PHYS 1406 —

— music performances by students ...

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Basic math: +, −, ×, ÷

(1.) 1 divided by 2π ?

~~1.5708~~

✓ 0,159 ≈ 0,16

$\frac{1}{4} = 0,25$

$1 \div 2 \times \pi$

0,5

1,5708

$\pi = ?$

$= 3,14$

$2\pi = 6,28$

$1 \div (2 \times \pi)$

$\frac{1}{2\pi} = 0,159$

(2.) $2 \div 3/2 = ?$

$\frac{4}{3}$ ✓

$\frac{2}{3/2} = 2 \times \frac{2}{3} = \frac{4}{3}$

$= 1,333$

(3.) $2^4 = ? = 16$

$2 \times 2 \times 2 \times 2$

4 times

$10^6 = 1,000,000$

$10 \times 10 \times 10 \times 10 \times 10 \times 10$

trillion: $10^{12} = 1,000,000,000,000$

HW assignments:

(1) Buy Powell book

(2) Read chpts 1 & 2 in Powell book

(3) Start reading section 1 in supplemental notes.

- logarithms
- physics terminology
- music terminology

18 Jan 2022:

— piazza — won't use
— course website: added links

Today:

1) Finish basic math review
2) "How music works" — chpts 1, 2
   Supplemental notes 1.1-1.6

Exponents (continued)

$10^0 = 1$

$3^{-2} = \frac{1}{3 \times 3} = \frac{1}{9} = 0.11$ | $3^2 = 3 \times 3 = 9$

$10^{-3} = 0.001 = \frac{1}{1000}$

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(41) Prefixes:

Centimeter = $\frac{1}{100}$ meter

Kilometer = 1000 meters

1 meter

Kilobyte, Megabyte, gigabyte

1000 million billion

10^6 10^9

~~nanobyte = 10^{-9} byte~~

100 cm = 1 m

1 cm = 0.01 m

millimeter = $\frac{1}{1000}$ m = 10^{-3} m

nanometer = $\frac{1}{10^9}$ m = 10^{-9} m

Micrometer = $\frac{1}{10^6}$ m = 10^{-6} m

(5.) Comparing two numbers

Joe = 5,5 ft = 66 in

Tim = 72 in $\left(\frac{1\,ft}{12\,in}\right)$ = 6 ft

↑ conversion

Tim is 0,5 ft taller than Joe

10 ~~dollars~~

5 Euros

15 pesos ←

Joe : 5,5 ~~ft~~ $\left(\frac{12\,in}{1\,ft}\right)$ = 66 in

Tim is 6 in taller than Joe

72 in − 66 in

$\frac{72 \text{ in}}{66 \text{ in}} = \frac{6 \text{ ft}}{5.5 \text{ ft}} = 1.09$

Tim's height is 9% larger than Joe's height

quarter → $\frac{\$3.00}{\$2.50} = 1.2$

↑ Great value

20% larger

Music: ratios, Fractions, percentages

20 Jan 2022:

1) chpt 2 : perfect pitch
2) Range of hearing
3) Tools for measuring the properties of sound
4) musical intervals / terminology (1.6 supplemental lecture notes)

Lab start on week #4

Mon 7 Feb { Wed 9 Feb, Thu, Fri

cycles/sec

~20 (Hz) — ~20,000 Hz

Hertz

f : Frequency (Hz) = $\frac{1 \text{ cycle}}{\text{sec}}$

T : period (sec, hr, days, ...)

$$f = \frac{1}{T}, \qquad T = \frac{1}{f}$$

$$fT = 1$$

Higher freqs : ultrasound

Lower freqs : infrasound

Range of hearing

22 Hz — 13,500 Hz (Joe)

17,500 Hz — 17.5 kilo Hz

"Mosquito ringtone" — 18,500 Hz

25 Jan 2022:

- "Course guide / lab manual" available at SUB
- Today — chpt 3 "How music works"
  "Notes vs. noise"

27 Jan 2022:

- "Course guide/lab manual" at SUB
- Another week of remote classes
- Continue discussing chpt 3 "Note vs. Noise"

↳ Key topics

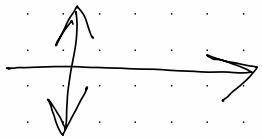
Harmonics, timbre, resonance
standing waves, Fourier
analysis / synthesis

$$T = 3 \text{ msec} \left(\frac{1 \text{ sec}}{1000 \text{ msec}} \right) = .003 \text{ sec}$$

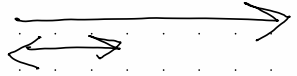
$$f = \frac{1}{T} = 333 \frac{1}{\text{sec}} = \boxed{333 \text{ Hz}}$$

$\frac{1}{\text{sec}}$ ↑ $\frac{\text{cycles}}{\text{sec}}$

"Transverse wave"



"Longitudinal wave"



1 Feb 2022:

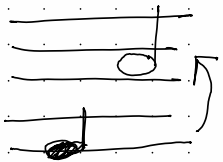
- F2F classes start next Tues Feb 8th
- Labs start next week (SC 130, 4:00-5:50pm)
  - instructions (T.A. Connor Aronoff, Nasir Siddique)
  - short quiz at the start of each lab
  - Need 75% or better in labs to pass the course
- Today — sec 1.6

lab #1
1) musical intervals
2) Oscillations / SHM — sec 2
3) standing waves / Fourier analysis

chpt 3 in "HMW"

