Harmonic Oscillation and Wave Interference

Student Guide — Revised V11

Why This Lesson

Oscillation around an equilibrium position can be used to describe the motion of many objects in nature from atoms to planets. When this motion repeats itself, it is often referred to as harmonic or periodic motion. This lesson will examine cantilever motion as a model system to investigate harmonic motion.

Knowledge of harmonic motion provides the foundation for understanding mechanical and electromagnetic waves. This understanding will prepare you to explore the physics of sound, light and other types of wave phenomena that we use to sense the world around us. In a later lesson, you will use your knowledge of harmonic oscillation and your expertise in applying experimental tools, to measure your own physiological tremor frequency.

Across two classes, you will investigate the oscillation of a cantilever, develop your understanding of waves, and use AI to analyze signals containing more than one frequency. You will graph measurements, apply FFTs and frequency filters, and evaluate whether your analysis is supported by the experimental evidence.

Learning Goals

Upon completion of this investigation, you should be able to:

Phenomena

- Describe equilibrium, restoring force, amplitude, period, frequency, phase, and damping in an oscillating cantilever.
- Explain linear superposition and how a complex waveform can be decomposed into its constituent frequencies.

Experimental Practices

- Connect a magnetic-field measurement to cantilever motion, estimate frequency by two methods, and evaluate evidence for frequency stability.
- Conduct FFT analysis, identify frequency bands, and use digital filters to separate out components of a complex signal.

Habits of Mind

- Commit to predictions, compare explanations with peers, and revise claims using observations and quantitative evidence.
- Distinguish measured magnetic-field data from AI-assisted calculations and model assumptions; document analysis choices and evaluate the limits of the conclusions.

What You Will Need

- A smartphone with phyphox and a magnetometer; a cube magnet and finishing nail for locating the sensor; a laptop or tablet for AI analysis and browser simulations.
- An AI tool that can read uploaded files, analyze data, and create downloadable graphs. No programming experience is required.
- The supplied Simple_Harmonic_Motion_Explorer.html and Wave_Interference_Explorer.html, opened in a browser for guided exploration of oscillations and interference.
- Instructor-provided cantilevers, a long spring and the designated smooth-floor area.
- A notebook and whiteboard for predictions.

Everyone will collect their own data from a single cantilever. Groups of two will work together to generate data for the dual cantilever experiment, but each student will still analyze the resulting data individually.

The Core Idea

- A restoring force points toward equilibrium. For small deflections, a cantilever can behave approximately like a harmonic oscillator. Damping reduces its amplitude as energy leaves the motion.
- A time graph describes how a signal changes at one location. A spatial graph shows the shape of a wave across positions at one instant. Period and wavelength belong to different axes.
- In a linear system, overlapping contributions add point by point. Reinforcement and cancellation describe their sum; cancellation at one place does not mean the waves have disappeared.
- An FFT reveals frequency content. A filter retains or attenuates selected frequency ranges. Both are tools whose outputs depend on the data and the choices you make.
- Driving question: How can we identify and recover two oscillating contributions from one measured signal, and what evidence tells us the recovery is trustworthy?

Optional references: OpenStax wave interference Waves interactive tutorial SciPy spectral analysis

Session A Harmonic Oscillation

Part 1 — Pre-Class Preparation **About 50 minutes**

A Observe and Predict the Oscillator Motion 10 minutes

Open the **Simple Harmonic Motion Explorer** in a browser. Work only in the first tab, *Observe and Predict*. Press Play and watch the free tip of the cantilever after it is released. Replay as often as you need.

Before you reveal the graph, answer the three prompts in your notes: What repeats, and what changes as you watch? As the swings become smaller, does the time for one complete back-and-forth motion change, and what makes you think so? Sketch the tip's displacement from its resting position versus time, labeling both axes and choosing upward as positive.

Then select *Show the motion graph* and compare the trace with your sketch. Note where they agree and what you would revise, and why. Keep your sketch and notes nearby, because the tutor will ask how your prediction compared with the graph. Leave the other two tabs for later.

