microscope the accelerating voltage is increased to 4 times, The resolving power of microscope will become

$$\lambda_{de} = \frac{h}{p} = \frac{h}{\sqrt{2mK}} = \frac{h}{\sqrt{2meV}}$$

(a) Doubled

(b) Halved

(c) Quadrupled

(d) Tripled

$$R \propto \frac{1}{\lambda} \propto \sqrt{V}$$

2 times

4 times

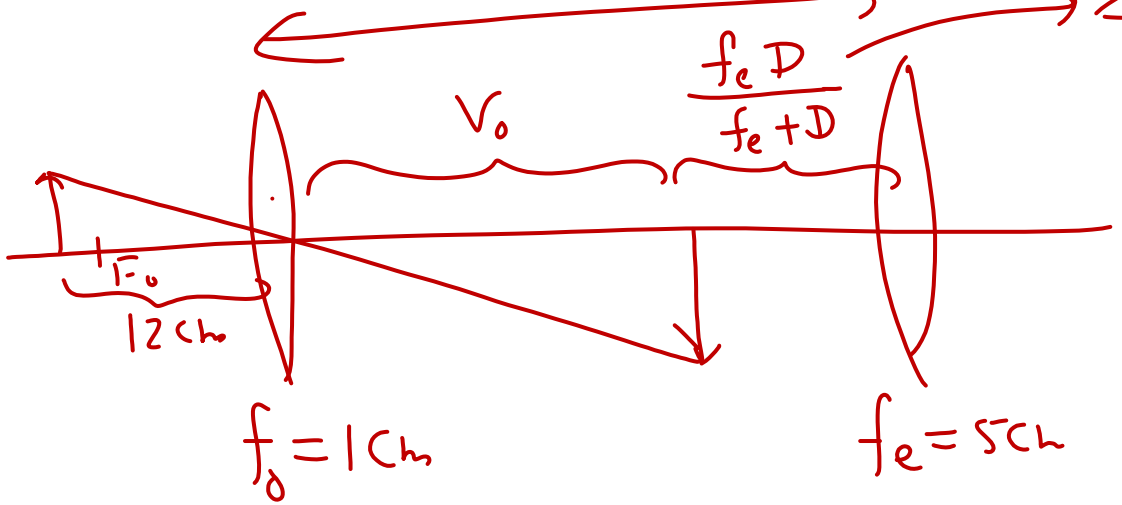
Q.17) In a compound microscope focal length of objective is 1 cm and that of eyepiece is 5 cm. Object is placed at distance 1.2 cm from objective. Length of microscope for maximum magnifying power is nearly

(a) 10 cm

(b) 12 cm

(c) 11 cm

(d) 9 cm



$\frac{5 \times 25}{30} = 4$ cm

$\frac{1}{+1} = \frac{1}{+V_0} - \frac{1}{-12}$

$\frac{1}{V_0} = 1 - \frac{10}{12} = \frac{1}{6}$

$V_0 = 6$ cm

$l = 6 + 4$ cm

$\simeq$ 10 cm

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