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| **Waves - Sound** | IB Physics Content Guide |

# Big Ideas

* Simple harmonic motion is a repeating relationship between an object’s position, velocity, and acceleration
* Waves are formed and transferred by particles oscillating in a medium
* All waves have properties can be measured and mathematically related
* Instruments resonate at specific frequencies due to the number of standing waves that fit in the length of the system
* Waves can occupy the same space at the same space to create constructive or destructive interference

# Content Objectives

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| 1 – Simple Harmonic Motion |  |
| I can qualitatively describe the motion of an oscillating system |  |  |  |
| I can relate the acceleration of an object in simple harmonic motion to its position |  |  |  |
| I can graph the displacement, velocity, and acceleration vs time for simple harmonic motion |  |  |  |
| I can interpret an SHM graph to describe the conditions at a specific point in an object’s motion |  |  |  |
| I can describe and relate the properties of period and frequency |  |  |  |
| I can calculate period and frequency from a scenario |  |  |  |
| I can qualitatively describe the energy changes that take place during an oscillation |  |  |  |

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| 2 – Properties of Traveling Waves |  |
| I can describe how waves carry energy through a medium |  |  |  |
| I can compare the properties of transverse and longitudinal waves |  |  |  |
| I can read a wave’s amplitude, wavelength, period, and frequency from a graph |  |  |  |
| I can label a graph with the location of a wave’s crest/compression and trough/rarefaction |  |  |  |
| I can describe the number of complete wavelengths represented in a picture |  |  |  |
| I can use the wave speed equation to mathematically relate speed, wavelength, and frequency |  |  |  |
| I can relate pitch and frequency for sound waves |  |  |  |

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| 3 – Sound |  |
| I can describe why sound travels at different speeds in different media |  |  |  |
| I can calculate how far a distant object is by timing an echo |  |  |  |
| I can describe the motion of a standing wave |  |  |  |
| I can identify and label the node and antinodes on a standing wave diagram |  |  |  |

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| 4 – Instruments |  |
| I can identify and label the node and antinodes on a standing wave diagram |  |  |  |
| I can describe the end conditions and nodes/antinodes for open/closed pipes and vibrating strings |  |  |  |
| I can calculate the wavelength or instrument length of a standing wave for different harmonics |  |  |  |

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| 5 – Wave Interference |  |
| I can qualitatively and quantitatively interpret cases of constructive and destructive interference |  |  |  |
| I can add up two waves with superposition to create a new waveform |  |  |  |
| I can describe applications and real-world examples for wave interference |  |  |  |
| I can use wavelength and source distance to identify maxima and minima for interference |  |  |  |

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| **Waves - Sound** | Shelving Guide |

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| --- | --- | --- | --- | --- |
|  | Variable Symbol | Unit |  | *Data Booklet Equations:* |
| Period |  |  |  | $$T=\frac{1}{f}$$ |
| Frequency |  |  |  |
| Wavelength |  |  |  | $$c=fλ$$ |
| Amplitude |  |  |  |  |
| Wave Speed |  |  |  |  |

## Simple Harmonic Motion Graphs

|  |  |
| --- | --- |
|  | Velocity vs Displacement |
| Accel. vs Displacement |
| Types of Waves | Picture | Definition | Examples |
| Transverse |  |  |  |
| Longitudinal  |  |  |  |

## Parts of a Wave

|  |  |
| --- | --- |
| Label the Wave:* Amplitude
* Wavelength
* Crest
* Trough
 |  |

## Harmonics

|  |  |  |  |
| --- | --- | --- | --- |
|  | Open Pipe | Closed Pipe | String |
| End Conditions |  |  |  |  |  |  |
| 3rd Harmonic |  |  |  |
| L = ( ) × λ | L = ( ) × λ | L = ( ) × λ |
| 2nd Harmonic |  |  |  |
| L = ( ) × λ | L = ( ) × λ | L = ( ) × λ |
| 1st Harmonic(Fundamental) |  |  |  |
| L = ( ) × λ | L = ( ) × λ | L = ( ) × λ |

## Interference

|  |  |  |  |
| --- | --- | --- | --- |
| Constructive | Path Difference =  | Destructive | Path Difference =  |
|  |  |