Physics 102Rec
Quiz # 8
Chapter 28

Name: Key Id#: Sect#:

1. A capacitor in an RC circuit is charged to 75% of its maximum value in 1.4 μsec.

(a) If R = 7 kΩ and ε = 12 V, what is the value of the time constant for the circuit?

$$q = q_{max}\left(1 - e^{-\frac{t}{\tau}}\right)$$

$$0.75\, q_{max} = q_{max}\left(1 - e^{-\frac{1.4\times10^{-6}}{\tau}}\right) \Rightarrow e^{-\frac{1.4\times10^{-6}}{\tau}} = 0.25$$

$$-\frac{1.4\times10^{-6}}{\tau} = \ln(0.25) \Rightarrow \tau = -\frac{1.4\times10^{-6}}{\ln(0.25)} = -\frac{1.4\times10^{-6}}{\ln(0.25)}$$

$$\boxed{\tau = 1\times10^{-6}\ s}$$

(b) What is the current in the resistor after 1.4 μsec?

$$I = \frac{\varepsilon}{R} e^{-\frac{t}{\tau}}$$

at $t = 1.4\ \mu s$

$$I = \frac{12}{7\times10^{+6}} e^{-\frac{1.4\times10^{-6}}{1\times10^{-6}}} = \boxed{4.2\times10^{-7}\ A}$$

(c) What is the voltage across the resistor after 1.4 μsec?

$$V = RI = 7\times10^{3} \times 4.2\times10^{-7} = \boxed{2.96\times10^{-3}\ V}$$