(1) Musical intervals — Appendix of 'HMW'

jump / step up from one musical note to another note



Major chord:

C – E – G

3rd 5th

Halfstep — semitones

Wholestep — tones

☆ Octave — ×2/1 — C → C : 12 semitones

☆ perfect Fifth : — 3/2 — C → G : 7 semitones

☆ perfect Fourth : — 4/3 — C → F : 5 semitones

☆ Major third — 5/4 — C → E : 4 semitones

minor third — 6/5

12 chromatic — S S S ... S

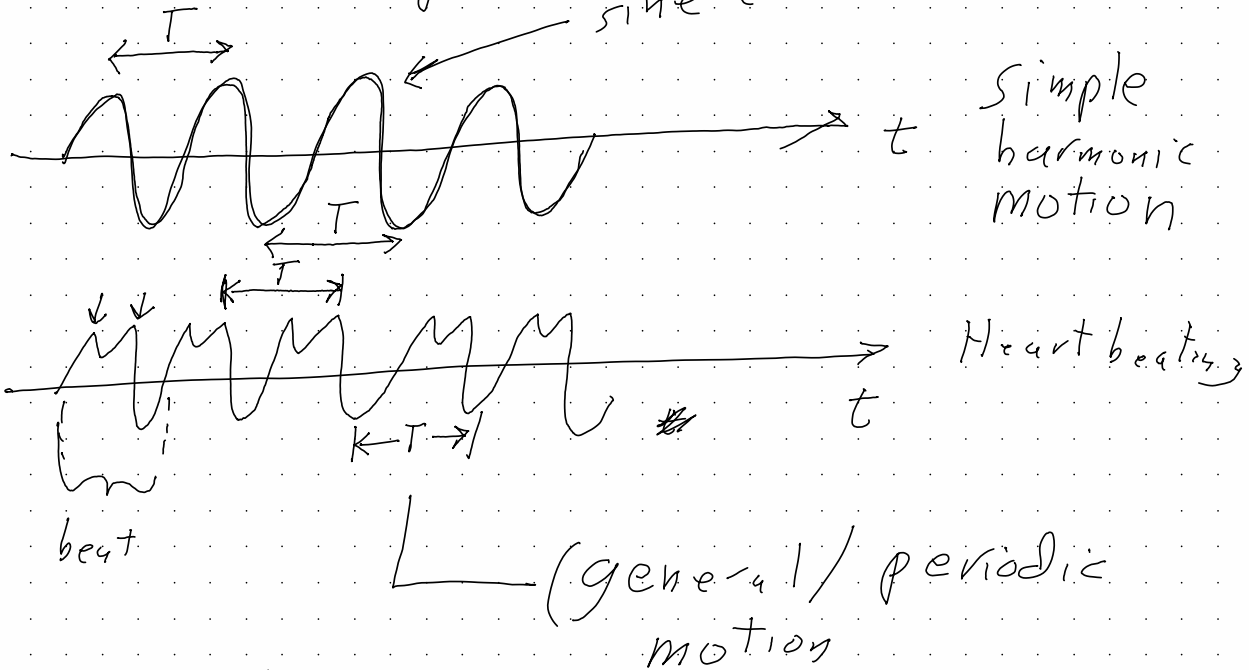
7 diatonic — T T S T T T S (W W)

5 pentatonic — T T 3 T 3 (W W)

(2.) Oscillations / periodic motion // Vibrations

(back-and-forth motion)

"motion that repeats"



└ (general / periodic motion

period (T) : time required for one complete oscillation

$$\boxed{\frac{1}{T} = f} = \frac{1 \text{ oscillation}}{\text{time for one oscillation}} = \frac{\#\text{ of osc.}}{1\text{ s}}$$

$$f = \frac{\#\text{ of oscillation}}{\text{time interval for those oscillation}}$$

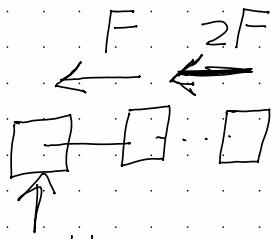
$$= \frac{\#\text{ of oscillation in } 1 \text{ sec}}{1 \text{ sec}}$$

$$\boxed{T = \frac{1}{f}}$$

$$= \text{Hz}$$

$$f = \frac{90 \text{ beats}}{\text{minute}} \cdot \frac{1 \text{ minute}}{60 \text{ sec}} = 1.5 \frac{\text{beat}}{\text{sec}} = \boxed{1.5 \text{ Hz}}$$

SHM whenever an object displaced from equilibrium experiences a restoring force that is proportional to the displacement



$T = 2\pi \sqrt{\frac{\text{mass}}{(\text{stiffness of the spring})}}$

π / 3.14...

(mass on a spring)

$T = 2\pi \sqrt{\frac{\text{length of string}}{\text{gravity}}}$

(simple pendulum)

(3) standing waves —
"building blocks" for complex vibrations
("atoms")