



Waves Properties & the Universal Wave Equation

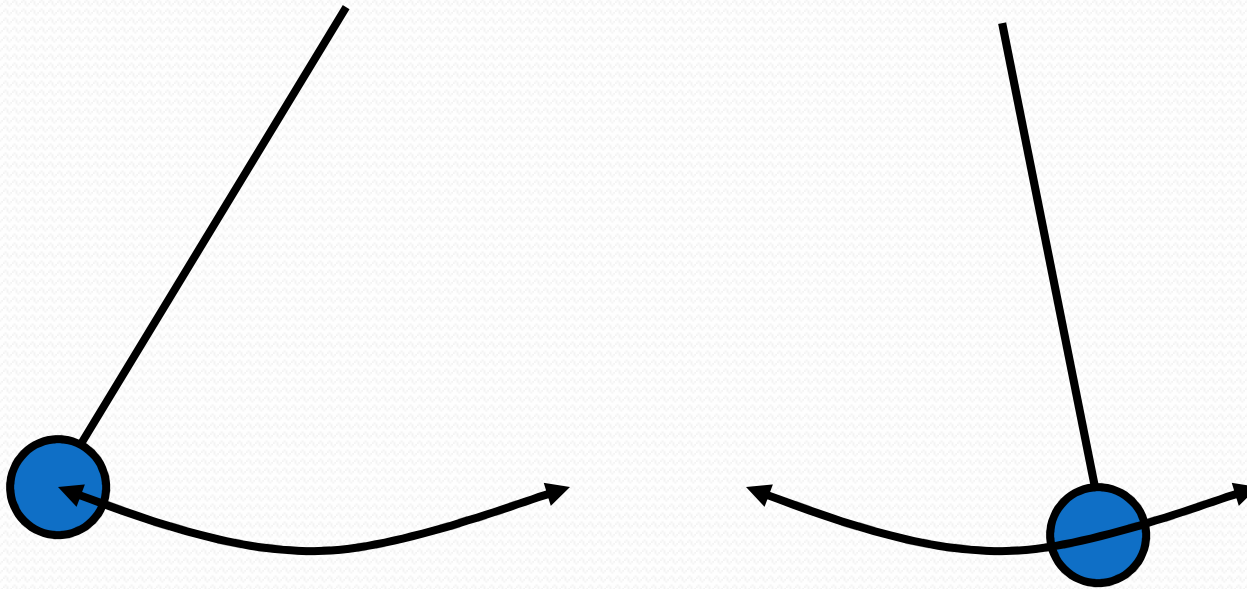


Objectives

- Differentiate between transverse and longitudinal waves
- Recognize and describe wavelength, wave speed, frequency, amplitude
- Understand the relation between and solve problems dealing with speed, frequency, amplitude, wavelength, period, and phase.
- Describe how a vibration causes a waveform
- Understand and use universal wave equation

