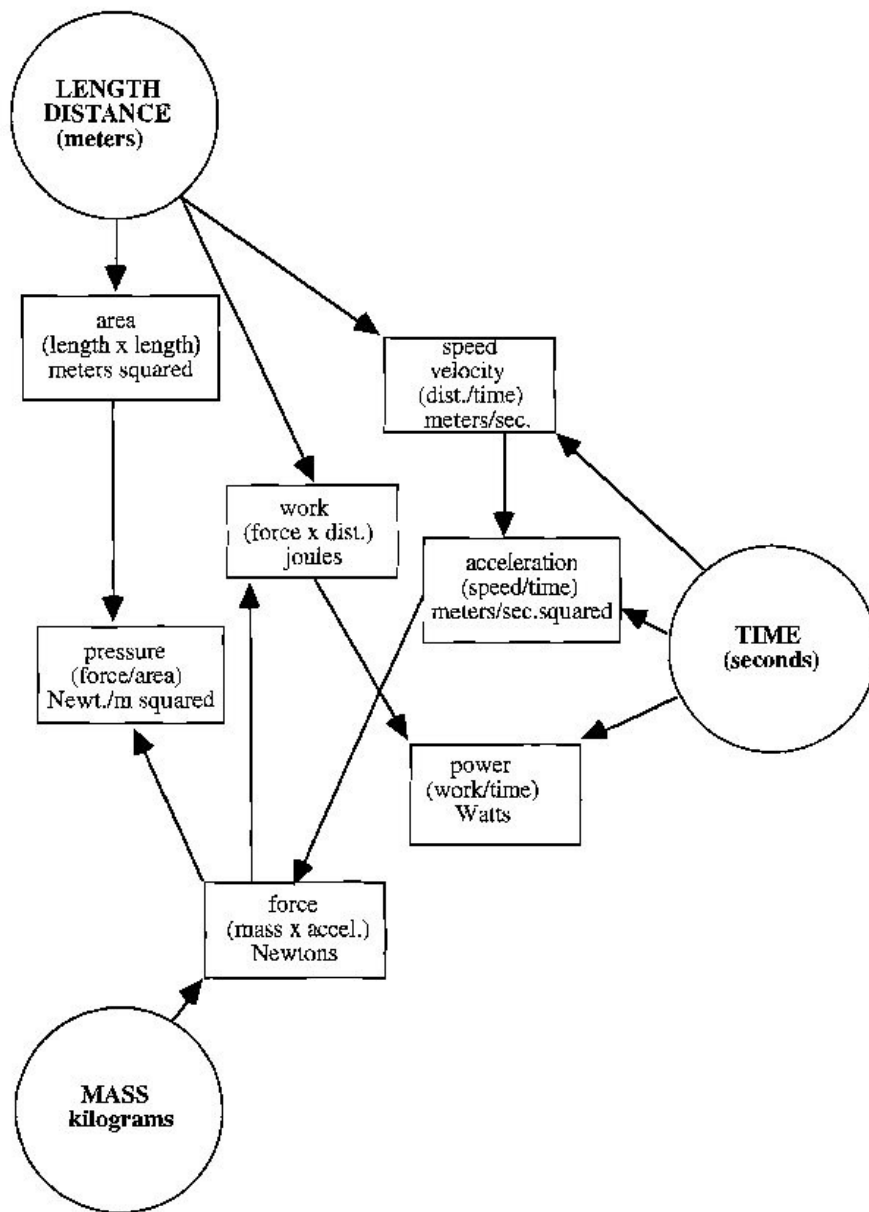


Fundamental Physical Quantities

T. Tunks
Acoustics of Music
SMU



IMPORTANT TERMS
Backus, Ch. 1
Fundamental Physical Quantities

Length - meters, feet (distance)

Time - seconds

Mass - kilograms, pounds

Speed, Velocity - distance per time (meters/second)

Area - length by length (m^2)!

