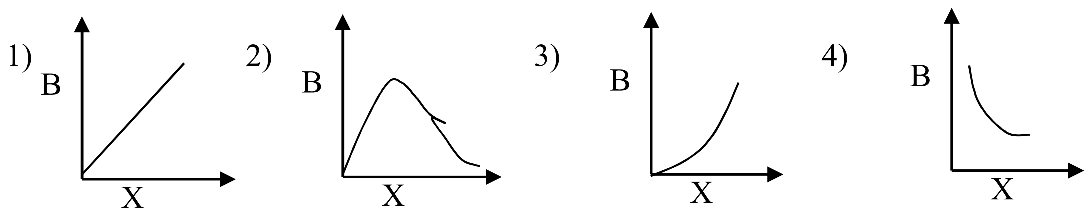
CET Physics – 2012

MAGNETIC EFFECT and MECHANICAL EFFECT of ELECTRIC CURRENT

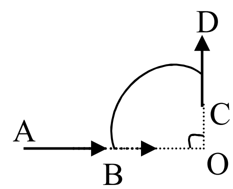
Key Answers

1. Which curve represents the correct variations of the magnetic field B due to long straight current carrying wire versus distance x from x-axis



Answer: Since = —, ∝ — the magnetic field at a point varies inversely with the distance of the point from the conductor, hence answer is (4)

2. A wire ABCD is bent as shown in figure. Section BC is a quarter circle of radius R. If the wire carries a current I, the value of the magnetic field at center O is



1) Zero 2) $\frac{\mu_0 i}{4r}$, direction along the bisector of angle OBC

3) $\frac{\mu_0 i}{8r}$, directed perpendicular to plane of the paper and into the paper

4) $\frac{\mu_0 i}{4\pi r}$, directed along the bisector of angle OBC

Answer: the magnetic field at a point due to an arc is = — —

= — — , = — this field is directed in to the paper hence (3)

3. The strength of the magnetic field at a point distance r near a long straight current carrying wire is B. The field at a distance r/2 will be

1) B/2 2) B/4 3) 4B 4) 2B

Answer: Since magnetic field at a point due to a long conductor is = — ∝ —

∝ — , B^1 = 2B , hence answer is (4)

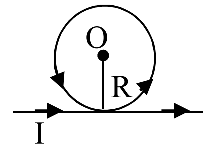
4. A current is flowing in a circular coil of radius R and the magnetic field at the center is B_0. At what distance on the axis of the coil from center the magnetic field will be $\frac{B_0}{8}$

1) $\sqrt{7}R$ 2) $\sqrt{3}R$ 3) 2R 4) 8R

Answer: = — ——— = —— – , = (+) ,

Take the power 2/3 on either side then, = + on solving R answer (2)

5. An infinite straight current carrying conductor is bent into a circle as shown in the figure. If the radius of the circle is R, the magnetic field at the center of the coil is



1) ∞ 2) Zero

3) $\frac{\mu_0 I}{2R}$ 4) $\frac{\mu_0 I}{2\pi R}(\pi+1)$

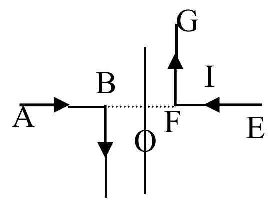
Answer: magnetic field at the center of the circle

$=\quad +$

$= \frac{\mu_0 I}{2R} + \frac{\mu_0 I}{2\pi R}$

$= \frac{\mu_0 I}{2\pi R}(\pi+1)$ **answer (4)**

6. Two long thin wires ABC and EFG are shown in figure. They carry currents 'I' as shown. The magnitude of the magnetic field at 'O' is



1) Zero 2) $\frac{\mu_0 I}{4\pi d}$ **3)** $\frac{\mu_0 I}{2\pi d}$ **4)** $\frac{\mu_0 I}{2\sqrt{2}\pi d}$

Answer: magnetic field at a point due to a straight conductor is

$= \text{—} (\quad\quad) +$ **angle subtended by AB at o is** $\propto=$ **and BC is** $=$

$= \text{—}$ **towards the observer similarly magnetic field at o due to EFG is also**

$= \text{—}$ **towards the observer hence the net field at o is** $= \quad +$

$= \text{—} + \text{—}$ **on solving** $= \text{—}$ **answer (3)**

7. Two circular current carrying coils of radii 3 cm and 6 cm are each equivalent to a magnetic dipole having equal magnetic moments. The currents through the coils are in the ratio of

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

Answer:magnetic moment $=$

$= \quad\quad =$

$=$

$\text{—} = \text{—} = - \quad\quad \text{—} = -$ **answer(4)**

8. The magnetic field at the centre of the circular coil of radius r carrying current I is B_1. field at the centre of another coil of radius 2r carrying same current I is B_2. The ratio B_1/B_2 is

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

Answer: magnetic field at the center of the circular coil is $= \text{—}$

$\propto \text{—} \quad \propto \text{—} \quad \propto \text{—} \quad \text{—} = -$ **hence (4)**

9. An electron is accelerated from rest through a potential difference V. this electron experiences a force F in a uniform magnetic field. On increasing the potential difference to V^1 , the force experienced by the electron in the same magnetic field becomes 2F. then, the ratio (V^1/V) is equal to

1) $\frac{4}{1}$ 2) – 3) – 4) –

Answer: = = **or** =—

Also , = = — ×

Therefore, — = — = —

∴ —— = – **Answer(1)**

10. Two circular coils P and Q are made from similar wires but the radius of Q is twice that of P. what should be the value of potential difference across them so that the magnetic induction at their centers may be the same?

