|  |  |
| --- | --- |
| **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

|  |
| --- |
| 1 – Light and the EM Spectrum |
| 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 | |  |  |  |

|  |
| --- |
| 2 – Reflection and Refraction |
| I can identify the angle of incidence and angle of reflection for a reflected wave ray | |  |  |  |
| 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 predict the direction that light will bend at a medium transition | |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 – Snell’s Law and Critical Angle |  | | | |
| I can mathematically relate the angles of refraction to the indices of refraction for the materials | |  |  |  |
| 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 | |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4 – Diffraction |  | | | |
| 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 | |  |  |  |

|  |
| --- |
| 5 – Polarization |
| 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 | |  |  |  |

|  |  |
| --- | --- |
| **Waves - Light** | 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 × 108 m s-1 | 1.0000 |
| Air | 2.999 × 108 m s-1 | 1.0003 |
| Water | 2.256 × 108 m s-1 | 1.33 |
| Glass | 1.974 × 108 m s-1 | 1.52 |

## Refraction

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |

## Reflection

|  |  |
| --- | --- |
| Law of Reflection |  |
| Angle of Incidence = Angle of Reflection |

Critical Angle

|  |  |  |
| --- | --- | --- |
| When |  |  |

Polarized Light

|  |  |  |
| --- | --- | --- |
|  | |  |
| I | Intensity Observed |
| I0 | Original Intensity |
| θ | Difference in Angle |

## Double Slit Experiment

|  |  |  |
| --- | --- | --- |
|  | | Label this diagram: |
| s | Distance between fringes |
| λ | Wavelength |
| D | Distance to Screen |
| d | Distance between slits |