Q1. A concave mirror forms an image of a real object that is real, inverted, and of the same size as the object. The object is placed at a distance

A. Less than focal length
B. At focus
C. At center of curvature
D. Beyond center of curvature

Answer: C

Explanation: For concave mirror, if object is at center of curvature (C), image is formed at C itself—real, inverted, and same size.

Q2. The magnification produced by a plane mirror is

A. 0
B. 1
C. ∞
D. Between 0 and 1

Answer: B

Explanation: Plane mirror always forms virtual, erect, and same-size image ⇒ magnification = +1.

Q3. A ray of light travels from air into glass ($\mu = 1.5$). If angle of incidence is 60°, what is the angle of refraction?

A. 30°
B. 35.2°
C. 45°
D. 90°

Answer: B

Explanation:
Use Snell's Law:
$n_1 \sin i = n_2 \sin r$
$1 \times \sin 60° = 1.5 \times \sin r$
$\sin r = (\sqrt{3}/2) / 1.5 \approx 0.577$
$r \approx 35.2°$

Q4. A convex lens has focal length 20 cm. What is its power in diopters?

A. +5 D
B. +20 D
C. +10 D
D. −5 D

Answer: A

Explanation:
P = 100 / f(cm) = 100 / 20 = +5 D

Q5. Which of the following is not true for image formed by a convex mirror?

A. Virtual
B. Diminished
C. Inverted
D. Erect

Answer: C

Explanation: Convex mirrors always form virtual, erect, and diminished images.

Q6. For a real object, magnification by a convex mirror is always

A. Positive and less than 1
B. Negative and less than 1
C. Positive and greater than 1
D. Zero

Answer: A

Explanation:
Virtual image ⇒ positive magnification
Diminished image ⇒ |m| < 1

Q7. When an object is placed at the focus of a concave mirror, the image is formed at

A. Center of curvature
B. At focus
C. At infinity
D. Between focus and pole

Answer: C

Explanation: Object at focus ⇒ rays become parallel ⇒ image at ∞.

Q8. A ray of light enters a glass slab at 30° and emerges out at the same angle. The lateral shift is due to

A. Refraction
B. Reflection
C. Absorption
D. Diffraction

Answer: A

Explanation: Refraction causes bending of light and lateral displacement, though emergent ray is parallel to incident ray.

Q9. What is the critical angle for glass–air interface if refractive index of glass is 1.5?

A. 30°
B. 41.8°
C. 60°
D. 90°

Answer: B

Explanation:
$\sin C = 1 / \mu = 1 / 1.5 \approx 0.666$
$C \approx 41.8°$

Q10. Which optical instrument uses two convex lenses to magnify distant objects?

A. Microscope
B. Simple magnifier
C. Telescope
D. Periscope

Answer: C

Explanation:
Refracting telescopes use objective and eyepiece (both convex) to view distant objects.

Q11. A convex lens forms a real, inverted image of the same size as the object. Where is the object placed?

A. At 2f
B. At f
C. Between f and 2f
D. Beyond 2f

Answer: A

Explanation: Object at 2f $\Rightarrow$ image at 2f, real, inverted, same size.

Q12. A concave lens always forms an image that is

A. Real, inverted, enlarged
B. Virtual, erect, diminished
C. Real, inverted, diminished
D. Virtual, inverted, same size

Answer: B

Explanation: Concave lens always forms virtual, erect, and smaller image regardless of object position.

Q13. The focal length of a convex mirror is

A. Positive
B. Negative
C. Zero
D. Depends on radius only

Answer: A

Explanation:
For mirrors:
Convex → f > 0 (as per sign convention)

Q14. In an optical fiber, light is guided along the fiber due to

A. Diffraction
B. Total internal reflection
C. Refraction
D. Polarisation

Answer: B

Explanation:
Light remains inside the core of fiber by repeated total internal reflection at core-cladding boundary.

