DPP 03

Polarization, Brewster's & Malus's Law

Q.1 When the angle of incidence on a material is 60°, the reflected light is completely polarized. The velocity of the refracted ray inside the material is $\sqrt{k} \times 10^8$ (in ms^{-1}). Then k is ______.

Q.2 A beam of plane polarised light of large cross-sectional area and uniform intensity of 3.3 W m^{-2} falls normally on a polariser (cross sectional area $3 \times 10^{-4} m^2$) which rotates about its axis with an angular speed of 31.4rad/s. The energy of light passing through the polariser per revolution, is close to $k \times 10^{-4}$J. Then k is _____.

Q.3 A polarizer – analyser set is adjusted such that the intensity of light coming out of the analyser is just 10% of the original intensity. Assuming that the polarizer – analyser set does not absorb any light, the angle by which the analyser need to be rotated further to reduce the output intensity to zero, is _____(in degree).

Q.4 A ray of light is incident on the surface of a glass plate of refractive index 1.732 at the polarising angle. The angle (in degree) of refraction of the ray is

Q.5 Unpolarized light of intensity I passes through an ideal polarizer A. Another identical polarizer B is placed behind A. The intensity of light beyond B is found to be $\frac{I}{2}$. Now another identical polarizer C is placed between A and B. The intensity beyond B is now found to be $\frac{I}{8}$. The angle between polarizer A and C is

(A) 0° (B) 30° (C) 45° (D) 60°

Q.6 A ray of light is incident on the surface of a glass plate at an angle of incidence equal to Brewster's angle ϕ. If μ represents the refractive index of glass with respect to air, then the angle between reflected and refracted rays is

(A) $90 + \phi$ (B) $\sin^{-1}(\mu \cos \phi)$ (C) 90° (D) $90° - \sin^{-1}(\sin \phi / \mu)$

Q.7 Unpolarized light of intensity I is incident on a system of two polarizers, A followed by B. The intensity of emergent light is $\frac{I}{2}$. If a third polarizer C is placed between A and B, the intensity of emergent light is reduced to $\frac{I}{3}$. The angle between the polarizers A and C is θ. Then

(A) $\cos\theta = \left(\frac{1}{3}\right)^{\frac{1}{2}}$ (B) $\cos\theta = \left(\frac{2}{3}\right)^{\frac{1}{4}}$ (C) $\cos\theta = \left(\frac{2}{3}\right)^{\frac{1}{2}}$ (D) $\cos\theta = \left(\frac{1}{3}\right)^{\frac{1}{4}}$

Q.8 Two beams, A and B of plane polarized light with mutually perpendicular planes of polarization are seen through a polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity), a rotation of polaroid through 30° makes the two beam appear equally bright. If the initial intensities of the two beams are I_A and I_B respectively, then $\frac{I_A}{I_B}$ equals

(A) $\frac{1}{3}$ (B) 3 (C) $\frac{3}{2}$ (D) 1

Q.9 A beam of unpolarised light of intensity I_0 is passed through a polaroid A and then through another polaroid B which is oriented so that its principal plane makes an angle of 45° relative to that of A. The intensity of the emergent light is

(A) $I_0/8$ (B) I_0 (C) $I_0/2$ (D) $I_0/4$

Q.10 When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of the light which does not get transmitted is

(A) zero (B) I_0 (C) $\frac{1}{2}I_0$ (D) $\frac{1}{4}I_0$

Q.11 The angle of incidence at which reflected light in totally polarized for reflection from air to glass (refractive index n), is

(A) $\sin^{-1}(n)$ (B) $\sin^{-1}(1/n)$ (C) $\tan^{-1}(1/n)$ (D) $\tan^{-1}(n)$

ANSWER KEY

1.	3	**2.**	1	**3.**	18.4°	**4.**	30	**5.**	(C)	**6.**	(C)
7.	(B)	**8.**	(A)	**9.**	(D)	**10.**	(C)	**11.**	(D)		