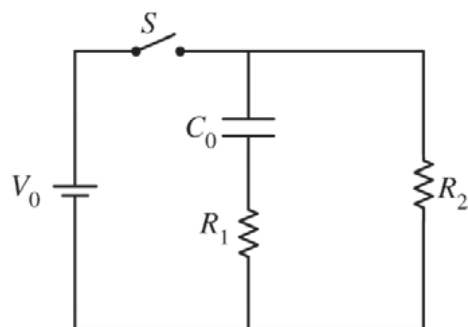


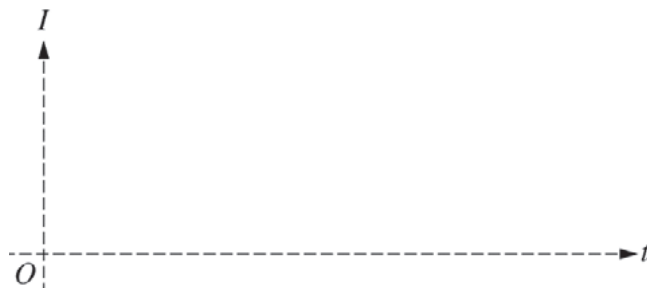


2. In the circuit above, an ideal battery of voltage V_0 is connected to a capacitor with capacitance C_0 and resistors with resistances R_1 and R_2 , with $R_1 > R_2$. The switch S is open, and the capacitor is initially uncharged.

- (a) The switch is closed at time $t = 0$. On the axes below, sketch the charge q on the capacitor as a function of time t . Explicitly label any intercepts, asymptotes, maxima, or minima with numerical values or algebraic expressions, as appropriate.



- (b) On the axes below, sketch the current I through each resistor as a function of time t . Clearly label the two curves as I_1 and I_2 , the currents through resistors R_1 and R_2 , respectively. Explicitly label any intercepts, asymptotes, maxima, or minima with numerical values or algebraic expressions, as appropriate.



The circuit is constructed using an ideal 1.5 V battery, an $80\ \mu\text{F}$ capacitor, and resistors $R_1 = 150\ \Omega$ and $R_2 = 100\ \Omega$. The switch is closed, allowing the capacitor to fully charge. The switch is then opened, allowing the capacitor to discharge.

- (c) The time it takes to charge the capacitor to 50% of its maximum charge is Δt_C . The time it takes for the capacitor to discharge to 50% of its maximum charge is Δt_D . Which of the following correctly relates the two time intervals?

_____ $\Delta t_C > \Delta t_D$ _____ $\Delta t_C = \Delta t_D$ _____ $\Delta t_C < \Delta t_D$

Justify your answer.

(d)

- i. Calculate the current through resistor R_2 immediately after the switch is opened.
- ii. Is the current through resistor R_2 increasing, decreasing, or constant immediately after the switch is opened?

____ Increasing ____ Decreasing ____ Constant

Justify your answer.

(e)

- i. Calculate the energy stored in the capacitor immediately after the switch is opened.
- ii. Calculate the energy dissipated by resistor R_1 as the capacitor completely discharges.