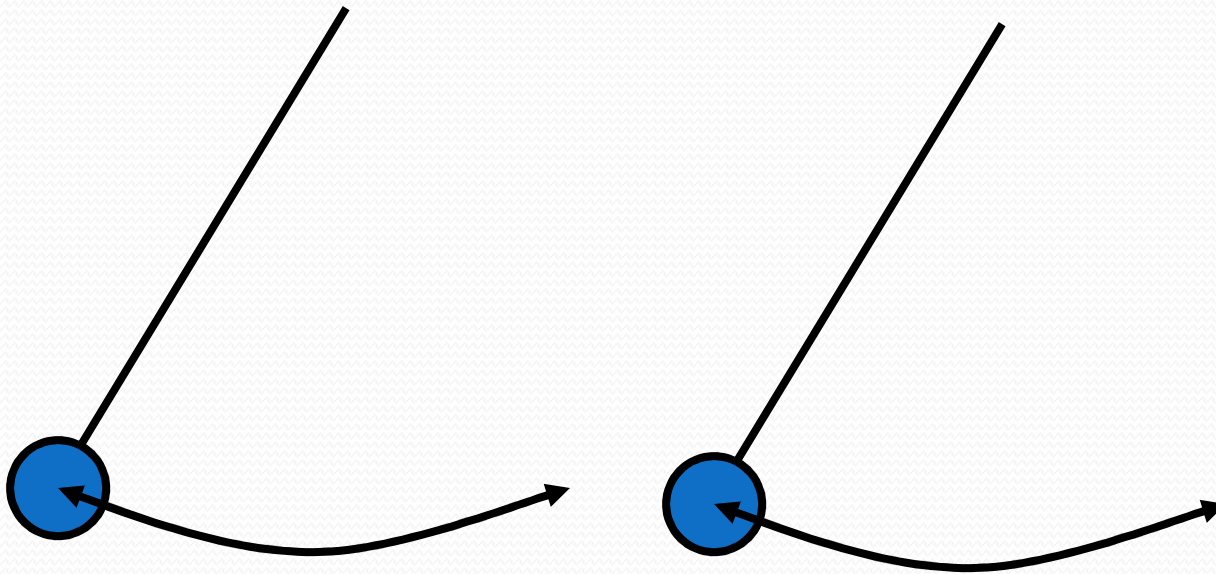
Wave Phase

- If two or more pendulums are swinging the same amount, but not at the same time, that are **out-of-phase**



