Physicsaholics

DPP – 4 (Wave Optics)

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Q 1. A beam of light strikes a piece of glass at an angle of incidence of 60° and the reflected beam is completely plane polarised. The refractive index of the glass is -
(a)1.5 (b) $\sqrt{3}$ (c) $\sqrt{2}$ (d) (3/2)

Q 2. **Statement-1 :**
On viewing the clear blue portion of the sky through a Calcite Crystal, the intensity of transmitted light varies as the crystal is rotated.

Statement-2 :
The light coming from the sky is polarized due to scattering of sun light by particles in the atmosphere. The scattering is largest for blue light.
(a) Statement-1 is true, statement-2 is false
(b) Statement-1 is true, statement-2 is true, statement-2 is the correct explanation of statement-1
(c) Statement-1 is true, statement-2 is true, statement-2 is not the correct explanation of statement-1
(d) Statement-1 is false, statement-2 is true

Q 3. 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) $\frac{1}{2} I_0$ (b) $\frac{1}{4} I_0$ (c) zero (d) I_0

Q 4. A ray of unpolarised light is incident on a glass plate at the polarising angle 57°.
Then -
(a) the reflected ray and the transmitted ray both will be completely polarised
(b) the reflected ray will be completely polarised and the transmitted ray will be partially polarised
(c) the reflected ray will be partially polarised and the transmitted ray will be completely polarised
(d) the reflected and transmitted both rays will be partially polarised

Q 5. Two Nicol prism are first crossed and then one of them is rotated through 60°. The percentage of incident light transmitted is
(a) 1.25 (b) 25.0 (c) 37.5 (d) 50

Q 6. A beam of unpolarized light is passing through two polarisers . Angle between transmission axes of polarisers is changing with constant rate. If incident beam has intensity I_0, Average intensity of transmitted beam average over long time interval is

(a) I_0

(b) $\frac{I_0}{2}$
(c) $\frac{I_0}{4}$
(d) $\frac{I_0}{3}$

Q 7. Mark the correct statement
(a) We can not get completely polarised light by scattering.
(b) In polarisation by partial reflection , refracted ray is completely polarised at angle of incidence $\tan^{-1}\mu$.
(c)Partially refracted ray has electric field in the plane of reflection only when incidence is at brewesters angle. (plane of incidence , normal and reflected ray is plane of reflection)
(d) None of these

