

Module 3

Depth Study

Brief

PH11-1, PH11-2, PH11-3, PH11-4, PH11-5, PH11-6, PH11-7, PH11-10

ORIENTATION

Purpose: design and communicate a focused investigation or secondary-data study that uses a Module 3 wave, sound, optics, or thermal model.

This asset deliberately stops short of being a lab manual. Detailed lab sheets can be built later. For now, this provides the research and writing structure needed for the 10-week learning sequence.

APPROVED STUDY LANES

LANE	POSSIBLE FOCUS	CORE MODEL
Wave transfer	speed, frequency, wavelength, medium change	$v = f\lambda$
Resonance	strings, pipes, standing waves	natural frequency and harmonics
Sound	pitch, loudness, intensity, distance	intensity and decibel scale
Ray optics	refraction, image formation, lenses	Snell's law or thin-lens model
Thermodynamics	heating, cooling, insulation, phase change	$Q = mc\Delta T$ or $Q = mL$

MINIMUM STUDENT DELIVERABLE

1. Research question.
2. Physics model and variables.
3. Method or data-source description.

4. Risk, validity, reliability, and accuracy notes where relevant.
 5. Data table or evidence summary.
 6. Graph, calculation, or comparison.
 7. Conclusion that answers the research question.
 8. Limitation and improvement.
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RESEARCH QUESTION TEMPLATES

- How does changing the medium affect wave speed or wavelength?
 - How does pipe length affect resonant frequency?
 - How does distance affect measured sound intensity?
 - How well does Snell's law predict refraction through a transparent block?
 - How does insulation affect the rate of thermal energy transfer?
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MARKING-FOCUSED SUCCESS CRITERIA

CRITERION	EVIDENCE EXPECTED
Question and hypothesis	specific independent/dependent variables and a physical prediction
Model selection	relevant equation, assumptions, and scope
Data quality	repeated trials or credible secondary data; units and uncertainty
Analysis	graph or calculation linked to the model
Evaluation	limitation and improvement connected to validity, reliability, or accuracy
Communication	concise scientific language, labelled variables, correct units

STUDENT WORKING
