

Welcome to PHYS 211 PLT





Topics for Today

1.

**Simple
Harmonic
Motion**

2.

**System
Resonance**



1. Simple Harmonic Motion

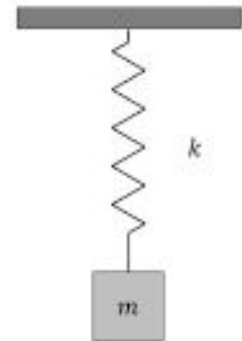




What is SHM

Simple Harmonic Motion occurs when an object is put into oscillation and proceeds back and forth in motion

Most common example of SHM is a single mass on a spring where the mass is given an excitation.





Differential Equation of SHM

$$\frac{d^2x}{dt^2} = -\omega^2 x$$

Derived from Newton's Second Law!

Solution of the Form:


$$x(t) = A \cos(\omega t + \phi)$$

With A being amplitude, omega the frequency, and phi being the phase shift(dependent on the initial conditions)


Taking Derivatives of Time:

$$v(t) = -\omega A \sin(\omega t + \phi)$$

$$a(t) = -\omega^2 A \cos(\omega t + \phi)$$



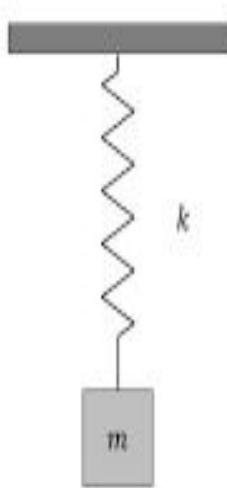
2. Resonance Frequency





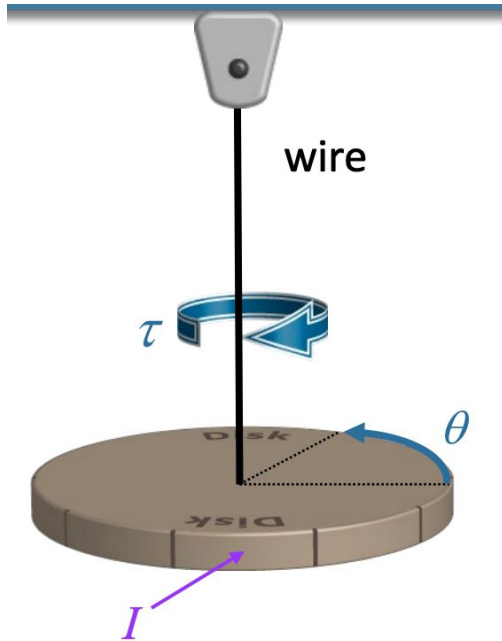
Mass on a Spring

The natural frequency is the frequency of oscillation an object exhibits given a disturbance



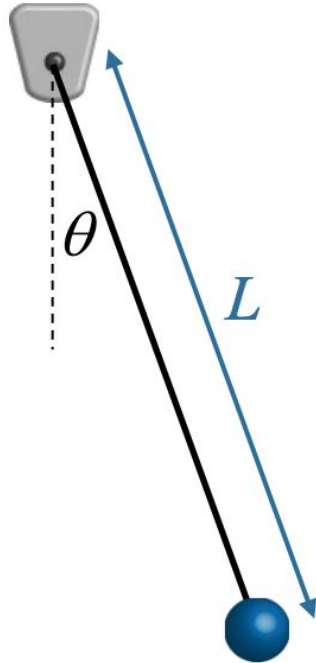
$$\omega^2 = k/m$$

Torsional Pendulum



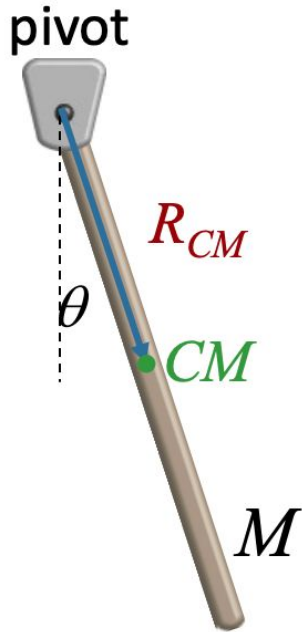
$$\omega^2 = \kappa/I$$

Simple Pendulum



$$\omega^2 = g/L$$

Physical Pendulum



$$\omega^2 = mgR_{CM}/I$$