Waves Tutorial

This website is designed to help you gain a better understanding of sound and sound waves. You need to complete the series of activities outlined below and answer any questions on this sheet.

If you are working on your device, add your answers below. Otherwise, write your answers in your book. Have fun!

# Wave Basics & Types of Waves

Go to [ophysics.com/waves1.html](https://ophysics.com/waves1.html). You should see a page with a blue ball hanging on a spring.

1. What is the difference between mechanical and electromagnetic waves? Provide one example of each type of wave.
2. What is the difference between transverse and longitudinal waves? Provide one example of each type of wave.

*Click ‘Next Page’.*

# Wave Characteristics & Terminology

1. Define the following terms:
	1. Amplitude
	2. Period
	3. Frequency
	4. Wavelength
2. Click ‘Run’ on the simulation.
	1. What happens to the transverse wave as you change the amplitude?
	2. What happens to the longitudinal wave as you change the amplitude?
	3. What happens to the waves as you change their frequency?
3. What does the speed of a wave depend on?
4. What does the frequency of a wave depend on?
5. What is the relationship between wavelength, speed and frequency?

*Click ‘Next Page’.*

# Sound Waves

1. Define the following terms:
	1. Ultrasonic
	2. Infrasonic
	3. Intensity
	4. Decibel
2. How is zero decibels defined?

*Click ‘Next Page’.*

# Reflection

1. What is a boundary, and what three things occur when a wave reaches one?
2. What happens to a wave when it reflects off a more rigid medium?
3. What happens to a wave when it reflects off a less rigid medium?

*Feel free to experiment with the reflection simulation, but it might make more sense once you’ve completed* ***Wave Interference and Superposition****. When you’re ready, click ‘Next Page’.*

# Resonance

1. Objects like pendulums and playground swings each have a frequency at which they naturally oscillate (swing back and forth). If a force is applied in time with this frequency, resonance occurs. What effect does resonance have on the motion of the object?

*Though you’re welcome to experiment with the simulation on this page, you might find the simulation at* [*https://www.walter-fendt.de/html5/phen/resonance\_en.htm*](https://www.walter-fendt.de/html5/phen/resonance_en.htm) *to be easier to use and more informative. When you’re ready, click ‘Next Page’.*

# Wave Interference

1. What is interference?
2. Click ‘Run’ on the simulation.
	1. What happens when the two waves meet?
	2. Pause the simulation and use the time slider to find when the two waves overlap completely. At what time does this occur?
	3. Run the simulation again and set Pulse2Height to -2. What happens now when the two waves meet?
3. What is the principle of superposition?

*Click ‘Next Page’.*

# Wave Interference & Superposition

1. Click on the play button in the bottom left of the simulation. The pink wave represents the combination of the red and blue waves.
	1. How is the pink wave similar to the red and blue waves?
	2. How is the pink wave different to the red and blue waves?
	3. What happens to each wave as you move from In Phase to Out of Phase?
2. Set the Red Wavelength to 4. Describe the new shape of the pink wave.
3. Leave the Red Wavelength at 4 and set the blue wavelength to 0.5. Describe the new shape of the pink wave.
4. What happens during constructive interference?
5. What happens during destructive interference?

*Feel free to experiment with other wavelength combinations! When you’re done, click ‘Next Page’.*

# Wave Interference & Standing Waves

1. What happens when two waves moving in opposite directions have the same wavelength? (Hint: click on ‘Show Standing Wave’ then ‘Run’ to see this in action.)

*Use the menu at the top of the page to skip ahead: go to Waves 🡪 Waves Tutorial 🡪 Interference: Beats.
(We’ll come back to standing waves later.)*

# Wave Interference: Beats

1. If you are a musician, you may have noticed that two instruments that are slightly out of tune make a strange pulsing sound when they are played together. These pulses are called **beats**. What causes this sound?
2. Click the ‘Play’ button towards the bottom of the page to hear these beats for yourself. Try increasing the Right ear frequency one Hz at a time (you will need to press ‘Play’ again every time you change the number). What happens to the beats as the frequencies get further apart? Explain mathematically why this happens.

*Click ‘Next Page’.*

# The Doppler Effect and Sonic Boom

1. When a car drives past you at high speed, you may have notice that the pitch of the sound you hear drops when it passes you. What is this phenomenon called, and why does it happen?
2. What is a sonic boom, and under what circumstances does it occur?