PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

RAY OPTICS

Example

1. An object is 30.0 cm from a spherical mirror along the central axis. The absolute value of lateral magnification is $\frac{1}{2}$. The image produced is inverted. What is the focal length of the mirror?

A. 10 cm

B. $-10cm$

C. -15

D. 15

Answer: B

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2. Locate the image of the point object O. The point C is centre of curvature of the spherical surface.

A. $-15cm$

B. 15 cm

C. 10 cm

D. $-10cm$

Answer: A

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3. A double convex lens is made of glass of refractive index 1.55 with both faces of same radius of curvature. Find the radius of curvature required, if focal length is $20cm$.

A. 20

B. 21

C. 22

D. 19

Answer: C

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4. An object of size $3.0cm$ is placed $14cm$ in front of a concave lens of focal length $21cm$. Describe the image produced by the lens. What happens if the object is moved further from the lens ?

A. Virtual image moves towards the focus

B. Erect, image moves towards the centre

C. Both (a) and (b)

D. None of the above

Answer: A

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5. A converging lens of focal length $5.0cm$ is placed in contact with a diverging lens of focal length $10.0cm$. Find the combined focal length of

the system.

A. $+10.0cm$

B. $-10.0cm$

C. 5.0 cm

D. $-5cm$

Answer: A

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6. A person who can see things most clearly at a distance of $10cm$. Requires spectacles to enable to him to see clearly

things at a distance of $30cm$. What should be the focal length of the spectacles ?

A. 15 cm

B. $-15cm$

C. 10 cm

D. $-10cm$

Answer: B

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7. A 20 D lens is used as a magnifier. Where should the object be placed to obtain maximum angular magnification? (Given, D=25 cm).

A. 4.17 cm

B. 4.7 cm

C. 4.07 cm

D. None of these

Answer: A

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8. The separation between the objective and the eyepiece of a compound microscope can be adjusted between 9.8 cm to 11.8 cm. If the focal lengths of the objective and the eyepiece are 1.0 cm and 6 cm respectively, find the range of the magnifying power if the image is always needed at 24 cm from the eye.

A. 31.16

B. 32.16

C. 33.16

D. 34.16

Answer: A

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9. A small telescope has an objective lens of focal length $140cm$ and eye piece of focal length $5.0cm$. What is the magnifying power of telescope for viewing distant objects when

(a) the telescope is in normal adjustment (i.e. when the image is at infinity)

(b) the final image is formed at the least distance of distinct vision $(25cm)$.

A. $28, 33.6$

B. $33.6, 28$

C. Both (a) and (b)

D. None of these

Answer: A

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Exercise 1 Topical Problems

1. A concave mirror of focal length f (in air) is immersed in water $(\mu = 4/3)$. The focal length of the mirror in water will be

A. f

B. $\frac{4}{3}f$

C. $\frac{3}{4}f$

D. $\frac{7}{3}f$

Answer: A

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2. An object is placed 40 cm from a concave mirror of focal length 20 cm. The image formed is

A. real, inverted and same in size

B. real, inverted and smaller in size

C. virtual, erect and larger in size

D. virtual, erect and smaller in size

Answer: A

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3. A point object is placed at a distance of 30 cm from a convex mirror of focal length 30 cm. The image will form at

A. infinity

B. pole

C. focus

D. 15 cm behind the mirror

Answer: D

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4. An object is placed at a distance of 30 cm from a concave mirror and its real image is formed at a distance of 30 cm from the mirror. The focal length of the mirror is

A. 15 cm

B. 45 cm

C. 30 cm

D. 20 cm

Answer: A

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5. A convex mirror of focal length f produced an image $(1/n)^{th}$ of the size of the object. The distance of the object from the

mirror is

A. $(n-1)f$

B. $\left[\frac{n-1}{n}\right]f$

C. $\left[\frac{n+1}{n}\right]f$

D. $(n+1)f$

Answer: A

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6. The focal length of a concave mirror is 50cm. Where an object be placed so that its image is two times and inverted

A. 75 cm

B. 60 cm

C. 125 cm

D. 50 cm

Answer: A

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7. An object of size 7.5 cm is placed in front of a convex mirror of radius of curvature 25 cm at a distance of 40 cm. The size of the image should be

A. 2.3 cm

B. 1.78 cm

C. 1 cm

D. 0.8 cm

Answer: B

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8. The image formed by a convex mirror of focal length $30cm$. is a quarter of the object. What is the distance of the object from the mirror ?

