



Oscillations and Periodic Motion

Learning




Target

Learning

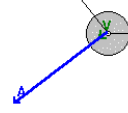


Target

Learning



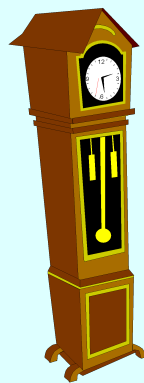

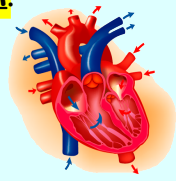
Target



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

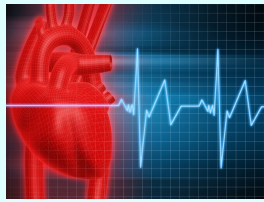
Periodic Motion

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.



Periodic Motion

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

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

$f = \frac{1}{T}$
 $f = \frac{1}{86,400s}$
 $f = 1.16 \times 10^{-5} Hz$

$\frac{1}{s}, s^{-1}, Hz$
 Hertz

Typical Periods and Frequencies

TABLE 13-1 Typical Periods and Frequencies

System	Period (s)	Frequency (Hz)
Precession of the Earth	8.2×10^{11} (26,000 y)	1.2×10^{-12}
Hour hand of a clock	43,200 (12 h)	2.3×10^{-5}
Minute hand of a clock	3600	2.8×10^{-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	5.0×10^{-2}	20
Wing beat of housefly	5.0×10^{-3}	200
Upper range of human hearing	5.0×10^{-5}	20,000
Computer processor	5.6×10^{-10}	1.8×10^9

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

2. 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?

$1,800,000,000 \text{ Hz}$
 $f = \frac{1}{T} \quad T = \frac{1}{f}$



UNIT 13 IN CLASS PROBLEMS

2. 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

3. 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?



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

UNIT 13 IN CLASS PROBLEMS

3. 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?



$T = 2(2.31 \text{ s}) = 4.62 \text{ s}$
 $f = \frac{1}{T} = \frac{1}{4.62 \text{ s}} = 0.216 \text{ Hz}$

Practice Makes Perfect

PRACTICE PROBLEMS (5-8)