NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 12th **PAPER CODE :- CWT-4**
CHAPTER :- MAGNETIC EFFECT OF CURRANT

ANSWER KEY

1.	(D)	**2.**	(C)	**3.**	(C)	**4.**	(A)	**5.**	(D)	**6.**	(B)	**7.**	(B)
8.	(B)	**9.**	(A)	**10.**	(D)	**11.**	(C)	**12.**	(B)	**13.**	(A)	**14.**	(A)
15.	(D)	**16.**	(C)	**17.**	(C)	**18.**	(C)	**19.**	(C)	**20.**	(D)	**21.**	(A)
22.	(B)	**23.**	(C)	**24.**	(B)	**25.**	(B)	**26.**	(A)	**27.**	(A)	**28.**	(C)
29.	(A)	**30.**	(A)	**31.**	(C)	**32.**	(C)	**33.**	(B)	**34.**	(B)	**35.**	(B)
36.	(B)	**37.**	(D)	**38.**	(A)	**39.**	(C)	**40.**	(A)	**41.**	(C)	**42.**	(C)
43.	(D)	**44.**	(A)	**45.**	(C)	**46.**	(A)	**47.**	(B)	**48.**	(B)	**49.**	(C)
50.	(D)												

SOLUTIONS

SECTION-A

1. (D)
Sol. Magnetic field at the centre of circular coil

$B = \frac{\mu_0 Ni}{2r}$

Ist case : N = 1, L = 2πr ⇒ $r = \frac{L}{2\pi}$

∴ $B = \frac{\mu_0 \times 1 \times i}{2r} = \frac{\mu_0 i}{2r}$

IInd case : N = 2, L = 2 × 2πr'

⇒ $r' = \frac{L}{4\pi} = \frac{r}{2}$ ∴ B' = $\frac{\mu_0 \times 2 \times i}{2r'} = \frac{\mu_0 \times 2i}{2 \times (r/2)} = \frac{4\mu_0 i}{2r} = 4B$

2. (C)
Sol. Field at the centre of a circular coil of radius r is $B = \frac{\mu_o I}{2r}$

3. (C)
Sol. The magnetic field inside a long straight solenoid-carrying current is the same at all points. It is because the magnetic field in the solenoid is constant because the lines are completely parallel to each other.

4. (A)
Sol. Field at a point x from the centre of a current carrying loop on the axis is

$$B = \frac{\mu_0}{4\pi}.\frac{2M}{x^3} = \frac{10^{-7} \times 2 \times 2.1 \times 10^{-25}}{(10^{-10})^3}$$

$$= 4.2 \times 10^{-32} \times 10^{30} = 4.2 \times 10^{-2} W/m^2$$

5. (D)
Sol. Magnetic field inside the hollow conductor (tube) is zero.

6. (B)
Sol. $B = \frac{\mu_0 i}{2\pi r}$ or $B \propto \frac{1}{r}$

7. (B)
Sol. $\frac{\mu_0}{4\pi} \times \frac{2\pi i}{r} = H \Rightarrow \frac{(10^{-7}) \times 2 \times 3.142 \times i}{0.05} = 7 \times 10^{-5}$

$\therefore i = \frac{7 \times 0.05 \times 10^{-5}}{2 \times 3.142 \times 10^{-7}} = \frac{35}{2 \times 3.142} = 5.6$ *amp*

8. (B)
Sol. $B = \frac{\mu_0 Ni}{2r} = \frac{4\pi \times 10^{-7} \times 50 \times 2}{2 \times 0.5} = 1.25 \times 10^{-4}\ T$

9. (A)
Sol. q = 1C, B = 0.5 T, v = 10 m/s
F = qBv
= 1 × 0.5 × 10 = 5N

10. (D)
Sol. The magnetic field is given by $B = \frac{\mu_0}{4\pi}\frac{2i}{r}$.
It is independent of the radius of the wire.