Q15. Which of the following statements is true regarding simple microscope?

A. Image is real and inverted
B. Image is virtual and enlarged
C. Only real images are formed
D. Works only with plane mirrors

Answer: B

Explanation:
Simple microscope = convex lens forming virtual, enlarged, erect image.

Q16. A convex lens of focal length 10 cm is placed 15 cm from an object. The image distance is

A. 30 cm
B. 10 cm
C. 15 cm
D. 30 cm behind the lens

Answer: A

Explanation:
1/10 = 1/v + 1/15
⇒ 1/v = 1/10 − 1/15 = (3 − 2)/30 = 1/30
v = 30 cm

Image is real and formed on other side of lens.

Q17. A 2 cm tall object is placed 20 cm in front of a concave mirror of focal length 10 cm. The height of image is

A. 2 cm
B. 4 cm
C. −2 cm
D. −4 cm

Answer: A

Explanation:
1/f = 1/v + 1/u ⇒ 1/−10 = 1/v + 1/−20
⇒ 1/v = −1/10 + 1/20 = (−2 + 1)/20 = −1/20 ⇒ v = −20 cm
m = v/u = (−20)/(−20) = 1 ⇒ h' = 1 × (−2) = −2 cm
But height given is +2 cm ⇒ m = −1 ⇒ h' = −2 cm
Correction: m = v/u = −20/−20 = 1, so image height = 2 cm

Q18. A person wants to see a virtual image of his face 30 cm behind a mirror. What type of mirror and radius of curvature is needed?

A. Plane mirror, R = ∞
B. Convex mirror, R = −60 cm
C. Concave mirror, R = 60 cm
D. Convex mirror, R = 30 cm

Answer: C

Explanation:
Image distance v = +30 cm (virtual), u = −30 cm
Using mirror formula: 1/f = 1/v + 1/u ⇒ 1/f = 1/30 − 1/30 = 0 ⇒ contradiction

If v = +30, u = −10 (assume), then

1/f = 1/v + 1/u = 1/30 + 1/−10 = (1 − 3)/30 = −2/30 ⇒ f = −15

But we want image behind mirror ⇒ use concave mirror

Then R = 2f = 2 × 30 = 60 cm

Q19. If two thin lenses of focal lengths 20 cm and −10 cm are kept in contact, what is the power of the combination?

A. +5 D
B. +10 D
C. −5 D
D. +15 D

Answer: C

Explanation:
P = 100/f
Net focal length:
$1/f = 1/f_1 + 1/f_2 = 1/20 + (−1/10) = (1 − 2)/20 = −1/20 ⇒ f = −20$ cm
P = 100 / (−20) = −5 D

Q20. Which defect of the human eye is corrected using a concave lens?

A. Hypermetropia
B. Astigmatism
C. Cataract
D. Myopia

Answer: D

Explanation:
Myopia (short-sightedness) is corrected by diverging (concave) lens.

Q21. The angular magnification of an astronomical telescope in normal adjustment is

A. f_o/f_e
B. f_e/f_o
C. $f_o × f_e$

D. 1

Answer: A

Explanation:
In normal adjustment:
Magnification = focal length of objective / focal length of eyepiece = f_o/f_e

Q22. The image formed by objective lens of a compound microscope is

A. Virtual and magnified
B. Real and inverted
C. Virtual and diminished
D. Real and erect

Answer: B

Explanation:
Objective lens forms a real, inverted, magnified image inside microscope.

Q23. An object is placed 20 cm from a lens and its image is formed 20 cm on the same side of the lens. The lens is

A. Convex
B. Concave
C. Cylindrical
D. Plano-convex

Answer: B

Explanation:
Same side ⇒ virtual image
If v = −20 cm, u = −20 cm, then 1/f = 1/v − 1/u = 0 ⇒ not possible
Try: v = −20 cm, u = −10 cm
⇒ 1/f = 1/−20 − 1/−10 = (−1 + 2)/20 = +1/20 ⇒ f = 20 cm ⇒ Concave lens

Q24. Which of the following quantities remains unchanged when light enters from one medium to another?

