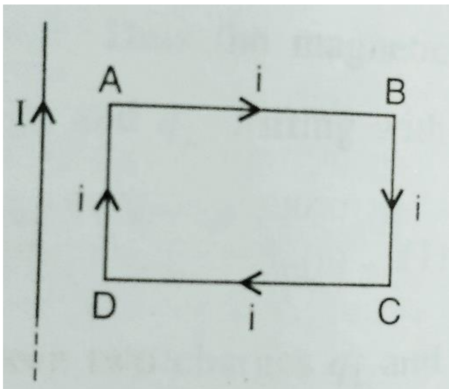
Magnetic Effects of Current

1. Magnetic induction is measured in:
   (a) weber (b) weber/m (c) weber/m^2 (d) weber/m^3
2. The force acting on a charge q moving with a velocity υ in a magnetic field of induction B is given by:
   (a) q/(υ ₓ B) (b) (υ ₓ B)/q (c) q/(υ ₓ B) (d) (υ . B)q
3. Two free parallel wire carrying currents in the opposite directions:
   (a) attract each other
   (b) repel each other
   (c) do not affect each other
   (d) get rotated to be perpendicular to each other
4. Two parallel wires carrying currents in the same direction attract each other because of:
   (a) potential difference between them
   (b) mutual inductance between them
   (c) electric forces between them
   (d) magnetic force between them
5. A free charged particle moves through a magnetic field. The particle may undergo a change in:
   (a) speed (c) direction of motion
   (b) energy (d) none these
6. An electron and a proton travel with equal speeds and in the same direction, at 90° to a uniform magnetic field. They experience forces which are initially:
   (a) in opposite direction and differing by a factor of about 1840
   (b) in the same direction and differing by a factor of about 1840
   (c) equal but in opposite directions
   (d) identical
7. A rectangular loop carrying a current *I* , is situated near a long straight wire such that the wire is parallel to one of the sides of the loop. If a steady current *I* is established in the wire as shown in the figure, the loop will: (figure no:-27.8)



   (a) rotate about an axis parallel to the wire
   (b) move away from the wire
   (c) move towards the wire (d) remain stationary

8. A coil of one turn is made of a wire of certain length and then from the same length a coil of two turns is made. If the same current is passed in both the cases, then the ratio of the magnetic induction at their centres will be:
   (a) 2 : 1 (b) 1 : 4 (c) 4 : 1 (d) 1 : 2
9. A uniform magnetic field acts at right angles to the direction of motion of electrons. As a result, the electron moves in a circular path of radius 2 cm. If the speed of the electrons is doubled, the radius of the circular path will be:
   (a) 2.0 cm (b) 0.5 cm (c) 4.0 cm (d) 1.0 cm
10. If a long copper rod carries a direct current, the magnetic field associated with the current will be:
    (a) only inside the rod
    (b) only outside the rod
    (c) both inside and outside the rod
    (d) neither inside nor outside the rod
11. A proton and an alpha-particle enter a uniform magnetic field with the same velocity. The period of rotation of the alpha-particle will be:
    (a) four times that of the proton
    (b) two times that of the proton
    (c) three times that of the proton
    (d) same as that of the proton
12. If two streams of protons move parallel to each other in the same direction, then these:
    (a) do not exert any force on one another
    (b) repel each other
    (c) attract each other
    (d) get rotated to be perpendicular to each other
13. Two straight long conductors AOB and COD are perpendicular to each other and carrying currents I_1 and I_2. The magnitude of the magnetic induction at a point P at a distance d from the point O in a direction perpendicular to the plane ABCD is:
    (a) $\mu_0/2\pi d(I_1 + I_2)$ (c) $\mu_0/2\pi d(I_1^2 + I_2^2)$
    (b) $\mu_0/4\pi d(I_1 - I_2)$ (d) $\mu_0/2\pi d(I_1 I_2/I_1 + I_2)$
14. The magnetic field *dB* due to a small current element *dl* at a distance r and an element carrying current *I* is:
    (a) $dB = \mu_0 I/4\pi(dl \times r/r)$ (c) $dB = \mu_0 I^2/4\pi(dl \times r/r^2)$
    (b) $dB = \mu_0 I^2/4\pi(dl \times r/r)$ (d) $dB = \mu_0 I/4\pi(dl \times r/r^3)$
15. A circular coil of radius 4 cm and 20 turns carries a current of 3 ampere. It is placed in a magnetic field of 0.5 tesla. The magnetic dipole moment of the coil is:
    (a) 0.3 ampere $\times$ metre^2 (c) 0.60 ampere $\times$ metre^2
    (b) 0.45 ampere $\times$ metre^2 (d) 0.15 ampere $\times$ metre^2

16. 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 masses of X and Y is:
(a) $(R_1/R_2)^{1/2}$ (b) (R_2/R_1) (c) $(R_1/R_2)^2$ (d) (R_1/R_2)