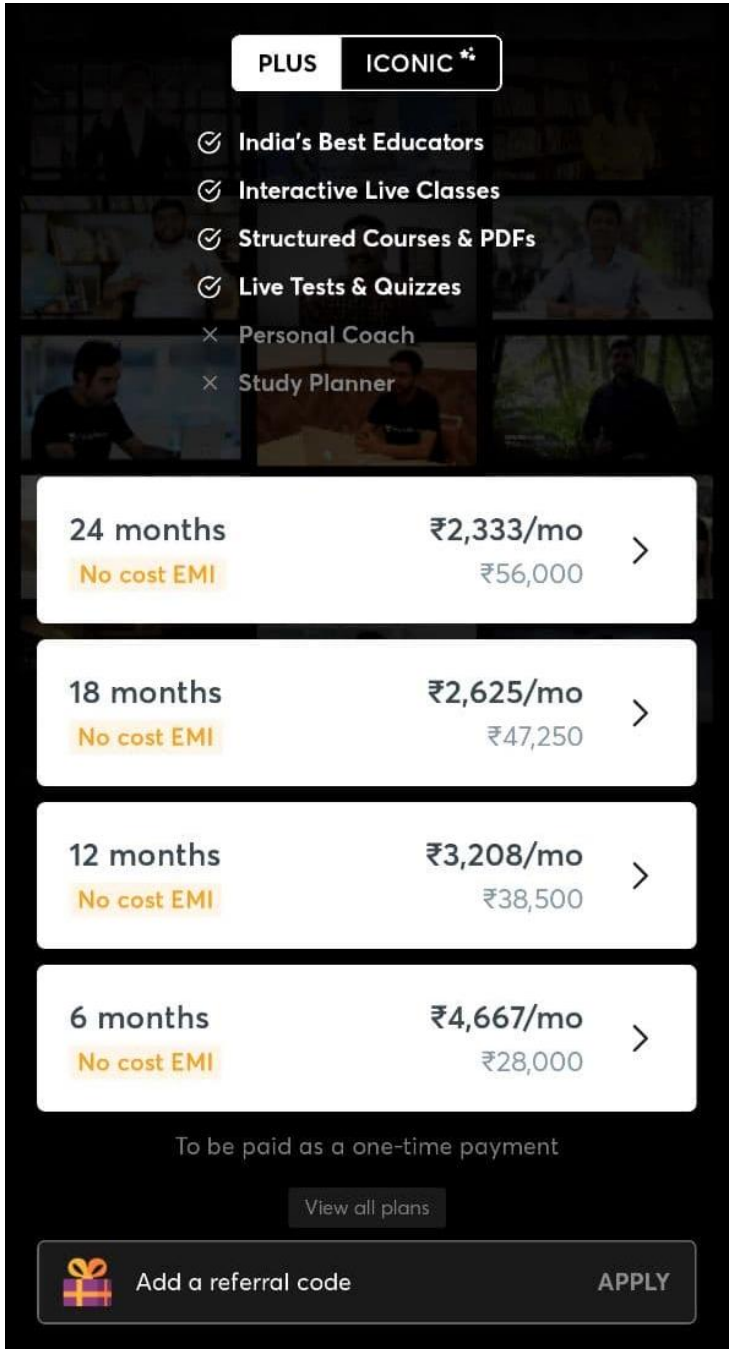
Q 8. Two polarizers have mutually perpendicular transmission axes . A third polarizer is placed between them . Its transmission axis is at angle π/3 with one and π/6 with other polarizer. A completely unpolarized light falls on combination . Ratio intensity of emergent light to encident light is
(a) 1/4
(b) 1/16
(c) 1/8
(d) 3/32

Q 9. Reason behind blue colour of sky is
(a) Refraction
(b) Polarisation
(c) Scattering
(d) None of these

Q 10. Some polarizers are placed on z axis with their transmission axes parallel to xy plane. When a beam of completely unpolarized light falls on combination from one side emergent intensity is quarter of incident intensity. If unpolarized beam falls from other side ratio of emergent intensity to incident intensity
(a) May be quarter
(b) Must be quarter
(c) May be greater than quarter
(d) May be zero

Answer Key

Q.1 b	**Q.2 b**	**Q.3 a**	**Q.4 b**	**Q.5 c**
Q.6 c	**Q.7 d**	**Q.8 d**	**Q.9 c**	**Q.10 b**



