Prob 2.3

\[ I(t) = I_0 e^{-\frac{t}{RC}} \]

\[ C_e = \frac{C_1 C_2}{C_1 + C_2} = \frac{(60 \mu F)(40 \mu F)}{60 \mu F + 40 \mu F} = 24 \mu F \quad (\text{Capacitors in series}) \]

\[ RC_e = (5 \pi^2)(24 \mu F) = 120 \mu s \]

\[ V_1(0) = \frac{Q_1}{C_1} = \frac{1 C}{60 \mu F} = 16.67 \text{ KV} \]

\[ I_0 = \frac{V_1(0) - V_2(0)}{R} = \frac{16.67 \text{ KV}}{5 \pi} = 3333 \text{ A} \]

The equation is:

\[ I(t) = 3333 e^{-\frac{t}{120 \mu s}} \]

(a) Peak Current \( I_0 = 3333 \text{ A} \); this is the in-rush current needed to charge the \( C_2 \).

(b) \( I \) @ 200\mu s after switch closes.

\[ I(200\mu s) = 3333 e^{-\frac{200}{120}} = 629.52 \text{ A} \]

(c) Ultimate energy stored in \( C_2 \)

\[ V_F = ? \quad Q_1(0) + Q_2(0) = Q_F \]

\[ C_1 V_1(0) + C_2 V_2(0) = (C_1 + C_2) V_F \]

\[ V_F = \frac{C_1 V_1(0)}{C_1 + C_2} = \frac{60 \mu F}{60\mu F + 40\mu F} (16.67 \text{ KV}) = 10 \text{ KV} \]

\[ E_F = \frac{1}{2} C_2 V_F^2 = \frac{1}{2} (40 \mu F)(10 \text{ KV})^2 = 2000 \text{ [J]} \]

(d) Ultimate voltage at \( C_1 \)

\[ V_1(\infty) = V_F = 10 \text{ KV} \]