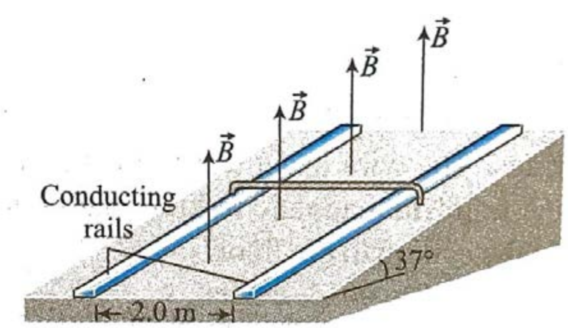
Ch—04 Moving Charges and Magnetism

Daily Practice Problem 06

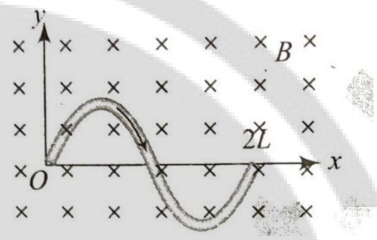
Q1. A straight wire of mass $200\ g$ and length 1.5 in carries a current of $2\ A$. It is suspended in mid-air by a uniform horizontal magnetic field $\vec{B}$. What is the magnitude of the magnetic field?

Q2. What is the force on a wire of length $4.0\ cm$ placed inside a solenoid near its centre, making an angle of $60°$ with its axis? The wire carries a current of $12\ A$ and the magnetic field due to the solenoid has a magnitude of $0.25\ T$.

Q3. Two conducting rails in the drawing are tilted upward so they each make an angle of $37°$ with respect to the ground. The vertical magnetic field has a magnitude of $0.050\ T$. The $0.20-kg$ aluminium rod $(length = 2.0\ m)$ slides without friction down the rails at a constant velocity. How much current flows through the rod?



Q4. A wire carrying a current i is placed in a uniform magnetic field in the form of the curve $y = a\,sin\left(\frac{\pi x}{L}\right)$ $0 \le x \le 2L$. The force acting on the wire is



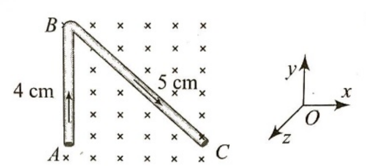
a. $\frac{iBL}{\pi}$

b. $iBL\pi$

c. $2iBL$

d. Zero

Q5. A uniform conducting wire ABC has a mass of $10g$. A current of $2\ A$ flows through it. The wire is kept in a uniform magnetic field $B = 2\ T$. The acceleration of the wire will be



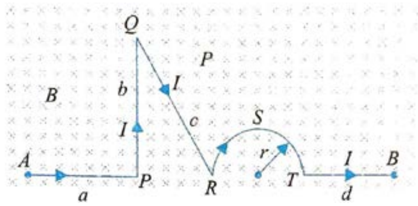
a. Zero

b. $12\ ms^{-2}$ along y-axis

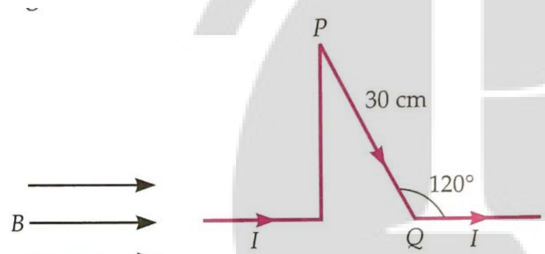
c. $1.2 \times 10^{-3} ms^{-2}$ along y-axis

d. $0.6 \times 10^{-3} ms^{-2}$ along y-axis

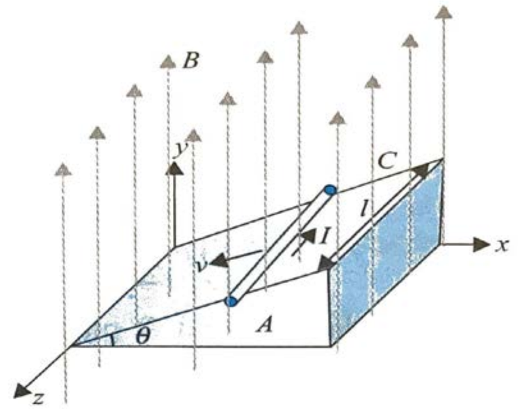
Q6. Calculate the force on a current carrying wire in a uniform magnetic field as shown in figure.



Q7. Find the magnitude of the magnetic force on the segment PQ placed in a magnetic field of $0.25\,T$, if a current of $5\,A$ flows through it, as shown in



Q8. A conducting rod of length l and mass m is moving down a smooth inclined plane of inclination θ with constant velocity v. A current i is flowing in the conductor in a direction perpendicular to paper inwards. A vertically upward magnetic field $\vec{B}$ exists in space. Then. magnitude of magnetic field $\vec{B}$ is



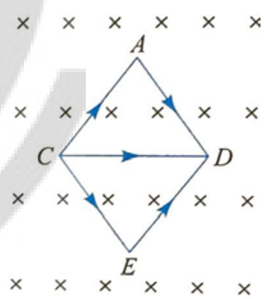
a. $\frac{mg}{il}\ sin\theta$

b. $\frac{mg}{il}\ tan\theta$

c. $\frac{mgcos\theta}{il}$

d. $\frac{mg}{ilsin\theta}$

Q9. Let current $i = 2\,A$ be flowing in each part of a wire frame as shown in figure. The frame is a combination of two equilateral triangles ACD and CDE of side $1\,m$. It is placed in uniform magnetic field $B = 4\,T$ acting perpendicular to the plane of frame. The magnitude of magnetic force acting on the frame is



a. 24 N

b. zero

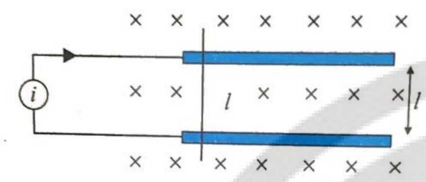
c. 16 N

d. 8 N

Q10. The figure below shows two long metal rails placed horizontally and parallel to each other at a separation l. A uniform magnetic field B exists in the vertically downward direction. 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 the value found in the previous part.



ANSWERS

1. 0.65 T

2. 0.10 N

3. 14 A

4. c

5. b

6. $IB\left(a+\sqrt{c^2-b^2}+2r+d\right)$

7. 0.32 N

8. b

9. 1

10. (a) $\frac{ilb}{mg}$

(b) The wire will slide towards right with acceleration $\frac{ilB}{2m}$