Module 9: Simple Harmonic Motion

Keywords: pendulum, spring, oscillation, circular motion

Formulas:

$x = A\cos(\omega t)$ (t: time; A: amplitude; ω: angular frequency)

$v = -A\omega\sin(\omega t)$ (derivative of x)

$a = -A\omega^2\cos(\omega t)$ (derivative of v)

$\omega = \frac{2\pi}{T}$ (T: period)

$T_p = 2\pi\sqrt{\frac{L}{g}}$, $\omega = \sqrt{\frac{g}{L}}$

$T_s = 2\pi\sqrt{\frac{m}{k}}$, $\omega = \sqrt{\frac{m}{k}}$

$PE_g = mgh$; $PE_s = \frac{1}{2}ks^2$; $KE = \frac{1}{2}mv^2$

General approach:

- Determine which kind of SHM you have (Spring vs. Pendulum vs. Orbit)
- Remember that energy is conserved.
- Find "critical points" (Maxium PE, Maximum KE)
  - maximum height / maximum compression
  - maximum velocity

Nazar Budaiev 2020