Problem 1.5

Determine the total charge transferred over the time interval of $0 \leq t \leq 10$ s when $i(t) = \frac{1}{2}t$ A.

Solution

Integrate both sides of the current equation with respect to time from 0 to 10.

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

$$\int_0^{10} i(t)\,dt = \int_0^{10} \frac{dq}{dt}\,dt$$

$$= q(10) - q(0)$$

Therefore, the charge transferred from $t = 0$ to $t = 10$ is

$$q(10) - q(0) = \int_0^{10} i(t)\,dt$$

$$= \int_0^{10} \frac{1}{2}t\,dt \ \text{A}$$

$$= \left. \frac{t^2}{4} \right|_0^{10} \ \text{C}$$

$$= \left(\frac{10^2}{4} - \frac{0^2}{4} \right) \text{C}$$

$$= 25 \ \text{C}.$$