7.2 | Waves - Light

IB Physics Content Guide

Big Ideas

- Light waves can be transformed through reflection, refraction, and diffraction
- Light travels at different speeds through different material

Content Objectives

7.2.1 – Light and the EM Spectrum

p. 153-155, 160-163

I can describe how the properties of electromagnetic waves change as frequency changes			
I can identify and use the speed of light to solve wave problems with the wave equations			
I can estimate the wavelength magnitude for the different EM waves			
I can provide real world examples for each of the electromagnetic waves			
I can describe how the intensity of a wave changes with distance			

7.2.2 – Reflection and Refraction

p. 172-177

I can identify the angle of incidence and angle of reflection for a reflected wave ray			
I can describe how the reflection of certain wavelengths gives color to objects			
I can use the law of reflection to predict the way light bounces off of a plane mirror			
I can relate the index of refraction of a material to the speed of light as it travels through			
I can qualitatively describe how light bends when transitioning between boundaries			
I can mathematically relate the angles of refraction to the indices of refraction for the materials			
I can predict the direction that light will bend at a medium transition			

7.2.3 – Critical Angle and Polarization

p. 178-179, 165-171

I can describe the phenomenon of Total Internal Reflection			
I can calculate the critical angle of incidence so that the light cannot escape the medium			
I can identify applications of total internal reflection and describe their importance			
I can describe the transformation that takes place when unpolarized light is polarized			
I can describe the interaction between two polarized filters at different orientations			
I can use Malus's Law to calculate the change in intensity when passing through polarized filters			

7.2.4 – Diffraction

p. 181-182, 186-188

I can describe how light bends around a boundary			
I can describe the interference pattern formed by two coherent waves			
I can predict the resulting image from a double slit experiment			
I can calculate the spacing between bright spots for the double slit experiment			
I can conceptually relate band spacing with wavelength and gap distance			

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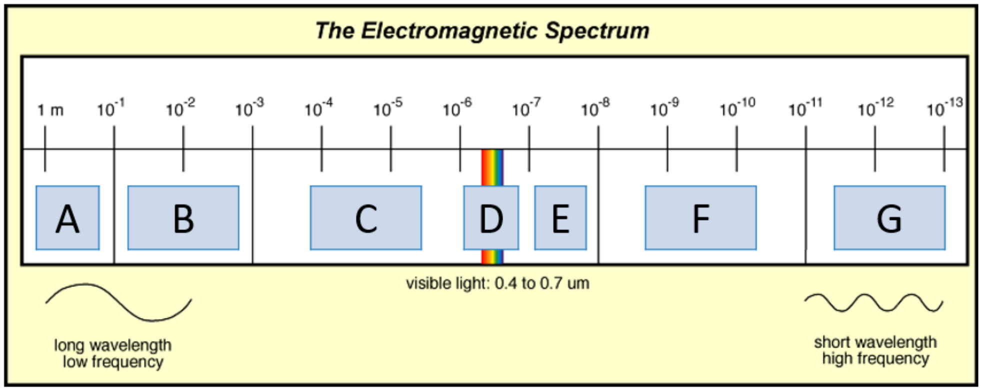
Shelving Guide

Electromagnetic Spectrum

A	Radiowaves
B	Microwaves
C	Infrared
D	Visible Light
E	Ultraviolet
F	X-Rays
G	Gamma Waves



