Answer on Question #40687, Physics, Electromagnetism

The magnetic flux linked with coil, in weber is given by the equation, $\Phi = 5t^2 + 3t + 16$. The induced emf in the coil in the fourth second is -

(1)10 V

(2)30 V

(3)45 V

(4)90 V

Solution:

Any change in the magnetic environment of a coil of wire will cause a voltage (emf) to be "induced" in the coil.

According to Faraday's Law

$$\text{Emf} = -\frac{\Delta\Phi}{\Delta t} = -\frac{d\Phi}{dt}$$

where Φ = magnetic flux. The minus sign denotes Lenz's Law.

Differentiate

$$\text{Emf} = \frac{d(5\text{t}^2 + 3\text{t} + 16)}{dt} = 10t + 3$$

Hence, induced emf at t = 3 s is

$$\text{Emf}_3 = 10 \cdot 3 + 3 = 33 \text{ V}$$

induced emf at t = 4 s

$$\text{Emf}_4 = 10 \cdot 4 + 3 = 43 \text{ V}$$

Induced emf in the fourth second is

$$\text{Emf} = \text{Emf}_4 - \text{Emf}_3 = 43 - 33 = 10 \text{ V}$$

Answer. (1) 10 V.