1. \[ V = V_{\text{max}} \sin \omega t \] 
\[ \Rightarrow \Phi_e = EA = \frac{V_{\text{max}}A}{d} \sin \omega t \]
\[ E = \frac{V}{d} = \frac{V_{\text{max}}}{d} \sin \omega t \]
\[ \frac{d\Phi_e}{dt} = \frac{V_{\text{max}}A}{d} \omega \cos \omega t \Rightarrow I_d = \epsilon_0 \frac{d\Phi_e}{dt} = \epsilon_0 \frac{V_{\text{max}}A}{d} \omega \cos \omega t \]
\[ A = \pi r^2 \Rightarrow r = \sqrt{\frac{A}{\pi}} \quad B = \frac{\mu_0 I_d}{2\pi r} = \frac{\mu_0 \epsilon_0 V_{\text{max}} \pi r}{2\pi r} \frac{V_{\text{max}}A}{d} \omega \cos \omega t \]
\[ \text{approx.} \]
\[ B = \frac{\mu_0 \epsilon_0 V_{\text{max}} \sqrt{A}}{2 \sqrt{\pi} \pi d} \cos \omega t \]

2. (a) (3-D perspective) \[ \begin{align*}
\text{E} & \rightarrow S \\
\text{B} & \rightarrow S
\end{align*} \]

(b) \[ f = \frac{c}{\lambda} = \frac{3 \times 10^8 \text{ m/s}}{91.567 \text{ m}} = 7.22 \text{ MHz} \]

(c) \[ E_{\text{max}} = 25 \text{ mV/m} \Rightarrow B_{\text{max}} = \frac{E_{\text{max}}}{c} = \frac{25 \times 10^{-3} \text{ V/m}}{3 \times 10^8 \text{ m/s}} = 8.3 \times 10^{-11} \text{ T} \]

(d) \[ S_{\text{av}} = \frac{1}{2} \mu_0 \frac{E_{\text{max}} B_{\text{max}}}{\lambda} = \frac{1}{2} \frac{25 \times 10^{-3} \text{ V/m}}{4 \pi \times 10^{-7} \text{ T/m}} \times 8.3 \times 10^{-10} \text{ T} \]
\[ \text{average} \quad S_{\text{av}} = 8.3 \times 10^{-7} \text{ W/m}^2 = 0.83 \mu\text{W/m}^2 \]

5. \[ \lambda = 723 \text{ nm} \quad (a) \quad \tan \theta_p = \lambda = 1.60 \]
\[ \theta_p = 58^\circ \]
\[ \lambda_n = \lambda / n = 452 \text{ nm} \]

5. \[ \lambda_n = \lambda / n = 452 \text{ nm} \]
3.

\[ M = \frac{-h}{p} = \frac{h'}{h} = \frac{-21.4 \text{ mm}}{30.0 \text{ mm}} = -0.713 \Rightarrow h' = 0.713p \]

\[ p - h' = 34.3 \text{ mm} = p - 0.713p = 0.287p \]

\[ \Rightarrow p = 34.3 \text{ mm} / 0.287 = 120 \text{ mm} \]

\[ f = \frac{1}{1} = \frac{1}{120 \text{ mm}} + \frac{1}{0.713 \times 120 \text{ mm}} = \frac{1}{50 \text{ mm}} \]

\( f = 50 \text{ mm} \)

(c) Mirror is concave, image is real.

4.

\[ \lambda = 623 \text{ nm} \]

\( l = 3.6 \text{ m} \)

\( d = 0.900 \text{ mm} \)

\( L = 2\pi \lambda = 1.81 \times 10^{-7} \text{ rad/m} \)

\[ \theta = \frac{2d}{\lambda} \sin \theta = \frac{h}{L} \]

\[ \theta = 4.15 \times 10^{-3} \text{ rad} \]

Interference minimum at \( d \sin \theta = \frac{1}{2} \lambda \Rightarrow \theta = \frac{\lambda}{2d} = 3.46 \times 10^{-4} \text{ rad} \)

\[ y = L \theta = 1.25 \text{ mm} \]