Answer on Question #51534, Physics, Electromagnetism

the current I in a conductor as a function of time t is given as I(t) = 5t^2 -3t +10 where current is in ampres A and t is in seconds s. what quantity of change moves across a section through the conductor during the interval t=2s to t=5s

(a) 154.4C

(b) 193.5C

(c) 225.5C

(d) 300.0C

Answer:

If the two requirements of an electric circuit are met, then charge will flow through the external circuit. It is said that there is a current - a flow of charge. Using the word current in this context is to simply use it to say that something is happening in the wires - charge is moving. Yet current is a physical quantity that can be measured and expressed numerically. As a physical quantity, current is the rate at which charge flows past a point on a circuit. As depicted in the diagram below, the current in a circuit can be determined if the quantity of charge Q passing through a cross section of a wire in a time t can be measured. The current is simply the ratio of the quantity of charge and time.

$$I(t) = \frac{dq}{dt}$$

$$dq = I(t)dt$$

$$I(t) = 5t^2 - 3t + 10$$

$$\int_0^q dq = \int_2^5 (5t^2 - 3t + 10)dt = \frac{5t^3}{3} - \frac{3t^2}{2} + 10t\,\Big|_2^5 = 193.5\ C$$

b) $q = 193.5\ C$