$f = 200$ Hz; $T = ?$

17. ORGANIZE AND PLAN The period T is related to the frequency f by the relationship $T = \frac{1}{f}$.

Given information: $f = 200$ Hz

SOLVE The period is $T = \frac{1}{200 \text{ Hz}} = 0.005 \text{ Hz}^{-1}$ → $5 \cdot 10^{-3}$ s

Frequency & Period Problems

1. A young girl is on a swing that completes 20.0 cycles in 25 seconds. What are its frequency and period?

2. A clock clicks 88 times in 22 seconds. Calculate the frequency and period of the clock.

3. The time interval between flashes on a stroboscope is 1/80 second. What is the frequency of the light flashes.

4. A spring vibrates 24, 000 times in 1.00 minutes. What are the frequency and period. [Hint: frequency is cycles per **second**.]

(1) $f = \frac{20}{25\text{ s}} = 0.8\text{ Hz}$ $T = 1.25\text{ s}$

(2) $f = \frac{88}{22} = 4\text{ Hz}$, $T = \frac{1}{4} = 0.25\text{ s}$

(3) $T = \frac{1}{80}\text{ sec} \rightarrow f = \frac{1}{T} = 80\text{ Hz}$

(4) $f = \frac{24,000}{60\text{ sec}} = 400\text{ Hz}$, $T = \frac{1}{400} = 2.5 \times 10^{-3}\text{ s}$

$k_2 = 55.2 \frac{N}{m}$ $m_2 = 0.454\,kg$ | $\omega_2 = ?$ $f_2 = ?$ $T_2 = ?$

38. ORGANIZE AND PLAN We are given the mass and spring constant in a mass-spring system.

The period of a mass-spring system is given by $T = 2\pi\sqrt{\frac{m}{k}}$

The frequency (in oscillations per second Hz) is simply the inverse of the period: $f = 1/T$

The angular frequency ω (in units of radians per second) is obtained via a unit transformation of the frequency in Hz.

$$\omega = 2\pi\left[rad/\cancel{osc}\right]\cdot f\left[\cancel{osc}/s\right] = 2\pi f\left[rad/sec\right]$$

$\omega = 2\pi f$

SOLVE Plugging in values: The period:

$$T = 2\pi\sqrt{\frac{0.450\text{ kg}}{55.2\text{ N/m}}} = 0.567\text{ s}$$

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

The frequency:

$$f = 1.76\text{ Hz}$$

The angular frequency:

$\omega = 2\pi f$

$$\omega = 11.1\text{ rad/s}$$

REFLECT Again, we demonstrate the utility of unit analysis. You must be able to comfortably transition between the period, frequency, and angular frequency.