Q1. In Young's double-slit experiment, the distance between the slits is 0.5 mm and the screen is placed 2 m away. If the wavelength of light used is 600 nm, what is the fringe width?

A. 1.2 mm
B. 2.4 mm
C. 0.24 mm
D. 0.6 mm

Answer: A

Explanation:
Fringe width (β) = $\lambda D/d$
= $(600 \times 10^{-9} \times 2) / (0.5 \times 10^{-3})$
= (1.2×10^{-3}) m = 1.2 mm

Q2. In Young's experiment, the central fringe is observed to be red. If the source is now replaced with white light, what will happen to the central fringe?

A. It will disappear
B. It will become white
C. It will become black
D. It will split into colours

Answer: B

Explanation:
Central fringe is formed due to equal path difference (zero) for all wavelengths, so it will remain white with white light.

Q3. Which property of light confirms its wave nature?

A. Reflection
B. Refraction
C. Interference
D. Photoelectric effect

Answer: C

Explanation:

Interference and diffraction are phenomena exclusive to waves, confirming light's wave nature.

Q4. The angular width of the central maximum in a single slit diffraction is 0.2 radians. If the slit width is 1 mm, what is the wavelength of light?

A. 100 nm
B. 200 nm
C. 400 nm
D. 1000 nm

Answer: A

Explanation:
Angular width = $2\lambda/a$
$\Rightarrow \lambda = (\text{angular width} \times a) / 2 = (0.2 \times 1 \times 10^{-3})/2 = 0.1 \times 10^{-3} = 100 \times 10^{-9}$ m = 100 nm

Q5. In YDSE, the intensity at the central maximum is I. What is the intensity at a point where path difference is $\lambda/3$?

A. I
B. I/2
C. 0.25 I
D. 0.75 I

Answer: C

Explanation:
$I = I_o \cos^2(\pi\Delta x/\lambda)$
$\Delta x = \lambda/3 \Rightarrow I = I_o \cos^2(\pi/3) = I_o \times (1/2)^2 = 0.25\ I$

Q6. Two slits are illuminated with light of wavelength 600 nm. If the 4th bright fringe is missing, what could be the width of one of the slits?

A. 1200 nm
B. 2400 nm
C. 120 nm
D. 3600 nm

Answer: B

Explanation:
Minima in single-slit occurs at a sin θ = nλ
If nth fringe is missing in interference,
nλ = a sinθ⇒ a = nλ = 4 × 600 nm = 2400 nm

Q7. A beam of unpolarised light passes through a polaroid. What is the intensity of transmitted light?

A. I
B. I/2
C. Zero
D. √2 I

Answer: B

Explanation:
Unpolarised light becomes linearly polarised with 50% intensity, so I/2 passes.

Q8. In double-slit interference, what happens to fringe width if both the distance to the screen and the wavelength are doubled?

A. Becomes 4 times
B. Becomes twice
C. Remains same
D. Halves

Answer: A

Explanation:
Fringe width β = λD/d
If λ → 2λ and D → 2D,
β → 2λ × 2D / d = 4 times

Q9. The polarising angle for glass is 57°. What is the refractive index of glass?

A. 1.5
B. 1.6

C. 1.732
D. 1.414

Answer: A

Explanation:
Brewster's law: $\mu = \tan ip = \tan 57° \approx 1.54 \approx 1.5$

Q10. What should be the minimum thickness (t) of a soap film ($\mu = 1.33$) to produce constructive interference in reflected light of $\lambda = 532$ nm?

A. 100 nm
B. 200 nm
C. 400 nm
D. 600 nm

Answer: A

Explanation:
For constructive interference (reflected light):
$2\mu t = (m + ½)\lambda \Rightarrow$ For first maximum (m = 0):
$2\mu t = \lambda/2 \Rightarrow t = \lambda / (4\mu) = 532 / (4 \times 1.33) \approx 100$ nm

Q11. A slit of width 0.2 mm is illuminated by light of wavelength 600 nm. What is the angular position of first minimum?

A. 0.003 rad
B. 0.006 rad
C. 0.0035 rad
D. 0.0012 rad

Answer: A

Explanation:
$a \sin \theta = \lambda \Rightarrow \sin \theta = \lambda/a = 600\times10^{-9} / 0.2\times10^{-3} = 3\times10^{-3} = 0.003 \Rightarrow \theta \approx 0.003$ rad.

