

86. When  $S$  is open for a long time, the charge on  $C$  is  $q_i = \mathcal{E}_2 C$ . When  $S$  is closed for a long time, the current  $i$  in  $R_1$  and  $R_2$  is  $i = (\mathcal{E}_2 - \mathcal{E}_1)/(R_1 + R_2) = (3.0\text{ V} - 1.0\text{ V})/(0.20\ \Omega + 0.40\ \Omega) = 3.33\text{ A}$ . The voltage difference  $V$  across the capacitor is then  $V = \mathcal{E}_2 - iR_2 = 3.0\text{ V} - (3.33\text{ A})(0.40\ \Omega) = 1.67\text{ V}$ . Thus the final charge on  $C$  is  $q_f = VC$ . So the change in the charge on the capacitor is  $\Delta q = q_f - q_i = (V - \mathcal{E}_2)C = (1.67\text{ V} - 3.0\text{ V})(10\ \mu\text{F}) = -13\ \mu\text{C}$ .