Phys 1402 2017-11-07 Lec 19

HW5 Due 11/21

Oscillations:

$$x = x_{max} \sin(2\pi f t)$$

x_{max}: Amplitude; f: Frequency; sin or cos()

Freq (f) in hertz (Hz) is # cycles / second.

Angular Freq: $\omega = 2\pi f$ in radians/s $= s^{-1}$

Period: $T = \frac{1}{f}$ in seconds

Period is time of one cycle.

Examples: mass and spring $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$

pendulum $f = \frac{1}{2\pi}\sqrt{\frac{g}{L}}$ (L: Length)

Waves are formed from many coupled oscillators. Disturbance and Energy move from one place to another. Particles or medium oscillates in place

Wavelength (λ) in meters is the length of one cycle on a photo of a wave.

(2)

The speed of a wave is the speed at which the disturbance or energy travels.

$$v = \frac{\Delta s}{\Delta t} \qquad v = \frac{\lambda}{T} \qquad \boxed{v = f\lambda}$$

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

Sound Waves

Air molecules oscillate forward/backward (Dan Russell waves)

$v \approx 340$ m/s Affected by temperature

$f \sim 20$ Hz $- 20{,}000$ Hz

20 Hz $-$ 20 kHz

Range of λ: Minimum $\lambda = \frac{v}{f} = \frac{340 \text{ m/s}}{20000 \text{ Hz}}$

$= 0.017$ m

$= 17$ mm

Max $\lambda = \frac{340 \text{ m/s}}{20 \text{ Hz}} = 17$ m

Light Waves $v = 3 \times 10^8$ m/s $\equiv c$

$f = 400 - 750$ THz

$\lambda = 400 - 750$ nm

$f\lambda = (750 \times 10^{-9} \text{ m})(400 \times 10^{12} \text{ Hz}) = 3 \times 10^8$ m/s