

1. $\rho = 0 \Rightarrow \vec{\nabla} \cdot \vec{E} = 0$
(ii) and (iii)

2. $e^{i(\omega t + kx)}$

$\omega = 20\pi$, $k = 10\pi$.

$\therefore v = \frac{\omega}{k} = 2 \text{ m/s}$

$\lambda = \frac{2\pi}{k} = \frac{2\pi}{10\pi} = 0.2 \text{ m}$

3. ① \rightarrow glass, ② \rightarrow air

(a) $\Gamma = \frac{n_1 - n_2}{n_1 + n_2} = \frac{\frac{3}{2} - 1}{\frac{3}{2} + 1} = \frac{1}{5} = 0.2$

(b) $\Gamma > 0$. \vec{E} does not flip sign.

(c) $T = 1 + \Gamma = 1.2$ or $1 + \frac{1}{5} = \frac{6}{5}$

4. $v = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{4 \times 10^{-6} \times 10 \times 10^{-9}}} \text{ m/s}$

$= \frac{1}{2 \times 10^{-7}} = 5 \times 10^6 \text{ m/s}$

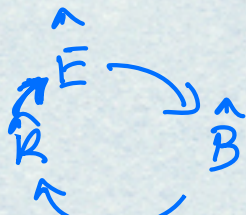
5. $\vec{k} = 3\hat{x} + 4\hat{y}$, $|\vec{k}| = 5$

a) $\lambda = \frac{2\pi}{5} = 1.257 \text{ m}$

b) $\omega = 2000$

$\therefore v = \frac{2000}{5} = 400 \text{ m/s}$

c) $\hat{k} = \frac{3}{5}\hat{x} + \frac{4}{5}\hat{y}$

d)  $\hat{k} \times \hat{E} = \hat{B}$

$\hat{E} = \hat{z}$

$\hat{B} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{3}{5} & \frac{4}{5} & 0 \\ 0 & 0 & 1 \end{vmatrix}$

$= \hat{x} \cdot \frac{4}{5} - \hat{y} \cdot \frac{3}{5}$

[The marks are self explanatory. There's no part marking. If a answer in certain part depends on previous ones, and the previous parts are incorrect, that automatically makes the answer in the current part void due to wrong/no explanation].