Acceleration - velocity per time (meters per second per second, or $m/sec.^2$)

Volume - area by height (m^3)

Force - mass by acceleration (1 newton = $1kg/sec^2$)

Work - force by distance (1 joule = 1 newton by (across) 1 meter)

Pressure - force per area ($newtons/m^2$)

Power - work per time (1 watt = 1 joule/sec)

Vector - a vector quantity is one that takes into account direction

Momentum - the property of a mass in motion to remain in motion

Equilibrium - occurs when the net force acting on a mass is zero, or no acceleration

NOTE: semantically, "by" means "times", and "per" means "divided by"

Backus, Ch. 2
Simple Vibrating systems

vibration - oscillation
periodic motion
period, T
cycle
frequency, f, Hz
simple harmonic motion, SHM
amplitude
displacement
restoring force
momentum
phase
sine curve
pure tone, sinusoid
fundamental frequency
mass - stiffness
natural frequencies
damping
driving force
 $f=1/T$
 $T=1/f$
envelope
wave history
time domain/frequency domain graphs

IMPORTANT TERMS

Backus, Ch. 3

Waves and wave propagation

medium

propagation

compression

expansion (rarefaction)

density

elasticity

longitudinal wave

transverse wave

tension

displacement-time, pressure-time curves

pressure/displacement phase relationship (90 degrees)

wavelength (λ)

speed of sound (343 m/s at 20 degrees C, 1131 ft/s at 72 degrees F)

$s=331 \text{ m/s at } 0 \text{ degrees C} \pm .6 \text{ m/s for each degree C different}$

$s=1087 \text{ ft/s at } 32 \text{ degrees F} \pm 1.1 \text{ ft/s for each degree F different}$

$s=d/t$

$t=d/s$

$d=st$

$s=f\lambda$

$\lambda=s/f$

$f=s/\lambda$

reflection

refraction

diffraction

phase

constructive interference,

destructive interference

beats ($f_b=f_1-f_2$)

Doppler effect

efficiency

intensity

inverse square law

absorption

$I_A = I - I_R$

absorption coefficient

$a = I_A/I$

IMPORTANT TERMS

Backus, Ch. 4

Complex Vibrations and Resonance

standing wave

node

antinode

$$\lambda = 2L$$

$$f_1 = s/2L$$

vibratory modes

harmonics, partials, overtones

open tube function (open pipe)

stopped (closed) tube function (stopped pipe)

end correction ($1/3 d$)

conical pipe function

vibratory modes of membranes and plates

resonance

sympathetic vibration

Helmholtz resonator

linear and logarithmic scales

IMPORTANT TERMS

Backus, Ch. 5

The Ear and Loudness

outer ear	intensity (I) in Watts per squared meter
pinna	intensity level (IL) in dB ($10 \log I_1/I_2$)
ear canal (auditory meatus)	intensity ratio
eardrum (tympanic membrane)	sound pressure level
middle ear	SPL) in dB ($20 \log p_1/p_2$)
oval window (fenestra ovalis)	threshold of audibility
round window (fenestra rotunda)	Fletcher-Munson curves
ossicles	equal loudness contours
hammer (malleus)	loudness level (LL) in phons
anvil (incus)	threshold of feeling (pain)
stirrup (stapes)	loudness (L) in sones
eustachian tube	masking
acoustic reflex	masked threshold
stapedius	partial masking
tensor tympani	sound level meter
inner ear	dB(A)
cochlea	temporary threshold shift
upper gallery (scala vestibuli)	permanent threshold shift
cochlear duct (scala media)	
Reissner's membrane	OSHA standard
lower gallery (scala tympani)	(85 dB, 8 hrs.;
basilar membrane	halve time for each 5 dB increase)
helicotrema	
organ of Corti	presbycusis
hair cells	
tectorial membrane	

IMPORTANT TERMS

Backus, Ch. 6

Tone Quality

timbre

steady state

transient/instrument identification

waveform

harmonic spectrum

Fourier components

resynthesis

phase of partials/waveform/timbre

averaging

average spectrum envelope

loudness spectrum

formants/formant region

long time averaging spectrum (LTAS)

vibrato

chorus effect

aural harmonics

combination tones

simple difference tone ($f_2 - f_1$)

cubic difference tone ($2f_1 - f_2$)

IMPORTANT TERMS

Backus, Ch. 7

Frequency and Pitch

cent

US standard notation

frequency ratios

pitch/amplitude

fusion

place theory

volley theory

critical band

roughness

beats

fundamental tracking

periodicity pitch

autocorrelation

harmonic pattern recognition

central pitch processing

tone height

chroma

pitch spiral

context and expectation

dominance region (500-2K Hz)

dominant harmonics (4,5 for bass, 2,3 for upper treble)

frequency discrimination/pitch discrimination

absolute/relative difference limen

absolute pitch

drift in internal standard