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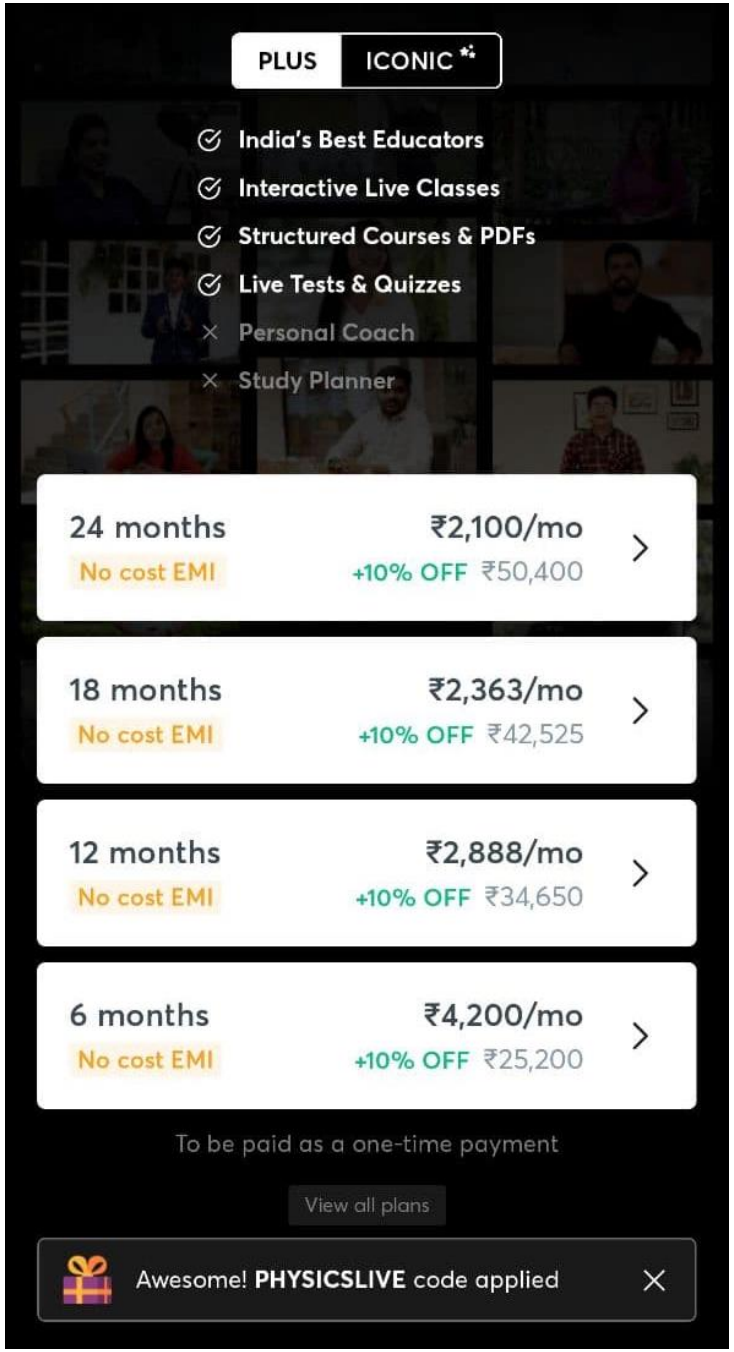
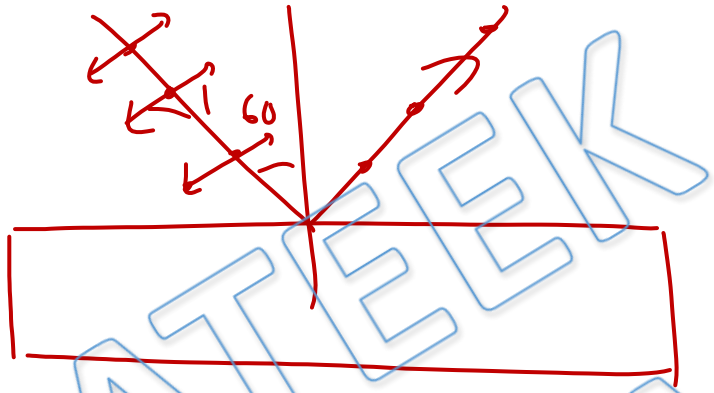


Written Solution

DPP 4 - Wave Optics : Polarisation ,Scattering

By Physicsaholics Team

Q 1) A beam of light strikes a piece of glass at an angle of incidence of 60º and the reflected beam is completely plane polarised. The refractive index of the glass is -



$\mu = \tan i_p$

$= \tan 60^\circ$

$\mu = \sqrt{3}$

(a)1.5 (b) $\sqrt{3}$ (c) $\sqrt{2}$ (d) (3/2)

Q 2)

Statement-1 :

