

Applications numériques

$$I) P_1 = \epsilon_0 \chi \bar{E} \quad (0,25) \quad \left\{ \begin{array}{l} P_2 \\ P_1 \end{array} \right. \frac{2d\bar{E}^2}{\epsilon_0 \chi \bar{E}} = 0,01 \quad (0,25)$$

$$P_2 = 2d\bar{E}^2 \quad (0,25)$$

$$\Rightarrow \frac{2d\bar{E}}{\epsilon_0 \chi} = 0,01 \Rightarrow \bar{E} = 0,01 \cdot \frac{\epsilon_0 \chi}{2d} \quad (0,25)$$

$$AN: \bar{E} = 0,01 \cdot \frac{8,85 \times 10^{-12} \cdot 1}{2 \times 10^{-23}} = \frac{8,85}{2} \cdot 10^{-14} \cdot 10^{23}$$

$$\bar{E} = 4,425 \times 10^9 \text{ V/m} \quad (0,25)$$

$$II) P_3 = 4 \chi^{(3)} \bar{E}^3 \quad (0,25)$$

$$\frac{P_3}{P_1} = 0,01 \Rightarrow \frac{4 \chi^{(3)} \bar{E}^3}{\epsilon_0 \chi \bar{E}} = 0,01 \quad (0,25)$$

$$\frac{4 \chi^{(3)} \bar{E}^2}{\epsilon_0 \chi} = 0,01 \Rightarrow \bar{E} = \sqrt{\frac{0,01 \cdot \epsilon_0 \chi}{4 \chi^{(3)}}} \quad (0,25)$$

$$AN: \bar{E} = \sqrt{\frac{0,01 \cdot 8,85 \times 10^{-12} \cdot 1}{4 \times 10^{33}}} = \sqrt{2,21 \times 10^{-14} \cdot 10^{33}}$$

$$\bar{E} = 4,69 \times 10^9 \text{ V/m} \quad (0,25)$$

$$III) I^{2\omega} = 2 \left(\frac{\mu_0}{\epsilon_0} \right)^{3/2} \frac{d^2}{n^3} \cdot L \cdot \omega^2 (I^\omega)^2 \quad (0,25)$$

$$\frac{I^{2\omega}}{I^\omega} = \frac{1}{10} = 2 \left(\frac{\mu_0}{\epsilon_0} \right)^{3/2} \frac{d^2}{n^3} \cdot L \cdot \omega^2 \cdot I^\omega$$

$$\Rightarrow L = \sqrt{\frac{1}{20} \frac{n^3}{d^2} \cdot \frac{1}{I^\omega \cdot \omega^2 \cdot \left(\frac{\mu_0}{\epsilon_0} \right)^{3/2}}} \quad (0,25)$$

$$= \sqrt{\frac{1}{20 \cdot I^\omega \cdot \omega^2} \cdot \frac{n^3}{d^2} \cdot \left(\frac{\epsilon_0}{\mu_0} \right)^{3/2}}$$

$$\omega = 2\pi f \quad (0,25)$$

$$\chi = \epsilon_r - 1 = n^2 - 1 \rightarrow n = \sqrt{1 + \chi} \quad (0,25)$$

$$AN: L = \sqrt{\frac{1}{20 \cdot 3 \cdot 10^{12} \cdot 10^4 \cdot (2,314 \times 10^4)^2 \cdot \left(\frac{10^{-23}}{10^{23}} \right)^2 \cdot \left(\frac{8,85 \times 10^{-12}}{4 \cdot \pi \cdot 10^7} \right)^{3/2}}} \quad (0,25)$$

$$L = 11,7 \mu\text{m} \quad (0,25)$$