B Guided AI Tutoring 30 minutes

Open the **Prelab Tutor: Harmonic Oscillation** document and read Part A. Upload the entire document to your AI tool, then type or say the starting prompt below. Text or voice mode both work.

Starting prompt: *I have uploaded my prelab tutor document. Please follow it and begin the tutoring conversation.*

Keep the tutor document open where you can see the figures; the tutor will refer to figures by number. Answer one question at a time in your own words and give your reasoning, even when you are unsure.

Allow up to 30 minutes – it will take less time if you are familiar with the material. When the session ends, save the conversation and the tutor's final feedback, and write down one question to bring to class.

C Review the In-Class Investigation 10 minutes

Read through Part 2 of this guide, Stages 1–8, so you know what you will do in class and what evidence you will collect at each stage. Review A Small Set of Relationships below, and confirm that you can open both supplied simulations and export a phyphox file.

A Small Set of Relationships

Quantity	Meaning and relationship
Amplitude A	Maximum displacement from equilibrium, measured from the resting position to one extreme. A = ½ × peak-to-peak distance.
Period T	Seconds for one complete cycle. Over n complete cycles, T = elapsed time ÷ n.
Frequency f	Cycles per second, measured in hertz (Hz). f = 1/T.
Phase φ	Position within a cycle. A full cycle is 360° or 2π radians.

For example, if 10 complete cycles take 4.0 s, the average period is 0.40 s and the frequency is 2.5 Hz. Measuring several cycles reduces the influence of uncertainty in either endpoint.

Part 2 — In-Class Investigation **110 minutes**

The Investigation Stage by Stage

Your instructor will pace the activities. Use this guide to decide what evidence to collect and what questions to ask. Finish the core task at each stage before pursuing extensions.

Stage	Focus	Minutes
1	Explore and locate your phone's magnetometer	15
2	Observe and describe one oscillator	10
3	Record and inspect a single cantilever	15
4	Use AI to graph and inspect your data	10
5	Use AI to determine the frequency and test its stability	20
6	Simulate the motion mathematically	15
7	Evaluate the frequency with an FFT	15
8	Explain and save your evidence	10

Stage 1 Explore and Locate Your Phone's Magnetometer

Your phone's magnetometer is a small chip whose location within the phone varies from one phone model to another. The cantilever tip must swing close to it, so we will locate it before starting our harmonic oscillator measurements.

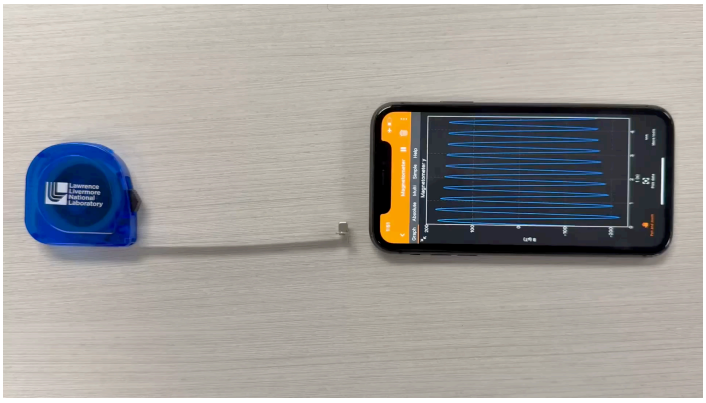
Open phyphox, choose the magnetometer module, and start a measurement. To locate the sensor, monitor the absolute field, the size of the field regardless of its direction. With nothing magnetic nearby, note its steady value; this background comes mostly from Earth's field and the phone itself.

Touch the head of a steel nail to the cube magnet for a moment, then set the magnet well away from the phone. The nail is now temporarily magnetized and behaves like a weak magnetic dipole. Holding the nail perpendicular to the screen, slowly scan its head across the screen in closely spaced passes while watching the absolute field. Because a dipole's field drops steeply with distance, the reading rises sharply only when the nail head passes close to the sensor. Narrow your passes around the largest reading, then note the position as precisely as you can.

