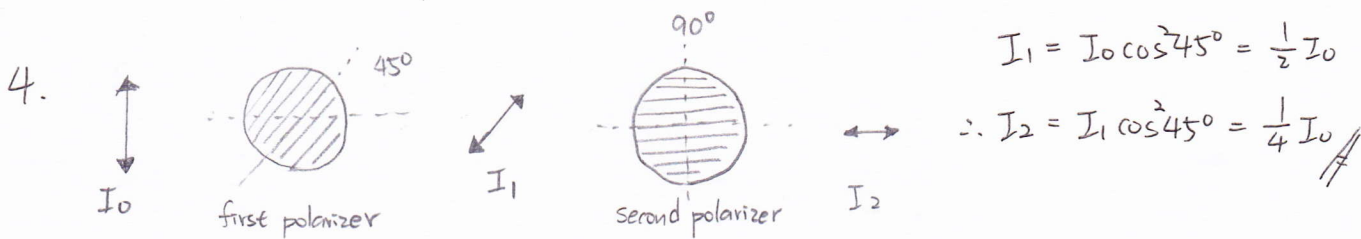


Ch 24 Assigned Questions

2014 Spring
PHYS 1Cb

1. (a) False. For example, violet light ($\lambda = 400\text{nm}$) and red light ($\lambda = 700\text{nm}$) has different λ .
- (b) False. For example, X-ray ($f = 10^{18}\text{Hz}$) has different frequency from microwave ($f = 10^{10}\text{Hz}$).
- (c) True. EM waves travel at $3 \times 10^8\text{ m/s}$ in vacuum.
- (d) True. $\vec{c} = \vec{E} \times \vec{B}$
- (e) False. Speed depends on the medium. All EM waves have same speed in ^{the} same medium.

2. $\frac{E_{\text{max}}}{B_{\text{max}}} = c \Rightarrow E_{\text{max}} = c \cdot B_{\text{max}} = 3 \times 10^8 \cdot 1.5 \times 10^{-7} = 4.5 \times 10 = 45 \text{ V/m}$



$$I_1 = I_0 \cos^2 45^\circ = \frac{1}{2} I_0$$

$$\therefore I_2 = I_1 \cos^2 45^\circ = \frac{1}{4} I_0$$

5. $f = 2.45 \text{ GHz} = 2.45 \times 10^9 \text{ Hz} \quad \therefore \lambda = \frac{c}{f} = \frac{3 \times 10^8}{2.45 \times 10^9} = 0.122 \text{ m} = 12.2 \text{ cm}$ (b)

7. The (i) frequency, (ii) wavelength and the (iii) speed of the EM wave stay constant.

The (iv) intensity I decreases $\therefore I = \frac{P}{A} = \frac{P}{4\pi r^2}$

The (v) amplitude of electric field E_{max} decreases because $I = \frac{E_{\text{max}}^2}{2\mu_0 c}$

8. EM wave travels in single direction \therefore (i) frequency, (ii) wavelength, (iii) speed, (iv) intensity and (v) the amplitude of magnetic field all stay constant.

10. $\therefore \frac{E}{B} = c = \text{constant}$ (i) \therefore the amplitude of magnetic field will be doubled, two times larger.

(ii) $I = \frac{E_{\text{max}}^2}{2\mu_0 c} \propto E_{\text{max}}^2 \quad \therefore$ the intensity will become 4 times larger.

11. This problem has been deleted.

12. $\therefore \vec{E} = \vec{B} \times \vec{c} \quad \therefore$ Using right hand rule, the direction of \vec{E} should be toward $-\hat{z}$ (d)