Q- A 2.00-nF capacitor with an initial charge of 5.10 μC is discharged through a 1.30-kΩ resistor.
(a) Calculate the current in the resistor 9.00 μS after the resistor is connected across the terminals of the capacitor.

The time constant of the capacitor resistor circuit is given by

τ = RC = $1.30*10^{3}*2.00*10^{-9}$ s = $2.6*10^{-6}$ s = 2.6 μs.

The discharge current in the circuit as a function of time is given by

$$i = \frac{q_0}{RC} * e^{-\frac{t}{\tau}}$$

Hence the current at the given time will be

$$i = \frac{5.10\mu C}{2.6\mu s} * e^{-\frac{9.00\mu s}{2.6\mu s}} = 1.96 * 0.031 = 0.06\,\text{A}$$

(b) What charge remains on the capacitor after 8.00 μS?

The time constant of the capacitor resistor circuit is given by

τ = RC = $1.30*10^{3}*2.00*10^{-9}$ s = $2.6*10^{-6}$ s = 2.6 μs.

The charge on the capacitor discharging through a resistance as a function of time is given by

$$q = q_0 * e^{-\frac{t}{\tau}}$$

Hence the charge on the capacitor after 8.00 μS time

$$q = 5.10\mu C * e^{-\frac{8.00\mu s}{2.6\mu s}} = 5.10\mu C * 0.046 = 0.235\mu C$$

(c) What is the maximum current in the resistor?

The current in the circuit is the maximum at t = 0 hence the maximum current will be

$$i = \frac{q_0}{RC} * e^{-\frac{0}{\tau}} = \frac{q_0}{RC} = \frac{5.10\mu C}{2.6\mu s} = 1.96\,\text{A}$$