

Simple harmonic motion · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Oscillations · 1.1

Reasoning

A swing gains a large amplitude when pushes arrive with the right timing. The forcing frequency and damping help determine the response. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Oscillations · 2.1

Reasoning

Simple harmonic motion has acceleration proportional to displacement and directed toward equilibrium. Period is time per cycle; frequency is its reciprocal. Damping transfers energy away from the oscillating system. resonance : A large response to periodic forcing near a natural frequency; damping: Energy transfer out of an oscillating system.

Oscillations · 3.1

Reasoning

Velocity is greatest near equilibrium for ideal SHM, while acceleration magnitude is greatest at extreme displacement. Resonance can occur near the natural frequency under periodic driving, with amplitude limited by damping. Measure time for several complete oscillations and divide. Define a cycle consistently and use a small displacement when the model requires it. Keep pendulum paths clear and record damping effects rather than assuming perfect motion.

Oscillations · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: 20 cycles take 32 s. $T = \text{total time} / \text{cycles} = 32 / 20 = 1.6$ s. $\text{Frequency} = 1 / T = 1 / 1.6 = 0.625$ Hz. A shorter total timing interval would make reaction-time error a larger fraction of the measurement.

Oscillations · 4.2

Reasoning

30 cycles take 45 s. Find period. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Oscillations · 5.1

Reasoning

Not every repeated motion is SHM. A force proportional to displacement but directed away from equilibrium does not produce SHM. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Oscillations · 5.2

Reasoning

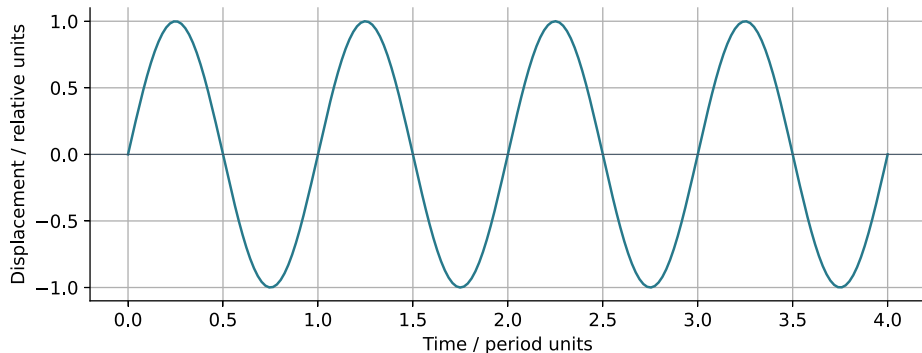
Every periodic motion satisfies the condition for simple harmonic motion. This claim is false: Not every repeated motion is SHM. A force proportional to displacement but directed away from equilibrium does not produce SHM.

Oscillations · 5.3

Reasoning

Oscillation, resonance and phase: Velocity is greatest near equilibrium for ideal SHM, while acceleration magnitude is greatest at extreme displacement. Resonance can occur near the natural frequency under periodic driving, with amplitude limited by damping.

Oscillations · diagram



- Original teaching diagram: Oscillation, resonance and phase
- Use the labels and the stated model together.

Oscillations · original transfer

Your turn

Twenty cycles take 32.0 ± 0.4 s. Find period and maximum absolute uncertainty, treating cycle count as exact. Why time several cycles?

Oscillations · transfer reasoning

Method and interpretation

$T = 1.60 \pm 0.02$ s, relative uncertainty 1.25%. A single cycle with the same ± 0.4 s timing uncertainty has much larger relative uncertainty. Define the cycle consistently.

Check yourself

- Explain damping using the stated model.
- Explain resonance using the stated model.
- Change one value in the original transfer; explain which assumption still matters.