GEOL3010 Light Problem Set 9

1. What is the velocity of light in a glass whose index of refraction is 1.50?

V = (3 x10^8)/1.50
V = 2 x10^8 m/s

2. Light travels at a velocity of 2.25 x 10^8 m/s in water. Calculate the index of refraction of water.

Nw = (3/2.25)
Nw = 1.33

3. What is the frequency of light that has a wavelength of 4861Å in a vacuum?

$\nu = c/\lambda$
ν = 3 x 10^{18} (Å/s) / 4861
ν = 6.17 x 10^{14} hz

4. What is the frequency of this light in water?

ν = 6.17 x 10^{14} hz
Frequency does not change

5. What is the wavelength of this light in water?

λ = 4861/1.33
λ = 3655 Å

6. In going from air to water, is light bent toward the normal (perpendicular), or away from the normal to the surface?

toward

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c = 3.0 x 10^8 m/sec

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7. In going from water to air, what is the critical angle (measured from the perpendicular), above which a ray from the water is totally reflected back into the water?

$N_i \sin \omega_i = n_r \sin \omega_r$
$1.33 \sin \omega_c = 1 * 1$
$\omega_c = \sin^{-1}(1/1.33)$
$\omega_c = 48.75^o$

8. A piece of glass has a Lambert's Law absorption coefficient of 0.5 cm^{-1} for all wavelengths of light. Calculate the percent of a beam of white light that is absorbed in passing through one centimeter of this glass.

$I/I_0 = \exp(-kt) = \exp(-0.5)$
$I/I_0 = 0.6065$
60.7% transmitted; 39.3% absorbed

9. In general, as the density of a liquid increases, does the index of refraction increase or decrease?

Increases

10. Most liquids expand on heating. As the temperature of a liquid increases, would you expect it index of refraction to increase or decrease?

Decreases