A. 30 cm

B. 90 cm

C. 120 cm

D. 60 cm

Answer: B

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9. A concave mirror gives an image three times as large as the object placed at a distance of 20 cm from it. For the image to be real, the focal length should be

A. 10 cm

B. 15 cm

C. 20 cm

D. 30 cm

Answer: B

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10. A point object is placed at a distance of 10 cm and its real image is formed at a distance of 20 cm from a concave mirror.

If the object is moved by 0.1 cm towards the mirror, the image will shift by about

A. 0.4 cm away from the mirror

B. 0.8 cm away from the mirror

C. 0.4 cm towards the mirror

D. 0.8 cm towards the mirror

Answer: A

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11. Object is placed 15 cm from a concave mirror of focal length 10 cm, then the nature of the image formed will be

A. magnified and inverted

B. magnified and erect

C. small in size and inverted

D. small in size and erect

Answer: A

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12. Where should a person stand straight from the pole of a convex mirror of focal length 2.0 m on its axis, so that the image formed become half of his original height?

A. $-2.60m$

B. $-4.0m$

C. $-0.5m$

D. $-2.0m$

Answer: D

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13. Find the position of image from given diagram.

A. $-15cm$

B. $-20cm$

C. $-30cm$

D. $-25cm$

Answer: C

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14. A plano convex lens is made of glass of refractive index 1.5. The radius of curvature of its convex surface is R. Its focal length is

A. R/2

B. R

C. 2 R

D. 1.5 R

Answer: C

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15. At what distance from a convex lens of focal length $30cm$ an object should be placed so that the size of image be $\frac{1}{4}$ that of object?

A. 30 cm

B. 60 cm

C. 15 cm

D. 150 cm

Answer: D

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16. A plano - convex lens is made of flint glass. Its focal length is

A. inversely proportional to the wavelength of light

B. longer for red than for blue

C. longer for blue than for red

D. the same for all colours

Answer: D

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17. Distance of an object from a concave lens of focal length 20 cm is 40 cm. Then linear magnification of the image

A. $= 1$

B. > 1

C. < 1

D. zero

Answer: B

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18. Where should an object be placed from a converging lens of focal length 20 cm, so as to obtain a real image of magnification 2?

A. 50 cm

B. 30 cm

C. $-50cm$

D. $-30cm$

Answer: D

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19. An object is placed at 10 cm from a lens and real image is formed with magnification of 0.5. Then the lens is

A. concave with focal length of 10/3 cm

B. convex with focal length of 10/3 cm

C. concave with focal length of 10 cm

D. convex with focal length of 10 cm

Answer: B

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20. The real image which is exactly equal to the size of an object is to be obtained on a screen with the help of a convex

glass of focal length 15 cm. For this, what must be in the distance between the object and the screen?

A. 15 cm

B. 30 cm

C. 45 cm

D. 60 cm

Answer: B

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21. A plano-convex lens of curvature of 30 cm and refractive index 1.5 produces a real image of an object kept 90 cm from it. What is the magnification?