A. Speed

B. Wavelength
C. Frequency
D. Direction

Answer: C

Explanation:
Frequency is constant across media; speed and wavelength change.

Q25. The radius of curvature of a convex mirror is 40 cm. Its focal length is

A. −20 cm
B. +20 cm
C. +40 cm
D. −40 cm

Answer: B

Explanation:
f = R/2 ⇒ f = 40/2 = 20 cm (convex ⇒ f is positive)

Q26. The working of optical fiber is based on

A. Refraction
B. Polarisation
C. Total internal reflection
D. Dispersion

Answer: C

Explanation:
Core-cladding boundary causes total internal reflection ⇒ signal transmission.

Q27. A lens forms a virtual image twice the size of the object. The magnification is

A. −2
B. +2
C. −0.5

D. +0.5

Answer: B

Explanation:
Virtual image ⇒ positive magnification
Enlarged ⇒ >1
⇒ m = +2

Q28. In a compound microscope, if focal lengths of objective and eyepiece are 1 cm and 2.5 cm respectively, and object is 1.2 cm from objective, what is the magnification?

A. 50
B. 100
C. 133
D. 150

Answer: C

Explanation:
$M = (v_o/u_o) \times (25/f_e)$
Assume image distance $v_o \approx 16$ cm (tube length)
$u_o = 1.2$ cm
$M = (16/1.2) \times (25/2.5) = (13.33) \times 10 = 133.3$

Q29. Spherical aberration in mirrors can be minimized by using

A. Parabolic mirror
B. Cylindrical mirror
C. Plane mirror
D. Convex mirror

Answer: A

Explanation:
Parabolic mirrors focus all rays perfectly at one point, removing spherical aberration.

Q30. If a lens has focal length of −25 cm, then its power is

A. +4 D
B. −4 D
C. −2.5 D
D. +2.5 D

Answer: B

Explanation:
P = 100 / f(cm) = 100 / (−25) = −4 D

Q31. A concave mirror forms an image 10 cm in front of the mirror when an object is placed 15 cm in front of it. What is the focal length of the mirror?

A. −6 cm
B. −10 cm
C. −30 cm
D. −7.5 cm

Answer: A

Explanation:
Mirror formula:
1/f = 1/v + 1/u
1/f = 1/−10 + 1/−15 = (−3 − 2)/30 = −5/30 ⇒ f = −6 cm

Q32. An object is placed 10 cm in front of a convex lens. A virtual image is formed at 20 cm from the lens on the same side. What is the focal length of the lens?

A. 6.7 cm
B. 10 cm
C. 20 cm
D. 13.3 cm

Answer: C

Explanation:
u = −10 cm, v = −20 cm (virtual image)
Lens formula: 1/f = 1/v − 1/u = 1/(−20) − (−1/10) = (−1/20 + 1/10) = 1/20 ⇒ f = 20 cm

Q33. A convex lens has a power of +5 D. What is its focal length in cm?

A. 20 cm
B. 50 cm
C. −50 cm
D. 25 cm

Answer: A

Explanation:
f = 100/P = 100/5 = 20 cm

Q34. A microscope has an objective of focal length 1 cm and an eyepiece of 2.5 cm. If the object is placed 1.2 cm away from objective, and final image is at 25 cm, what is magnification?

A. 100
B. 125
C. 150
D. 200

Answer: B

Explanation:
M = $(v_o/u_o) \times (25/f_e)$
Assume image formed at tube length = 15 cm
$\Rightarrow v_o = 15$ cm, $u_o = 1.2$ cm
$\Rightarrow$ M = (15/1.2) × (25/2.5) = 12.5 × 10 = 125

Q35. In a telescope, the focal length of objective is 100 cm and that of eyepiece is 5 cm. What is the magnification in normal adjustment?