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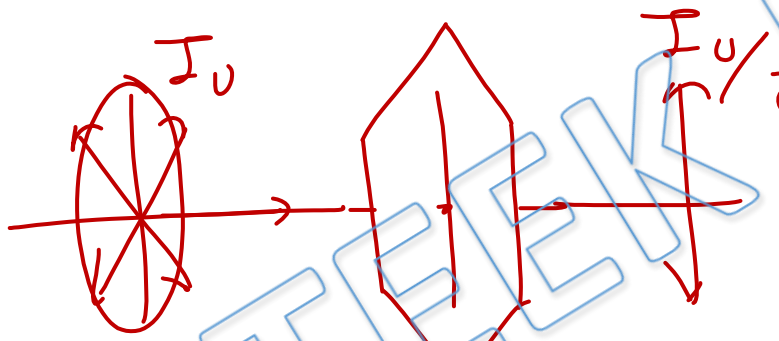
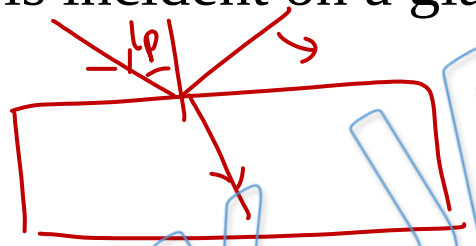


(a) $\frac{1}{2} I_0$ (b) $\frac{1}{4} I_0$ (c) zero (d) I_0

Q 4) A ray of unpolarised light is incident on a glass plate at the polarising angle 57º. Then -



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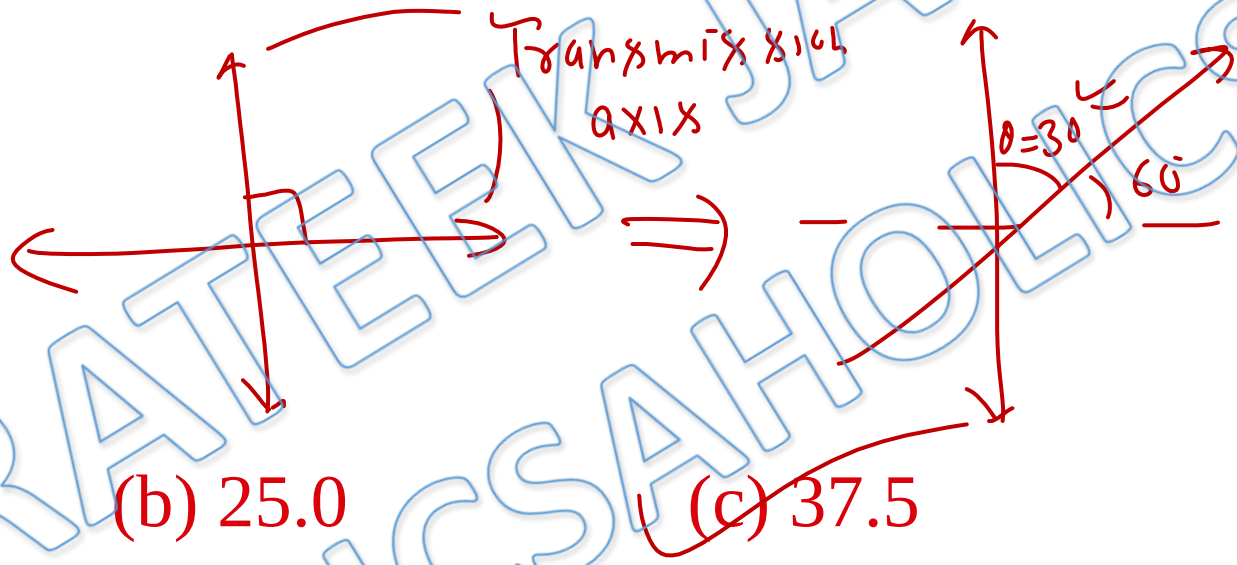

