In the circuit shown switch S is connected to point A for a long time.
(a) What is the potential at point C? (b) Now S is switched to point B. What is the potential at C after a long time? (c) How much charge flows through R from the time the switch is thrown to B until current stops flowing in R. (d) Find the current in R as a function of time. Be sure to put numerical value for all quantities, including the time constant.

(a) \( V_C = \mathcal{E} = 12 \, \text{volts} \)

(b) \( V' = \frac{Q'}{C'} = V'' = \frac{Q''}{C''} \)

\[
\frac{Q'}{C'} = \frac{C'}{C''} = 4.5
\]

Also \( Q' + Q'' = Q_0 = C'V_0' \)

\[
= (30 \, \text{pF})(12 \, \text{V}) = 360 \, \text{pC}
\]

\( Q' = 295 \, \text{pC} \) and \( Q'' = 65 \, \text{pC} \)

\( V' = V'' = 9.8 \, \text{volts} \)

(c) \( \Delta Q = Q'' = 65 \, \text{pC} \)
Problem 4

In the circuit shown switch $S$ is connected to point $A$ for a long time. (a) What is the potential at point $C$? (b) Now $S$ is switched to point $B$. What is the potential at $C$ after a long time? (c) How much charge flows through $R$ from the time the switch is thrown to $B$ until current stops flowing in $R$. (d) Find the current in $R$ as a function of time. Be sure to put numerical value for all quantities, including the time constant.

(d) $Q' \text{ decays with a time constant } t_c = R \left( \frac{C' C''}{C' + C''} \right)$

$$t_c = 5.46 \times 10^{-7} \text{ sec}$$

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$$I = -\frac{dQ'}{dt} = I_o e^{-t/t_c}$$

When $S$ is switched to $B$, $V_R = 12 \text{ volts (at } t=0)$

$$I_o = \frac{12}{R} = \frac{12}{10^5} = 120 \mu A$$

$$I = (120 \mu A) e^{-t/(5.46 \times 10^{-7} \text{ sec})}$$