Additional Problems For Self Practice (APSP)

PART-I: PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions :

1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

1. An electron is moving with velocity $\vec{v}$ in the direction of magnetic field $\vec{B}$, then force acting on electron is :-
(1) Zero (2) $e(\vec{v} \times \vec{B})$ (3) $e(\vec{B} \times \vec{v})$ (4) All

2. Work done in rotating a magnet of magnetic moment M with angle θ in external magnetic field H is :
(1) MH cosθ (2) $MH \sin^2 \frac{\theta}{2}$ (3) MHsinθ (4) MH(1 – cosθ)

3. Which of the following is proportional to energy density in magnetic field B :
(1) $\frac{1}{B}$ (2) $\frac{1}{B^2}$ (3) B (4) B^2

4. Which one of the following is ferro magnetic ?
(1) Co (2) Zn (3) Hg (4) Pt

5. Sometimes positive charged particle comes from space towards earth with high velocity perpendicular to surface of earth. Its deviation due to the magnetic field of earth will be :
(1) towards north (2) towards south (3) towards west (4) towards east

6. For paramagnetic materials magnetic susceptibility is related with temperature as :
(1) $\propto T^2$ (2) $\propto T^1$ (3) $\propto T^{-1}$ (4) $\propto T^2$

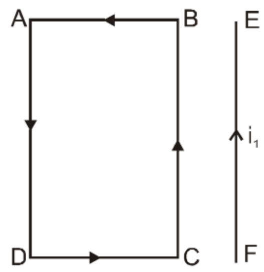
7. Current I is flowing in a conducting circular loop of radius R. It is kept in a magnetic field B which is perpendicular to the plane of circular loop. Find the magnetic force acting on the loop.
(1) IRB (2) 2πIRB (3) Zero (4) πIRB

8. A magnetic field can be produced by :-
(1) A moving charge (2) A changing electric field
(3) A stationary charge (4) Both (A) and (B)

9. The magnetic field at the centre of semi-circular wire carrying current i is
(1) $\frac{\mu_0 i}{2r}$ (2) $\frac{\mu_0 i}{4r}$ (3) $\frac{\mu_0 i}{r}$ (4) $\frac{\mu_0 i}{2\pi r}$

10. If current in two parallel wires flow in opposite directions, the force between the wires will be :
(1) attractive (2) repulsive (3) zero
(4) attractive or repulsive depending on the material of wires

11. A wire EF carrying current i_1 is placed near a current carrying rectangular loop ABCD as shown. Then the wire EF



(1) remains unaffected
(2) is attractted towards loop
(3) is repelled away from loop
(4) first attracted and then repelled

12. If a current of i amp is flowing in the winding of solenoid and n is the number of turns per unit length, then the magnetic field at the centre of solenoid is

(1) $\mu_0 ni$ (2) $\frac{\mu_0 ni}{2}$ (3) $\frac{\mu_0 i}{2n}$ (4) $\frac{\mu_0 i}{n}$

13. The magnetic field $\vec{B}$ in a circular coil does not depend on :

(1) current (2) radius (3) number of turns (4) area

14. On a magnetic needle placed in a uniform magnetic field :

(1) $F \neq 0, \tau \neq 0$ (2) $F \neq 0, \tau = 0$ (3) $F = 0, \tau \neq 0$ (4) $F = 0, \tau = 0$

15. Two conductors having current in opposite directions ....

(1) attract each other (2) repel each other
(3) do not affect each other (4) effect depends on the material of wire

16. Two similar coils are kept mutually perpendicular such that their centres coincide. At the centre, find the ratio of the magnetic field due to one coil and the resultant magnetic field through both coils, if the same current is flown :

(1) $1 : \sqrt{2}$ (2) 1 : 2 (3) 1 : 3 (4) $\sqrt{3}$: 1

17. An electron moves at right angle to a magnetic field of 1.5×10^{-2} T with a speed of 6×10^{7} m/s. If the specific charge of the electron is 1.7×10^{11} C/kg. The radius of the circular path will be :

(1) 2.9 cm (2) 3.9 cm (3) 2.35 cm (4) 2 cm

18. A bar magnet of magnetic moment $\vec{M}$ is placed in the magnetic field $\vec{B}$. The torque acting on the magnet is:

(1) $\vec{M} \times \vec{B}$ (2) $\vec{M} - \vec{B}$ (3) $\frac{1}{2}\vec{M} \times \vec{B}$ (4) $\vec{M} + \vec{B}$

19. An electron and proton enter a magnetic field perpendicularly. Both have same kinetic energy. Which of the following is true ?