1) = 2 2) = 3 3) = 4 4) = ——

Answer: = — —— = — ——

= , = =

— = $\frac{\times}{\times}$ = — × — = – **Answer (3)**

11. A circular loop of radius R, carrying a current I, lies in x-y plane with its centre at origin. The total magnetic flux through x-y plane is

1) directly proportional to I 2) directly proportional to R

3) inversely proportional to R 4) zero

Answer: the number of magnetic fields entering the coil are equal to number field lines leaving the coil hence the flux through the coil is zero. Answer (4)

12. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed . The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

1) 2) , 3) 4)

Answer: The angular momentum L of the particle is given by =

Where =

∴ = **Further i=q×n=—**

Magnetic moment, = —× ;

∴ —— ⇒ — = ——— = —— **Answer (3)**

13. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may have

1) E = 0, B = 0 2)E = 0, B≠ 0 3) E≠ 0, B≠ 0 4)all the above

Answer: There is no change in velocity. It can be possible when electric magnetic fields are absent, i.e., E=0, B=0. Or when electric and magnetic fields are present but

force due to electric field is equal and opposite to the force due to magnetic field,(i.e., E 0, B 0). Or when E=0 but B 0.

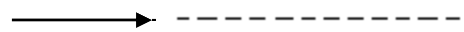
, i.e., sin =0, i.e., are in the same direction.

Answer(4)

14. A wire extending from x = 0 to x = a, carries a current i. If point P is located at x = 2a. The magnetic field due to the wire at P is

1) $\frac{\mu_0 I}{2\pi r}$ 2) $\frac{\mu_0 I}{\pi a}$ 3) $\log_e \frac{\mu_0 I}{2\pi a}$ 4) Zero

Answer:



X=o x = a x = 2a

Angle made by the wire at the point p is , by Biot Savart's law

since

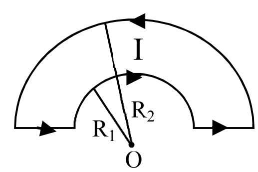
sin

dB=0 Answer (4)

15. The wire loop formed by joining two semi circular sections of radii R_1 and R_2 and centre O, carries a current I as shown. The magnetic field at O has a magnitude

1) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ 2) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

3) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$ 4) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$



Answer: angle subtended by the arcs of radius R_1 and R_2 at the point o is But

magnetic field at a point due to an arc is

Hence, magnetic field due to R_1 is

away from its observer

towards the observer

due to R_2 is

net field at O is B=B_1-B_2

$\frac{\mu_0 I}{4}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ answer (1)

16. Two concentric coils carry the same current in opposite directions. The diameter of the inner coil is half that of the outer coil. If the magnetic field produced by the outer coil at the common centre is 1 tesla, the net field at the centre is

1) 1 T 2) 2 T 3) 3 T 4) 4 T

Answer: magnetic field at the center of a circular coil is

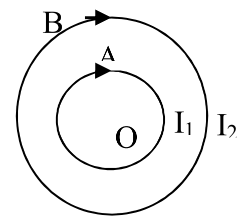
Magnetic field due to outer coil

Magnetic field due to inner coil $\propto \frac{}{} =$ $=$ **since $B_1 > B_2$**

Net magnetic field at the center, $B = B_1 - B_2$ (directions of currents are opposite)

B= 2-1=1T answer (1)

17. A and B are two concentric circular conductors of centre O and carrying currents I_1 and I_2 as shown in figure. The ratio of their radii is 1 : 2 and ratio of the flux densities at O due to A and B is 1 : 4. The value of I_1/I_2 is



1) $\frac{1}{8}$ 2) $\frac{1}{3}$ 3) $\frac{1}{6}$ 4) $\frac{1}{4}$

Answer: Magnetic field produced at the center of the circular coil is

$= \frac{0}{2}$ $\propto$ $_1 \propto \frac{}{}$ $\propto \frac{I_2}{2}$

$\frac{}{} = \frac{}{}$

$\frac{}{} = \frac{}{}$

$\frac{}{} = \frac{}{}$

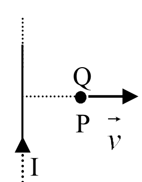
Answer (1)

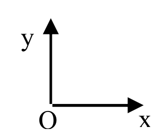
18. A TG of reduction factor 1 A is placed with the plane of its coil perpendicular to the magnetic meridian. When a current of 1 A is passed through it, the deflection produced is
1) 30^0 2) 60^0 3) 45^0 4) Zero
Answer: on keeping the plane of the coil normal to the magnetic meridian ,if the current passing through the coil is in clockwise direction then the magnetic needle is in the direction of magnetic meridian hence the angle made by the needle is 0^0 (4)

19. A current of 2A produces a deflection of 30^0 in a TG. A deflection of 60^0 will be produced in it by a current of
1)1 A 2) 3 A 3) 4 A 4) 6 A
Answer: $=$ **also** $=$

$\frac{}{} = \frac{}{}$, $\frac{}{} = \frac{}{}$ $\frac{}{} = \frac{\sqrt{}}{\sqrt{}}$ **on solving** $=$ **hence answer (4)**