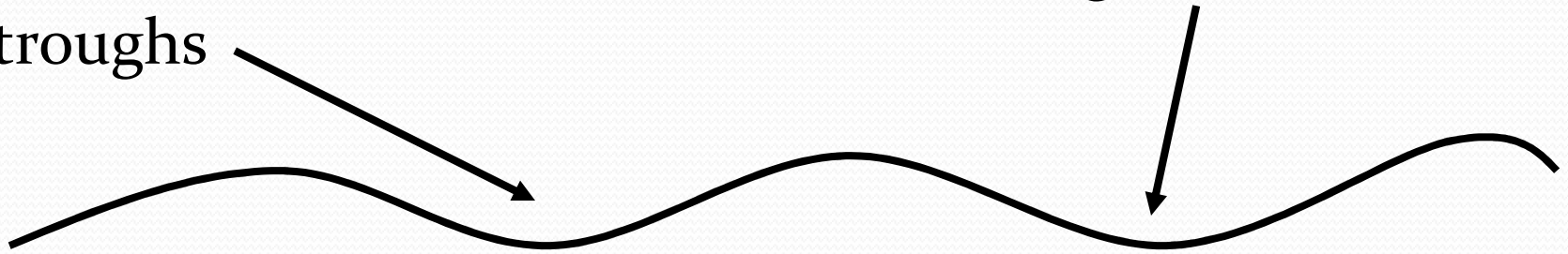
Wave Phase

- If two or more pendulums are swinging exactly together, they are **in-phase**

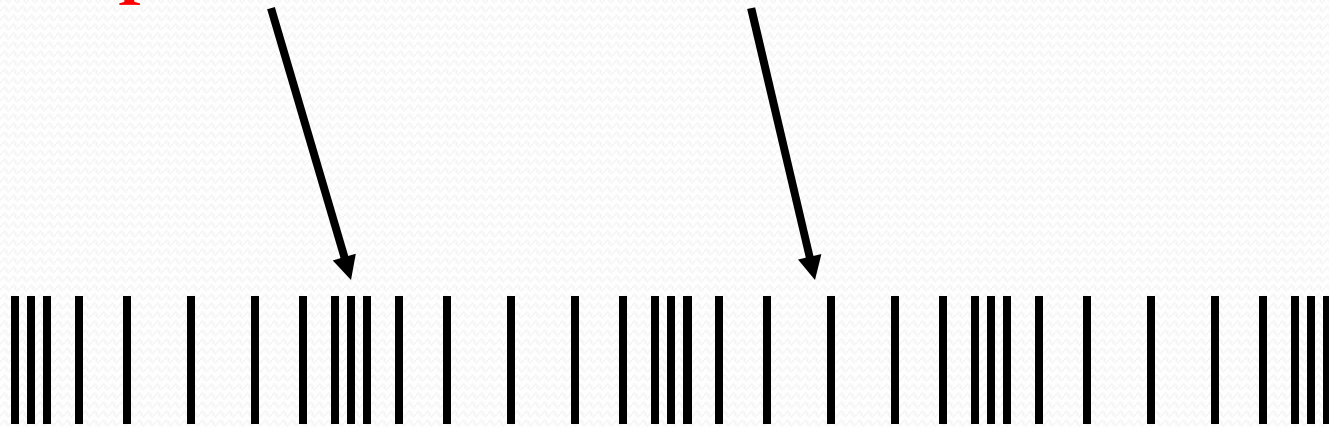


Waveform

- A transverse wave consists of alternating crests and troughs

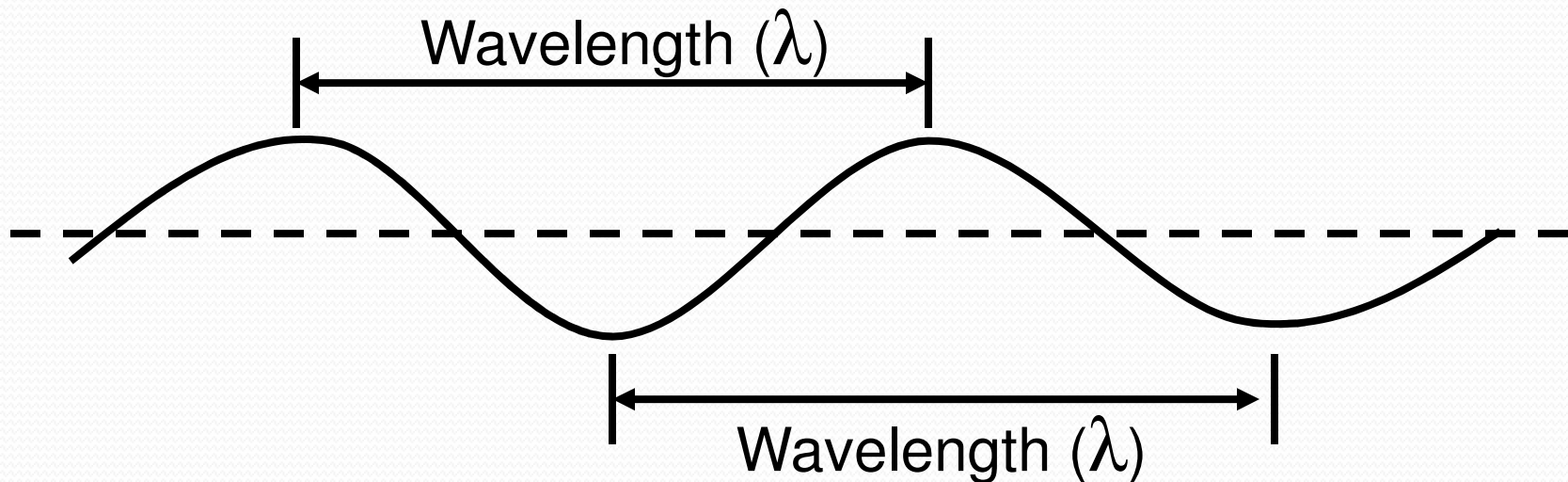


- A longitudinal wave consists of alternating **compressions** and **rarefactions**



