O. P. JINDAL SCHOOL, RAIGARH (CG) 496 001
Phone: 07762-227042, 227293, 227001 (Extn. 49801, 49802, 49804, 49806); Fax: 07762-262613; website: www.opjsrgh.in; e-mail:opjsraigarh@jspl.com

Question Bank (Class – XII, Physics, Set – 1)

Chapter 1: Electric Charges and Field
Chapter 2: Electric Potential and Capacitance
Chapter 3: Current Electricity
Number of Questions: 60

1. One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then,
   (a) masses of A and B still remain equal
   (b) mass of A increases
   (c) mass of B decreases
   (d) mass of B increases

2. If the charge on the body is 1 nC, then how many electrons are present on the body?
   (a) 1.6×10^{-19} (b) 6.25×10^{9}
   (c) 6.25×10^{27} (d) 6.25×10^{28}

3. Two point charges placed at a certain distance r in air exert a force F on each other. Then, the distance r' at which these charges will exert the same force in a medium of dielectric constant K is given by
   (a) r (b) r/K
   (c) $r/\sqrt{K}$ (d) $r\sqrt{K}$

4. A charge q is placed at the centre of the line joining two equal charges Q and Q. The system of the three charges will be in equilibrium, if q is equal to
   (a) $-Q/2$ (b) $-Q/4$ (c) $+Q/4$ (d) $+Q/2$

5. A long cylindrical wire carries a positive charge of linear density λ. An electron $(-e, m)$ revolves around it in a circular path under the influence of the attractive electrostatic force.
   The speed of electron is
   (a) $v \propto r^0$ (b) $v \propto r^2$
   (c) $v \propto \frac{1}{r}$ (d) $v \propto \frac{1}{r^2}$

6. In nature, the electric charge of any system is always equal to
   (a) half integral multiple of the least amount of charge
   (b) zero
   (c) square of the least amount of charge
   (d) integral multiple of the least amount of charge

7. An object A has a charge of $-2\ \mu C$ and the object B has a charge of $+6\ \mu C$. Which of the following is true?
   (a) $F_{AB} = -3F_{BA}$ (b) $F_{AB} = -F_{BA}$
   (c) $3F_{AB} = -F_{BA}$ (d) $F_{AB} = 4F_{BA}$

8. Electric charges of $1\mu C$, $-1\mu C$ and $2\mu C$ are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side 10 cm.
   The resultant force on the charge at C is
   (a) 0.9 N (b) 1.8 N
   (c) 2.7 N (d) 3.6 N

9. A charge q is placed at the point of intersection of body diagonals of a cube. The electric flux passing through any one of its face is ***(CBSE SQP 2020)***
   (a) $\frac{q}{6\varepsilon_0}$ (b) $\frac{3q}{\varepsilon_0}$ (c) $\frac{6q}{\varepsilon_0}$ (d) $\frac{q}{3\varepsilon_0}$

10. Two parallel infinite line charges $+\lambda$ and $-\lambda$ are placed with a separation distance R in free space. The net electric field exactly mid-way between the two line charges is
    (a) zero (b) $\frac{2\lambda}{\pi\varepsilon_0 R}$
    (c) $\frac{\lambda}{\pi\varepsilon_0 R}$ (d) $\frac{1}{2\pi\varepsilon_0 R}$

11. If 100 J of work has to be done in moving an electric charge of 4 C from a place, where potential is – 10 V to another place where potential is V volt, find the value of V.

