ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

SOLUTION TO WORK SHEET 29

Subject : PHYSICS

CLASS : XII

08.07.20

Chapter: EM induction.

Topic: Motional e.m.f in two parallel rails , motional e.m.f of a rotating rod in uniform $\vec{B}$, e = 1/2 BwL^2 ,L & M.

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

1. A conducting rod of length *L* is moving in a transverse magnetic field of strength *B* with velocity v. The resistance of the rod is R. The current in the rod is

   (a) $\frac{Blv}{R}$ (b) Blv (c) zero (d) $\frac{B^2v^2L^2}{R}$

   Ans. (c) zero

2. The magnitude of the earth's magnetic field at a place is B_0 and the angle of dip is δ. A horizontal conductor of length *L* lying in magnetic north-south moves Eastwards with a velocity v. The emf induced across the conductor is

   (a) zero (b) B_0 Lv sin δ (c) B_0Lv (d) None of these

   Ans. (b) B_0 Lv sin δ

3. A horizontal straight wire 20 m long extending from east to west is falling with a speed of 5.0 ms^{-1} at right angles to the horizontal component of the earth's magnetic field 0.30 x 10^{-4} wbm^{-2}. The instantaneous value of the emf induced in the wire will be

   (a) 6.0 mV (b) 3mV (c) 4.5 mV (d) 1.5 mV

   Ans. (b) 3mV

4. A metal conductor of length 1m rotates vertically about one of its ends at angular velocity 5 rad/s. If the horizontal component of earth's magnetic field is 0.2 x 10^{-4} T, then the emf developed between the ends of the conductor is

   (a) 5μV (b) 5 mV (c) 50μV (d) 50 mV

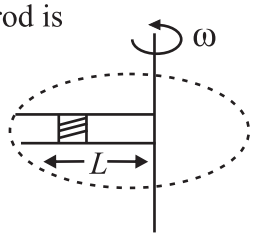
   Ans. (c) 50μV

5. A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of earth's magnetic field H_E at a place. If H_E = 0.4G at the place, what is the induced emf between the axle and the rim of the wheel? (Take, IG = 10^{-4} T)

   (a) 6.28 x 10^{-5} V (b) 62.8 x 10^{-5} V (c) 0.628 x 10^{-5} V (d) 62.8 x 10^{-5} mV

   Ans. (a) 6.28 x 10^{-5} V

6. A horizontal rod of length *L* rotates about a vertical axis with a uniform angular velocity ω. A uniform magnetic field *B* exists parallel to axis of rotation. Then, potential difference between the two ends of the rod is



   (a) $\omega L^2 B$ (b) $\omega^2 LB$

   (c) $\frac{1}{2}\omega L^2 B$ (d) $\frac{1}{2}\omega^2 LB$

   Ans. (c) $\frac{1}{2}\omega L^2 B$

7. A helicopter rises vertically with a speed of 100 m^{-1}. If helicopter has length 10 m and horizontal component of earth's magnetic field is 5 x10^{-3} Wbm^{-2}, then the induced emf between the tip of nose and tail of helicopter is

(a) 50 V (b) 0.5 V 5 V (d) 25 V

Ans. 5 V (c)

8. 2(a) long wire is movd with a velocity 1 ms^{-1} in a magnetic field of intensity 0.5 Wbm^{-2} in direction perpendicular to the field. The emf induced will be

(a) 2 V (b) 1 V 0.1 V (d) 0.5 V

Ans. (b) 1 V (c)

9. Two parallel rails of a railway track insulated from each other and with the ground are connected to a millivoltmeter. The distance between the rails is 1 m. A train is travelling with a velocity of 72 kmh^{-1} along the track. The reading of the millivoltmeter (in mV) is (vertical component of the earth's magnetic induction is 2 x 10^{-5} T)

(a) 1.44 (b) 0.72 (c) 0.4 (d) 0.2

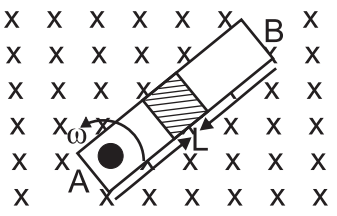
Ans. (c) 0.4

10. A metal disc of radius 100 cm is rotated at a constant. angular speed of 60 $rads^{-1}$ in a plane at right angles to an external field of magnetic induction 0.05 Wbm^{-2} The emf induced between the centre and a point or the rim will be

(a) 3V (b) 1.5V (c) 6V (d) 9V

Ans. (b) 1.5V

11. A copper rod of length L rotates at an angular velocity ω in a uniform magnetic field B as shown. What is the induced emf across the ends ?



(a) $\frac{1}{2}\omega BL^2$ (b) $\frac{1}{3}\omega BL^2$

(c) $\frac{1}{2}\omega BL^3$ (d) $\frac{1}{4}\omega BL^2$

Ans. (a) $\frac{1}{2}\omega BL^2$

12. Inductance depends on the

(a) geometry of the coil (b) intrinsic material properties (c) both (a) and (b) (d) Neither (a) nor (b)

Ans. (c) both (a) and (b)

13. If a medium of relative permeability μ_r had been present instead of air, the mutual inductance would be

(a) $M = \mu_r\mu_0 n_1 n_2 \pi r_1 l$ (b) $M = \mu_0 n_1 n_2 \pi r_1^2 l$ (c) $M = \mu_r n_1 n_2 \pi r_1^2 l$ (d) $M = \mu_r\mu_0 n_1 n_2 \pi r_1^2 l$

Ans. (d) $M = \mu_r\mu_0 n_1 n_2 \pi r_1^2 l$

14. Mutual inductance of a pair of coil, solenoids etc., depends on their

(a) separation (b)relative orientation (c) neither (a) nor (b) (d) both (a) and (b)

Ans. (d) both (a) and (b)

15. A current passing through a coil of self-inductance of 2 mH changes at the rate of 20mAs^{-1}. The emf induced in the coil is

(a) 10μV (b) 40μV (c) 10 mV (d) 40 mV)

Ans. (b) 40μV