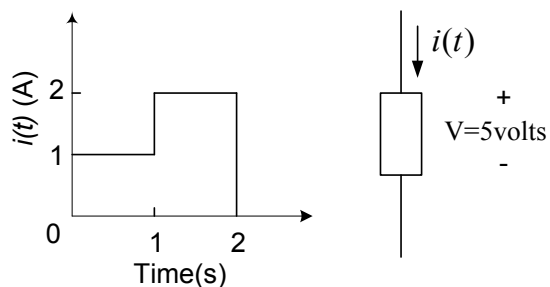


TOPIC

Electricity and Magnetism – Section XI – Question 6

QUESTION

The energy in Joules absorbed by the electrical element at time 2 seconds most nearly is



- (A) 5
- (B) 15
- (C) 30
- (D) 40

HINT

The electrical power of any electrical element is the product of current and voltage;

$$p = iv.$$

Current is the rate of change of charge with respect to time,

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

whereas voltage is the amount of energy required to take a single charge from point a to point b ,

$$v = \frac{dw}{dq}.$$

Hence, power can be defined as the rate of change of energy

$$p = \frac{dw}{dt}.$$

Therefore, if power is the derivate of energy, then energy is the integral of power

$$w(t) = \int_0^t p(t)dt = \int_0^t (iv)dt$$

SOLUTION

Since, voltage is constant, then

$$\begin{aligned} w(t) &= \int_0^t (iv)dt \\ &= \int_0^2 (iv)dt \\ &= \int_0^1 (iv)dt + \int_1^2 (iv)dt \\ &= \int_0^1 (1 \times 5)dt + \int_1^2 (2 \times 5)dt \\ &= 5t \Big|_0^1 + 10t \Big|_1^2 \end{aligned}$$

$$=5 - 0 + 20 - 10$$
$$=15 \text{ Joules}$$

ANSWER

(B)

CONTRIBUTOR

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