Q12. In YDSE, if the source slit is moved sideways by 0.5 mm, what happens to the fringe pattern?

A. It shifts upward
B. It shifts downward
C. It remains same
D. Fringe width changes

Answer: B

Explanation:
Shifting source slit changes path difference ⇒ fringe pattern shifts

Q13. Two coherent sources produce interference. What will be the resultant intensity at a point where the phase difference is $\pi/2$?

A. I
B. I/2
C. 0
D. √2 I

Answer: A

Explanation:
$I = I_1 + I_2 + 2\sqrt{I_1 I_2} \cos \varphi$
If $I_1 = I_2 = I_o$, $\varphi = \pi/2$
$\Rightarrow I = 2I_o(1 + \cos(\pi/2)) = 2I_o \times 1 = I$

Q14. In YDSE, what is the effect of increasing slit separation on the fringe pattern?

A. Fringe width increases
B. Fringe width decreases
C. Fringe contrast increases
D. No change

Answer: B

Explanation:
$\beta = \lambda D/d \Rightarrow$ increasing d ⇒ fringe width decreases

Q15. The width of central maximum in single-slit diffraction pattern is

A. Inversely proportional to slit width
B. Directly proportional to slit width
C. Independent of slit width
D. Depends on distance to screen only

Answer: A

Explanation:
Width = $2\lambda D / a \Rightarrow$ inversely proportional to slit width

Q16. In a Young's double-slit experiment, the ratio of intensities at two points is 4:1. What is the phase difference between them?

A. $\pi/2$
B. π
C. $\pi/3$
D. $\pi/4$

Answer: A

Explanation:
Intensity ratio = $(I_1/I_2) = (A_1 + A_2)^2 : (A_1 - A_2)^2$
$\sqrt{I_1/I_2} = (2A \cos(\varphi/2)) \Rightarrow \sqrt{4/1} = 2 \Rightarrow \cos(\varphi/2) = 1/\sqrt{2} \Rightarrow \varphi/2 = \pi/4 \Rightarrow \varphi = \pi/2$

Q17. In YDSE, if monochromatic light is replaced by white light, what will be observed on the screen?

A. Colored central fringe
B. Colored fringes with white central fringe
C. No fringes
D. Central fringe disappears

Answer: B

Explanation:
Different wavelengths interfere differently except at center (zero path difference), so central fringe is white and others are colored.

Q18. The amplitude of two waves is in the ratio 3:4. The ratio of their maximum to minimum intensities in interference will be:

A. 7:1
B. 49:1
C. 25:1
D. 9:16

Answer: B

Explanation:
$I_{max} = (A_1 + A_2)^2 = (3 + 4)^2 = 49$
$I_{min} = (A_1 - A_2)^2 = (4 - 3)^2 = 1$
Ratio = 49:1

Q19. What is the fringe width if the wavelength is 500 nm, distance between slits is 1 mm and screen is 2 m away?

A. 0.5 mm
B. 1 mm
C. 2 mm
D. 0.25 mm

Answer: B

Explanation:
$\beta = \lambda D/d = (500 \times 10^{-9} \times 2) / (1 \times 10^{-3}) = 1 \times 10^{-3}$ m = 1 mm

Q20. Which of the following phenomena shows the particle nature of light?

A. Interference
B. Diffraction
C. Polarisation
D. Photoelectric effect

Answer: D

Explanation:
Photoelectric effect cannot be explained using wave theory; it supports particle nature.

Q21. A light wave enters from air into glass. Its frequency remains same but:

A. Wavelength increases
B. Speed increases
C. Wavelength decreases
D. None of the above

Answer: C

Explanation:
v = fλ. Frequency remains constant in all media, so if speed decreases in denser medium, wavelength also decreases.

Q22. A single slit of width 0.3 mm is illuminated with light of 500 nm. The angular width of central maximum is:

A. 3.3×10^{-3} rad
B. 2.5×10^{-3} rad
C. 1.5×10^{-3} rad
D. 5.5×10^{-3} rad

Answer: A

Explanation:
Angular width = $2\lambda/a = (2 \times 500 \times 10^{-9}) / (0.3 \times 10^{-3}) = 3.3 \times 10^{-3}$ rad

Q23. Displacement current is introduced to:

A. Maintain continuity of current
B. Displace electric field
C. Transfer electrons
D. Produce heat

Answer: A

Explanation:
Displacement current was introduced by Maxwell to explain current continuity in situations like charging a capacitor.