Why the absolute field here: To find the sensor, you want the strongest response no matter which way the field points. A single component can change sign or pass through zero as the nail moves past, even near the sensor, while the absolute field grows as the nail gets closer. We use the nail because the cube magnet's field is strong enough to saturate the sensor temporarily, so it stops responding normally. If that happens, hold your phone and move it in a figure-eight pattern for several seconds to recalibrate it.

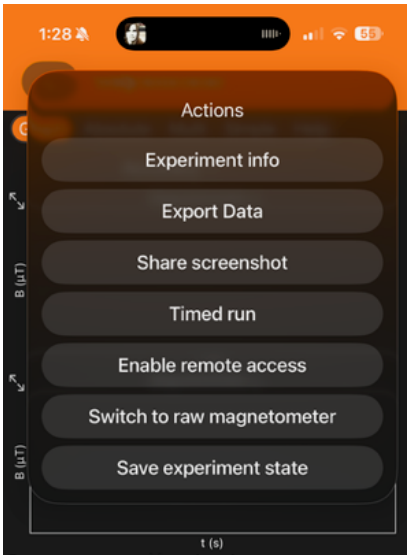
Record your phone model and sketch your phone's outline with the sensor location marked. Compare with a classmate who has a different model.

Stage 2 Observe and Describe the Cantilever Oscillation



Explore your cantilever's motion. The cantilever is made from a miniature tape measure; the beam is the thin metal "tape." The tape measure should lie flat on a table so the oscillation is in the x-y plane of the phone, as shown in the figure. (In this configuration, gravity does not act along the direction of the oscillation.) Change the length and the initial displacement and observe the oscillation. Also test how placing a magnet on the tip affects what you observe. Explain what makes the tip return toward equilibrium and why it continues past equilibrium. Distinguish the shrinking amplitude from the rate at which cycles repeat, using the ideas from your prelab tutoring: equilibrium, amplitude, restoring force, period, frequency, and damping. As the amplitude decreases, do you think the period changes if all other variables (length and tip mass) stay the same? Record your prediction.

Stage 3 Record the Motion and Manually Determine Frequency



Position the phone so the cantilever tip swings past the sensor location you found, and keep the phone and the base of the tape measure stationary. In the phyphox magnetometer module, tap the three dots and select "Switch to raw magnetometer" before collecting data. Use the module's graph view to observe the individual field components of the oscillating magnetic field. Depending on how the cube magnet's dipole is oriented, each field component will show a different pattern. A signed component rises as the tip moves one way and falls as it moves the other, so it follows the oscillation directly.

Start the cantilever oscillating by releasing it from an initial displacement of a centimeter or less. You should see visible oscillation for at least 60 seconds; if the oscillations continue, collect for 120 seconds. Your goal is for at least one field component to show a smooth, slowly decaying oscillation. When you believe you have a well-behaved data set, show it to an instructor before moving on. Once the instructor approves your data, take a screenshot and export the data for analysis. In your notebook, record the free length, release conditions, magnet placement, phone orientation, and the field component you will analyze.

Before leaving phyphox, use the select data tool to measure the time spanned by 10 full periods, selecting a maximum (or minimum) and the matching one 10 cycles later. Use this time to determine the period and frequency of the cantilever. Record both values in your notebook so you can compare them with your AI analysis in later stages.

Stage 4 Use AI to Graph and Inspect Your Data

Use AI to graph the field component that gives the most symmetric representation of the tip's oscillation. Look at the entire data set, as well as expanded regions showing a few cycles at the beginning, middle,

and end of the recording. Do not smooth the data at this point. Use AI to determine the data collection rate, then verify it yourself by inspecting the time stamps in the data file.

Measurement judgment: The sensor records magnetic field, not displacement. Small motion can produce an approximately proportional change in one field component, but the relationship need not be linear over large deflections. Keep field units on your graphs. Frequency can be useful even when field amplitude is not a calibrated measure of motion or energy.

Stage 5 Use AI to Analyze Frequency over Time

Ask AI to suggest methods for determining the frequency over a series of 2 second time regions. Choose a method and apply it to a time interval similar to the one you measured in phyphox. Check that your Stage 3 phyphox estimate agrees with the AI result.

