

Waves

CHAPTERS 17, 18, and 19

The Basics of Waves

Involves kinetic energy(energy in motion)

- A wave is a _____ that transfers _____ through matter or space
- The energy is transferred through a _____ (liquid, solid, or gas)
- The medium has no overall _____ itself(simply transfers the energy)

Waves Traveling Through a Medium

- _____ of medium vibrate
- Waves move forward, but medium stays put(ex. buoy in water)
- Density: as density of medium increases, the _____ of wave _____
- _____: waves travel faster through mediums who can return to original shape more quickly(ex. steel vs. air)

Transverse Waves

- Motion of medium is at right angles to the direction in which wave travels(ex. ocean wave, string)
- Two primary parts:
 - ① _____ - high point of wave(maximum upward displacement of medium particle)
 - ② _____ - low point of wave(maximum downward displacement of medium particle)

LONGITUDINAL WAVES

- _____ - crowding of molecules in medium
- _____ - fewer molecules in medium after compression
- Wave moves when one layer of molecules pushes against another layer
- Motion is _____ to direction of wave
 - ex. clapping hands(feel the air)
 - ex. sound waves(are all longitudinal)

Longitudinal Waves

- Compressions: Areas where molecules _____ together
- Rarefactions: Area where molecules are _____ apart
- Wavelength: Distance between 2 _____ or _____
- Rarefactions: Area where _____ are spread apart
- Wavelength: Distance between 2 compressions or rarefactions
- Frequency: # of _____ passing a certain point each second

DIAGRAM AND LABEL A TRANSVERSE AND LONGITUDINAL WAVE

CHARACTERISTICS OF A WAVE

- *Amplitude*- total distance molecules are displaced(indicates energy of wave)
- *Wavelength*(λ)- distance between 2 consecutive crests or troughs(cm or m)
- *Period* – The time required to complete one full wave cycle

- *Frequency*(Hz)- number of waves per unit time..... 1Hz = 1 wave/second
- *Speed*- is constant in a given medium **speed= frequency x wavelength**

SPEED OF WAVES

** speed = frequency x wavelength: FORMULA TRIANGLE:

- Since speed is _____ in a medium:
 1. When frequency _____, wavelength ↓
 2. When frequency _____, wavelength ↑

Sample Problems

- A wave has a frequency of 10 Hz and a wavelength of 30m. Calculate its speed.

- If the frequency of a wave in question 1 were 20 Hz, what would be its wavelength?

Wave Interactions

REFLECTION

- When a wave strikes a barrier and bounces back(ex. water wave hitting breakwall)

_____ wave: incoming wave

_____ wave: bounced-back wave

Write out the Law of Reflection

Refraction

- The _____ of a wave due to a change in speed which occurs as the wave moves from one _____ to another

- Bending of waves _____ the edge of a barrier

- Ex. Hearing a radio next door, without actually seeing the radio

Diffraction

- The _____ of waves around the edge of an obstacle

- This results in a new set of waves being formed

Draw a diagram of diffraction

INTERFERENCE

- 2 waves meeting at the same point at the same time → a new wave is formed

- _____: 2 crests combine, forming a single, larger wave (combine amplitudes)

Constructive Interference

- _____: crest of one wave combines w/ trough of another(decreases amplitude)

SOUND WAVES

- Sound waves are _____
 1. Motion of medium // to wave motion
 2. Consists of compressions/rarefactions
- Transmitting sounds(elasticity is key):
 - move _____ through gases
 - move _____ through liquids
 - move _____ through solids
- Determined by 2 factors:
 - _____ - higher the temp, faster the sound travels
 - _____ - more elastic the medium, faster the sound travels
- Sound travels 340m/s in air(light travels 1,000,000x faster!!)
ex. thunderstorm

INTENSITY

- How much energy the wave has
- Determined by _____ (\uparrow amp = \uparrow energy)
- Determines the _____ of sound

- Loudness measured in _____ (dB):

- Ex. Ticking of watch..... 20 dB
- Normal conversation..... 60 dB
- Shouting..... 90 dB
- Rock concert..... 120 dB
- Jet taking off..... 150 dB

- 85 dB sustained will cause damage to ears
- 120 dB will cause immediate damage

PITCH

- _____ is how high or low a sound is
- depends how fast/slow molecules of a medium _____
- Pitch = frequency(Hz)
- Humans can hear pitches between 20Hz and 20,000 Hz.
(>20,000Hz is *ultrasonic*)
- Dogs, dolphins, and tortoises can hear ultrasonic pitches.

Doppler Effect

- Is a change in frequency/pitch due to motion of sound or motion of observer of sound
- As sound moves closer, frequency _____
- As sound moves away, frequency _____

DESCRIBE A SONIC BOOM

WAVE INTERACTION IN SOUND

- _____: ability of an object to absorb energy (of its own natural frequency) from another source.

ex. Tuning in a radio, uses resonance to match the frequency of radio to the station

- *Constructive interference*: waves _____ and intensify sound

- *Destructive interference*: waves _____ each other out, decreasing sound (ex. dead spots in a hall with hard surfaces)

- *Acoustics*: the science of _____

SONAR

- _____ Known as “sound navigation and ranging”

- Measure of reflected sound waves (ultrasonic) bouncing off a _____ object

- Distance of object = (speed of sound waves) x (1/2 total time of travel)

MUSIC...OR NOISE

- Scientists define music as having.....

1. A _____ quality (subjective!!)

2. A definite, identifiable _____

3. A definite, repeating _____ (rhythm)

- Horns, drums, strings vibrate to create sound

ex. stringed instruments:

- *shorter strings* = frequency

- *more tension* = _____ frequency

-thinner strings = _____ frequency

CREATE A DIAGRAM OF THE EAR

CREATE A DIAGRAM OF THE EYE

HOW DO LENSES AND MIRRORS WORK