Phys 2120
Hints — HW15, Week of Apr. 28 (due May. 2)

1. Use $\lambda f = c$. Watch the units...

2. The E and B fields in an electromagnetic wave (along their respective directions) are related by $E = cB$. (This is true at all times, not just for the maximum values.)

3. Again, $E = cB$.

4. The The intensity I is related to the electric field amplitude E_m by:

$$I = S_{\rm avg} = \frac{1}{2c\mu_0} E_m^2$$

Also, for radiation from a point source of power P the intensity at a distance r is

$$I = \frac{P}{4\pi r^2}$$

From these, you can solve for r.

5. As before, $E_m = cB_m$.

6. Find the intensity of the radiation $I = S_{\rm avg}$ using the formula given above.

7. The power dissipated is the intensity times the cross-sectional area of the beam:

$$P = IA$$

8. The first polaroid sheet (the "polarizer") changes the intensity of the light by a factor of $\frac{1}{2}$. The second sheet (the "analyzer") gives a further factor of $\cos^2\theta$.

When the problem says (for example) that the beam intensity is reduced by 81.2%, it means that the light which has passed through both sheets is $(100 - 81.4)\% = 18.6\% = 0.186$ of the original intensity.

Solve for θ.

9. You are given the *vacuum* wavelength of the light, so use $\lambda f = c$.

10. $\lambda_{\rm med} = \lambda/n$

11. $v_{\rm med} = \frac{c}{n}$

12. I may toss this one... on mine there was no possible asnwer because the angle of refracted ray was impossibly large! If yours comes out like this, just input 0 as the answer, and the computer will think it's OK!

Use Snell's law; in air, use $n = 1.000$.

13. Snell's Law!

$$\lambda f = c \quad \text{or else} \quad \lambda_{\text{med}} f = v_{\text{med}} \qquad c = 2.998 \times 10^8 \,\tfrac{\text{m}}{\text{s}} \qquad v_{\text{med}} = \frac{c}{n}$$

$$n_! \sin\theta_1 = n_2 \sin\theta_2$$