Repeat the AI analysis over 2 second oscillations near the middle and the end of your data set, and compare the values. Ask AI to create graphs of your data that mark the time interval used in each analysis. Make a small table of interval, number of cycles, elapsed time, and frequency. Explain whether the differences appear meaningful given how well the endpoints can be located. Fewer visible oscillations or noisier peaks can weaken your comparison.

Stage 6 Simulate the Motion Mathematically

So far you have described the motion with period and frequency. A complete description of the signal also needs its baseline, where in the cycle it starts, and how quickly it fades.

A useful model is a cosine signal with a baseline, amplitude, frequency, and starting phase:

$$s(t) = C + A\cos(2\pi ft + \varphi)$$

The equation uses phase in radians; the simulator's phase slider uses degrees.

Open the Simple Harmonic Motion Explorer and select the **Simple harmonic motion** tab. Change A, f, C, and φ one at a time. If time allows, try the Mystery curve challenge: read the values of the green curve from the graph, then match it with the sliders.

Select **With damping** and turn on Show the decay envelope. Predict whether increasing γ changes the spacing between peaks in this simulation, then test your prediction. Write down which quantities the simulation treats as independent controls, and compare that assumption with your Stage 5 evidence. In a damped signal, the amplitude envelope decreases with time. We test this model against the data rather than assume that every real signal follows it exactly.

Ask AI to fit short early and late segments of your record to a sinusoid with a baseline, showing the raw data, fit, and residuals. Use shorter segments if the amplitude changes noticeably. Compare these frequencies with your Stage 3 and Stage 5 estimates.

Stage 7 Evaluate the Frequency Using a Fast Fourier Transform (FFT)

An FFT is an efficient calculation of a discrete Fourier transform: it describes the recorded signal in terms of sinusoidal frequency components. A time graph asks how the signal changes; a spectrum asks which frequencies contribute. An amplitude spectrum plots the magnitude of each frequency component, while a power spectrum plots the square of that magnitude, which makes the strongest peaks stand out more. Both place the main peak at the same frequency.

Use AI to convert the time-domain signal to the frequency domain and graph the power spectrum. Ask it to identify the peak frequency and compare it with your previous results. A finite, damped record generally produces a peak with some width rather than an infinitely thin line.

Ask AI to compare a shorter and a longer useful portion of the same recording. Keep the sample rate unchanged and label each duration. Examine both the frequency and the width of the power spectrum peak. A weak late signal may add little useful information even though it extends the record.

Many details affect the quality of an FFT analysis, and the table below explains a few of them. If the topic interests you, ask AI to explain the mathematics and the variables in the analysis method in more detail.

Choice	Question it answers
Sampling rate	How rapidly can the signal change without being misrepresented? Frequencies of interest must lie below half the sampling rate; use comfortably more than two samples per cycle.
Record duration	How finely are FFT frequencies spaced? For N samples at rate f_s, the record span for the transform is N/f_s and bin spacing is f_s/N.
Window function	How should we handle the finite record's edges? A taper can reduce spectral leakage, while broadening peaks and changing amplitude scaling.

Stage 8 Explain and Save Your Evidence

Compare your time and frequency graphs with another group. Explain one feature that is easier to see in each representation.

Answer individually before consulting AI: Why can amplitude fall while frequency stays approximately constant? What would persuade you that frequency really changed? What does the magnetometer measure directly?

Part 3 — Between-Class Work for Session A	As needed

Complete In-Class Activity

If you did not finish the core analysis in class, use the guide and Class Slides to complete it as needed before Session B. No new investigation is assigned between classes.

Session B Part 1 — Pre-Class Preparation	No assignment

No additional assignment. Bring your Session A measurements and analysis files to Session B.

Session B Recovering Two Oscillations

Part 2 — In-Class Investigation **110 minutes**

In Part 1 of this investigation, you studied the motion of a single cantilever as a model of a harmonic oscillator. You observed that its amplitude decreased over time while its frequency remained approximately constant. You also learned several ways to determine the frequency of an oscillating signal, including using a Fast Fourier Transform (FFT) to convert measurements from the time domain to the frequency domain.

