<u>Quiz 20.1A</u>

An unknown capacitor and a 33500 Ohm resistor are connected in series with a 78.0 Volt power source. At t = 0.00 s, a switch a closed to complete the circuit, and the capacitor begins to charge. A student determines that the voltage drop across the resistor after 1.33 seconds is 38.0 Volts.

a) What is the current in the circuit at this time?
b) What is the time constant of this circuit?
c) What is the capacitance of the capacitor in this circuit?
d) At t = 1.33 seconds, what is the charge on the capacitor?

a) $I = \frac{\Delta V}{R} = \frac{38}{33500} = \boxed{1.13 \times 10^{-3} A}$

b) $I_{max} = \frac{\varepsilon}{R} = \frac{78}{33500} = 2.328 \times 10^{-3} A$

$I = I_{max} \, e^{-t/\tau}$

$\frac{1.13}{2.328} = e^{-t/\tau}$

$0.487 = e^{-t/\tau}$

$-0.719 = -t/\tau$

$t = 0.719 \tau$

$\boxed{\tau = \frac{1.33}{0.719} = 1.85 \text{ s}}$

$1.848 = (33500) C$

c) $\boxed{C = 5.52 \times 10^{-5} F}$

d) $\Delta V_R + \Delta V_C = 78$

$\Rightarrow \Delta V_C = 40 V = \frac{Q}{C}$

$\boxed{Q = 2.21 \times 10^{-3} C}$