A. 4

B. 0.5

C. 1.5

D. 2

Answer: D

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22. The minimum distance between an object and its real image formed by a convex lens is

A. 1.5 f

B. 2 f

C. 2.5 f

D. 4f

Answer: D

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23. A convex lens of refractive index 3/2 has a power of 2.5°. If it is placed in a liqud of refractive index 2,the new power of the lens is

A. 2.5 D

B. $-2.5D$

C. $1.25D$

D. $-1.25D$

Answer: D

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24. Two thin lenses of focal lengths f_1 and f_2 are in contact. The focal length of this combination is

A. $f_1 + f_2$

B. $\frac{f_1 f_2}{f_1 + f_2}$

C. $\frac{1}{2}(f_1 + f_2)$

D. $\frac{f_1 + f_2}{f_1 f_2}$

Answer: D

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25. Two thin lenses, one of focal length + 60 cm and the other of focal length – 20 cm are put in contact. The combined focal length is

A. $+15cm$

B. $-15cm$

C. $+30cm$

D. $-30cm$

Answer: D

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26. A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of the combination is

A. $-1.5D$

B. $-6.5D$

C. $+6.5D$

D. $+1.5D$

Answer: A

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27. Two similar plano-convex lenses are combined together in three different ways as show in the adjoining figur . The ratio of the focal length in three cases will be

A. $2:2:1$

B. $1:1:1$

C. $1:2:2$

D. $2:1:1$

Answer: B

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28. Two thin lenses of focal lengths 20 cm and 25 cm are placed in a contact. The effective power of the combination is

A. 9D

B. 2D

C. 3D

D. 7D

Answer: A

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29. We combined a convex lens of focal length f_1 and concave lens of focal lengths f_2 and their combined focal length was F . The combination of these lenses will behave like a concave lens, if

A. $F_1 > f_2$

B. $f_1 < f_2$

C. $f_1 = f_2$

D. $f_1 \leq f_2$

Answer: A

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30. For a normal eye, the least distance of distinct vision is.....and far point is..... .

A. 0.25 m

B. 0.50 m

C. 25 m

D. infinite

Answer: A

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31. When we see an object the image formed on the retina is

A. real and inverted

B. virtual and erect

C. real and erect

D. virtual and inverted

Answer: A

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32. The focal length of a normal eye lens is about

A. 1 mm

B. 2 cm

C. 25 cm

D. 1 m

Answer: B

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33. An object is placed at a distance u from a simple microscope of focal length f. The angular magnifiction obtaioned depends

A. on f but not on u

B. on u but not on f

C. on f as well as u

D. Neither on f nor on u

Answer: A

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34. Magnifying power of a simple microscope is (when final image is formed, at D=25cm from eye)

A. $\frac{D}{f}$

B. $1+\frac{D}{f}$

C. $1+\frac{f}{D}$

D. $1-\frac{D}{f}$

Answer: B

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35. In a compound microscope, the intermediate image is

A. virtual, erect and magnified

B. real, erect and magnified

C. real, inverted and magnified

D. virtual, erect and reduced

Answer: C

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36. A compound microscope has two lenses. The magnifying power of one is 5 and the combined magnifying power is 100. The magnifying power of the other lens is

A. 10

B. 20

C. 50

D. 25

Answer: B

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37. The length of the compound microscope is $14cm$. The magnifying power for relaxed eye is 25. If the focal length of eye lens is $5cm$, then the object distance for objective lens will be

A. 1.8 cm

B. 1.5 cm

C. 2.1 cm

D. 2.4 cm

Answer: A

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38. If the focal length of objective and eye lens are $1.2cm$ and $3cm$ respectively and the object is put $1.25cm$ away from the objective lens and the final image is formed at infinity. The magnifying power of the microscope is

A. 150

B. 200

C. 250

D. 400

Answer: B

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39. The focal length of objective and eye lens of a microscope are $4cm$ and $8cm$ respectively. If the least distance of distinct vision is $24cm$ and object distance is $4.5cm$ from the objective lens, then the magnifying power of the microscope will be

A. 18

B. 32

C. 64

D. 20

Answer: B

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40. If the telescope is reversed .i.e., seen seen from the objective side, then

