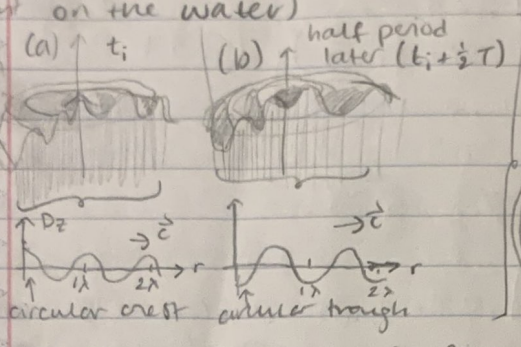
Chapter 17 Textbook Notes

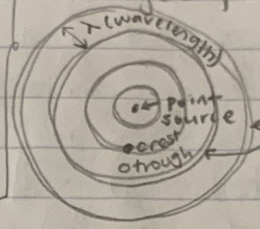
17.1 - Wavefronts

(Review displacement & wavelength eq's)

- **surface wave** - a wave that propagates in 2 dimensions (like a ripple on the water)



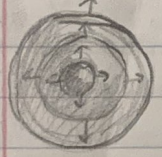
Point source = source of wave localized to a single point in space



wavefront = curves/surfaces that all have the same phase

As each circular ripple expands, energy per unit circumference must decrease ~~somehow~~

- The expansion of circular wavefronts causes the energy per unit length along a wavefront to decrease as $\frac{1}{r}$. so every wave amplitude is proportional to $\frac{1}{\sqrt{r}}$ (Amplitude decreases as wavefront moves away from the source.) This has nothing to do with energy dissipation!!! It is entirely due to the spreading out of the wave, which causes the energy to be distributed over a larger surface.

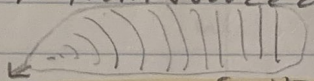


Spherical waves - propagate in 3D

For spherical waves, when a wavefront reaches a distance r from the source, the energy in the wavefront is spread out over surface area $A = 4\pi r^2$, so energy per unit area is $\propto$ to $\frac{1}{r^2}$

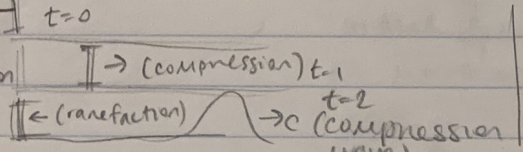
tldr: Amplitude of wavefronts decrease with distance r from source as $\frac{1}{\sqrt{r}}$ in 2 dimensions & $\frac{1}{r}$ in 3 dimensions

Far from the point source, 2D wavefronts become **planar wavefronts**



17.2 - Sound

- Human ear can detect longitudinal waves in 20 Hz - 20 kHz range (10 octaves)

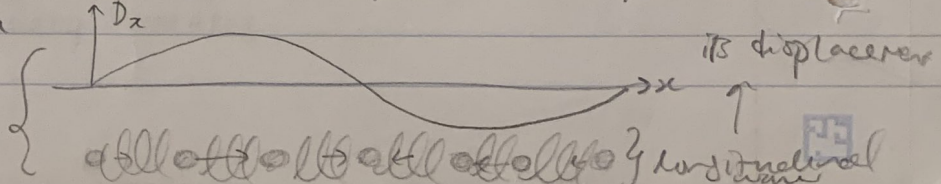


rarefaction

compressional wave - consists of compressions & rarefaction disturbances

wave speeds depends on density & elastic properties of the medium

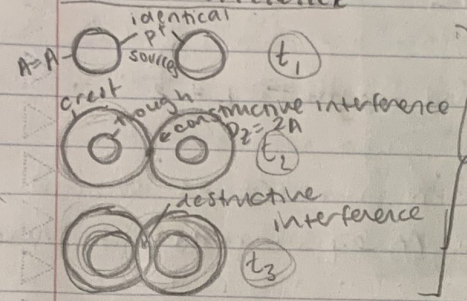
mechanical model for longitudinal waves



Chapter 17 Textbook Notes (continued)

- The compressions & rarefactions in longitudinal waves occur @ the locations where the medium displacement is 0.
- sound waves form spherical wavefronts

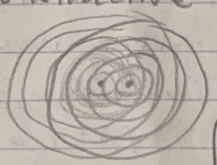
17.3 - Interference.



Trough meets trough - constructive interference, A=-2A

Trough meets crest - destructive interference, A=0

Crest meets crest - constructive interference A=2A



Moiré pattern gives illusion of bands radiating

In phase - 2 sources w/ same phase

Coherent - constant phase difference

Moiré pattern - pattern produced by overlapping circles

Nodal lines - lines where 2 waves cancel each other & vector sum of medium displacement is 0

Nodes - ⊖ Antinodes - ○ (negative), ● (positive),

When waves from two coherent sources interfere, the amplitude of the sum of those waves in certain directions is less than that of a single