

- 1.10** The current that enters an element is shown in Fig. P1.10. Find the charge that enters the element in the time interval  $0 < t < 20$  s.

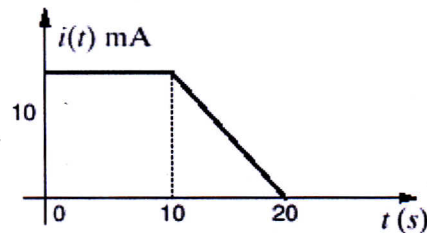


Figure P1.10

**SOLUTION:**

$$i(t) = m_1 t + b$$

$$m_1 = \frac{10 - 0}{10 - 20} = -1$$

$$i(t) = -t + b$$

$$10 = -10 + b$$

$$b = 20$$

$$i(t) = -t + 20 \text{ mA}$$

$$q(t) = \int_0^{20} i(t) dt$$

$$q(t) = \int_0^{10} 10 \times 10^{-3} dt + \int_{10}^{20} \frac{20-t}{1000} dt$$

$$q(t) = 10 \times 10^{-3} t \Big|_0^{10} + \frac{1}{1000} \left[ 20t - \frac{t^2}{2} \right]_{10}^{20}$$

$$q(t) = 0.1 + \frac{1}{1000} \left[ 20(20) - \frac{(20)^2}{2} - 20(10) + \frac{(10)^2}{2} \right]$$

$$q(t) = 0.1 + \frac{1}{1000} [200 - 200 + 50]$$

$$q(t) = 0.15 \text{ C}$$