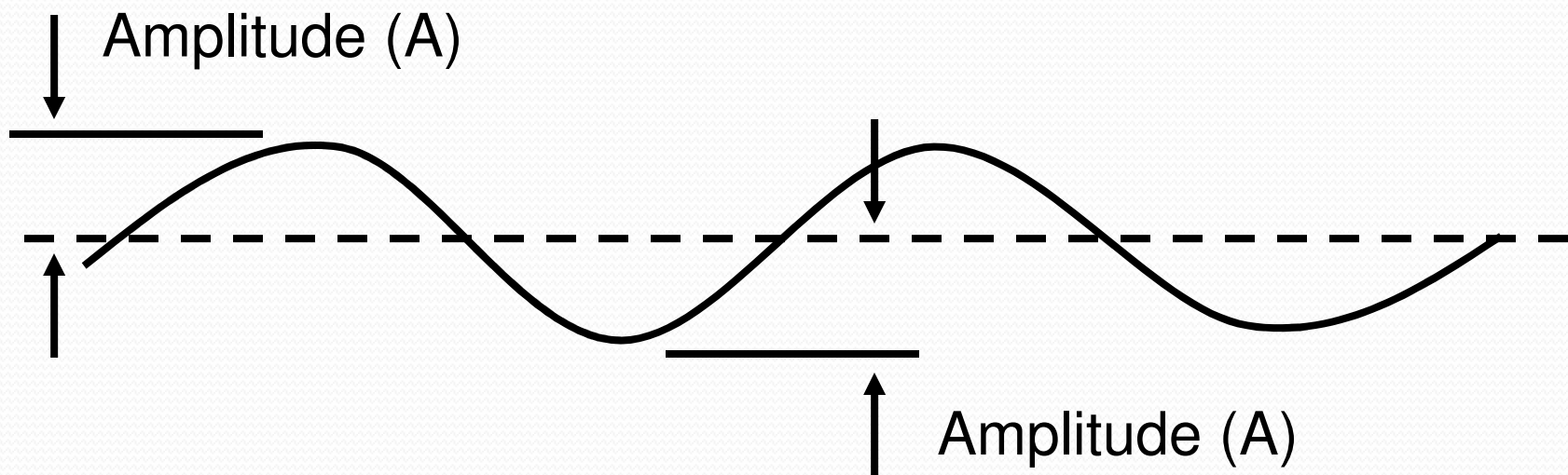
Wavelength

- Distance from the start to the finish of one waveform (between 2 crests or 2 troughs)
- Denoted by the Greek letter Lambda (λ)
- Measured in units of distance (m, ft, mm...)



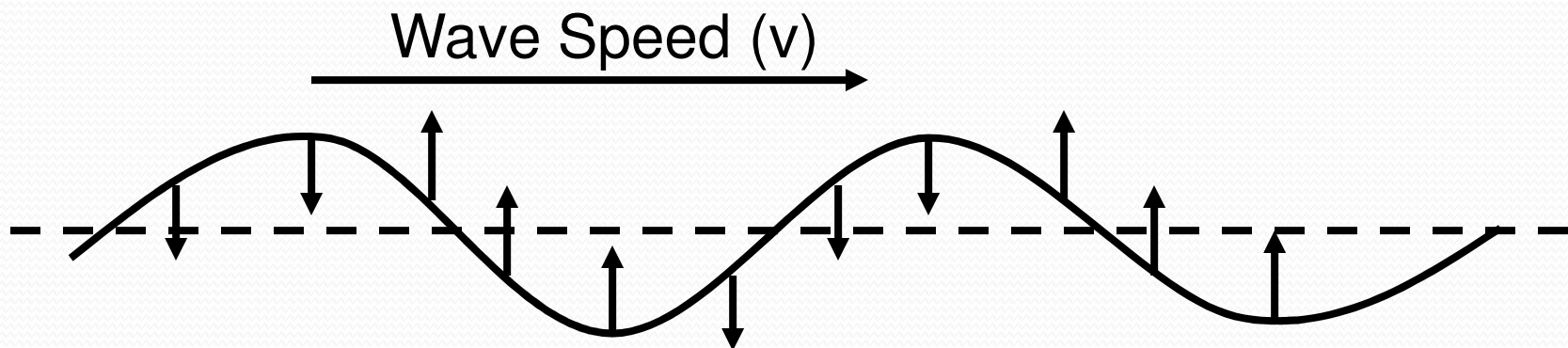
Amplitude

- Height of a crest or a trough
- Denoted by the capital letter A
- Measured in units of distance (m, ft, mm...)



