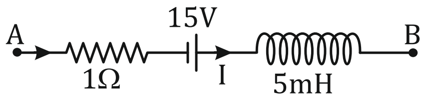
DPP 05

L-R Circuit

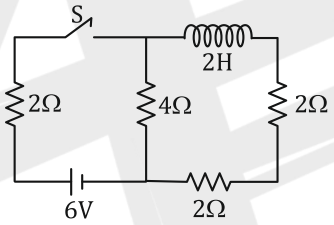
1. The network shown in figure is part of a complete circuit. If at a certain instant the current (I) is 5 A, and is decreasing at a rate of 10^3 A/s then $V_B - V_A =$ ______V.



2. An inductor of 10mH is connected to a 20 V battery through a resistor of 10kΩ and a switch. After a long time, when maximum current is set up in the circuit, the current is switched off. The current in the circuit after 1μs is $\frac{x}{100}$ mA. Then x is equal to ______.

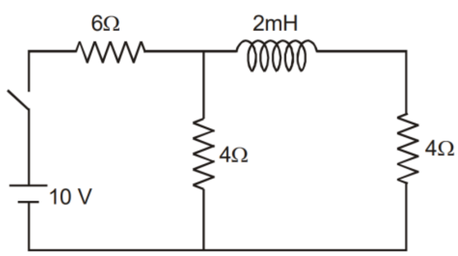
(Take $e^{-1} = 0.37$)

3. For the given circuit the current through battery of 6 V just after closing the switch ' S ' will be ______A.



4. Two inductors L_1 (inductance 1mH, internal resistance 3Ω) and L_2 (inductance 2mH, internal resistance 4Ω), and a resistance R (resistance 12Ω) are all connected in parallel across a 5 V battery. The circuit is switched on at time t = 0. The ratio of the maximum to the minimum current (I_{max}/I_{min}) drawn from the battery is ______.

5. In the given circuit find the ratio of i_1 to i_2. Where i_1 is the initial (at t = 0) current, and i_2 is steady state (at t = ∞) current through the battery:

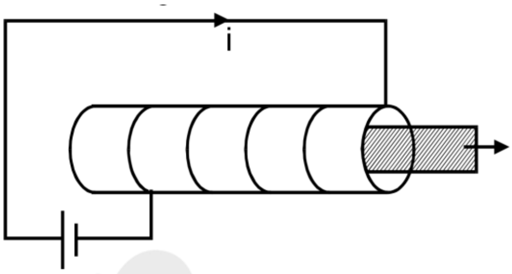


(A) 1.0 (B) 0.8 (C) 1.2 (D) 1.5

6. In a series L-R growth circuit, if maximum current and maximum induced emf in an inductor of inductance 3mH are 2 A and 6 V respectively, then the time constant of the circuit is :

(A) 1 ms. (B) 1/3 ms. (C) 1/6 ms (D) 1/2 ms

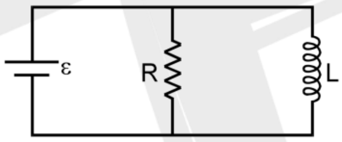
7. A solenoid having an iron core has its terminals connected across an ideal DC source and it is in steady state. If the iron core is removed, the current flowing through the solenoid just after removal of rod



(A) increases (B) decreases

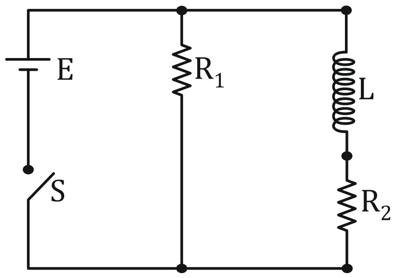
(C) remains unchanged (D) nothing can be said

8. The battery shown in the figure is ideal. The values are $\varepsilon = 10$ V, $R = 5\Omega$, $L = 2$H. Initially the current in the inductor is zero. The current through the battery at $t = 2$ s is



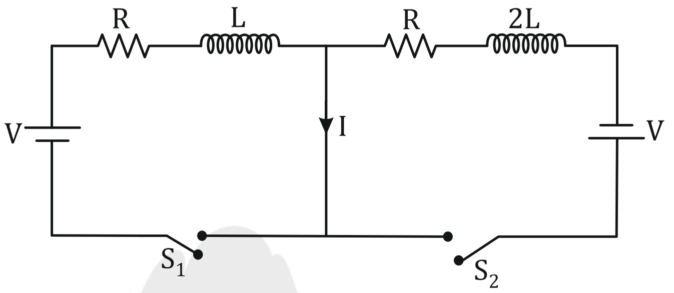
(A)12 A (B) 7 A (C) 3 A (D) none of these

9. An inductor of inductance $L = 400$mH and resistors of resistances $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf 12 V as shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at $t = 0$. The potential drop across L as a function of time is



(A) $6e^{-5t}$ V (B) $\frac{12}{t}e^{-3t}$ V (C) $6(1 - e^{-t/0.2})$V (D) $12e^{-5t}$ V

10. In the given figure, the switches S_1 and S_2 are closed simultaneously at $t = 0$ and a current starts to flow in the circuit. Both the batteries have the same magnitude of the electromotive force (emf) and the polarities are as indicated in the figure. Ignore mutual inductance between the inductors. The current I in the middle wire reaches its maximum magnitude I_{max} at time $t = \tau$. Which of the following statements is (are) true?



(A) $I_{max} = \frac{V}{2R}$ (B) $I_{max} = \frac{V}{4R}$ (C) $\tau = \frac{L}{R}\ln\ 2$ (D) $\tau = \frac{2L}{R}\ln\ 2$

ANSWER KEY

1.	15V	**2.**	74	**3.**	1	**4.**	8	**5.**	(B)	**6.**	(A)	**7.**	(A)
8.	(A)	**9.**	(D)	**10.**	(B, D)								