You also explored superposition and interference through the prelab tutoring and the wave activity with the long spring. You physically observed that transverse waves propagating in a spring can overlap, reinforce, or cancel in the observed displacement.

In Part 2, you will build on these concepts by investigating a system with two oscillating cantilevers, each with a different frequency. Your smartphone's magnetometer will measure their combined magnetic field, producing a signal that is more complex than either individual oscillation. You will use AI-assisted analysis, FFTs, and digital filtering to identify the two frequencies and separate the contributions of the individual cantilevers.

The central challenge: Can you separate a complex signal into the individual oscillations that produced it? How can you verify that your analysis accurately represents the original oscillations?

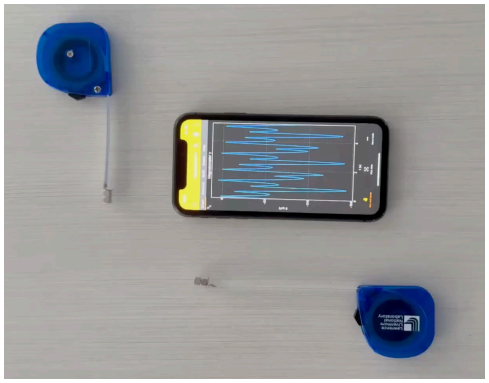
Stage	Core activity	Minutes
9	Explore interference and beats	10
10	Record the dual cantilevers	30
11	Identify frequencies with FFTs	25
12	Filter and reconstruct the signals	35
14	Discuss and defend conclusions	10

Stage 9 Explain Interference and Beats

Open the Two-Wave Interference Explorer in your browser. With damping off, compare identical waves, opposite phase, and unequal amplitudes. Pause at selected times and verify the displayed sum by adding the two signal values yourself. Explain the conditions needed for complete cancellation throughout the record.

Select Beats and move the frequencies closer together. Predict whether the large-amplitude bursts become closer together or farther apart. For nearby frequencies, the beat frequency is the absolute frequency difference. At 2.0 and 2.2 Hz, the amplitude maxima recur about every 5 s. Use the 20 s time view to check several bursts.

Stage 10 Dual Cantilever Measurement



Work with a partner to measure the combined magnetic field from two oscillating cantilevers. Set up two cantilevers with different lengths (e.g., 7 and 9 cm) so they oscillate at different frequencies. Position them on opposite sides of the phone, adjusting their locations so that each produces a magnetic-field signal of approximately the same amplitude at the magnetometer. The figure illustrates one possible arrangement for a phone with its magnetometer near the upper-left corner. It will be easiest to set this up for a sensor near a corner of the phone. Compare your phone with your partner's and choose the one that provides the best sensor location for this experiment.

Use small initial deflections and keep the magnets far enough apart that the cantilevers do not noticeably interact. Test this by oscillating one cantilever while the other remains at rest. If the stationary cantilever begins to move, increase their separation or adjust the setup.

Once you have a satisfactory arrangement, **keep the phone, cantilever supports, and magnet positions fixed** throughout the measurements. Using the same magnetometer axis, collect three recordings:

1. **Cantilever A only:** A oscillating while B remains at rest.
2. **Cantilever B only:** B oscillating while A remains at rest.
3. **Both cantilevers:** A and B oscillating simultaneously.

Aim for approximately 30 seconds of data for each recording, provided the oscillations remain clearly detectable. Take a screenshot and export the CSV data file for each measurement. Clearly label all three datasets (A, B, and A+B).

Share the three datasets with your partner. Although you collect the measurements together, **each student will independently analyze the data** in the following stages.

Stage 11 Identify the Two Frequencies Using an FFT

In Stage 10, you collected three magnetic-field recordings: cantilever A oscillating alone, cantilever B oscillating alone, and both cantilevers oscillating simultaneously. Your goal is to determine whether you can identify the frequencies of both cantilevers from their combined signal.

