

one condition makes it simple harmonic: the pull back home always scales with how far you've strayed

Periodic and oscillatory motion *

- periodic motion repeats itself after a fixed interval, the period T
- oscillatory motion is periodic motion that goes back and forth about a mean position
- displacement x is measured from the mean position, and changes with time
- frequency counts repeats per second: $\nu = \frac{1}{T}$, and angular frequency $\omega = 2\pi\nu = \frac{2\pi}{T}$

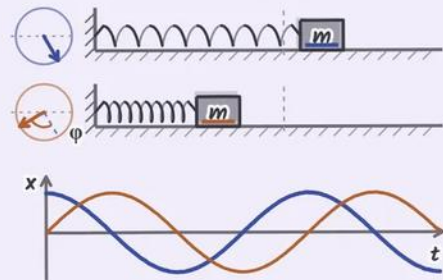
Simple harmonic motion, the one condition

- in SHM the restoring force is proportional to the displacement from the mean position
- and it always points back toward the mean position: $F = -kx$
- that single condition is what makes a motion SHM, not just any back-and-forth swing
- it follows at once that $a = -\omega^2 x$, proportional to x and opposite in sign

Displacement and phase

displacement $x(t) = A \sin(\omega t + \phi)$

phase, which fixes the state at time t $\omega t + \phi$



the lower one a quarter behind

two identical springs, the lower a quarter turn behind: its phasor trails by ϕ , its trace comes a quarter cycle later

A is the amplitude and ϕ the phase constant, fixed by where the motion is at $t = 0$. NCERT writes $A \cos(\omega t + \phi)$: the same motion, the clock started at an end