(1) Trajectory of electron is less curved (2) Trajectory of proton is less curved
(3) Both trajectories are equally curved (4) Both move on straight line path

20. Two parallel wires carrying currents in the same direction attract each other because of

(1) potential difference between them (2) mutual inductance between them
(3) electric force between them (4) magnetic force between them

21. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v. The time period of the motion

(1) depends on v and not on R (2) depends on both R and v
(3) is independent of both R and v (4) depends on R and not on v

22. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment μ is given by :

(1) $\frac{qvR}{2}$ (2) qvR^2 (3) $\frac{qvR^2}{2}$ (4) qvR

23. A particle of mass M and charge Q moving with velocity $\vec{v}$ describes a circular path of radius R when subjected to a uniform transverse magnetic field of induction B. The work done by the field when the particle completes one full circle is

(1) $\left(\frac{mv^2}{R}\right)2\pi R$ (2) Zero (3) BQ.2πR (4) BQv.2πR

24. The charge on a particle Y is double the charge on particle X. These two particles X and Y after being accelerated through the same potential difference enter a region of uniform magnetic field and describe circular paths of radii R_1 and R_2 respectively. The ratio of the mass of X to that of Y is :

(1) $(2R_1 / R_2)^2$ (2) $(R_1 / 2R_2)^2$ (3) $R_1^2 / 2R_2^2$ (4) $2R_1 / R_2$

25. Two long parallel wires P and Q are both perpendicular to the plane of the paper with distance 5m between them. If P and Q carry current of 2.5 A and 5A respectively in the same direction, then the magnetic field at a point half way between the wires is :

(1) $\frac{\sqrt{3}\mu_0}{2\pi}$ (2) $\frac{\mu_0}{\pi}$ (3) $\frac{3\mu_0}{2\pi}$ (4) $\frac{\mu_0}{2\pi}$

26. There are 50 turns of a wire in every cm length of a long solenoid. If 4A currents is flowing in the solenoid, the approximate value of magnetic field along its axis at an internal point and at one end will be respectively :

(1) 12.6×10^{-3} Wb/m², 6.3×10^{-3} Wb/m² (2) 12.6×10^{-3} Wb/m², 25.1×10^{-3} Wb/m²

(3) 25.1×10^{-3} Wb/m², 12.6×10^{-3} Wb/m² (4) 25.1×10^{-5} Wb/m², 12.6×10^{-5} Wb/m²

27. The vector form of Biot-Savart's law for a current carrying element is

(1) $\vec{dB} = \frac{\mu_0}{4\pi}\frac{I\vec{dl}\sin\phi}{r^2}$ (2) $\vec{dB} = \frac{\mu_0}{4\pi}\frac{Idl \times \hat{r}}{r^2}$ (3) $\vec{dB} = \frac{\mu_0}{4\pi}\frac{I\vec{dl} \times \hat{r}}{r^3}$ (4) $\vec{dB} = \frac{\mu_0}{4\pi}\frac{I\vec{dl} \times \hat{r}}{r^2}$

28. A particle of charge -16×10^{-18} C moving with velocity $10ms^{-1}$ along the x-axis enters a region where a magnetic field of induction B is along the y-axis and an electric field of magnitude 10^4V/m is along the negative z-axis. If the charged particle continues moving along the x-axis, the magnitude of B is

