1. A 0.200-kg particle slides around a horizontal track. The track has a smooth vertical outer wall forming a circle with a radius of 1.50 m. The particle is given an initial speed of 4.00 m/s. After one revolution, its speed has dropped to 2.00 m/s because of friction with the rough floor of the track. (a) Find the energy transformed from mechanical to internal in the system owing to friction in one revolution. (5%) (b) Calculate the coefficient of kinetic friction. (5%) (c) What is the total number of revolutions the particle before stopping? (10%)

2. In the circuit of Figure 1, the switch S has been open for a long time. It is then suddenly closed. Determine the time constant (a) before the switch is closed (5%) and (b) after the switch is closed. (5%) (c) Let the switch be closed at t = 0. Determine the current in the switch as a function of time. (10%)

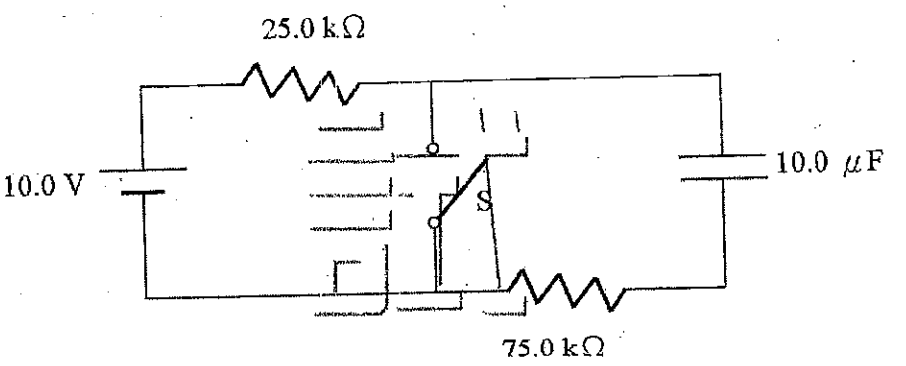

Figure 1

3. As shown in Figure 2, a bullet of mass m and speed v passes completely through a pendulum bob of mass M. The bullet emerges with a speed of $v/2$. The pendulum bob is suspended by a stiff rod of length l and negligible and negligible mass. What is the minimum value of v such that the pendulum bob will barely swing through a

complete vertical circle? (15%)

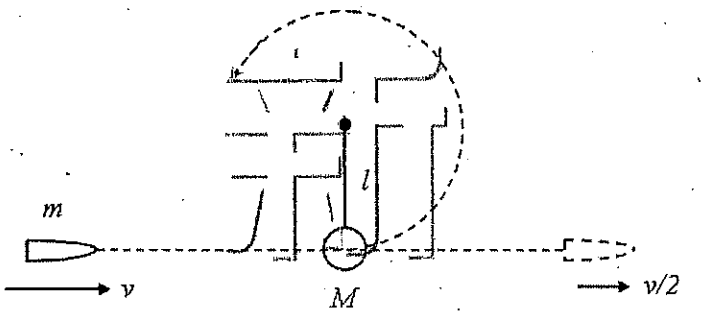

Figure 2

4. Two 3.00-μC point charges are located on the x axis. One is at x = 1.00 m, and the other is at x = -1.00 m. (a) Determine the electric field on the y axis at y = -0.500 m. (8%) (b) Calculate the electric force on a -2.00-μC charge placed on the y axis at y = -0.500 m. (7%)

5. An electric power plant that would make use of the temperature gradient in the ocean has been proposed. The system is to operate between 20.0 °C (surface water temperature) and 5.00 °C (water temperature at a depth of about 1 km). (a) What is the maximum efficiency of such a system? (5%) (b) If the useful power output is 75.0 MW, how much energy is taken in from the warm reservoir per hour? (10%) (c) In view of your answer to part (a), do you think such a system is worthwhile? Note that the "fuel" is free. (5%)

6. A simple pendulum with a length of 2.23 m and a mass of 6.00 kg is given an initial speed of 2.00 m/s at its equilibrium position. Assume that it undergoes simple harmonic motion and determine its (a) period (5%) (b) total energy. (5%)