11. (C)
Sol. When a loop (of any size)is placed in a uniform magnetic field, then the force acting on the loop is zero.

12. (B)
Sol. Magnetic field at centre of a circular coil,

$B = \frac{\mu_0 ni}{2r}$

Here $N = \frac{1}{2}$

∴ $B = \frac{\mu_0 \left(\frac{1}{2}\right) i}{2r} = \frac{\mu_0 i}{4r}$

13. (A)
Sol.

$$B = \mu_0 ni \Rightarrow \frac{B}{B'} = \frac{n}{n'} \times \frac{i}{i'} = \frac{1}{(1/2)} \times \frac{1}{2} = 1 \Rightarrow B' = B$$

14. (A)

Sol. $B = \frac{\mu_0}{4\pi}\cdot\frac{2i}{r} \Rightarrow B \propto i$

15. (D)

Sol. Since electron is moving is parallel to the magnetic field, hence magnetic force on it $F_m = 0$.

The only force acting on the electron is electric force which reduces it's speed.

16. (C)

Sol. East, (By $\vec{F} = q(\vec{v} \times \vec{B})$) or by applying Fleming's left hand rule.

17. (C)

Sol.

$$T = \frac{2\pi m}{qB} = \frac{2\pi r}{v} = \frac{2 \times 3.14 \times 0.45}{2.6 \times 10^7} = 1.08 \times 10^{-7}\ \text{sec}$$

18. (C)

Sol. $r = \frac{mv}{qB} \Rightarrow r \propto v, \quad \Rightarrow r_2 = 2r_1 = 2 \times 2 = 4cm$

19. (C)

Sol. $\vec{F} = q\vec{v} \times \vec{B}$

20. (D)

Sol. The deflection produced by the electric field may be nullified by that produced by magnetic field.

21. (A)

Sol. $F = qvB\sin\theta = qvB\sin 0 = 0$

22. (B)

Sol. $\omega = \frac{2\pi}{T} = \frac{qB}{m} \Rightarrow \omega \propto v^{\circ} \quad \left(\because T = \frac{2\pi m}{qB}\right)$

23. (C)

Sol. $r = \frac{mv}{qB} \Rightarrow \frac{r_\alpha}{r_p} = \frac{m_\alpha}{m_p} \times \frac{q_p}{q_\alpha} = \frac{4}{1} \times \frac{1}{2} = \frac{2}{1}$

24. (B)

Sol. Two wires, if carries current in opposite direction, they repel each other.

25. (B)

Sol. When a charged particle enters a magnetic field perpendicularly, it moveson a circular path. Therequired centripetal force is provided by magnetic force.

i.e., magnetic force = Centripetal force

or $qvB = \frac{mv^2}{r}$ ∴

$r = \frac{mv}{qB}$

Now kinetic energy of the particle,

$K = \frac{1}{2}mv^2 \Rightarrow$

$mv = \sqrt{2mK}$

Therefore, Eq. (i) becomes

$r = \frac{\sqrt{2mK}}{qB}$ or

$r \propto \sqrt{m} \qquad \therefore \frac{r_e}{r_p} = \sqrt{\frac{m_e}{m_p}}$

As $m_e < m_p$; so, $r_e < r_p$

Hence, trajectory of proton is less curved.

26. (A)

Sol. Two straight conductors carry current in same direction, then attractive force acts between them.

27. (A)

Sol.

$$F = \frac{\mu_0}{4\pi}\frac{2 \times i_1 i_2}{a} = \frac{10^{-7} \times 2 \times 5 \times 5}{0.1} = 5 \times 10^{-5}\ N/m$$

28. (C)

Sol. $M = i\pi r^2$

29. (A)

30. (A)

Sol. $F = \frac{\mu_0}{4\pi}\frac{2i_1 i_2}{a} = 10^{-7} \times \frac{2 \times 10 \times 10}{0.1} = 2 \times 10^{-4} N$

Direction of current is same, so force is attractive.