20. A very long straight wire carries a current I. At the instant when a charge +Q at point P has velocity $\vec{v}$, as shown, the force on the charge is :





1) Opposite to ox 2) Along ox
3) Opposite to oy 4) Along oy
Answer : By right hand clasp rule magnetic field at a point is into the board. Hence by fleming's left hand rule. the direction of force acting on the charge is along oy answer(4)

21. A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 divisions per milliampere and voltage sensitivity is 2 divisions per millivolt. In order that each division reads 1 volt, the resistance in ohm needed to be connected in series with the coil will be
1) 99995 2) 9995 3) 10^3 4) 10^5

Answer : Ig = 150/10 = 15 mA also potential difference required for 2 division deflection = 1 mV ∴ the maximum potential difference required for 150 divisions is 75 mV. Galvanometer re $\frac{V_{max}}{I_g}=\frac{75}{15}=5\Omega$ $\quad R=\frac{V}{I_g}-G \quad \frac{150}{15}\times10^{-3}-5$

R =10000 – 5 = 9995 Ω in series

22. A proton, a deutron and an α - particle having the same kinetic energy are moving in circular trajectories in a constant magnetic field. If r_p, r_d and r_α denote respectively the radii of the trajectories of these particles, then :

1) $r_\alpha = r_p < r_d$ 2) $r_\alpha > r_d > r_p$ 3) $r_\alpha = r_d > r_p$ 4) $r_p = r_d = r_\alpha$

Answer :

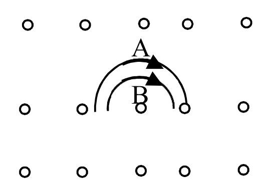
$$\frac{mv}{Bq}=\frac{\sqrt{2mE_K}}{Bq}$$

$$r_p : r_d : r_\alpha = \frac{\sqrt{m_p}}{q_p} : \frac{\sqrt{m_d}}{q_d} : \frac{\sqrt{m_\alpha}}{q_\alpha}$$

$$\therefore r_p : r_d : r_\alpha = \frac{\sqrt{1}}{1} : \frac{\sqrt{2}}{1} : \frac{\sqrt{4}}{2} =$$

$_1H^1$, $_1H^2$, $_1H^3$

23. Two particles A and B masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of the particles are v_A and v_B respectively and the trajectories are as shown in the figure. Then :



1) $m_A v_A < m_B v_B$ 2) $m_A v_A > m_B v_B$
3) $m_A < m_B$ and $v_A < v_B$ 4) $m_A = m_B$ and v_A and v_B

Answer :

Radius of path described by the charged particle — if B, q constant then

$r \propto mv$, As $r_A > r_B$ hence $v_A > v_B$ ∴ $m_A v_A > m_B v_B$

24. Two long conductors separated by a distance d have currents I_1 and I_2 in same direction. They exert a fore F on each other. If current in one is increased to two times and distance is made 3d. The new value of force between them is :

1) $\frac{F}{3}$ 2) $-2F$ 3) $\frac{F}{2}$ 4) $\frac{2F}{3}$

Answer: $F=\frac{\mu_0 I_1 I_2}{2\pi a}$, $F' \propto \frac{2I_1I_2}{3a}$ $\quad F' \propto \frac{2}{3}F$ **answer(4)**

25. A milliammeter of range 10 mA has a coil of resistance 1Ω. To use it as a voltmeter of range 10 V, the resistance that must be connected in series with it is

1) 9 Ω 2) 99 Ω 3) 999 Ω 4) 1000 Ω

Answer: $R=\frac{V}{Ig}-G = \frac{10}{10\times10^{-3}}-1 = 1000-1=999\ \Omega$ Answer(3)

26. A particle of mass m carrying charge q is accelerated by a p.d. V. It enters perpendicularly in a region of uniform magnetic field B and executes circular arc of radius R. The specific charge (q/m) is

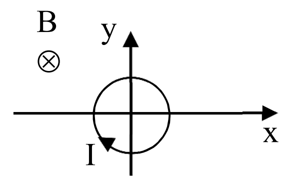
1) $\dfrac{2V}{B^2R^2}$ 2) $\dfrac{V}{2BR}$ 3) $\dfrac{VB}{2R}$ 4) $\dfrac{mV}{BR}$

Answer:

work done W = E_k Vq = ½ mv^2 $R = \dfrac{mv}{Bq}$, $v = \dfrac{BqR}{m}$ $\dfrac{q}{m} = \dfrac{v^2}{2V}$

specific charge $\dfrac{q}{m} = \dfrac{B^2q^2R^2 / m^2}{2V}$ $\dfrac{q}{m} = \dfrac{2V}{B^2R^2}$ **answer(1)**

27. A conducting loop carrying a current I is placed in a uniform magnetic field pointing into the plane of the paper as shown. The loop will have a tendency to :



1) Contract 2) Expand
3) Move towards +ve x-axis 4) Move towards –ve x-axis

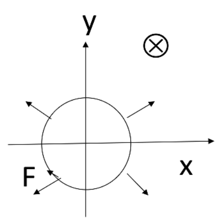
Answer : Since net force on a current carrying loop in uniform magnetic field is zero, hence loop cannot translate hence (3) and (4) are wrong. From Fleming's left hand rule we can see that magnetic field is perpendicular to the board and inwards and current in the loop is clockwise hence the magnetic force on each element of the loop is radially outwards hence, the loop will have tendency to expand. Answer(2)

