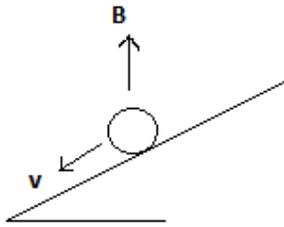


(C) $\frac{2\pi q}{r} 10^{-7} \text{ NA}^{-1}\text{m}^{-1}$

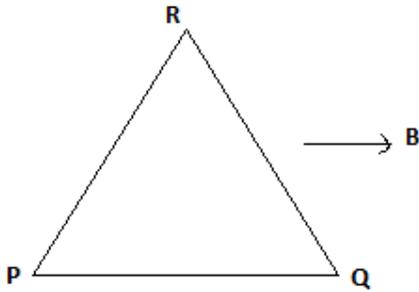
(D) $\frac{2\pi nq}{r} 10^{-7} \text{ NA}^{-1}\text{m}^{-1}$

8. A wire is carrying a current from east to west. The direction of magnetic field above it is
(A) east to west (B) west to east
(C) south to north (D) north to south
9. A circular loop of area 0.02 m^2 carrying a current of 10 A is placed with its plane perpendicular to the magnetic field 0.2 T . The torque acting on the loop is
(A) 0.01 Nm (B) 0.001 Nm
(C) zero (D) 0.8 Nm

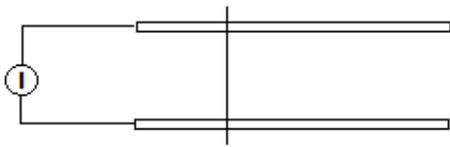


10. A conducting rod of length L carrying a current I perpendicular to the paper and inwards is moving down the smooth inclined plane of inclination θ with the horizontal with a uniform speed v . A vertically upward magnetic field B exists in the space as shown. The magnitude of the magnetic field is
(A) $\frac{mg}{IL} \sin \theta$ (B) $\frac{mg}{IL} \cos \theta$
(C) $\frac{mg}{IL} \tan \theta$ (D) $\frac{mg}{IL \sin \theta}$
11. A circular loop of area 1 cm^2 carrying a current of 10 A is placed in a magnetic field of 0.1 T perpendicular to the plane of the loop. The torque on the loop due to the magnetic field is
(A) 0 (B) 10^{-4} N-M
(C) 10^{-2} N-m (D) 1 N-m
12. An electric current I enters and leaves a uniform circular wire of radius a through diametrically opposite points. A charged particle q moving along the axis of the circular wire passes through its center at speed v . The magnetic force acting on the particle when it passes through the center has magnitude
(A) $\frac{\mu_0 i q v}{2a}$ (B) $\frac{\mu_0 i q v}{2\pi a}$
(C) $\frac{\mu_0 i q v}{a}$ (D) zero

Numerical problems



13. Figure shows an equilateral triangular loop of side L carrying a current I in the anticlockwise direction. Find the force acting on the three wires.



14. Figure shows two long metal rails placed horizontally parallel to each other at a separation of L . A uniform magnetic field B exists into the paper. A wire of mass m can slide on the rails. The rails are connected to a constant current source which drives a current I in the circuit. The friction coefficient between the rails and the wire is μ . (a) what should be the minimum value of μ which can prevent the wire from sliding on the rails? (b) describe the motion of the wire if the value of μ is half of what is found in part (a).

15. The magnetic field in a region is given by $\vec{B} = B_0 \left[1 + \frac{x}{l} \right] \hat{k}$. A square loop of side l and carrying a current I is placed with its edges parallel to x-y axes. Find the magnitude of the net magnetic force experienced by the loop.

16. A rectangular coil of 100 turns has length 5 cm and width 4 cm. It is placed with its plane parallel to a uniform magnetic field and a current of 2 A is sent through the coil. Find the magnitude of the magnetic field if the torque acting on the coil is 0.2 N-m

17. A circular loop carrying a current I has wire of total length L . A uniform magnetic field B exists parallel to the plane of the loop. (a) find the torque on the loop. (b) if the same length of the wire is used to form a square loop, what would be the torque? Which is larger?

18. Consider a non conducting ring of radius r and mass m which has a total charge q distributed uniformly on it. The ring is rotated about its axis with an angular speed ω . (a) find the equivalent electric current in the ring. (b) find the magnetic moment μ of the ring. (c) show that $\mu = \frac{q}{2m} l$ where l is the angular momentum of the ring about its axis of rotation.

19. Consider a non conducting plate of radius r and mass m which has a charge q distributed uniformly over it. The plate is rotated about its axis with an angular speed ω . Show that the magnetic moment μ and the angular momentum l of the plate are related as $\mu = \frac{q}{2m}l$
20. Consider a solid sphere of radius r and mass m which has a charge q distributed uniformly over its volume. The sphere is rotated about its diameter with an angular velocity ω . Show that the magnetic moment μ and the angular momentum l of the sphere are related as $\mu = \frac{q}{2m}l$