ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

SOLUTION TO WORK SHEET 30

Subject : PHYSICS 09.07.20

CLASS : XII

Chapter : EM Induction

Topic : L due to a solenoid, M of two solenoids one placed inside other, energy stored within an inductor and magnetic energy density.

Multiple Choice Question : **1 x 15 = 15**

1. An inductor having coefficient of self-induction 40 mH. What is the energy stored in it, when a current of 2A is passed through it?

   (a) 40 mJ (b) 80 mJ (c) 20 mJ (d) 100 mJ

   Ans. (b) 80 mJ

2. Energy required to establish a current of 4A in a coil of self-inductance L = 200 mH is

   (a) 0.16 J (b) 0.18 J (c) 0.40 J (d) 1.6 J

   Ans. (d) 1.6 J

3. A long solenoid has 1000 turns. When a current of 4A flow through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self-inductance of the solenoid is

   (a) 3H (b) 2H (c) 1H (d) 4H

   Ans. (c) 1H

4. The inductance of a coil is L = 10H and resistance $R = 5\,\Omega$. If applied voltage of battery is 10V and if switches off in 1 ms, find induced emf of inductor.

   (a) 2×10^4 V (b) 1.2×10^4 V (c) 2×10^{-4} V (d) none of these

   Ans. (a) 2×10^4 V

5. Three solenoid coils of same dimension, same numbers of turns and same numbers of layers of winding are taken. Coil 1 with inductance L_1 was wound using a wire of resistance $11\,\Omega\ m^{-1}$, coil 2 with inductance L_2 was wound using the similar wire but the direction of winding was reserved in each layer, coil 3 with inductance L_3 was wound using a superconducting wire. The self-inductance of the coils L_1, L_2, L_3 are such that

   (a) $L_1 = L_2 = L_3$ (b) $L_1 = L_2$, $L_3 = 0$ (c) $L_1 = L_3$, $L_2 = 0$ (d) $L_1 > L_2 > L_3$

   Ans. (b) $L_1 = L_2$, $L_3 = 0$

6. If a coil is open, then L and R respectively become

   (a) ∞, 0 (b) 0, ∞ (c) ∞, ∞ (d) 0, 0

   Ans. (b) 0, ∞

7. In a coil when current changes from 10A to 2A in time 0.1 s, induced emf is 3.28 V. What is the self-inductance of coil?

   (a) 4H (b) 0.4H (c) 0.04H (d) 5H

   Ans. (c) 0.04H

8. In 0.1 s, the current in a coil increases from 1A to 1.5A. If inductance of coil is 60 mH, then induced current in external resistance of $3\,\Omega$ will be

(a) 1A (b) 0.5A (c) 0.2A (d) 0.1A

Ans. (d) 0.1A

9. A coil of N = 100 turns carries a current, I = 5A and creates a magnetic flux, $\phi = 10^{-5}\text{Tm}^2$ per turn. The value of its inductance L will be

(a) 0.05 m H (b) 0.10 mH (c) 0.15 mH (d) 0.20 mH

Ans. (d) 0.20 mH

10. A circular coil has 500 turns of wires and its radius is 5 cm. The self-inductance of the coil is

(a) 25 x 10^{-3} mH (b) 25 mH (c) 50 x 10^{-3} H (d) 50 x 10^{-3} mH

Ans. (b) 25 mH

11. The energy stored in an inductor of self-inductance L henry carrying a current of I ampere is

(a) L^2I (b) $-LI^2$ (c) $\frac{1}{2}\ LI^2$ (d) $\frac{1}{2}\ L^2T$

Ans. (c) $\frac{1}{2}\ LI^2$

12. Magnetic flux of $10\,\mu$ Wb is linked with a coil, when a current of 2 mA flows through it. What is the self-inductance of the coil?

(a) 10 mH (b) 5 mH (c) 15 mH (d) 20 mH

Ans. (b) 5 mH

13. What is the self-inductance of a solenoid of length 31.4 cm, area of cross-section 10^{-3}m^2 and total number of turns 10^3?

(a) 4 mH (b) 4 H (c) 40 H (d) 0.4 H

Ans. (a) 4 mH

14. A solenoid 60 cm long has 50 turns on it and is wound on an iron rod 7.5 mm radius. Find the flux through the solenoid when the current in it is 3A and the relative permeability of iron is 600

(a) 1.66 Wb (b) 2.66 Wb (c) 1.66 mWb (d) $1.66\,\mu$ Wb

Ans. (c) 1.66 mWb

15. The expression for the magnetic energy stored in a solenoid in terms of magnetic field B, area A and length l of the solenoid, is

(a) $\frac{1}{2\mu_0}BAl$ (b) $\frac{1}{2\mu_0}B^2Al$ (c) $\frac{1}{\mu_0}B^2Al$ (d) $\frac{1}{\mu_0}BA^2l$

Ans. (a) $\frac{1}{2\mu_0}BAl$

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