28. A conducting circular loop of radius r carries a constant current i. It is p[laced in a uniform magnetic field $\vec{B_0}$ such that $\vec{B_0}$ is perpendicular to the plane of the loop. The magnetic force acting on the loop is :

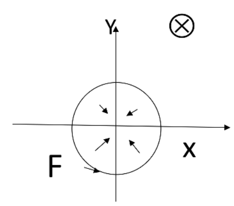
1) ir$\vec{B_0}$ 2) 2πir$\vec{B_0}$ 3) Zero 4) πir $\vec{B_0}$

Answer:

net force acting is zero but loop expands



net force acting is zero but loop contracts



Answer(3)

29. 2 MeV proton is moving perpendicular to a uniform magnetic field of 2.5 T, the force on the proton is : (mass of the proton = 1.6 x 10^{-27} kg)

1) 10 x 10^{-12} N 2) 8 x 10^{-11} N 3) 2.5 x 10^{-10} N 4) 8 x 10^{-12} N

Answer :

Ek = ½ mv2 2MeV = 2 x 1.6 x 10^{-13} = ½ mv^2 = 3.2 x 10^{-13} J

$v = \sqrt{\dfrac{2E_k}{m}} = \sqrt{\dfrac{2x3.2\times10^{-13}}{1.6\times10^{-27}}}$ **x 10^7 m/s**

F = Bqv Sin 90^0 , F = 2.5 x 1.6 x 10^{-19} x 2 x 10^7 = 8 x 10^{-12} N

30. A charged particle enters a magnetic field at an angle of 45^0 with the magnetic field. The path of the particle will be

1) A helix 2) An ellipse 3) A circle 4) A straight line

Answer:

charged particle moving with ϴ not equal to 0^0 and 90^0 the trajectory of the particle is a helix this is because the component of v perpendicular to B ie v sin ϴ makes the particle moves in circle and the component v cos ϴ which is parallel to B makes the particle move along the straight line. The resultant of these two motion is an helix. (1)

31. 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 mass of X to that of Y is :

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) $\frac{R_1}{R_2}$

Answer : $R = \frac{mv}{Bq}$ $R = \frac{\sqrt{2mVq}}{Bq}$ — $E_k = W$, $E_k = ½ mv^2$

$\frac{R_1}{R_2} = \sqrt{\frac{m_x}{m_y}}$ $\frac{m_x}{m_y} = \left(\frac{R_1}{R_2}\right)^2$ $\frac{m^2v^2}{2} = mVq$ $mv = \sqrt{2mVq}$

Answer(3)

32. A charged particle is moving in a uniform magnetic field in a circular path of radius r. When the energy of the particle is four times, then the new radius will be :

1) $\frac{r}{\sqrt{2}}$ 2) 2r 3) $\frac{r}{2}$ 4) $r\sqrt{2}$

Answer :

Radius of the path of charged particle is $r = \frac{mv}{Bq}$ $r = \frac{\sqrt{2mE_K}}{Bq}$

$r \propto \sqrt{E_K}$ $r' \propto \sqrt{E_K'}$ $\frac{r'}{r} = \sqrt{\frac{E_k'}{Ek}} = \sqrt{\frac{4E_k}{Ek}}$ $\frac{r'}{r} = 2, \ r' = 2r$

Answer(2)

33. An electron accelerated through a potential difference enters into a uniform transverse magnetic field and experience a force F. If the accelerating potential is increased to 2V, the electron in the same magnetic field will experience a force :

1) F 2) $\frac{F}{2}$ 3) $\sqrt{2}F$ 4) 2F

Answer :

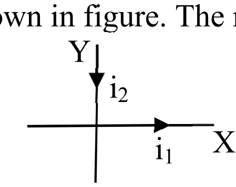
$E_k = W$ $½ mv^2 = eV$ $v = \left(\frac{2 \ eV}{m}\right)^{1/2}$ $F = evB, \theta = 90^0$

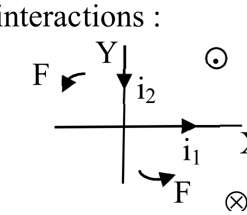
$F = \left(\frac{2 \ eV}{m}\right)^{1/2} B$ — $\frac{F_2}{F_1} = \sqrt{\frac{V_2}{V_1}} = \sqrt{\frac{2V}{V}}$

answer(3)

34. Two wires A and B carry currents as shown in figure. The magnetic interactions :

1) push i_2 away from i1





2) push i_2 close to i1
3) turn i_2 clockwise
4) turn i_2 anticlockwise

Answer :

Magnetic field produced due to i_1 in x is into the board on one side and towards the observer on another side, hence by Fleming's left hand rule force on i_2 is anticlockwise answer(4)

35. When two TGs of the same radii are connected in series, a flow of current in them produces deflections of 60^0 and 45^0. The ratio of the number of turns is

1) $\frac{4}{3}$ 2) $\frac{\sqrt{3}}{1}$ 3) $\frac{(\sqrt{3}+1)}{1}$ 4) $\left(\frac{\sqrt{3}+1}{\sqrt{3}-1}\right)$

