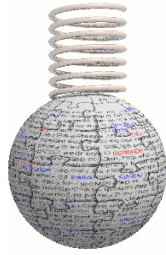


**UNIT 13**

**VIBRATIONS,  
WAVES, AND  
SOUND**



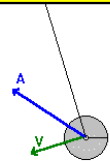
$$\frac{L_f}{L_r} = \frac{I_f \omega_f}{I_r \omega_r}$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I_f \omega_f^2 + \frac{1}{2}I_r \omega_r^2$$



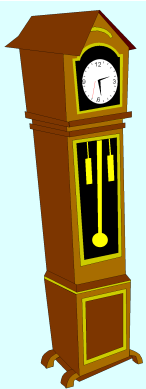
PRACTICE	LABS	TESTS
Unit 12 Problems	Rube Goldberg Machines	Unit 13 Test Wednesday (4/17/19)

**Oscillations and Periodic Motion**



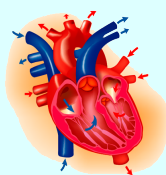
**13.1**

I can describe, interpret, and solve problems involving oscillations and periodic motion.



**Periodic Motion**

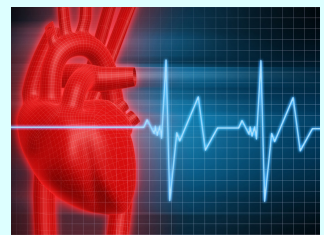
A motion that repeats itself over and over is referred to as **periodic motion**.



**Periodic Motion**

The **period, T**, is the time required for one cycle of periodic motion.

t



## Periodic Motion

The **frequency,  $f$** , is the number of oscillations per unit time.

$$\frac{1}{s} = s^{-1} = \text{Hz}$$

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

## Typical Periods and Frequencies

TABLE 13-1 Typical Periods and Frequencies

System	Period (s)	Frequency (Hz)
Precession of the Earth	$8.2 \times 10^{11}$ (26,000 y)	$1.2 \times 10^{-12}$
Hour hand of a clock	43,200 (12 h)	$2.3 \times 10^{-5}$
Minute hand of a clock	3600	$2.8 \times 10^{-4}$
Second hand of a clock	60	0.017
Pendulum in grandfather clock	2.0	0.50
Human heartbeat	1.0	1.0
Lower range of human hearing	$5.0 \times 10^{-2}$	20
Wing beat of housefly	$5.0 \times 10^{-3}$	200
Upper range of human hearing	$5.0 \times 10^{-5}$	20,000
Computer processor	$5.6 \times 10^{-10}$	$1.8 \times 10^9$

### UNIT 13 IN CLASS PROBLEMS

- The processing "speed" of a computer refers to the number of binary operations it can perform in one second, so it is really a frequency. If the processor of a personal computer operates at 1.80 GHz, how much time is required for one processing cycle?
- A tennis ball is hit back and forth between two players warming up for a match. If it takes 2.31 s for the ball to go from one player to the other, what are the period and frequency of the ball's motion?

### UNIT 13 IN CLASS PROBLEMS

- The processing "speed" of a computer refers to the number of binary operations it can perform in one second, so it is really a frequency. If the processor of a personal computer operates at 1.80 GHz, how much time is required for one processing cycle?

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

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



### UNIT 13 IN CLASS PROBLEMS

- The processing "speed" of a computer refers to the number of binary operations it can perform in one second, so it is really a frequency. If the processor of a personal computer operates at 1.80 GHz, how much time is required for one processing cycle?

$$T = \frac{1}{f} = \frac{1}{1.8 \times 10^9 \text{ cycles/s}}$$

$$T = 5.56 \times 10^{-10} \text{ s}$$



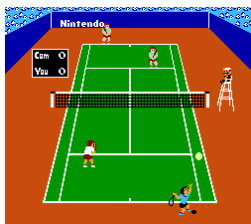
### UNIT 13 IN CLASS PROBLEMS

- A tennis ball is hit back and forth between two players warming up for a match. If it takes 2.31 s for the ball to go from one player to the other, what are the period and frequency of the ball's motion?



**UNIT 13 IN CLASS PROBLEMS**

2. A tennis ball is hit back and forth between two players warming up for a match. If it takes 2.31 s for the ball to go from one player to the other, what are the period and frequency of the ball's motion?



$$T = 2 (2.31 \text{ s}) = 4.62 \text{ s}$$

$$f = \frac{1}{T} = \frac{1}{4.62 \text{ s}} = 0.216 \text{ Hz}$$

A yellow sticky note with the text "Practice Makes Perfect" written on it. The note is pinned to a light yellow background. To the right of the note, the text "PRACTICE PROBLEMS (1-5)" is written in a large, bold, black font.