A. object will appear very small

B. object will appear very large

C. there will be no effect on the image formed by the telescope

D. image will be slightly greater than the earlier one

Answer: A

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41. The aperture of a telescope is made large, because

A. increase the intensity of image

B. decrease the intensity of image

C. have greater magnification

D. have lesser resolution

Answer: A

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42. In an astronomical telescope, the focal length of the objective lens is 100 cm and of eye-piece is 2 cm . The magnifying power of the telescope for the normal eye is

A. 50

B. 10

C. 100

D. $\frac{1}{50}$

Answer: A

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43. The focal lengths of the objective and eye lenses of a telescope are respectively 200 cm and 5 cm . The maximum magnifying power of the telescope will be

A. -40

B. -48

C. -60

D. -100

Answer: B

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44. The number of lenses in a terrestrial telescope is

A. two

B. three

C. four

D. six

Answer: B

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45. Reflecting telescope consists of

A. convex mirror of large aperture

B. concave mirror of large aperture

C. concave lens of small aperture

D. None of the above

Answer: B

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46. An astronomical telescope in normal adjustment receives light from a distant source S. The tube length is now decreased slightly

A. no image will be formed

B. a virtual image of S will be formed at a finite distance

C. a large, real image of S will be formed behind the eye piece, far away from it

D. a small, real image of S will be formed behind the eye-piece, closes to it

Answer: B

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47. An astronomical telescope has an angular magnification of magnitude 5 for distant object. The separation between the objective and the eyepiece is 36 cm and the final image is formed at infinity. The focal length f_0 of the objective and the focal length f_0 of the eyepiece are

A. $f_o = 45cm$ and $f_e = -9cm$

B. $f_o = -7.2cm$ and $f_e = 5cm$

C. $f_o = 50cm$ and $f_e = 10cm$

D. $f_o = 30cm$ and $f_e = 6cm$

Answer: D

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48. Magnification produced by astronominal telescope for normal adjustment is 10 and length of telescope is 1.1m. The magnification when the image is formed at least distance of distinct vision $(D = 25cm)$ is-

A. 6

B. 14

C. 16

D. 18

Answer: B

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Exercise 2 Miscellaneous Problems

1. When light wave suffers reflection at the interface from air to glass, the change in phase of the reflected wave is equal to

A. zero

B. $\frac{\pi}{2}$

C. π

D. 2π

Answer: C

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2. Two identical glass $\left(\mu_g = 3/2\right)$ equi- convex lenses of focal length f each are kept in contact. The space between the two lenses is also filled with water $\left(\mu_g = 4/3\right)$. The focal length of the combination is

A. f/3

B. f

C. $\frac{4f}{3}$

D. $\frac{3f}{4}$

Answer: D

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3. An air bubble in a glass slab with refractive index 1.5 (near normal incidence) is $5cm$ deep when viewed from one surface and $3cm$ deep when viewed from the opposite face. The thickness (in cm) of the slab is

A. 8

B. 10

C. 12

D. 16

Answer: C

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4. A person can see clearly objects only when they lie between 50 cm and 400 cm from his eyes. In order to increase the miximum distance of distinct vision to infinity , the person has to use, will be

A. convex, + 2.25 D

B. concave, - 0.25 D

C. concave, - 0.2 D

D. convex, + 0.15 D

Answer: B

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5. A astronomical telescope has objective and eyepiece of focal lenghts 40 cm 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be seperated by a distance

A. 46.0 cm

B. 50.0 cm

C. 54.0 cm

D. 37.3 cm

Answer: C

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6. Match the corresponding entries of Column I with Column II . [Where, m is the magnification produced by the mirror]

A.

$A \to a$ and $c, B \to a$ and $d, C \to a$ and $b, D \to c$ and d

B.

$A \to a$ and $d, B \to b$ and $c, C \to b$ and $d, D \to d$ and c

C.

$A \to c$ and $d, B \to b$ and $c, C \to b$ and $c, D \to a$ and d

D.

