

GLY 4200

25 points

HOMEWORK 9

### Properties of Light in Minerals

Show all work. Label answers, including units. Express answers to the correct number of significant figures.

The relationship between the speed of light ( $c$ ), frequency ( $f$ ), and wavelength ( $\lambda$ ) is:

$$c = f\lambda$$

$$c = 2.998 \times 10^8 \text{ m/s.}$$

1. If  $\lambda = 555 \text{ nm}$ , what is  $f$ ?

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2. If  $f = 6.76 \times 10^{14} \text{ Hz}$ , what is  $\lambda$  (expressed in nm)?

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The index of refraction is defined as:

$$n = \frac{c_{\text{vacuum}}}{c_{\text{medium}}}$$

3.  $n_{\text{Chloroargyrite}} = 2.07$ . What is the speed of light in chloroargyrite?

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Snell's Law is given by the equation:

$$\frac{\sin \angle i}{\sin \angle r} = \frac{n_r}{n_i}$$

4. If light travels from air into sylvite, and the angle of incidence is  $29.6^\circ$ , what is  $\Delta r$ ?  
 $n$  for sylvite = 1.490.

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Brewster's Law of maximum polarization is:

$$\frac{n_r}{n_i} = \tan \angle i$$

5. For sylvite, what is  $\Delta i$ ?

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The critical angle is given by a variation of Snell's Law:

$$\frac{n_i}{n_r} \cdot \sin \angle i = 1.00$$

6. Suppose light passes from sylvite into air. What is the critical angle? HINT: Remember that light is going from sylvite into air. What is the incident medium?

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The formula for the Numerical Aperture (N.A.) is:

$$N.A. = n \sin \mu, \text{ where}$$

$$\mu = \frac{\angle \text{angular\_aperature}}{2}$$

7. If the angular aperture is  $35.7^\circ$ , and  $n = 1.544$ , what is N.A.?