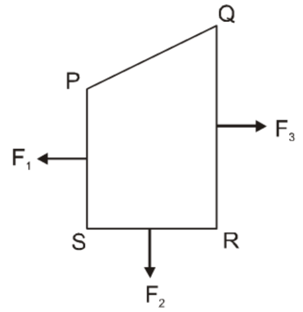
(1) 10^{16} Wb/m² (2) 10^5 Wb/m² (3) 10^3 Wb/m² (4) 10^{-3} Wb/m²

29. A beam of electrons passed undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move :

(1) in an elliptical orbit (2) in a circular orbit

(3) along a parabolic path (4) along a straight line

30. A closed loop PQRS carrying a current is placed in a uniform magnetic field. if the magnetic forces on segments PS, SR and RQ are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown the directions shown, the force on the segment QP is



(1) $F_3 - F_1 - F_2$ (2) $\sqrt{(F_3 - F_1)^2 + F_2^2}$

(3) $\sqrt{(F_3 - F_1)^2 - F_2^2}$ (4) $F_3 - F_1 + F_2$

Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

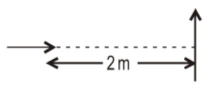
1. A particle mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction $\vec{B}$. After 3 s the kinetic energy of the particle will be
(1) 3T (2) 2T (3) T (4) 4T

2. In a certain region of space electric field $\vec{E}$ and magnetic field $\vec{B}$ are perpendicular to each other and an electron enters in region perpendicular to the direction of $\vec{B}$ and $\vec{E}$ both and moves undeflected, then velocity of electron is :
(1) $\frac{|\vec{E}|}{|\vec{B}|}$ (2) $\vec{E}\times\vec{B}$ (3) $\frac{|\vec{B}|}{|\vec{E}|}$ (4) $\vec{E}.\vec{B}$

3. If a long hollow copper pipe carries a current, then magnetic filed is produced :
(1) inside the pipe only (2) outside the pipe only
(3) both inside and outside the pipe (4) no where

4. A straight wire of diameter 0.5 mm carrying a current of 1A is replaced by another wire of diameter 1 mm carrying the same current. The strength of magnetic field far away is :
(1) twice the earlier value (2) one-half of the earlier value
(3) one quarter of the earlier value (4) same as earlier value

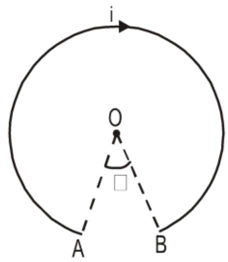
5. Two identical magnetic dipoles of magnetic moments 1.0 A-m^2 each, placed at a separation of 2 m with their axes perpendicular to each other. The resultant magnetic field at a point midway between the dipole is:



(1) 5×10^{-7} T (2) $\times 10^{-7}$ T (3) 10^{-7} T (4) 2×10^{-7} T

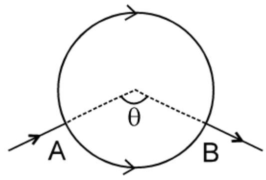
6. Two infinitely long, thin, insulated, straight wires lie in the x-y plane along the x and y-axis respectively. Each wire carries a current I, respectively in the positive x-direction and positive y-direction. The magnetic field will be zero at all points on the straight line:
(1) y = x (2) y = – x (3) y = x – 1 (4) y = – x + 1

7. A current carrying wire AB of the length 2πR is turned along a circle, as shown in figure. The magnetic field at the centre O.



(1) $\frac{\mu_0 i}{2R}\left(\frac{2\pi-\theta}{2\pi}\right)^2$ (2) $\frac{\mu_0 i}{2R}\left(\frac{2\pi-\theta}{2\pi}\right)$
(3) $\frac{\mu_0 i}{2R}$ $(2\pi - \theta)$ (4) $\frac{\mu_0 i}{2R}$ $(2\pi + \theta)_2$

8. A battery is connected between two points A and B the circumference of a uniform conducting ring of radius r and resistance R. One of the arcs AB of the ring subtends an angle θ at the centre. The value of the magnetic induction at the centre due to the current in the ring is:



(1) zero, only if $\theta = 180^o$ (2) zero for all values of θ
(3) proportional to $2(180^o - \theta)$ (4) inversely proportional to r

9. A solenoid of length 0.4 m and diameter 0.6 m consists of a single layer of 1000 turns of fine wire carrying a current of 5.0×10^{-3} ampere. Find the magnetic field on the axis at the middle and at the ends of the solenoid. (Given $\mu_0 = 4\pi \times 10^{-7} \frac{V-s}{A-m}$).

