

Let's Play With Physics

Wave Optics — Polarization

Practice Questions

1. The intensity of transmitted light when a polaroid sheet is placed between two crossed polaroids at 22.5° from the polarization axis of one of the polaroids is (I_0 is the intensity of polarised light after passing through the first polaroid):

- (A) $\frac{I_0}{8}$
- (B) $\frac{I_0}{16}$
- (C) $\frac{I_0}{4}$
- (D) $\frac{I_0}{2}$

2. An unpolarized light beam travelling in air is incident on a medium of refractive index 1.73 at Brewster's angle. Then:

- (A) Both reflected and transmitted light are perfectly polarized with angles of reflection and refraction close to 60° and 30° , respectively.
- (B) Transmitted light is completely polarized with angle of refraction close to 30° .
- (C) Reflected light is completely polarized and the angle of reflection is close to 60° .
- (D) Reflected light is partially polarized and the angle of reflection is close to 30° .

3. An unpolarised light beam strikes a glass surface at Brewster's angle. Then:

- (A) The reflected light will be partially polarised.
- (B) The refracted light will be completely polarised.
- (C) Both the reflected and refracted light will be completely polarised.
- (D) The reflected light will be completely polarised but the refracted light will be partially polarised.

4. If unpolarised light is incident on a plane surface of refractive index $\sqrt{3}$ at Brewster's angle, then the angle of refraction is:

- (A) 0°
- (B) 30°
- (C) 60°
- (D) 90°

5. A beam of unpolarised light of intensity I_0 is passed through polaroid A , then through another polaroid B oriented at 60° to A , and finally through another polaroid C oriented at 45° relative to B . The intensity of the emergent light is:

- (A) $\frac{I_0}{16}$
- (B) $\frac{I_0}{4}$

- (C) $\frac{I_0}{2}$
(D) $\frac{I_0}{32}$

6. The Brewster's angle i_b for an interface should be:

- (A) $45^\circ < i_b < 90^\circ$
(B) $i_b = 90^\circ$
(C) $0^\circ < i_b < 30^\circ$
(D) $30^\circ < i_b < 45^\circ$

7. After passing through a polariser, a linearly polarised light of intensity I is incident on an analyser making an angle of 30° with that of the polariser. The intensity of light emitted from the analyser will be:

- (A) $\frac{3I}{4}$
(B) $\frac{I}{4}$
(C) $\frac{I}{2}$
(D) $\frac{I}{\sqrt{2}}$

8. Unpolarised light is incident from air on a plane surface of a material of refractive index μ . At a particular angle of incidence i , it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation?

- (A) Reflected light is polarised with its electric vector parallel to the plane of incidence.
(B) Reflected light is polarised with its electric vector perpendicular to the plane of incidence.
(C) $i = \sin^{-1}\left(\frac{1}{\mu}\right)$
(D) $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

9. Two Polaroids P_1 and P_2 are placed with their axes perpendicular to each other. Unpolarised light of intensity I_0 is incident on P_1 . A third polaroid P_3 is kept between P_1 and P_2 such that its axis makes an angle 45° with that of P_1 . The intensity of transmitted light through P_2 is:

- (A) $\frac{I_0}{8}$
(B) $\frac{I_0}{16}$
(C) $\frac{I_0}{4}$
(D) $\frac{I_0}{2}$

10. Unpolarized light of intensity 32 W m^{-2} passes through three polarizers such that the transmission axes of the first and second polarizer make an angle of 30° with each other and the transmission axis of the last polarizer is crossed with that of the first. The intensity of the final emerging light will be:

- (A) 32 W m^{-2}
- (B) 3 W m^{-2}
- (C) 8 W m^{-2}
- (D) 4 W m^{-2}

11. A beam of unpolarised light of intensity I_0 is passed first through a tourmaline crystal A and then through another tourmaline crystal B oriented so that its principal plane is parallel to that of A . The intensity of the final emergent light is:

- (A) I_0
- (B) $\frac{I_0}{2}$
- (C) $\frac{I_0}{4}$
- (D) $\frac{I_0}{\sqrt{2}}$

12. Two polaroids are kept crossed to each other. Now one of them is rotated through an angle of 45° . The percentage of incident light now transmitted through the system is:

- (A) 15%
- (B) 25%
- (C) 50%
- (D) 60%

13. If the polarising angle for a material is 60° , then the refractive index of the material will be:

- (A) 1.3
- (B) $\sqrt{2}$
- (C) $\sqrt{3}$
- (D) $3\sqrt{2}$

14. A clear sheet of polaroid is placed on the top of a similar sheet so that their polarising axes make an angle of 30° with each other. The ratio of the intensity of the emerging light to that of the incident unpolarised light is:

- (A) 1 : 1
- (B) 3 : 8
- (C) 1 : 2
- (D) 3 : 4

15. The phenomenon of polarization of light shows that light has which nature?

- (A) Longitudinal wave nature

- (B) Transverse wave nature
 - (C) Particle nature
 - (D) Both longitudinal and transverse nature
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Answer Key

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|--------|--------|--------|---------|---------|
| 1. (A) | 4. (B) | 7. (A) | 10. (C) | 13. (C) |
| 2. (C) | 5. (A) | 8. (B) | 11. (B) | 14. (B) |
| 3. (D) | 6. (A) | 9. (A) | 12. (B) | 15. (B) |

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