

24. When displaced from equilibrium, the net force exerted by the springs is  $-2kx$  acting in a direction so as to return the block to its equilibrium position ( $x = 0$ ). Since the acceleration  $a = d^2x/dt^2$ , Newton's second law yields

$$m \frac{d^2x}{dt^2} = -2kx .$$

Substituting  $x = x_m \cos(\omega t + \phi)$  and simplifying, we find

$$\omega^2 = \frac{2k}{m}$$

where  $\omega$  is in radians per unit time. Since there are  $2\pi$  radians in a cycle, and frequency  $f$  measures cycles per second, we obtain

$$f = \frac{\omega}{2\pi} = \frac{1}{2\pi} \sqrt{\frac{2k}{m}} .$$