Oscillations

Many physical systems near equilibrium are describe by the following **Differential Equation**:

$$a = -\omega^2 x$$

a is acceleration, x is position

By using analogy with rotation, we have found in class that solution to this equation is an oscillatory motion with period $T=2\pi/\omega$:

Angular Frequency, $\omega = 2\pi/T$

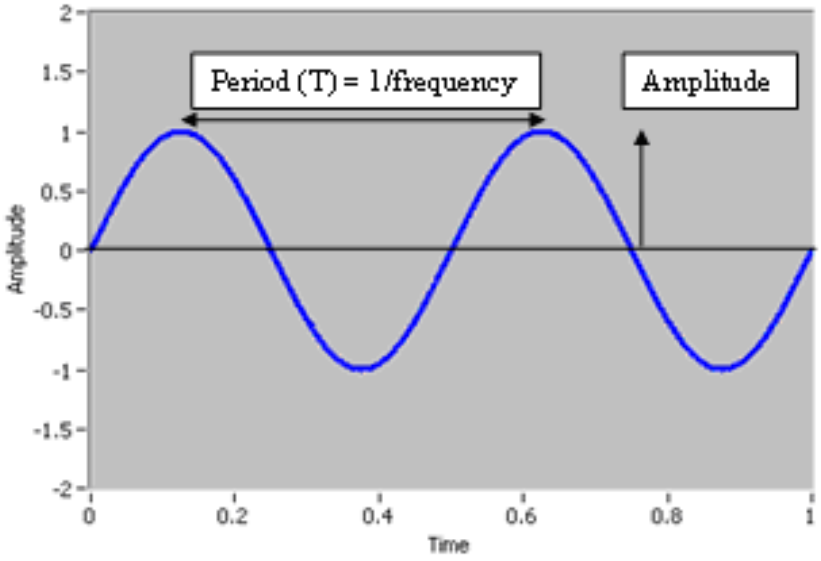
$$x(t) = A\sin(\omega t + \varphi_0)$$

Amplitude

Phase Shift

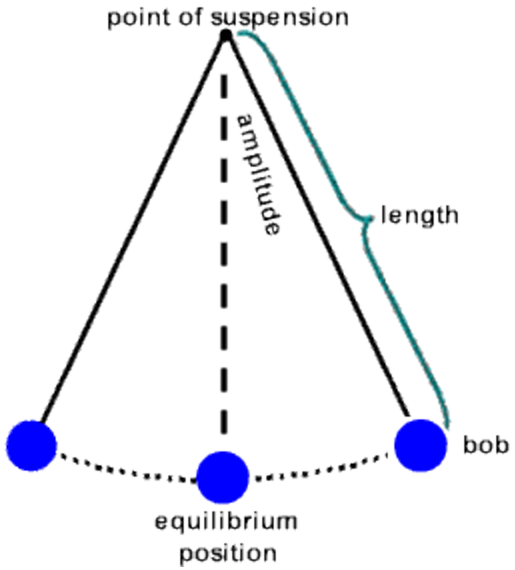
$$T = \frac{1}{f} = \frac{2\pi}{\omega}$$

Parameter	Formula	Units
Period	T	s
Frequency	f=1/T	1/s=Hz (Hertz)
Angular frequency	$\omega=2\pi f=2\pi/T$	1/s
Amplitude	A	varies



Example: Period of small oscillations of a pendulum

$$T = 2\pi\sqrt{\frac{L}{g}}$$ *L* is length.



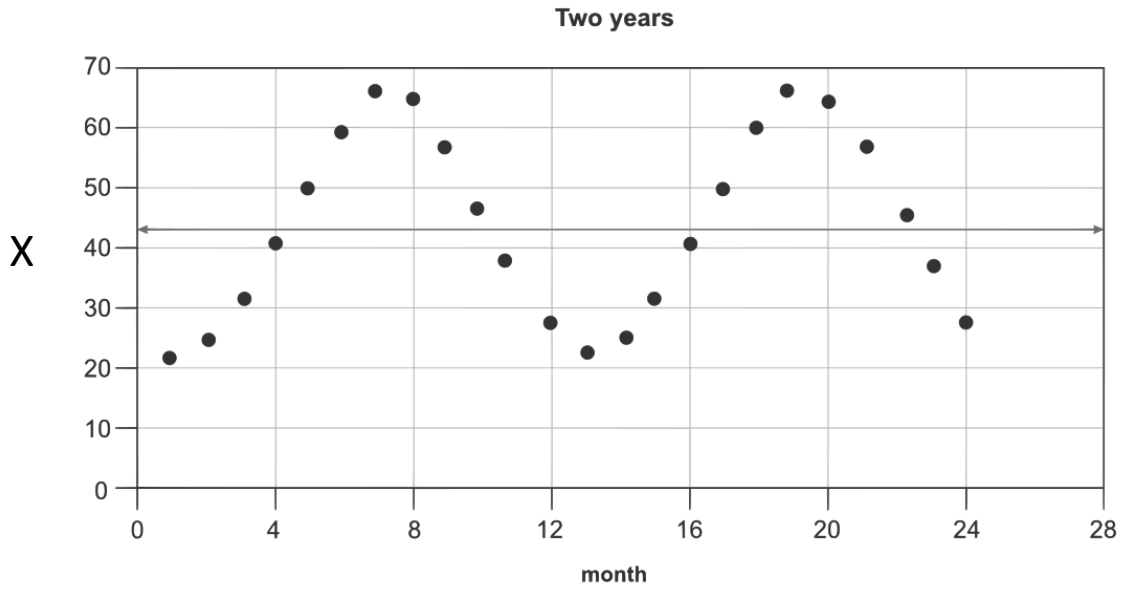
Homework

Problem 1

A mass **m** is attached to a spring with spring constant **k**. There is no other forces acting on the mass. Find the period **T** of its oscillation.

Problem 2

Write a formula that would fit the plot x(t), shown below (t in months):



Problem 3

a) Design and builds a pendulum that has a period T=1s.
b) Measure this period. Make several measurements, find the average and estimate the error in your experiment.
c) Have this pendulum around during the time of our next class