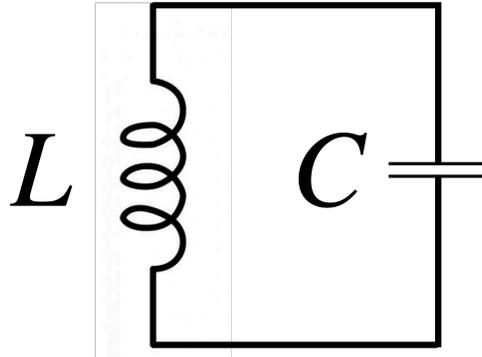# PHYS2063 Wave Physics Homework #1 Due Thursday 25 Aug 2022

This homework assignment is due at the start of class on the date shown. You may submit a PDF of your solutions to the Canvas page for the course, or bring a paper copy to class.

This diagram shows an inductor L and a capacitor C connected in series:

The voltage drop across an inductor is $V_L = L\,dI/dt$ where I is the current flowing through the inductor. The voltage drop across a capacitor is $V_C = q/C$ where q is the charge on the capacitor plates. Kirchoff's voltage law says that the sum of all voltage drops around a closed loop is zero. You can assume that the wires connecting the inductor and capacitor have no resistance. The charge (and current) are functions of time t.

Find the differential equation for the charge $q(t)$ and show that it implies that $q(t)$ has a simple harmonic time dependence. Find the (angular) frequency ω in terms of L and C for these oscillations.

Assume the values $L = 0.1$ mH and $C = 1$ μF. At time $t = 0$ the current in the circuit is $I_0 = 100$ μA and the charge on the capacitor is $q_0 = 1$ nC. Find the amplitude and phase of the oscillations for $q(t)$.