

Answer on Question 65468, Physics, Electric Circuits

Question:

Did you dare touch the Van de Graaff? The maximum charge that our classroom Van de Graaff generator could hold on its dome was about $5 \mu\text{C}$. Assume that when you get shocked by the generator, all of this charge passes through you in just one-hundredth of a second ($1.00 \cdot 10^{-2} \text{ s}$). (a) Calculate the associated average current for getting shocked by the Van de Graaff generator, and express your answer in units of mA (milliamperes). Now, let's say you are feeling bold and opt to lick a 9 V battery. The resistance for wet skin is about 2000Ω . (b) Calculate the associated current through your tongue when you place it across the terminals of a 9 V battery, and express your answer in the same units of mA .

Solution:

(a) By the definition of the current we get:

$$\bar{I} = \frac{\Delta Q}{\Delta t} = \frac{5 \cdot 10^{-6} \text{ C}}{1.00 \cdot 10^{-2} \text{ s}} = 0.5 \cdot 10^{-3} \text{ A} = 0.5 \text{ mA}.$$

(b) We can find the current through the tongue from the Ohm's law:

$$I = \frac{V}{R} = \frac{9 \text{ V}}{2000 \Omega} = 4.5 \cdot 10^{-3} \text{ A} = 4.5 \text{ mA}.$$

Answer:

(a) $\bar{I} = 0.5 \text{ mA}$.

(b) $I = 4.5 \text{ mA}$.