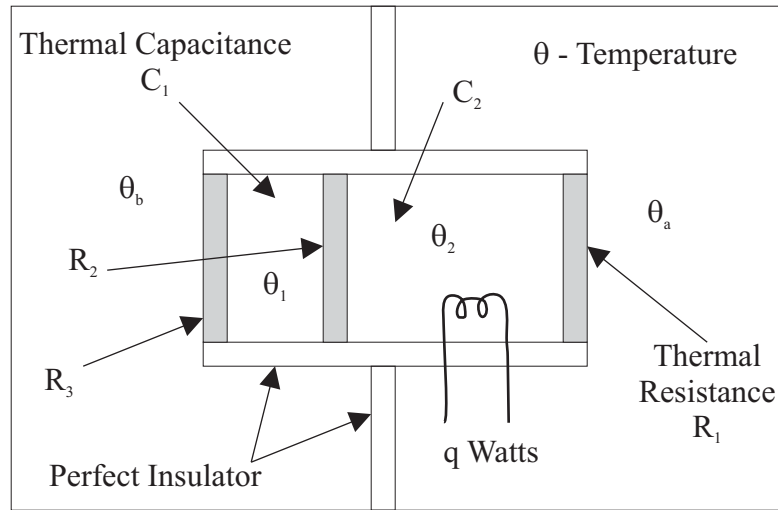


1. Consider the thermal system shown below.
 - a) Find an equivalent electrical circuit.
 - b) Write out the necessary equations to solve for θ_1 and θ_2 .



2. A small room is perfectly insulated, except for two windows. The thermal capacitance of the room is 10, and the thermal resistance of each window is 1. The temperature outside the room is 20 degC, and the initial temperature inside the room is 20 degC. A 20 Watt light bulb is turned on in the room at time $t=0$.

- a) Find an electrical circuit model of this thermal system.
- b) Find the temperature in the room as a function of time.
- c) Plot your response.

3. Below is a simple model of a furnace. An object of temperature θ_1 is being heated in a furnace by an electric heater supplying heat at the rate of $q(t)$. The temperature inside the furnace is θ_2 , the walls are at θ_3 and ambient temperature is θ_a . Assume that heat is being transferred by convection only. The thermal resistance is different at each boundary.

- a) Find an electrical circuit model of this thermal system.
- b) Write out the dynamic equations for this system.

