PHYS 462 (optics) HW#6

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1 8.5

$$\tilde{E} = \frac{\hat{i} - \hat{j}}{\sqrt{2}} E_\circ e^{(\omega t + (x+y)/\sqrt{2}\lambda + \pi/2)i}$$

2 8.9

We are told that the angle between the light and the polariser is 60° we also know that the intensity goes as $\cos^2(\theta)$ of the incident light. So the intensity will be $(\cos(60))^2 = (\frac{1}{2})^2 = .25$ so 25% of the light will be transmitted.

3 8.14

We will assume that the polariser is ideal given no other information. We then see that there is a 60° angle between the polariser and the incident light. From the previous section we know that the intensity will be quartered to $50W/m^2$.

4 8.18

If we take non-polarized light and polarize it the intensity is reduced by the average value of $\cos^2(x)$ witch is $\frac{1}{2}$ so the first polariser reduces the intensity by .5. if we then have a polariser at 50° off of the previous one we will reduce the intercity by another $\cos^2(50)$ so our intensity will be $I = I_\circ \cdot .5cos^2(50°) = 207W/m^2$. With the third polariser in place we then get $I = I_\circ \cdot .5cos^2(25°)cos^2(25°) = 337W/m^2$.

5 8.23

The light leaving the paper has lost its polarization since the paper absorbs the light and then transmits the light.

6 8.30

This will be the Brewsters angle so (8.25) $\tan(\theta) = n = 1.39$.

7 8.35

In the crystal the ordinary waves have a index of 1.5443 so there wavelength is $381.60nm$ and there frequency is preserved at $c/\lambda = 5.09E14Hz$. The extraordinary light has a index of 1.5534 and so will have a wavelength of $379.36nm$ and the same frequency of $5.09E14Hz$.

8 8.41

The initial polariser will reduce the outgoing light by 1/2 however the quarter wave plates will not reduce intensity and will simply rotate the light by $\pi/20$ thus oner it has gone through all of the plates it will be rotated by $\pi/2$ and be able to go through the last polariser. So the total intensity will be reduced by 1/2.