

Ap Physics Problems And Solutions

Question:

An RC circuit is built using a $1.0 \text{ M}\Omega$ resistor, an initially uncharged $20 \text{ }\mu\text{F}$ capacitor, and a battery with a terminal voltage of 5.0V . Which equation would be used to determine the charge in Coulombs on the plates of the capacitor as a function of time?

- a. $q = 100 \times 10^{-6}(1 - e^{-t/20})$
- b. $q = 100 \times 10^{-6}(1 - e^{t/20})$
- c. $q = 100 \times 10^{-6}(e^{-t/20})$
- d. $q = 1 - e^{-t/20}$
- e. $q = e^{-t/20}$

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Answer:

The correct answer is *a*. The general formula for determining the charge accumulating on a capacitor's plates as a function of time is given by $q = CV(1 - e^{-t/RC})$. Substitute in the values given in the problem to arrive at the correct answer:

$$q = CV(1 - e^{-t/RC})$$

$$q = (20 \times 10^{-6})(5)(1 - e^{-t/((1 \times 10^6)(20 \times 10^{-6})})}$$

$$q = 100 \times 10^{-6}(1 - e^{-t/20})$$

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