Step 1 — Predict what you will observe

Before analyzing the data, consider what you expect to see when both cantilevers oscillate simultaneously.

- How might the combined magnetic-field signal differ from the signals produced by the individual cantilevers?
- If you use an FFT to analyze the combined signal, how many major frequency peaks do you predict?

Record your predictions before consulting AI.

Step 2 — Determine the frequency of each cantilever

Upload the recordings for cantilevers A and B to your AI tool. Ask AI to:

- Graph each magnetic-field signal versus time include full and zoomed in graphs.
- Calculate the FFT and graph the power spectrum for each recording.
- Identify the dominant frequency of each cantilever.

Record the frequency of each cantilever. These measurements will provide reference values for interpreting the combined signal.

Step 3 — Analyze the combined signal

Upload the recording collected when both cantilevers were oscillating. Ask AI to:

- Graph the combined magnetic-field signal versus time.
- Calculate its FFT and graph the power spectrum.
- Identify the dominant frequency peaks and label their frequencies.

Compare the combined signal with the individual cantilever recordings. Is it easy to recognize the two oscillations in the time-domain graph? Are their frequencies easier to identify in the power spectrum?

Step 4 — Compare your results

Ask AI to display the three power spectra as vertically stacked panels with a common frequency axis so you can compare their peak positions directly.

- Does the combined spectrum contain peaks at approximately the same frequencies measured for cantilevers A and B?
- Can you identify which peak corresponds to each cantilever?
- How closely do the frequencies agree?

Ask AI to create a small table summarizing your results.

Measurement	Dominant frequency (Hz)
Cantilever A alone	
Cantilever B alone	
Both cantilevers: Peak 1	
Both cantilevers: Peak 2	

Stage 12 Separate the Oscillations Using Frequency Filters

How can we separate two oscillations that have been combined into one signal? Think about a red color filter: white light contains many frequencies, but the filter transmits mostly red light and reduces other colors. A digital frequency filter works on recorded data rather than light. It keeps a selected range of frequencies and reduces others.

In Stage 11, the FFT revealed two frequency peaks in the combined measurement. An FFT identifies frequencies; filtering goes a step further by recovering time-varying contributions. In this stage, we will explore the use of mathematical applications of filters in a similar way in which you have seen white light being filtered by colored glass. A low-pass filter retains lower frequencies, a high-pass filter retains higher frequencies, and a band-pass filter retains a selected frequency range.

Step 1 — Explore Frequency Filters using a Simulation

Open the Frequency Filter Explorer simulation in your browser. Your instructor will guide the class through it. The first three tabs apply filters to light, where you see the result as a color on a screen. The Filter a signal tab applies the same filters to a signal like your magnetometer recording. On each tab, make your prediction before you reveal the screen or the filtered signal.

As you explore, record the following in your notebook:

- Low-pass and High-pass: the cutoff that makes white light look orange and the cutoff that makes it look blue. Which end of the spectrum does each filter keep?
- Band-pass: with Two lasers selected, the lower and upper cutoffs that pass only Laser 2. Then move the lasers closer together. Which Edge setting still separates them?
- Filter a signal: the band you set around each peak in panel B. Keep each band as a component. In panel D, how closely does the sum of the two components match the original signal?
- In one or two sentences, explain how a colored filter acting on white light is like a band-pass filter acting on your cantilever recording.

Step 2 — Define Your Bandpass Filter

Look at the power spectrum from Stage 11. Before asking AI to filter the data, identify one band around the peak for cantilever A and another around the peak for cantilever B. Each band should include its peak without overlapping the other peak. Record the lower and upper frequency limits for each band. Ask AI to show your chosen bands on the spectrum and explain whether their widths are reasonable.

Step 3 — Filter and Graph the Recovered Waveforms

Ask AI to apply the two band-pass filters to the magnetic-field of the combined recording. Create three vertically aligned time-domain graphs: (A) the original combined signal, (B) the lower-frequency filtered component, and (C) the higher-frequency filtered component. Show the same clear 5-second interval and use matching time axes and, where practical, matching magnetic-field scales. Label each filtered graph with its frequency band.