$A \to b$ and $c, B \to b$ and $c, C \to b$ and $d, D \to a$ and d

Answer: D

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7. Calculate the focal length of a reading glass of a person, if the distance of distinct vision is 75cm.

A. 75.2 cm

B. 25.6 cm

C. 100.4 cm

D. 37.5 cm

Answer: D

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8. A person wants a real image of his own, 3 times enlarged. Where should he stand in front of a concave mirror of radius of curvature of 30cm.

A. 90 cm

B. 10 cm

C. 20 cm

D. 30 cm

Answer: C

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9. The magnification power of a convex lens of focal length 10cm, when the image is formed at the near point is

A. 6

B. 5.5

C. 4

D. 3.5

Answer: D

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10. The velocity of image object and mirror both are moving towards each other with velocities $4ms^{-1}$ and $5ms^{-1}$ respectively, is

A. $-14ms^{-1}$

B. $15ms^{-1}$

C. $-9ms^{-1}$

D. $14ms^{-1}$

Answer: A

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11. A plano convex lens fits exactly into a plano concave lens. Their plane surfaces are parallel to each other. If the lenses are made of different materials refractive indices μ_1 and μ_2 and R is the radius curvature of the curved surface of the lenses, the focal length of the combination is

A. $\frac{R}{2(\mu_1 + \mu_2)}$

B. $\frac{R}{2(\mu_1 - \mu_2)}$

C. $\frac{R}{(\mu_1 - \mu_2)}$

D. $\frac{2R}{(\mu_2 - \mu_1)}$

Answer: C

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12. For a normal eye, the cornea of eye provides a converging power of $40D$ and the least converging power of the eye lens behind the cornea is $20D$. Using this information, the distance between the retina and the cornea eye lens can be estimated to be

A. 5 cm

B. 2.5 cm

C. 1.67 cm

D. 1.5 cm

Answer: C

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13. When an object is placed 40cm from a diverging lens, its virtual image is formed 20cm from the lens. The focal length and power of lens are

A. F = -20 cm, P = -5 D

B. F = -40 cm, P = -5 D

C. F = -40 cm, P =-2.5 D

D. F = -20 cm, P = -2.5 D

Answer: C

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14. A magnifying glass of focal length 5cm is used to view an object by a person whose smallest distance of distinct vision is

25cm. If he holds the glass close to eye, then the magnification is

A. 5

B. 6

C. 2.5

D. 3

Answer: B

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15. A person has a minimum distance of distinct vision as 50cm. The power of lenses required to read a book at a distance of 25cm is

A. 3 D

B. 1 D

C. 2 D

D. 4 D

Answer: C

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16. A concave mirrorr of focal length f_1 is placed at a distance of d from a convex lens of focal length f_2. A beam of light coming from infinity and falling on this convex lens-concave mirrorr combination returns to infinity. The distance d must equal.

A. $f_1 + f_2$

B. $-f_1 + f_2$

C. $2f_1 + f_2$

D. $-2f_1 + f_2$

Answer: C

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17. The image formed by a convex mirror of focal length $30cm.$ is a quarter of the object. What is the distance of the object from the mirror ?

A. 30 cm

B. 60 cm

C. 90 cm

D. 120 cm

Answer: C

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18. In a compound microscope, the focal length of the objective and the eye lens are $2.5cm$ and $5cm$ respectively. An object is placed at $3.75cm$ before the objective and image is formed at the least distance of distinct vision, then the distance between two lenses will be $(i.\ e.$ length of the microscope tube)

A. 11.67 cm

B. 12 cm

C. 12.75 cm

D. 13 cm

Answer: A

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19. A thin convex lens of refractive index 1.5cm has 20cm focal length in air. If the lens in completely immersed in a liquid of refractive index. 1.6, then its focal length will be

A. $-160cm$

B. $-100cm$

C. $+10cm$

D. $+100cm$

Answer: A

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