(1) $\frac{\pi \times 10^{-5}}{\sqrt{13}}T$, $2\pi \times 10^{-6}$ Wb/m^2 (2) $\frac{2\pi \times 10^{-6}}{\sqrt{13}}T$, $2\pi \times 10^{-6}$ Wb/m^2
(3) $\frac{\pi \times 10^{-5}}{\sqrt{13}}T$, $\pi \times 10^{-6}$ Wb/m^2 (4) $\frac{\pi \times 10^{-5}}{\sqrt{13}}T$, $3\pi \times 10^{-6}$ Wb/m^2

10. Two particles X and Y having equal charges, after being accelerated through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii R_1 and R_2 respectively. The ratio of the masses of X to that of Y.

(1) $\left(\frac{R_1}{R_2}\right)^{1/2}$ (2) $\frac{R_2}{R_1}$ (3) $\left(\frac{R_1}{R_2}\right)^2$ (4) $\frac{R_1}{R_2}$

11. A proton of mass m and charge q enters a magnetic field B with a velocity v at an angle θ with the direction of B. The radius of curvature the resulting path is

(1) $\frac{mv}{qB}$ (2) $\frac{mv\sin\theta}{qB}$ (3) $\frac{mv}{qB\sin\theta}$ (4) $\frac{mv\cos\theta}{qB}$

12. A circular coil of radius 20 cm and 20 turns of wire is mounted vertically with its plane in magnetic meridian. A small magnetic needle (free to rotate about vertical axis) is placed at the center of the coil. It is deflected through 45° when a current is passed through the coil in equilibrium Horizontal component of earth's field is 0.34×10^{-4} T. The current in coil is:

(1) $\frac{17}{10\pi}$ A (2) 6A (3) 6×10^{-3} A (4) $\frac{3}{50}$ A

13. The magnetic field of a given length of wire carrying a current for a single turn circular coil at centre is B, then its value for two turns for the centre is B, then its value for two turns for the same wire when same current passing through it is :-

(1) $\frac{B}{4}$ (2) $\frac{B}{2}$ (3) 2B (4) 4B

14. An elastic circular wire of length ℓ carries an anticlockwise current I. It is placed in a uniform magnetic field B(out of paper) such that its plane is perpendicular to the direction of B. The wire will experience-
(1) no force (2) a stretching force (3) a compressive force (4) a torque

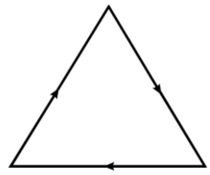
15. An electron (charge = 1.6×10^{-19} coulomb) is moving in a circle of radius 5.1×10^{-11} m at a frequency of 6.8×10^{15} revolutions/sec. The equivalent current is approximately.
(1) 5.1×10^{-3} amperes (2) 6.8×10^{-3} amperes
(3) 1.1×10^{-3} amperes (4) 2.2×10^{-3} amperes

16. An ionized gas contains both positive and negative ions. If it is subjected simultaneously to an electric field along the + x direction and a magnetic field along the +z direction, then
(1) positive ions deflect towards +y direction
(2) all ions deflect towards +y direction
(3) all ions deflect towards –y direction
(4) positive ions deflect towards –y direction and negative ions towards +y direction

17. A particle of mass 0.6 g and having charge of 25 nC is moving horizontally with a uniform velocity $1.2 \times 10^4\ ms^{-1}$ in a uniform magnetic field, then the value of the minimum magnetic induction is: ($g = 10 ms^{-2}$)
(1) Zero (2) 10 T (3) 20 T (4) 200 T

18. A magnetic needle (small magnet) is kept in a nonuniform magnetic field. It .
(1) may experience a force and torque
(2) may experience a force but not a torque
(3) may experience a torque but not a force
(4) will experience neither a force nor a torque

