True or False: EM Waves can have velocities higher than c.

A. True
B. False
C. I don't know what to believe anymore

ANNOUNCEMENTS

- Quiz 6 (Next Friday)
  - Given two infinite plane waves at different frequencies, determine the resulting wave in a "good conductor"
  - Sketch the waves in free space and in the conductor
  - Discuss the implications from your analysis

Given two waves, $f_1(t) = A\cos(\omega_1 t)$ and $f_2(t) = A\cos(\omega_2 t)$, let's propose an average frequency: $\omega_a = \frac{1}{2}(\omega_1 + \omega_2)$ and a modulation frequency: $\omega_m = \frac{1}{2}(\omega_1 - \omega_2)$. How can you write ω_1 and ω_2 in terms of these frequencies?

A. $\omega_1 = \omega_a - \omega_m \qquad \omega_2 = \omega_a + \omega_m$
B. $\omega_1 = \omega_a + \omega_m \qquad \omega_2 = \omega_a - \omega_m$
C. $\omega_1 = \frac{\omega_a + \omega_m}{2} \qquad \omega_2 = \frac{\omega_a - \omega_m}{2}$
D. $\omega_1 = \frac{\omega_a - \omega_m}{2} \qquad \omega_2 = \frac{\omega_a + \omega_m}{2}$
E. None of these

Given two waves, $f_1(t) = A\cos(\omega_1 t)$ and $f_2(t) = A\cos(\omega_2 t)$, which of the following correspond to the total wave, $f_T(t)$?

A. $A\cos(\omega_1 t) + A\cos(\omega_2 t)$
B. $A^2\cos(\omega_1 t)\cos(\omega_2 t)$
C. $2A\cos((\omega_1 + \omega_2)t)\cos((\omega_1 - \omega_2)t)$
D. $2A\cos(\frac{(\omega_1+\omega_2)}{2}t)\cos(\frac{(\omega_1-\omega_2)}{2}t)$
E. More than one of these

For our atomic model of permittivity we found $\widetilde{\varepsilon}$ to be

$$\widetilde{\varepsilon} = \varepsilon_0 \left(1 + \frac{Nq^2}{\varepsilon_0 m} \sum_i \frac{f_i}{(\omega_i^2 - \omega^2) - i\gamma_i \omega} \right)$$

We also know that $\dfrac{n}{c} = \dfrac{\widetilde{k}}{\omega} = \sqrt{\widetilde{\varepsilon}\mu}$.

- Find (and simplify) a formula for n, assuming the term adding to "1" above is small.
- In that limit, find k_R and k_I. What does each one tell you, physically?
- Sketch both of these as functions of ω (assuming that only one term in that sum "dominates")