Preparation Notes for Chapter 18 (Standing Waves 2-3 classes)

THIS IS STILL PRETTY ROUGH; JUST A QUICK TRANSCRIPTION FROM MY PAPER NOTES

Section title

Day 1 Reading is 18.1-18.4; review problems 18.7, 18.23

Day 2 Reading is 18.5-18.7; review problems 18.49, 18.33

(1) Superposition of waves: net displacement of medium = sum of displacements from the two individual waves; example of two waves traveling same direction, same f,λ, A but different ϕ; $y = 2Acos(\phi/2)sin(kx - \omega t + \phi/2)$ (using $y = y_1 + y_2$ and $sin(a) + sin(b) = 2cos(a - b)/2sin(a + b)/2$; example from text of two routes for sound to travel; $\Delta r = n\lambda$ in phase, constructive; $\Delta r = n\lambda/2$ n odd, destructive

(2) presentation on standing waves in string

(3) Followup/summary: two waves travelling in opposite directions, same amplitude and frequency; $y = 2Asin(kx)cos(\omega t)$; not traveling (no $kx - \omega t$ term); amplitude depends on position x; each position follows SHM with same frequency ω; nodes where zero displacement when $kx = n\pi$; greatest amplitude at anti-nodes where $kx = n\pi/2$ with n odd

(4) presentation on standing waves in air

(5) Followup/summary: closed end is node, open end is antinode; open at one end $f_n = nv/4L$, n is odd; open at both ends, $f = nv/2L$

(6) Discussion: how does temperature affect ability of string and wind instruments to hold their pitch?

(7) Presentations on other applications of standing waves in air columns (straw, blowing bubbles, mailing tubes, etc); follow-up by instructor as necessary)

(8) presentation on beats (difficult topic for experiment);

(9) followup on math; $y = A2cos(2\pi t(f_1 - f_2)/2)cos(2\pi t(f_1 + f_2)/2)$ (using $cos(a) + cos(b) = 2cos(a - b)/2cos(a + b)/2)$; sketch envelope and pattern; note are plotting y versus time i.e. variation in intensity at some fixed point x; intensity goes as amplitude squared; maxima wherever cos(diff)= 1, -1; 2 maxima per period; frequency of maxima is $2(f_1 - f_2)/2$ so $f_b = f_1 - f_2$ (absolute value)

(10) discussion: Act 26 (Can you hear the beat frequency?)

(11) problem 18.49 (beat frequency when tension of string on piano slips)

(No concept map available yet for this chapter.)

Suggested Presentation Topics

See master list