How do the filtered signals visually compare to your measurements of the magnetic field vs time for the independent A and B cantilever oscillations?

Step 4 — Check the Frequencies with an FFT

Ask AI to calculate a new FFT and power spectrum for each filtered signal, using the full useful recording rather than only the five-second display. Label the dominant peak frequencies. Compare them with the

independent single-cantilever measurements from Stage 11. Does each filtered signal show the expected frequency, with the other cantilever frequency strongly reduced?

Important: finding a selected frequency after filtering is partly expected because the filter was designed to retain it. Agreement with the independently measured cantilever frequencies provides stronger evidence.

Step 5 — Reconstruct and Evaluate the Original Signal

Ask AI to add the two recovered signals point by point. Plot their sum overlaid on the baseline-removed original combined signal, using the same time interval and units. Show a separate graph of the difference (original minus reconstructed signal), called the residual. How closely does the sum reproduce the original? Where do you see disagreement?

Save the three-panel waveform figure, the two filtered power spectra, and the reconstruction comparison. Record the filter bands and analysis choices so you can explain how the results were produced.

Stage 13 Optional Extension — Test the Reliability of the Separation

If you have completed the core investigation and have time remaining, test whether your recovered oscillations are sensitive to the filter settings. Otherwise, move directly to Stage 14. This is an extension, not a prerequisite for the wrap-up.

Step 1 — Test Filter Width

Select one band-pass filter. Predict what might happen if the frequency band becomes slightly narrower or wider. Ask AI to repeat the filtering with one modestly changed band while keeping the other band fixed. Compare the recovered waveform and power spectrum with your original results, using the same graph scales.

Does the main frequency remain stable? Does the recovered amplitude or waveform shape change? A very narrow band may remove part of a real damped signal; a very wide band may retain contributions that do not belong to the intended cantilever.

Step 2 — Evaluate a Limitation

Choose one limitation you actually observed or suspect: weak late oscillations, noise, two peaks that are too close, interaction between cantilevers, changing magnetic-field response with position, or distortion near the ends of the filtered record. Describe how it could affect your result and what additional measurement or analysis would help you test it.

Ask AI to describe the filter method, how it handled phase, and whether the start or end of the record might be distorted. You do not need to reproduce the mathematics, but you should be able to explain why these choices could matter.

Stage 14 Explain and Defend Your Conclusion

Prepare a two-minute explanation to share with a classmate. Use your original and recovered waveforms, the FFT peaks, and the reconstruction overlay to answer the central question: Can one measured signal reveal the two oscillating contributions that produced it? State your main claim, point to at least two pieces of evidence, and acknowledge one limitation.

Individual Reflection — Answer Before Using AI

What could you see in the combined FFT that was difficult to determine from the original time graph?

How do the separate cantilever recordings support your identification of the two recovered frequencies?

Which decision did you make or verify rather than simply accepting AI’s recommendation?

Connect back to superposition: oscillating contributions add, and the combined signal can show reinforcement or cancellation even when both contributions remain present.

Part 3 — Post-Class Work for Session B — About 105 minutes

A Prepare Your Evidence Report 45 minutes

Write your main claim and reasoning before asking AI to draft a report of approximately 4–6 pages using your verified results, figures, and decision log. Revise every claim to match the evidence. Include only measurements and uncertainties you can explain.

Include the sensor setup and single-cantilever measurements; combined signal and FFT; selected filter bands; recovered time-domain waveforms and their FFTs; reconstruction and residual. Clearly label measured data and AI-assisted analysis, and discuss one limitation or reliability test.

End with your own reflection: Which prediction changed? What did AI enable you to investigate? Which result required your judgment? What limitation remains? Ask AI to critique your reasoning after you draft it.

B Retrieval Practice and Course Review 30 minutes

Use the course retrieval tool for 30 minutes. Do your best to answer the questions thoughtfully and build your retention of the lesson you have done over the semester to date.

Everything You Turn In

- Your evidence report, including the selected graphs and individual reflection; include an extension only if assigned or completed.