Q24. Two waves have intensities in ratio 1:9. What is the resultant intensity if they interfere constructively?

A. 100 units
B. 25 units
C. 36 units
D. 16 units

Answer: D

Explanation:
Resultant intensity = $(\sqrt{I_1} + \sqrt{I_2})^2 = (1 + 3)^2 = 16$ units

Q25. The central maximum in diffraction pattern is:

A. Bright and broad
B. Dark and narrow
C. Bright and narrow
D. Dark and broad

Answer: A

Explanation:
The central maximum in single-slit diffraction is the brightest and widest.

Q26. A light wave passes through a medium where its speed is 2×10^8 m/s. What is the refractive index of the medium?

A. 1.5
B. 1.33
C. 2.0
D. 1.2

Answer: A

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

Q27. The displacement current between the plates of a capacitor is maximum when:

A. The plates are fully charged
B. The current in the circuit is zero
C. The rate of change of electric field is maximum
D. Voltage is constant

Answer: C

Explanation:
Displacement current Id = $\varepsilon_o \times (dE/dt) \Rightarrow$ Maximum when rate of change of electric field is maximum.

Q28. A diffraction pattern is obtained using a single slit. If the slit width is halved, the width of central maximum becomes:

A. Half
B. Double
C. Same
D. Four times

Answer: B

Explanation:
Width $\propto 1/a \Rightarrow$ If $a \rightarrow a/2$, width becomes double

Q29. Which of the following is a condition for sustained interference?

A. Equal amplitude sources
B. Monochromatic sources
C. Incoherent sources
D. Same direction of light

Answer: B

Explanation:
Coherent, monochromatic sources are required for sustained and stable interference.

Q30. Which component of Maxwell's equations introduces the concept of displacement current?

A. Gauss's law
B. Ampere’s law with correction
C. Faraday’s law
D. Gauss's law for magnetism

Answer: B

Explanation:
Modified Ampere’s law includes displacement current term:
$\nabla \times B = \mu_o(J + \varepsilon_o \, dE/dt)$

Q31. In a Young’s double-slit experiment, if the distance between the slits is doubled and the screen is moved half as far, what happens to the fringe width?

A. Doubles
B. Halves
C. Becomes one-fourth
D. Remains same

Answer: C

Explanation:
Fringe width $\beta = (\lambda D)/d$.
If $D \rightarrow D/2$ and $d \rightarrow 2d$,
Then $\beta \rightarrow (\lambda \times D/2)/(2d) = (\lambda D)/(4d) = ¼ \times$ original β.

Q32. The slit separation in YDSE is 0.5 mm, screen distance is 2 m, and fringe width is 2 mm. What is the wavelength of light used?

A. 400 nm
B. 500 nm
C. 600 nm
D. 800 nm

Answer: B

Explanation:

$\beta = (\lambda D)/d \Rightarrow \lambda = (\beta \times d)/D = (2 \times 10^{-3} \times 0.5 \times 10^{-3})/(2) = 0.5 \times 10^{-6}$ m = 500 nm

Q33. In a medium, light travels with a speed of 2.25×10^8 m/s. If the frequency is 5×10^{14} Hz, what is its wavelength?

A. 450 nm
B. 600 nm
C. 400 nm
D. 500 nm

Answer: A

Explanation:
$\lambda = v/f = (2.25 \times 10^8)/(5 \times 10^{14}) = 4.5 \times 10^{-7}$ m = 450 nm

Q34. In a single-slit diffraction experiment, the width of central maximum becomes 3 mm when the slit width is 0.1 mm. What will be the angular width?

A. 0.03 rad
B. 0.05 rad
C. 0.015 rad
D. 0.01 rad

Answer: B

Explanation:
Angular width = $2\lambda/a$.
Given width on screen = 3 mm = 0.003 m
Distance D not given, but using approximate θ = width / D $\Rightarrow$ need context or D.
But generally, width $\propto 1/a \Rightarrow$ a $\downarrow$, width $\uparrow$.

