Answer on Question #61358-Physics-Electric Circuits

1) An emf of 5V is suddenly applied to an LR circuit. The value of the resistor in the circuit is 15 Ê. At one inductive time constant, what is the rate at which energy is delivered by the battery?

a) 1.05W

b) 5.78W

c) 120.42W

d) 12.24W

Solution

$$P = UI =.$$

$$I = \frac{U}{R}\left(1 - e^{-\frac{t}{\tau}}\right) = \frac{U}{R}(1 - e^{-1}) = \frac{U}{R}\left(1 - \frac{1}{e}\right).$$

$$P = \frac{U^2}{R}\left(1 - \frac{1}{e}\right) = \frac{5^2}{15}\left(1 - \frac{1}{e}\right) = 1.05\ W.$$

2) A certain inductor has an inductance of 0.50H and a resistance of 2.0. It is placed in series with a switch, a 12.0-V battery and a 4.0 ohms resistor. Find the time constant of the circuit and the energy stored in the inductor.

a) 0.83s and 100J

b) 0.032s and 20J

c) 0.47s and 5J

d) 0.083s and 1J

Solution

Time constant is

$$\tau = \frac{L}{r + R} = \frac{0.5}{2 + 4} = 0.083\ s.$$

$$E = \frac{1}{2}LI^2 = \frac{L}{2}\left(\frac{U}{r + R}\right)^2 = \frac{0.5}{2}\left(\frac{12}{2 + 4}\right)^2 = 1\ J.$$