Answer: In series current through both the coils are equal

$\mathbf{I_1 = I_2}$, $\frac{2rB_H \tan\theta_1}{\mu_0\ n_1} = \frac{2rB_H \tan\theta_2}{\mu_0 n_2}$ $\frac{n_1}{n_2} = \frac{\tan\theta_1}{\tan\theta_2}$ $\frac{n_1}{n_2} = \frac{\tan 60^0}{\tan 45^0}$, $\frac{n_1}{n_2} = \frac{\sqrt{3}}{1}$

Answer(2)

36. A solenoid 1.5m long and 0.4 cm in diameter possesses 10 turns per cm length. A current of 5 A flows through it. The magnetic field at the middle on the axis inside the solenoid is

1) $4\pi \times 10^{-2}$ T 2) $4\pi \times 10^{-3}$ T 3) $2\pi \times 10^{-3}$ T 4) $2\pi \times 10^{-5}$ T

Answer: magnetic field at the middle along the axis of the solenoid

answer(3)

37. The magnetic field at the centre of a circular current carrying conductor of radius r is B_c. The magnetic field on its axis at a distance r from the centre is B_a. The value of $B_c : B_a$ will be

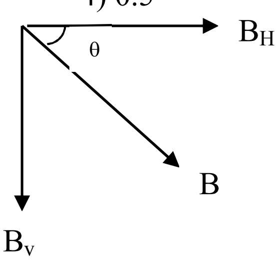
1) $2\sqrt{2}:1$ 2) $\sqrt{2}:1$ 3) $1:\sqrt{2}$ 4) $1:2\sqrt{2}$

Answer:

x = r **on solving** **Answer (1)**

38. At a certain place, the angle of dip is 30^0 and horizontal component of earth's magnetic field is 0.5 oersted. The earth's total magnetic field (in oersted) is

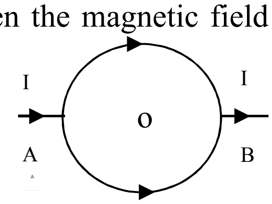
1) $\sqrt{3}$ 2) 1 3) $\frac{1}{\sqrt{3}}$ 4) 0.5



Answer:

Answer(3)

39. A and B are diametrically opposite points of a uniform circular conductor of radius r. A current of I amp enters the conductor at A. Then the magnetic field at O, the centre of the circle is (in T)



1)10 $\times$ —— 2) 10 $\times$ —

3) 10 $\times$ — 4) Zero

Answer: The magnetic fields at the center due to the two portions of the conductor are equal and opposite. Therefore the resultant field at the center is zero. Ans (4)

40. Two circular coils have number of turns in the ratio 1:3 and redii in the ratio 3:1. If the same current flows through them, the magnetic fields at their centers will be in the ratio

1)1:1 2)1:3 3)3:1 4) 1:9

Answer: The field due to the first coil is = ——

= ——

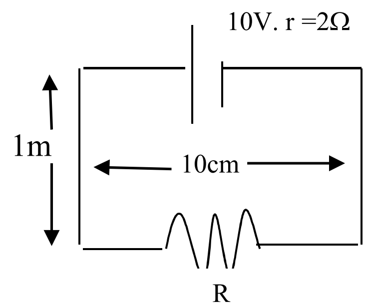
$\therefore$ — = — . — $\propto$ –

— = –.– = – **Answer (4)**

41. In the figure shown, the force per unit length of the long parallel wires is $2x10^{-6}Nm^{-1}$ then the resistance R is

1) 1 Ω 2) 2 Ω

3) 4Ω 4) 8Ω



Answer: =— = —— = ———— $\times$. $\times$ $\times$ = $\times$

=— , **R+r = –**

R+2=10 **R=8Ω**

Answer(4)

42. The deflecting couple of the coil of a suspended coil galvanometer, if the number of turns 2000, area is $6x10^{-4}\,m^2$, field is 1T When the coil carries a current of 1 μ A is

1) $6x10^{-6}$ Nm 2) $6x10^{-7}$Nm 3) $2x10^{-7}$ Nm 4) $3x10^{-6}$Nm

Answer: C_D= nBIA

$C_D=2\times10^3\times1\times1\times10^{-6}\times6\times10^{-4}$

$= 2\times10^{-7}$ Nm answer(2)

43. If an α - particle describes a circular path of radius r in a magnetic field B, then the radius of the circular path described by a proton of same energy in the same magnetic field is :

1) 2r 2) $\frac{r}{2}$ 3) $\frac{r}{\sqrt{2}}$ 4) r

Answer: =– = ——— **, for same E_k and m** $\propto$

— = —— = —× — =

Hence $r_p = r_\alpha = r$ answer(4)

44. Two concentric circular coils of 5 turns each are situated in the same plane. Their radii are 0.1 m and 0.2 m and they carry currents of 0.1 A and 0.3 A respectively in the opposite directions. The magnetic field at the common centre in T is

1)– 2) – 3) zero 4)

Answer: The field due to the first coil is = — × —— = –

The field due to the second coil is = — × —— = —

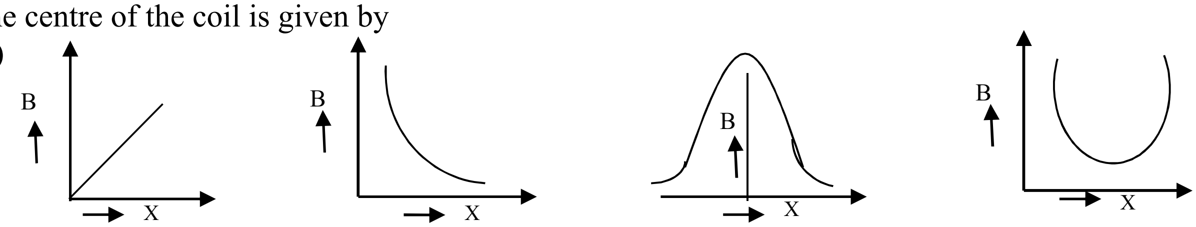
These two fields are in opposite directions. ∴ Their resultant is ,