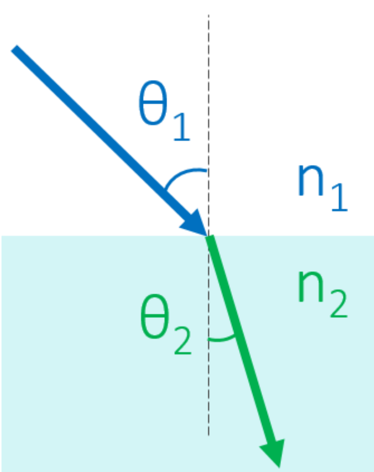
Index of Refraction

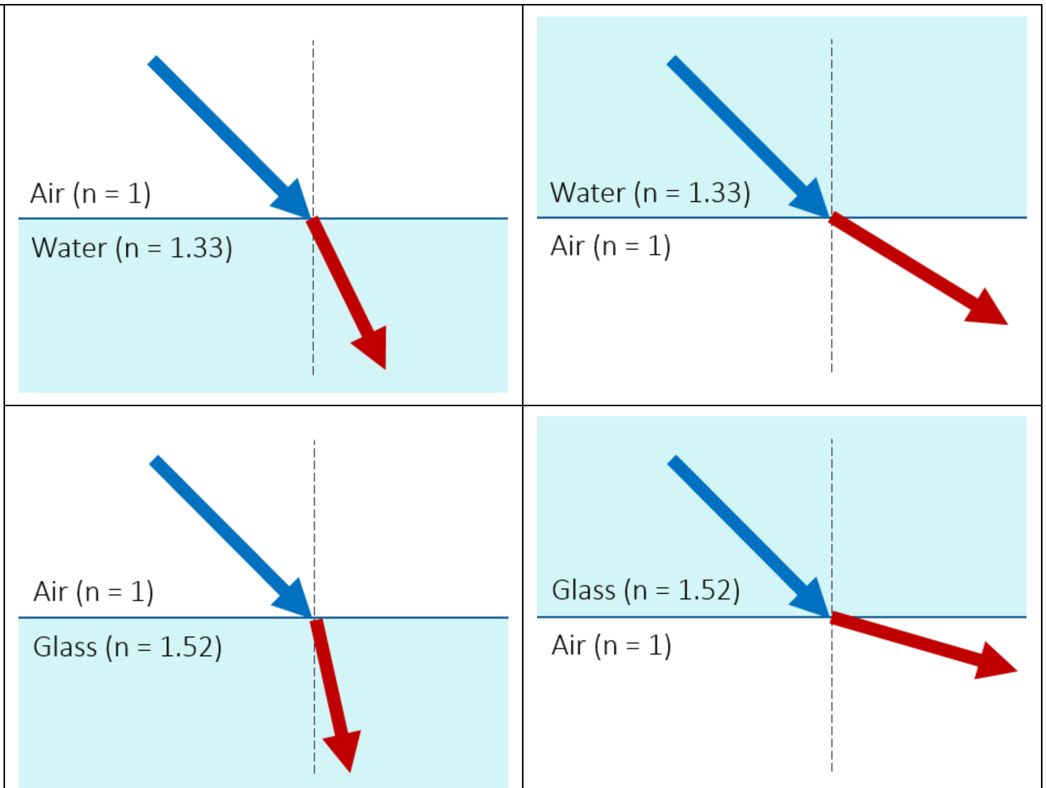
Medium	Wave Speed (v)	Index of Refraction (n)
Vacuum	3.00×10^8 m s^{-1}	1.0000
Air	2.999×10^8 m s^{-1}	1.0003
Water	2.256×10^8 m s^{-1}	1.33
Glass	1.974×10^8 m s^{-1}	1.52

$$\frac{n_1}{n_2} = \frac{v_2}{v_1}$$

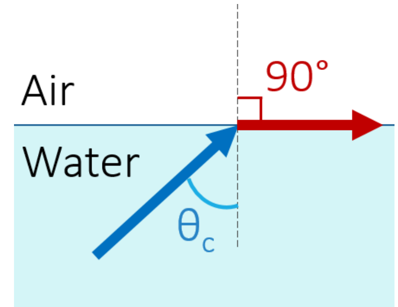
Refraction

$$\frac{n_1}{n_2} = \frac{sin\theta_2}{sin\theta_1}$$

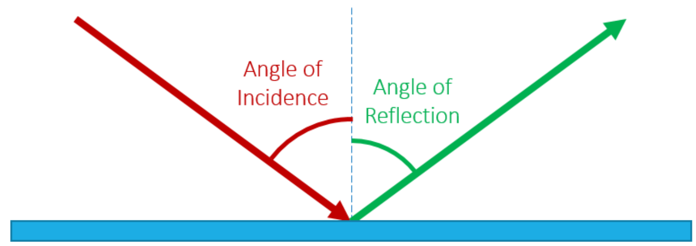




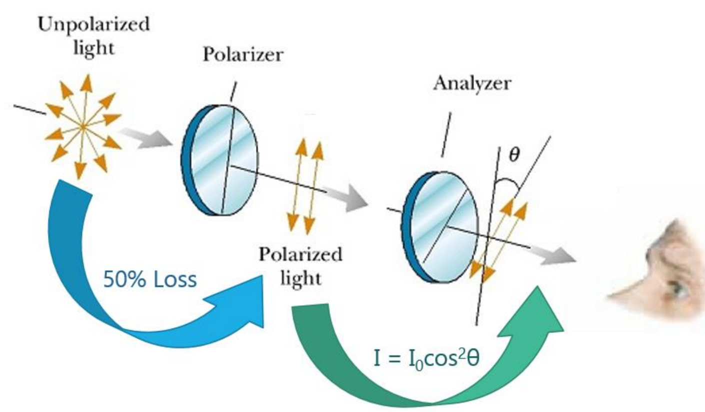
Critical Angle

When $\theta_1 = \theta_c$ $\theta_2 = 90°$	$\theta_c = sin^{-1}\left(\frac{n_2}{n_1}\right)$	

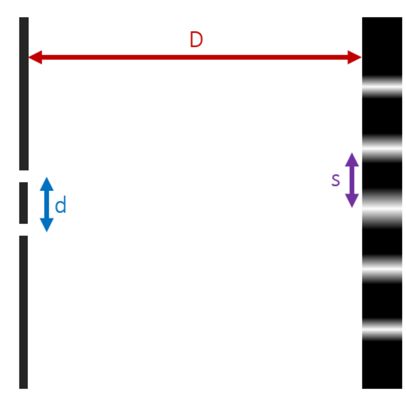
Reflection

Law of Reflection	
Angle of Incidence = Angle of Reflection	

Polarized Light

$I = I_0 cos^2\theta$		
I	Intensity Observed	
I_0	Original Intensity	
θ	Difference in Angle	

Double Slit Experiment

$s = \frac{\lambda D}{d}$		*Label this diagram:* 
s	Distance between fringes	
λ	Wavelength	
D	Distance to Screen	
d	Distance between slits	