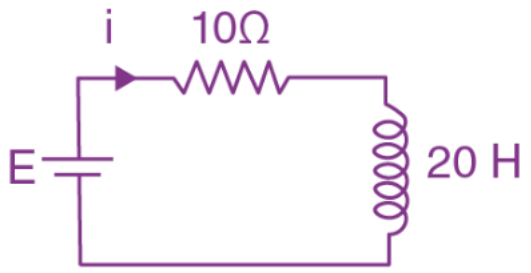
Question 2) A 20 Henry inductor coil is connected to a 10 ohm resistance in series as shown in the figure. The time at which rate of dissipation of energy (Joule's heat) across the resistance is equal to the rate at which magnetic energy is stored in the inductor, is



Solution:

$i = i_0 (1 - e^{-t/\tau})$

$di/dt = (i_0/\tau)\, e^{-t/\tau}$

$di/dt = [E/(10 \times 2)]\, e^{-t/2}$ ———(1) [since $\tau = L/R = 20/10 = 2$] $[L(di/dt)i] = i^2R$

$\Rightarrow L(di/dt) = iR$ ———(2)

From equation (1) and (2) we get

$L\,[E/(10 \times 2)]\, e^{-t/2} = iR$

$(L/R)[E/(20)]\, e^{-t/2} = i_0 (1 - e^{-t/\tau})$ [since $\tau = L/R = 20/10 = 2$] $[E/10]\, e^{-t/2} = [E/10)\,(1 - e^{-t/\tau})$

$e^{-t/2} = ½$

$t/2 = \ln 2$