17. A circular current carrying coil has a radius R. The distance from the centre of the coil on the axis where the magnetic induction will be (1/8)th of its value at the centre of the coil, is:
(a) $R/\sqrt{3}$ (b) $R\sqrt{3}$ (c) $2R\sqrt{3}$ (d) $(2/\sqrt{3})R$

18. A current of I ampere flows in a circular are of wire which subtends an angle of $(3\pi/2)$ radians at its centre, whose radius is R. The magnetic induction B at the centre is:
(a) $\mu_0 I/R$ (b) $\mu_0 I/2R$ (c) $2\mu_0 I/R$ (d) $3\mu_0 I/8R$

19. An electron and a proton having equal moment enter in a uniform magnetic field normal to the lines of force. If the radii of curvature of circular path be r_e and r_p respectively., then:
(a) $r_e/r_p = m_e/m_p$ (b) $r_e/r_p = \sqrt{m_e/m_p}$ (c) $r_e/r_p = \sqrt{m_p/m_e}$ (d) $r_e/r_p = 1/1$

20. A proton, a deuteron (nucleus of $_1H^2$) and an α-particle with the same KE enter in a region of uniform magnetic field, moving at right angles to B. What is the ratio of the radii of their circular paths?
(a) $1 : \sqrt{2} : 1$ (b) $1 : \sqrt{2} : \sqrt{2}$ (c) $\sqrt{2} : 1 : 1$ (d) $\sqrt{2} : \sqrt{2} : 1$

21. Two identical coils carrying equal currents have a common centre and their planes are at right angles to each other. Find the ratio of the magnitudes of the resultant magnetic at the centre and the field due to one coils alone:
(a) 2 : 1 (b) 1 : 1 (c) $1 : \sqrt{2}$ (d) $\sqrt{2} : 1$

22. Two long parallel wire P and Q are both perpendicular to the plane of the paper with distance of 5 m between them. If P and Q carry current of 2.5 amp and 5 amp respectively in the same direction, then the magnetic field at a point half-way between the wires is:
(a) $(3\mu_0/2\pi)$ (b) (μ_0/π) (c) $(\sqrt{3}\mu_0/2\pi)$ (d) $(\mu_0/2\pi)$

23. An electron of mass m is accelerated through a potential difference of V and then it enters a magnetic field of induction B normal to the lines. Then, the radius of the circular path is:
(a) $\sqrt{2eV/m}$ (b) $\sqrt{2Vm/eB^2}$ (c) $\sqrt{2Vm/eB}$ (d) $\sqrt{2Vm/e^2B}$

24. A straight wire carrying a current I_1 amp runs along the axis of a circular current I_2 amp. Then, the force of interaction between the two current carrying conductors is:
(a) ∞ (c) $\mu_0/4\pi \; 2I_1I_2$ N/m
(b) zero (d) $2I_1I_2/r$ N/m

25. An arbitrary shaped closed coil is made of a wire of length L and a current I ampere is following in it. If the plane of the coil is perpendicular to magnetic field B, the force on the coil is:
(a) $2IBL$ (b) IBL (c) zero (d) $1/2IBL$

26. Magnetic induction at the centre of a circular coil is given by:

(a) $\mu_0 NI/2r$ (b) $\mu_0 Nir^2/r^2 + x^2)^{3/2}$ (c) $\mu_0 NI/2r^2$ (d) $\mu_0 NI/r$

27. A cell is connected between two points of a uniformly thick circular conductor. I_1 and I_2 are the currents following in the two parts of the circular conductor of radius a; then the magnetic field at the centre of the loop will be:

(a) zero (b) $\mu_0/2a\ (I_1 - I_2)$ (c) $\mu_0/2a\ (I_1 + I_2)$ (d) $\mu_0/a\ (I_1 + I_2)$

28. A proton moving with a velocity υ is acted upon by electric field E and magnetic field B. The proton will move undeflected if:

(a) E is perpendicular to B

(b) E is parallel to υ and perpendicular to B

(c) E and B both are parallel to υ

(d) E, B and υ are mutually perpendicular and $\upsilon = E/B$

29. A circular coil of radius R carries an electric current. The magnetic field due to the coil at a point on the axis of the coil located at a distance r from the centre of coil such that r >>R, varies as:

(a) $1/r$ (b) $1/r^{1/2}$ (c) $1/r^2$ (d) $1/r^3$

30. The radius of the circular path or helical path followed by the test charge q_0 moving in magnetic field B the some velocity υ is:

(a) $m\upsilon \sin\theta/q_0B$ (b) $m\upsilon \cos\theta/q_0B$ (c) $m\upsilon/q_0B$ (d) $m\upsilon \tan\theta/q_0B$

31. A long solenoid carrying a current produces a magnetic field b along its axis. If the current is doubled and the number of turns per cm is halved, then new value of the magnetic field is:

(a) B (b) 2B (c) 4B (d) B/2

32. Energy associated with a moving charge is due to a:

(a) electric field

(b) magnetic field

(c) both electric field and magnetic field

(d) none of the above

33. An are of a circle of radius R subtends an angle $\pi/2$ at the centre. It carries a current I. The magnetic field at the centre will be:

