1 a $\Phi = B(t)\cdot A \cdot N = B_0 \sin \omega t \cdot \pi r^2 \cdot N$

$$V_\varepsilon = -\frac{d\Phi}{dt} = -\underbrace{N\pi r^2 B_0\, \omega}_{V_{max}} \cos \omega t$$

$$V_{max} = N\cdot\pi r^2 \cdot B_0 \cdot \omega = 100\cdot\pi\cdot(0{,}10\,m)^2\cdot 0{,}05\,T\cdot 2\pi\cdot 20\,s^{-1} = 19{,}74\,V$$

$$V_{eff} = \frac{V_{max}}{\sqrt{2}} \text{ (sinusoidal)} \Rightarrow V_{eff} = \underline{\underline{13{,}96\,V}}$$

b Si L es despreciable, solo hay una resistencia óhmica en el circuito:

$$I_{eff} = \frac{V_{eff}}{R} = \frac{13{,}96\,V}{5\,\Omega} = \underline{\underline{2{,}79\,A}}$$

c Si L no es despreciable, tenemos un circuito RL serie:

$$|Z| = \sqrt{R^2 + (\omega L)^2} = \sqrt{(5\,\Omega)^2 + (2\cdot\pi\cdot 20\,s^{-1}\cdot 0{,}05\,H)^2}$$
$$= \sqrt{(5\,\Omega)^2 + (6{,}28\,\Omega)^2} = 8{,}0\,\Omega$$

$$\Rightarrow I_{eff} = \frac{V_{eff}}{|Z|} = \frac{13{,}96\,V}{8{,}0\,\Omega} = \underline{1{,}74\,A}$$

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3 $\vec{E}(z,t) = E_0 \sin(kz - \omega t)\,\hat{u}_y$

a $E(z)$, luego la dirección de propagación es la del eje z, hacia valores positivos debido al signo (−) entre kz y ωt.

b onda EM: $\omega = ck$; $\lambda = \frac{c}{f} = \frac{3\cdot 10^8\,\frac{m}{s}}{95\cdot 10^6\,\frac{1}{s}} = \underline{\underline{3{,}16\,m}}$; $T = \frac{1}{f} = \frac{1}{95\cdot 10^6\,s^{-1}} = \underline{\underline{1{,}05\cdot 10^{-8}\,s}}$

c $k = \frac{2\pi}{\lambda} = \frac{\omega}{c} \Rightarrow \underline{\underline{k = 1{,}99\,m^{-1}}}$

d onda EM: $B_0 = \frac{E_0}{c} = \frac{10\,N/C}{3\cdot 10^8\,\frac{m}{s}} = \underline{\underline{3{,}33\cdot 10^{-8}\,T}} \rightarrow \underline{\underline{\vec{B} \uparrow\uparrow \hat{u}_x}}$

$\vec{B} \perp \vec{E}$ y $\vec{B} \perp$ dir. propagación

② ⓐ $|Z_1| = \sqrt{R_1^2 + X_c^2} = \sqrt{(10\Omega)^2+(10\Omega)^2} = 14{,}14\,\Omega$

$|Z_2| = \sqrt{R_2^2 + X_c^2} = \sqrt{(40\Omega)^2+(30\Omega)^2} = 50\,\Omega$

i)

$\Rightarrow I_{1,eff} = \frac{V_{eff}}{|Z_1|} = \frac{115\,V}{14{,}14\,\Omega} = \underline{8{,}13\,A}$

$I_{2,eff} = \frac{V_{eff}}{|Z_2|} = \frac{115\,V}{50\,\Omega} = \underline{2{,}3\,A}$

ii) $\tan\delta_1 = \frac{-X_c}{R_1} = \frac{-10\,\Omega}{10\,\Omega} = -1 \Rightarrow \delta_1 = -45^\circ = \underline{-0{,}79\,(rad)}$

$\tan\delta_2 = \frac{X_L}{R_2} = \frac{30\,\Omega}{40\,\Omega} = \frac{3}{4} \Rightarrow \delta_1 = 36{,}87^\circ = \underline{0{,}64\,(rad)}$

ⓑ $\langle P_1\rangle = V_{eff}\cdot I_{eff,1}\cdot\cos\delta_1 = 115\,V\cdot 8{,}13\,A\cdot\cos(-45^\circ)$
$= \underline{661{,}1\,W}$

$\langle P_2\rangle = V_{eff}\cdot I_{eff,2}\cdot\cos\delta_2 = 115\,V\cdot 2{,}3\,A\cdot\cos 36{,}87^\circ = \underline{211{,}6\,W}$

ⓒ $\langle P\rangle = V_{eff}\cdot I_{eff}\cdot\cos\delta$

Se puede calcular la impedancia total del circuito Z:

$\frac{1}{Z} = \frac{1}{Z_1} + \frac{1}{Z_2}$ y, a partir de ella, calcular

$I_{eff} = \frac{V_{eff}}{|Z|}$ y $\tan\delta = \frac{Im\{Z\}}{Re\{Z\}}$ pero, puesto que nos dan δ y obviamente

$$\boxed{\begin{aligned}\langle P\rangle &= \langle P_1\rangle + \langle P_2\rangle\\ &= 661{,}2\,W + 211{,}6\,W\\ \langle P\rangle &= 872{,}7\,W\end{aligned}}$$

podemos hacer $I_{eff} = \frac{\langle P\rangle}{V_{eff}\cdot\cos\delta}$

$= \frac{872{,}7\,W}{115\,V\cdot\cos(-29{,}9^\circ)} = \underline{8{,}75\,A}$

Obviamente, (!)
$I_{eff} \neq I_{eff\,1} + I_{eff\,2}$