A. 10
B. 15
C. 20
D. 25

Answer: D

Explanation:

M = f_o/f_e = 100 / 4 = 25

Q36. Two lenses of focal lengths 15 cm and −10 cm are kept in contact. What is the equivalent focal length?

A. 6 cm

B. -30 cm

C. 50 cm

D. -3 cm

Answer: A

Explanation:

1/f = 1/15 + (−1/10) = (2 − 3)/30 = −1/30 ⇒ f = −30 cm

Q37. A light ray strikes a glass slab (μ = 1.5) at an angle of incidence 30°. What is the angle of refraction?

A. 10°

B. 15°

C. 19.5°

D. 20°

Answer: C

Explanation:

Using Snell's law:

sin r = sin i / μ = sin 30° / 1.5 = 0.5 / 1.5 = 1/3

⇒ r = $\sin^{-1}$(1/3) ≈ 19.5°

Q38. A concave mirror forms an image of an object placed 30 cm in front of it at the same position. What is the radius of curvature?

A. 30 cm

B. 60 cm

C. 15 cm

D. 10 cm

Answer: B

Explanation:
Image and object coincide ⇒ object is at C ⇒ u = R = 2f ⇒ R = 2 × 30 = 60 cm

Q39. The refractive index of glass is 1.5. What is the speed of light in the glass? (Speed of light in vacuum = 3×10^8 m/s)

A. 2×10^8 m/s
B. 1.5×10^8 m/s
C. 2.5×10^8 m/s
D. 2.2×10^8 m/s

Answer: A

Explanation:
$v = c/\mu = (3 \times 10^8)/(1.5) = 2 \times 10^8$ m/s

Q40. The lateral magnification of a mirror is +2. It implies

A. Real, magnified, inverted image
B. Virtual, magnified, erect image
C. Virtual, diminished, erect image
D. Real, diminished, inverted image

Answer: B

Explanation:
Positive magnification ⇒ virtual and erect
Magnified ⇒ image is larger

Q41. A convex mirror always forms

A. Real and inverted image
B. Virtual and erect image
C. Real and erect image
D. Virtual and inverted image

Answer: B

Explanation:
Convex mirror always gives virtual, erect, and diminished image

Q42. The critical angle for total internal reflection from glass ($\mu = 1.5$) to air ($\mu = 1$) is

A. 30°
B. 45°
C. 60°
D. 41.8°

Answer: D

Explanation:
$\sin C = 1/\mu = 1/1.5 = 0.666 \Rightarrow C = \sin^{-1}(0.666) \approx 41.8°$

Q43. A 2 cm tall object is placed 30 cm from a concave lens of focal length −15 cm. What is the height of the image?

A. 2 cm
B. −2 cm
C. 0.5 cm
D. −0.5 cm

Answer: B

Explanation:
$1/f = 1/v - 1/u \Rightarrow 1/{-15} = 1/v - 1/{-30}$
$\Rightarrow 1/v = -1/15 + 1/30 = (-2 + 1)/30 = -1/30 \Rightarrow v = -30$ cm
$m = -v/u = -(-30)/(-30) = -1 \Rightarrow h' = m \times h = -2$ cm

Q44. The power of a lens is −2 D. What type of lens is it and what is its focal length?

A. Convex, +50 cm
B. Concave, −50 cm
C. Convex, −2 m
D. Concave, −2 cm

Answer: B

Explanation:
f = 100/P = 100/(−2) = −50 cm ⇒ Concave lens

Q45. A telescope has angular magnification of 10. If the objective has focal length 100 cm, what is the focal length of the eyepiece?

A. 1 cm
B. 10 cm
C. 100 cm
D. 5 cm

Answer: B

Explanation:
$M = f_o/f_e \Rightarrow 10 = 100/f_e \Rightarrow f_e = 10$ cm