So in such cases, use:
Angular width = $2 \times \lambda/a$
$= 2 \times 500 \times 10^{-9} / (0.1 \times 10^{-3}) = 10^{-5} / 10^{-4} = 0.05$ rad

Q35. A polarizer and analyzer are oriented such that the intensity of light reduces to 25%. What is the angle between their axes?

A. 30°
B. 45°
C. 60°
D. 90°

Answer: C

Explanation:
$I = I_o \cos^2\theta \Rightarrow 0.25I_o = I_o \cos^2\theta \Rightarrow \cos^2\theta = 0.25 \Rightarrow \cos\theta = 0.5 \Rightarrow \theta = 60°$

Q36. What happens to the interference pattern if one of the slits in YDSE is closed?

A. Pattern becomes brighter
B. Pattern vanishes
C. Central fringe remains
D. Pattern becomes colored

Answer: B

Explanation:
Interference needs two coherent sources. If one slit is closed, no interference pattern is observed.

Q37. Which wave property remains unchanged when light enters from air to glass?

A. Speed
B. Wavelength
C. Amplitude
D. Frequency

Answer: D

Explanation:
Frequency remains constant when light moves between media. Speed and wavelength change.

Q38. A beam of unpolarized light of intensity I_o passes through a polarizer. What is the intensity of the transmitted light?

A. I_o

B. $I_o/2$
C. $I_o/\sqrt{2}$
D. Zero

Answer: B

Explanation:
A polarizer allows only the component of light in one direction.
Transmitted intensity = $I_o/2$

Q39. The first minimum in single-slit diffraction pattern occurs when:

A. $a \sin\theta = \lambda$
B. $a \cos\theta = \lambda$
C. $a \tan\theta = \lambda$
D. $a/\lambda = \sin\theta$

Answer: A

Explanation:
In single slit, first minimum condition:
$a \sin\theta = \lambda$, where a = slit width.

Q40. A light of wavelength 600 nm produces a fringe width of 2.4 mm. What would be the fringe width if light of 400 nm is used?

A. 1.6 mm
B. 3.6 mm
C. 2.0 mm
D. 1.2 mm

Answer: A

Explanation:
$\beta \propto \lambda \Rightarrow \beta_2 = \beta_1 \times (\lambda_2/\lambda_1) = 2.4 \times (400/600) = 1.6$ mm

Q41. In electromagnetic waves, the direction of electric field, magnetic field and propagation are:

A. All parallel
B. All perpendicular
C. Electric and magnetic parallel, wave perpendicular
D. Electric and magnetic perpendicular, wave direction parallel to electric field

Answer: B

Explanation:
In EM waves, E ⊥ B ⊥ propagation direction — mutually perpendicular.

Q42. Which of the following phenomena cannot be explained by Huygens' wave theory?

A. Diffraction
B. Reflection
C. Polarisation
D. Interference

Answer: C

Explanation:
Huygens' theory cannot explain polarization since it assumes scalar waves.
Polarization proves vector nature of light.

Q43. In a Young's double-slit experiment, the wavelength of light used is 600 nm and the fringe width observed on the screen is 2 mm. If the distance between the slits is 0.3 mm, what is the distance between the slits and the screen?

A. 0.5 m
B. 1.0 m
C. 1.5 m
D. 2.0 m

Answer: B

Explanation:
Fringe width,
$\beta = (\lambda D)/d$
$\Rightarrow D = (\beta \times d)/\lambda$
$= (2 \times 10^{-3} \times 0.3 \times 10^{-3}) / (600 \times 10^{-9})$

$= (0.6 \times 10^{-6}) / (600 \times 10^{-9})$
$= 1.0$ m

Q44. If the amplitude of the resultant wave in interference is zero, the intensity becomes:

A. Maximum
B. Minimum
C. Zero
D. Infinite

Answer: C

Explanation:
If amplitude = 0 (destructive interference), then
$I = A^2 = 0 \Rightarrow$ Zero intensity

Q45. What is the main significance of displacement current?

A. Explains interference
B. Causes diffraction
C. Ensures continuity in Ampere's law
D. Has no physical meaning

Answer: C

Explanation:
Displacement current modifies Ampere’s law to include changing electric fields in regions like capacitors, ensuring current continuity.