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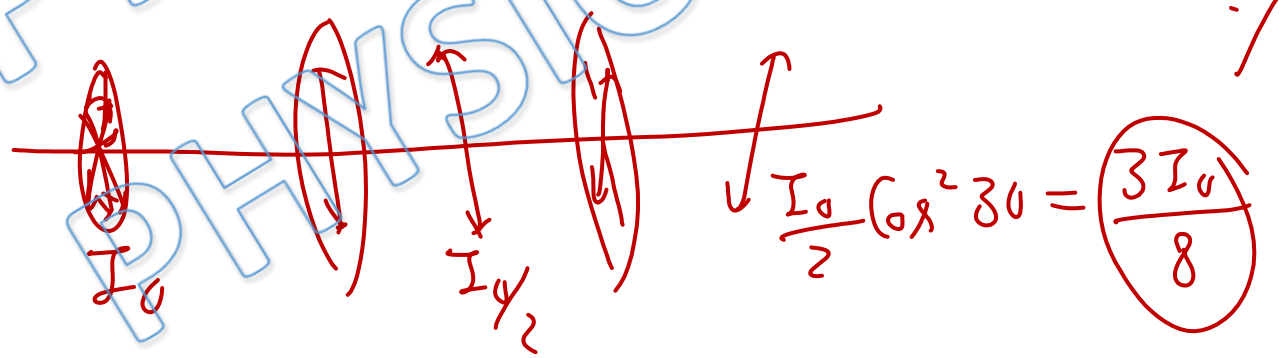

$\% = \frac{3}{8} \times 100 = 37.5\%$

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(a) I_0

(b) $\frac{I_0}{2}$

(c) ~~$\frac{I_0}{4}$~~

(d) $\frac{I_0}{3}$

$$I = \frac{I_0}{2}\cos^2\theta$$

$$I = \frac{I_0}{2}\cos^2\omega t$$

$$\langle I \rangle = \frac{I_0}{2}\langle \cos^2\omega t \rangle$$

$$= \frac{I_0}{4}\langle 2\cos^2\omega t \rangle = \frac{I_0}{4}\langle 1+\cos 2\omega t \rangle$$

$$= \frac{I_0}{4}$$

Q 7) Mark the correct statement

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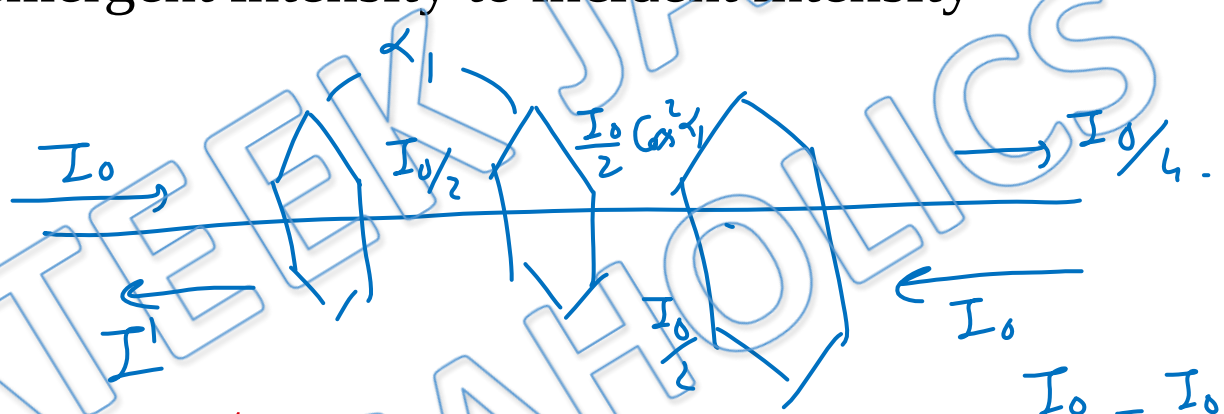

$$\frac{I_0}{4} = \frac{I_0}{2}\cos^2\alpha_1\cos^2\alpha_2\cos^2\alpha_3 - - -\cos^2\alpha_{10}$$

$$I' = \frac{I_0}{2}\cos^2\alpha_{10}\cos^2\alpha_9\cos^2\alpha_8 - - -\cos^2\alpha_1$$

$$= I_0/4.$$

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