31. (C)

32. (C)

33. (B)

34. (B)

Sol. $W_1 = MB(\cos 0^o - \cos 90^o) = MB(1 - 0) = MB$

$W_2 = MB(\cos 0^o - \cos 60^o) = MB\left(1 - \frac{1}{2}\right) = \frac{MB}{2}$

$\therefore W_1 = 2W_2 \Rightarrow n = 2$

35. (B)

SECTION-B

36. (B)

Sol. $\vec{\tau} = \vec{M} \times \vec{B} \Rightarrow \vec{\tau} = 50\hat{i} \times (0.5\hat{i} + 3\hat{j})$

$= 150(\hat{i} \times \hat{j}) = 150\hat{k} N \times m.$

37. (D)

38. (A)

Sol. Torque on a bar magnet in earths magnetic field (B_H) is $\tau = MB_H \sin\theta$. τ will be maximum if sin θ = maximum *i.e.* θ = 90°. Hence axis of the magnet is perpendicular to the field of earth.

39. (C)

Sol. Magnetic moment of the loop.

M = NIA = 2000 × 2 × 1.5 × 10^{-4} = 0.6 J/T

torque τ = MBsin30°

$= 0.6 \times 5 \times 10^{-2} \times \frac{1}{2}$

$= 1.5 \times 10^{-2}$ Nm

40. (A)

Sol. The horizontal components are $(B_H)_1 = B\cos\phi_1$ and $(B_H)_2 = B\cos\phi_2$

$\therefore \frac{(B_H)_1}{(B_H)_2} = \frac{\cos\phi_1}{\cos\phi_2} = \frac{\cos 30^o}{\cos 45^o} = \frac{\sqrt{3}}{2} \times \sqrt{2} = \frac{\sqrt{3}}{\sqrt{2}}$

41. (C)

42. (C)

Sol.

$B_H = B\cos\phi; \therefore B = \frac{B_H}{\cos\phi} = \frac{0.5}{\cos 30^o} = \frac{0.5}{\sqrt{3}/2} = \frac{1}{\sqrt{3}}$

43. (D)

Sol. $B_0 = V_0$ also total intensity $B = \sqrt{B_0^2 + V_0^2}$

$\Rightarrow B = \sqrt{2}B_0$

44. (A)

45. (C)

46. (A)

Sol. Due to metallic frame the deflection is only due to current in a coil and magnetic field, not due to vibration in the strings. If string start oscillating, presence of metallic frame in the field make these oscillations damped.

47. (B)

Sol. Time period in vibration magnetometer

$T = 2\pi\sqrt{\frac{I}{MB_H}}$, At poles $B_H = 0$ so $T = \infty$

48. (B)

Sol. In sum position $T \propto \frac{1}{\sqrt{M_1 + M_2}}$ and in difference position $T \propto \frac{1}{\sqrt{M_1 - M_2}}$

$\Rightarrow \frac{3^2}{T^2} = \frac{2M - M}{2M + M} \Rightarrow T^2 = 9 \times 3 \sec^2$

$\therefore T = 3\sqrt{3}$ sec

49. (C)

Sol. A freely suspended magnet always points in the North-South direction even in the absence of any other magnet. This suggests that the Earth itself behaves as a magnet which causes a freely suspended magnet (or magnetic needle) to point always in a particular direction: North and South. The shape of the Earth's magnetic field resembles that of a bar magnet of length one-fifth of the Earth's diameter buried at its center.

50. (D)

Sol. (A) – R

The magnetic field induction (B) is directly proportional to the current flowing through the wire.

(B) – S

1 tesla = 10^4 Gauss

$\Rightarrow$ 1 Gauss = 10^4 tesla = 0.0001 tesla

Hence, tesla is the S.I unit of magnitic field induction

(C) – P

The S.I unit of intensity of magnetic field (H) is Am^{-1}.

(D) – Q

The magnetic susceptibility = $\frac{I}{H}$ is a constant for a given substance has no unit.