= — – –

= (—— = –) **Answer (1)**

45. The variation of magnetic field B due to a circular coil carrying current with distance x from the centre of the coil is given by

1)



Answer: the expression for the field is = × —— (+) **, at the centre of the coil i.e., x=0, the field is maximum.As x increases, the field decreases on either side of a coil as shown in the fig(3) hence answer is (3)**

46. The number of turns in the coils of two TG's are n_1 and n_2 and the radii of their coils are r_1 and r_2 respectively. The TG's are converted in series and the current is passed through them. The deflections produced in them will be equal only if

1) = 2) = 3) = 4) =

Answer: the current through both the TG are equal.

∴ ——tan = ——tan .

For to be equal to , — = — = hence answer is (1)

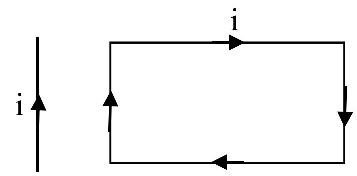
47. Two resistances of 2Ω and 5 Ω are connected in series with a TG of resistance 3Ω and a cell of emf 10V and negligible internal resistance. The deflection produced in the TG if its reduction factor is $1/\sqrt{3}$ A is

1)30^0 2) 45^0 3) 50^0 4) 60^0

Answer: the current in the circuit is = —— = —— = — =

$= \quad , \quad - = \therefore \frac{\sqrt{k}}{} , \quad \therefore \quad =$ **hence answer is (4)**

48. 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 and its in the plane of the loop. If steady current I is established in the wire as shown in the figure, the loop will :



1) Rotate about an axis parallel to the wire
2) Move away from the wire
3) Move towards the wire
4) Remain stationary

Answer : A straight wire carrying current produce non uniform field towards right of it. Force bc and ad get cancelled. Force on ab is attractive where as an cd it is repulsive as F α1/d. Therefore Force of attraction is more hence, loop move towards the wire. Answer (3)

49. A moving coil galvanometer of resistance 100 Ω is converted to ammeter by a resistance of 0.1 Ω in the circuit. Galvanometer gives full scale deflection at 100 μA. The minimum current in the circuit for maximum deflection is

1) 100.1 mA 2) 1000.1 mA 3) 1.001 mA 4) 10.01 mA

Answer: $= \quad , \quad = \quad -$

$= [\quad] , \quad = \quad k \quad . \quad]$

I= 100.1 mA answer(1)

50. With a resistance R connected in series with a galvanometer of resistance 100 Ω it acts as a voltmeter of range 0 – V. To thrice the range, a resistance of 1000 Ω is to be connected in series with R. Then the value of R is (in Ω) :

1) 1100 2) 800 3) 900 4) 400

Answer: G=100Ω, V=V, V'=3V, R=?

$= - \quad , - = \quad +$

To increase the range to thrice the initial

$+ \quad - - \quad ==(\quad +) -$

$+ \quad = \quad + \quad = \quad +$

800=2R because G=100

Hence R=400Ω answer(4)

51. A voltmeter has a range 0 – V with a series resistance R. With a series resistance 2R, the range is 0 – V'. The correct relation between V and V' is

1) V' > 2V 2) V' = 2V 3) V' >> 2V 4) V' < 2V

Answer: $= - \quad , - = \quad +$ **for constant**

Vα (R+G)

$- = \quad , \quad - = \quad < 1$

V' < 2V answer(4)

52. To increase the range of voltmeter :
1) A shunt must be used 2) The resistance of the voltmeter must be decreased
3) The series resistance must be increased 4) The resistance must be removed

Answer: — , —

Vα (R+G)

Hence the range of voltmeter increases with series resistance R answer(3)_

53. To send 10% of the main current through a moving coil galvanometer of resistance 99 ohm, the shunt required is (in ohm)
1) 10 2) 9.9 3) 9 4) 11

Answer: — , — — , 10S=G+S ,

10S=99+S , 9S=99,

S=11Ω answer(4)

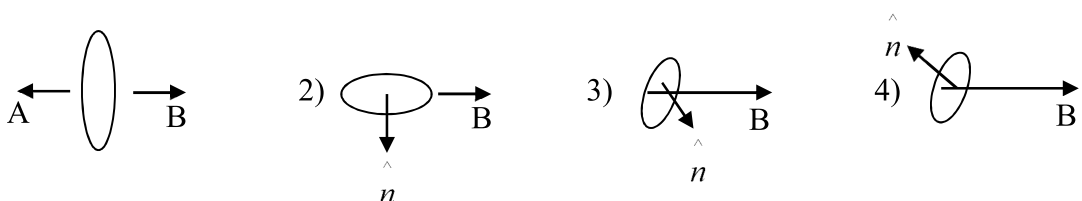
54. A galvanometer has a resistance G and a current Ia flowing in it produces full scale deflection. S_1 is the value of the shunt, which converts it into an ammeter of range 0 – I and S_2 is the shunt for the range 0 – 2I. The ratio S_1/S_2 is