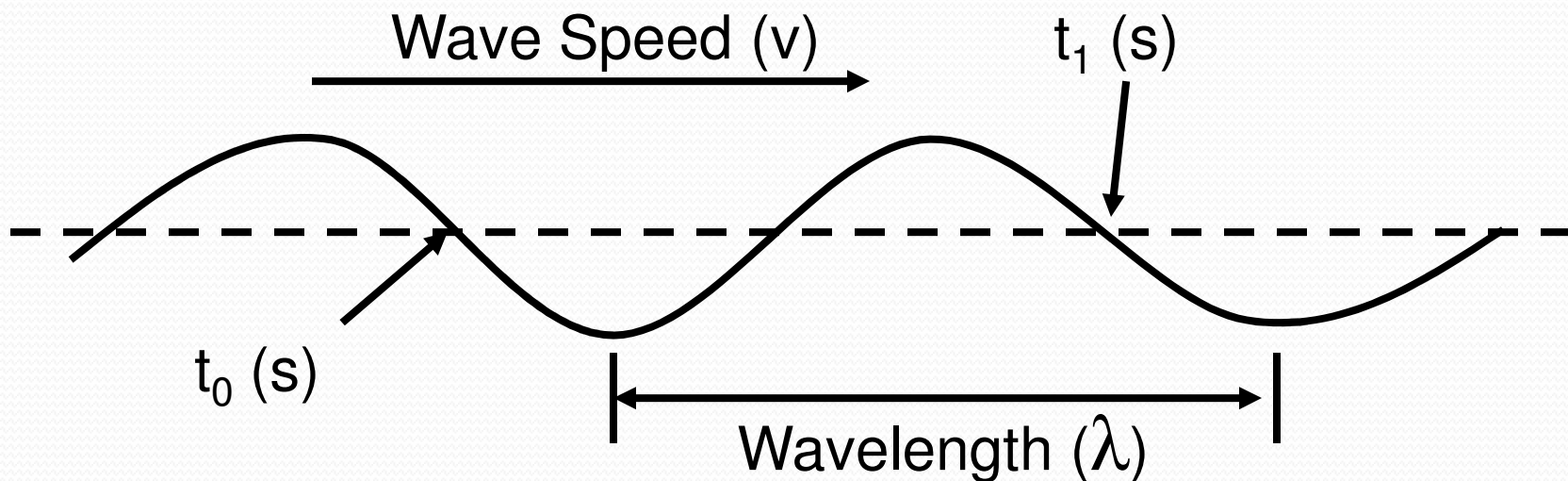
Wave Speed

- How fast a crest or trough moves past a fixed point
- Denoted by the lower case letter v
- Measured in units of velocity (m/s, ft/s...)



Universal Wave Equation

- Velocity = Distance / Time
- Wave speed = Wavelength / Period
- $v = \lambda / t$ (but frequency = $1/\text{Period} = 1/t$)
- $v = f * \lambda$





Practice Questions

- Heath - Physics

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Summary

- Transverse waves - alternating crests/troughs
- Longitudinal waves - alternating compressions/rarefactions
- 1 vibration produces 1 complete waveform
- Wavelength = distance from the start to finish of one wave or between midpoints of successive compressions
- Wave speed unaffected by changing amplitude
- Frequency is inversely proportional to wavelength (as long as medium does not change)
- Universal wave equation: $v=f\lambda$

Homework

- Heath - Physics

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