19. A current I flows along a triangular loop having sides of equal length a'. The strength of magnetic field at the centre of the loop is :

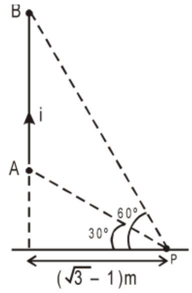


(1) $\frac{3\ \mu_0\ I}{2\ \pi a}$
(2) $\frac{9\ \mu_0\ I}{2\ \pi a}$
(3) $\frac{3\sqrt{3}\ \mu_0\ I}{2\ \pi a}$
(4) $\frac{3\ \mu_0\ I}{4\ \pi a}$

20. A vertical wall is in North South direction. A current carrying wire is kept in the wall such that to the west of the wall magnetic field is towards South. Then the wire should be
(1) vertical and current is upwards
(2) vertical and current is downwards
(3) Horizontal and current is towards west
(4) Horizontal and current is towards east.

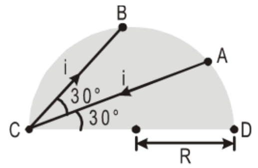
21. The magnetic lines of force due to a straight current carrying wire will be:
(1) circular for finite length of wire
(2) circular for semi-infinite wire
(3) circular for infinite wire
(4) all of the above

22. A straight wire current element is carrying current 100 A, as shown in figure. The magnitude of magnetic field at point P which is at perpendicular distance $(\sqrt{3}-1)m$ from the current element if end A and end B of the element subtend angle 30º and 60º at point P, as shown, is :



(1) 5×10^{-6} T
(2) 2.5×10^{-6} T
(3) 2.5×10^{-5} T
(4) 8×10^{-5} T

23. A current carrying wire is placed in the grooves of an insulating semi circular disc of radius 'R', as shown. The current enters at point A and leaves from point B. Determine the magnetic field at point D.



(1) $\frac{\mu_0 I}{8\pi R\sqrt{3}}$
(2) $\frac{\mu_0 I}{4\pi R\sqrt{3}}$
(3) $\frac{\sqrt{3}\ \mu_0 I}{4\pi R}$
(4) none of these

24. An infinitely long current carrying wire is placed along x-axis such that it lies between x = 0 to x = + ∞ (infinity). The current is in direction of positive x-axis. Let B_1, B_2 and B_3 be the magnitude of magnetic field at points A(a, a), B(0, a) and C(–a, a) respectively. Then pick the incorrect option.
(1) $B_1 > B_2 > B_3$
(2) $B_2 = \frac{B_1 + B_3}{2}$
(3) $B_1 : B_2 : B_3 = \sqrt{2}+1 : 1 : \sqrt{2}-1$
(4) $\frac{B_1 B_3}{B_2^2} = \frac{1}{2}$

APSP Answers

PART-I

1.	(1)	**2.**	(4)	**3.**	(4)	**4.**	(1)	**5.**	(4)	**6.**	(3)	**7.**	(3)
8.	(4)	**9.**	(2)	**10.**	(2)	**11.**	(2)	**12.**	(1)	**13.**	(4)	**14.**	(3)
15.	(2)	**16.**	(1)	**17.**	(3)	**18.**	(1)	**19.**	(2)	**20.**	(4)	**21.**	(3)
22.	(1)	**23.**	(2)	**24.**	(3)	**25.**	(4)	**26.**	(3)	**27.**	(4)	**28.**	(3)
29.	(2)	**30.**	(2)										

PART - II

1.	(3)	**2.**	(1)	**3.**	(2)	**4.**	(4)	**5.**	(2)	**6.**	(1)	**7.**	(1)
8.	(2)	**9.**	(1)	**10.**	(3)	**11.**	(3)	**12.**	(1)	**13.**	(4)	**14.**	(2)
15.	(3)	**16.**	(3)	**17.**	(3)	**18.**	(1,2,3)	**19.**	(2)	**20.**	(1)	**21.**	(4)
22.	(1)	**23.**	(2)	**24.**	(3)								