1) $\frac{S_1}{S_2} = \frac{I}{2}\left(\frac{I - I_a}{2I - I_a}\right)$ 2) $\frac{S_1}{S_2} = \left(\frac{2I - I_a}{I - I_a}\right)$ 3) 1 4) 2

— , — , — , —

Therefore, — — answer(2)

55. A current carrying loop is placed in a uniform magnetic field in four different orientations, I, II, III and IV, arrange them in the decreasing order of potential energy :



1) I > III > II > IV 2) I > II > III > IV
3) I > IV > II > III 4) III > IV > I > II

Answer :

Magnetic Potential Energy $U = -\vec{M}\cdot\vec{B} = -MB\cos\theta$

θ = angle between $\vec{B}$ and $\vec{M}$

$\vec{M}$= magnetic moment,

U_{max} when $\theta = 180^0$, U_{min} when $\theta = 0^0$

So as θ decreases from 180^0 to 0^0 its potential energy also decreases. Hence (3) I > IV > II > III

Because, $U = 1$ *for* $\theta = 180^0$

$U = \frac{1}{\sqrt{2}}$ *for* $\theta = 135^0$

$U = 0$ *for* $\theta = 270^0$

$U = -\frac{1}{\sqrt{2}}$ *for* $\theta = 315^0$

56. 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

Answer:

On passing the electric current in a conductor a magnetic field will be produced. Since the two parallel conductors are carrying current that results in a magnetic field. That means both conductors are in the magnetic field of the other. Hence they experience an attractive magnetic force according to Fleming's left hand rule answer(4)

57. An ammeter and a voltmeter are joined in series to a cell. Their readings are A and V respectively. If a resistance is now joined in parallel with the voltmeter, then

1) A will increase, V will decrease 2) A will decrease, V will increase
3) Both A and V will decrease 4) Both A and V will increase

Answer:

When resistance is joined in parallel with the voltmeter the equivalent resistance is less than both the resistance, as a result of this current in A will increase and voltmeter reads the potential difference of the resistance. But the potential difference of the cell is more than the potential difference of resistance therefore V decreases answer(1)

58. A voltmeter of range 3V and resistance 200 Ω cannot be converted to an ammeter of range

1) 10 mA 2) 100 mA 3) 1 A 4) 10 A

Answer:

$new\ current\ required\ I_g = \frac{V}{G}$, $I_g = \frac{3}{200} = 0.015 = 15mA$

So new range cannot be less than 15mA

Hence it can't be converted into an ammeter of range 10mA answer(1)

59. A uniform electric and magnetic fields are acting along same direction in a certain region. An electron projected in the direction of fields with some velocity

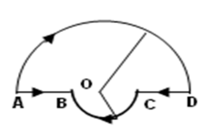
1) It will turn towards right of direction of motion
2) It will turn towards left of direction of motion
3) Its velocity will decrease
4) Its velocity will increase

Answer:

Since the charge particle is moving along the magnetic field direction hence the magnetic force acting F=Bqv sin ϴ is zero because ϴ is zero but the electron will experience an electric force F=Eq opposite to field. Hence its velocity will be increased.

Answer(4)

60. Two semi-circlar loops of radii R and r are connected to two straight conductors AB and CD as shown in the figure. A current of I A is passed through the loops as shown. The resultant field at their common centre is



1) — 2) — - -
3) — - - 4) —

Answer : The field at O due to the straight conductors AB and CD is zero. The field at O due to the semicircle loop of radius R is

— — — -

The field at O due to the semicircle loop of radius r is

— — — -

These two fields are in the same direction. Therefore their resultant is

= + = — + — = — - + - T **answer(2)**

61. The resistance of an ideal ammeter is?

1) Infinite 2) very high 3)Small 4)Zero

Answer: (4) Zero

62. To increase the range of voltmeter:

1.A shunt must be used

2.The resistance of the voltmeter must be decreased

3.The series resistance must be increased.

4.The resistance must be removed.

Answer: (3)The series resistance must be increased.

63. A galvanometer coil has a resistance of 1.5Ω and gives full scale deflection for a current of 4 mA. To convert it in to an ammeter of range 0 to 6 A

1. 0.1Ω resistance is to be connected in parallel to the galvanometer.
2. 0.1Ω resistance is to be connected in series with the galvanometer.
3. 1 mΩ resistance is to be connected in parallel to the galvanometer.
4. 10 mΩ resistance is to be connected in series with the galvanometer

Answer: = — = × × — = × — = × Ω

= 1 mΩ answer(3)

64. A long straight wire carries 10 A. As electron travels perpendicular to this wire at a distance of 0.1 m with a velocity of 5×10^{6} ms^{-1}. Then the force acting on the electron due to the current in the wire is

1) Zero 2) 0.6×10^{-17} N 3) 2.1×10^{-17} N 4) 2.2×10^{-17} N

Answer: $\theta = 0^0$ or 180^0 F = Bqv sinθ

F = 0 answer(1)

65. A proton and a deuteron both having the same kinetic energy, enter perpendicularly into a uniform magnetic field B. For motion of proton and deuteron on circular path of radius R_P and R_d respectively, the correct statement is :

