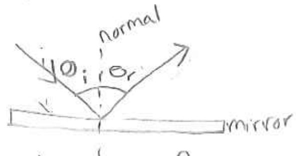
Topic 6C: Wave Phenomena – Reflection and Refraction

Skill 55 – Law of Reflection $\theta_i = \theta_r$ where θ is measured to normal

2 types of Reflection

Regular (smooth mirrors)



clear image forms

Diffuse

normal lines in different directions
image can't form but light & colors are visible

For glass reflection is often accompanied by refraction (reflection happens to waves & particles)

Skill 56 – Refraction and Snell's Law

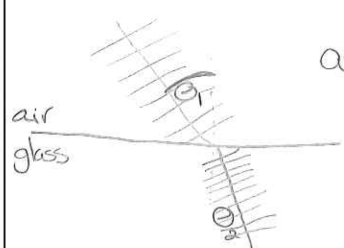
n = index of refraction given on PRT or in question

$n = \frac{c}{v}$ $\quad \frac{n_2}{n_1} = \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \left(\frac{\sin\theta_1}{\sin\theta_2}\right)$ Not on PRT

$\boxed{\text{Snell's Law } n_1\sin\theta_1 = n_2\sin\theta_2}$

index of refraction is inverse to wavelength $\frac{n_2}{n_1} = \frac{\lambda_1}{\lambda_2}$; Speed $\frac{n_2}{n_1} = \frac{v_1}{v_2}$; angle of refraction $\left(\frac{n_2}{n_1} = \frac{\sin\theta_1}{\sin\theta_2}\right) = n_1\sin\theta_1 = n_2\sin\theta_2$

Frequency remains the same



as light moves from air (n_1) to glass (n_2) the index increases

$n_2 > n_1$ therefore $v_2 < v_1$; $\lambda_2 < \lambda_1$; $\theta_2 < \theta_1$

in other words as n increases, light slows down, wavelength decreases, and light bends toward normal (θ decreases)

If a light wave moves from a high "n" to a low "n" it may be unable to exit (refract) at high angles. This is because

$\theta_2 = \sin^{-1}\left(\frac{n_1\sin\theta_1}{n_2}\right)$ where max value for $\frac{n_1\sin\theta_1}{n_2}$ is 1

Critical angle can be found using

$\theta_{crit} = \sin^{-1}(n_1/n_2)$ This is the angle at which only reflection occurs

if $\frac{n_1\sin\theta_1}{n_2}$ is greater than 1 calculation will register as an error
→ light will internally reflect