(a) $\mu_0 I/2R$ (b) $\mu_0 I/8R$ (c) $\mu_0 I/4R$ (d) $2\mu_0 I/5R$

34. A current i ampere flows along an infinitely long straight thin walled tube, then the magnetic induction at any points inside the tube is:

(b) infinite (b) zero (c) $\mu_0 I/4R$ 2i/r tesia (d) 2i/r tesia

35. A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be:

(a) nB (b) n^2B (c) 2nB (d) $2n^2B$

36. Two long conductors, separated by a distance d carry currents I_1 and I_2 in the same direction. They exert a force F on each other. Now, the current in on of them is increased to two times and its direction is reversed. The distance is also increased to 3d. The new value of force between them is:

(a) -2F (b) F/3 (c) -2F/3 (d) -F/3

37. A straight wire of mass 200 g and length 1.5 m carries a current of 2A. It is suspended in mid-air by a uniform horizontal magnetic field B. The magnitude of B (in tesla) is: (assume g = 9.8 ms^{-2})

(a) 2 (b) 1.5 (c) 0.55 (d) 0.66

38. Graph of force per unit length between two long parallel current carrying conductors and the distance between them is:

(a) straight line (b) parabola (c) ellipse (d) rectangular hyperbola

39. When a positively charged particle enters in a uniform magnetic field with uniform velocity, its trajectory can be:

(i) a straight line (ii) a circle (iii) a helix

(a) (i) only (b) (i) ot (ii) (c) (i) or (iii) (d) any one of (i), (ii) and (iii)

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

(a) 1 : √2 (b) 1 : 2 (c) 1 : 3 (d) 3 : 1

41. A proton and a deuteron with the same initial kinetic energy enter in a magnetic field in a direction perpendicular to the direction of the field. The ratio of the radii of the circular trajectories described by them is:

(a) 1 : 4 (b) 1 : √2 (c) 1 : 1 (d) 1 : 2

42. Two circular coils of radius R and 2R carry current I and 2I respectively. If magnetic induction at their centres are B_1 and B_2 then B_1/B_2 is:

(a) 1 : 1 (b) 1 : 2 (c) 1 : 4 (d) 2 : 1

43. Magnetic field intensity H at the centre of a circular loop of radius r carrying current *I* emu is:

(a) r/*I* oersted (b) 2 πr/r oersted (c) *I*/2 πr oersted (d) 2 πr/*I* oersted

44. A wire of length 2 m carrying a current of 1 A is bent to from a circle. The magnetic moment of the coil is:

(a) 2π Am^2 (b) 1/π Am^2 (c) π Am^2 (d) 2/π Am^2

45. A current loop consists of two identical semi-circular parts each of radius R, one lying in the x , y-plane and the other in x, z-plane. If the current in the loop is i. The resultant magnetic field due two semi-circular parts at their common centre is:

(a) $\mu_0 i/2\sqrt{2}R$ (b) $\mu_0 i/2R$ (c) $\mu_0 i/4R$ (d) $\mu_0 i/\sqrt{2}R$

46. A current *I* flows in an infinitely long wire with cross-section in the from of a semi-circular ring of radius R. The magnitude of the magnetic induction along its axis is:

(a) $\mu_0 I/\pi^2 R$ (b) $\mu_0 I/2\pi^2 R$ (c) $\mu_0 I/2\pi R$ (d) $\mu_0 I/4\pi R$

47. A proton, a deuteron and an α-particle having the same kinetic energy are moving in circular trajectories in a constant magnetic field. If rp , rd and rα denote respectively the radii of the trajectories of these particles then:

(a) $r_\alpha = r_d > r_p$
(b) $r_\alpha = r_d = r_p$
(c) $r_\alpha < r_d < r_p$
(d) $r_\alpha = r_p < r_d$
(e) $r_\alpha > r_d > r_p$

48. Two particles A and B having equal charges +6C, after being accelerated through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii 2 cm and 3 cm respectively. The ratio of mass of A to that of B is:

(a) 4/9 (b) 9/5 (c) 1/2 (d) 1/3 (e) 9/4

49. A long straight wire of radius a carries a steady current *I*. The current is uniformly distributed over its cross-section. The ratio of magnetic fields B and B' radial distances a/2 and 2a respectively, from the axis of the wire is:

(a) 1/4 (b) 1/2 (c) 1 (d) 4

Ans – 1.- c , 2.- c ,3- b 4- d 5- c 6-c 7- c 8- b 9- c 10- c 11- b 12- b 13- c 14- d 15- a 16- c 17- b 18- d 19- d 20- a 21-d 22- d 23- b 24- b 25- c 26- a 27- a 28- d 29- d 30- a 31- a 32- a 33- c 34- b 35- b 36- c 37- d 38- d 39- d 40- a 41- b 42- a 43- b 44- b 45- a 46- a 47- d 48- a 49- c