1) $R_d = \sqrt{2}\ R_P$ 2) $R_P = \frac{R_P}{\sqrt{2}}$ 3) $R_d = R_P$ 4) $R_d = 2R_P$

Answer: = — = —

— = √ — , , =

$_1H^1$, $_1H^2$

— = - × - = —/√ , = √ **answer(1)**

66. A magnetic field :

1) Always exerts a force on charged particle

2) Never exerts a force on charged particle

3) Exerts a force, if the charged particle is moving across the magnetic field lines

4) Exerts a force, if the charged particle is moving along the magnetic field lines

Answer: Exerts a force, if the charged particle is moving across the magnetic field lines (3)

67. A charged particle enters a magnetic field at an angle of 90^0 with the magnetic field. The path of the particle will be :

1) A helix 2) An ellipse 3) A circle 4) A straight line

Answer: (3)A circle

68. A uniform magnetic field is at right angles to the direction of motion of proton. As a result, the proton describes a circular path of radius 2.5 cm. If the speed of proton is doubled, then the radius of the circular path will be :

1) 1.25 cm 2) 2.5 cm 3) 5.0 cm 4) 10 cm

Answer: F=Bqv

— =

— = — = — = , =

= 2× 2.5= 5 cm answer(3)

69. An electron is shot in steady electric and magnetic fields E and B respectively mutually perpendicular to each other. If E = 1 V/cm and B = 2T, then the velocity of electron is

1) 50 ms^{-1} 2) 2 ms^{-1} 3) 0.5 ms^{-1} 4) 200 ms^{-1}

Answer: $\theta=90^0$, F_m=Bqv, Also F_m=E_q

Eq=Bqv

= = / = —— = **answer(1)**

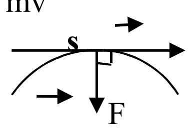
70. If an electron describes half a revolution in a circle of radius r, in a magnetic field B, the energy acquired by it is :

1) Zero 2) ½ mv^2 3) ¼ mv^2 4) πr BeV

Answer: W= Fcosθ , θ = 0

W=0 , W=E=0

Answer(1)



71. A charged particle enters a region of non-uniform field and eventually comes out of it. As it emerges, its :

a. Speed is greater as compared to the speed at entry point
b. Velocity remains unchanged
c. Velocity may change but speed remains unchanged
d. Speed cannot be estimated as data is insufficient

Answer: Velocity may change but speed remains unchanged answer(3)

72. If protons are shot perpendicular to a magnetic field :

e. Magnetic field will have no influence on the motion of protons
f. Protons will continue to move in the same direction but will gain momentum
g. Protons will continue to move in the opposite directions but will gain momentum
h. They will bend in an arc of a circle

Answer: They will bend in an arc of a circle (4)

73. A power line lies along the east-west direction and carries a current of 10 A. The force per metre due to the earth's magnetic field of 10^{-4} T is :

1) 10^{-5} N 2) 10^{-4} N 3) 10^{-3} N 4) 10^{-2} N

Answer: F_m=BIl sinθ , — = × = = answer(3)

74. If a voltmeter is to be used in place of an ammeter then we must connect with the voltmeter a:

1) Low resistance in parallel 2) High resistance in parallel

3) High resistance in series 4) Low resistance in series

Answer: Low resistance in parallel answer(1)

75. A charged particle of a mass m and charge q travels on a circular path of radius r and perpendicular to mag. field B. Time period of revolution is :

1) 2π q B/m 2) 2π m / qB 3) 2π m q/B 4) 2π q^2 B/m

Answer : $=$, $=$, $=$

Now, $= = =$ **answer(2)**

76. Two thin long parallel wires separated by a distance d carry a current I A each in the same direction. They will :

1) Attract each other with a force $\frac{\mu_0 I^2}{2\pi d^2}$ 2) Repel each other with a force $\frac{\mu_0 I^2}{2\pi d^2}$

3) Attract each other with a force $\frac{\mu_0 I^2}{2\pi d}$ 4) Repeal each other with a force $\frac{\mu_0 I^2}{2\pi d}$

Answer: (3)Attract each other with a force $\frac{\mu_0 I^2}{2\pi d}$

77. When an additional resistance of 1980 ohm is connected in series with a voltmeter, the scale division has 100 times larger value. Resistance of the voltmeter R_V, is :

1) 10 Ω 2) 20 Ω 3) 30 Ω 4) 40 Ω

Answer: Voltmeter ranges increases 100 times

Therefore $= = -$

$=$ **answer (2)**

78. An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude

1) $\frac{\mu_0 n^2 e}{2r}$ 2) $\frac{\mu_0 ne}{2r}$ 3) $\frac{\mu_0 ne}{2\pi r}$ 4) $\frac{\mu_0 ne^2}{2r}$

Answer: (2)

79. An electron is revolving in a circular orbit of radius r. It is making n revolutions/sec. The magnetic moment of the electron is

1) Zero 2) $\pi r^2 ne$ 3) $2\pi rn^2$ 4) $\frac{\mu_0 ne}{2r}\pi r^2$

Answer: M= nIA

M= πr^2ne (2)

80. A circle coil has one turn and carries a current I. The same wire is turned into a coil of their turns and the same current is passed, the field at the center

1) Remains unchanged 2) Decreases to 1/3rd of the original value

3) Increases to 1/3rd times the original value 4) Increases to 9 times the original value

Answer: $=$

$=$

$=$ **answer(4)**