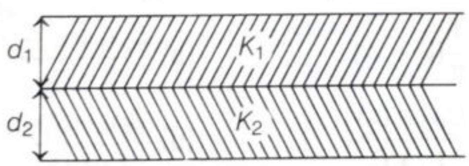
(a) 5 V (b) 10 V
(c) 25 V (d) 15 V

12. A parallel plate air capacitor has a capacitance 18 μF. If the distance between the plates is tripled and a dielectric medium is introduced, the capacitance becomes 72 μF. The dielectric constant of the medium is

(a) 4 (b) 9
(c) 12 (d) 2

13. A parallel plate capacitor is made of two dielectric blocks in series. Effective dielectric constant K is

(NCERT Exemplar)



(a) $\frac{K_1d_1 + K_2d_2}{d_1 + d_2}$ (b) $\frac{K_1d_1 + K_2d_2}{K_1 + K_2}$
(c) $\frac{K_1K_2(d_1 + d_2)}{(K_1d_2 + K_2d_1)}$ (d) $\frac{2K_1K_2}{K_1 + K_2}$

14. An air capacitor is charged with an amount of charge q and dipped into an oil tank. If the oil is pumped out, the electric field between the plates of capacitor will

(a) increase
(b) decrease
(c) remain the same
(d) becomes zero

15. Three capacitors 3μF, 6μF and 6μF are connected in series to a source of 120 V. The potential difference (in volt) across the 3μF capacitor will be

(a) 40 (b) 30
(c) 40 (d) 60

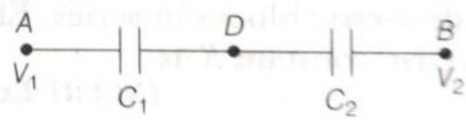
16. A parallel plate capacitor is made by stacking n equally spaced plates connected alternately. If the capacitance between any two plates is C, then the resultant capacitance is

(a) C (b) nC
(c) $(n-1)C$ (d) $(n+1)C$

17. The potential energy of a charged parallel plate capacitor is U_0. If a slab of dielectric constant K is inserted between the plates, then new potential energy will be

(a) $\frac{U_0}{K}$ (b) U_0K^2
(c) $\frac{U_0}{K^2}$ (d) U_0^2

18. Two condensers C_1 and C_2 in a circuit are joined as shown in figure. The potential of point A is V_1 and that of B is V_2. The potential of point D will be



(a) $\frac{1}{2}(V_1 + V_2)$ (b) $\frac{C_2V_1 + C_1V_2}{C_1 + C_2}$
(c) $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$ (d) $\frac{C_2V_1 - C_1V_2}{C_1 + C_2}$

19. A parallel plate air capacitor has a capacitance 18 μF. If the distance between the plates is tripled and a dielectric medium is introduced, the capacitance becomes 72 μF. The dielectric constant of the medium is

(a) 4 (b) 9
(c) 12 (d) 2

20. An electric field of 1000 V/m is applied to an electric dipole at angle of 45°. The value of electric dipole moment is 10^{-29} C-m. What is the potential energy of the electric dipole?

(a) -9×10^{-20} J (b) -10×10^{-29} J
(c) -20×10^{-18} J (d) -7×10^{-25} J

21. The current in a wire varies with time according to the equation $i = 4 + 2t$, where i is in ampere and t is in second. The quantity of charge which passes through a cross-section of the wire during the time $t = 2$ s to $t = 6$ s is

(a) 40 C (b) 48 C
(c) 38 C (d) 43 C

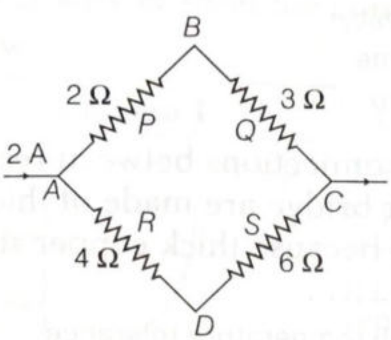
22. If charges move without collisions through the conductor, their kinetic energy would also change, so that the total energy is

(a) changed (b) unchanged
(c) doubled (d) halved

23. At room temperature (27.0°C) the resistance of a heating element is 100 Ω. What is the temperature of the element, if the resistance is found to be 117 Ω, given that the temperature coefficient of the material of the resistor is 1.70×10^{-4} /°C.

(a) 27°C (b) 1027°C (c) 17°C (d) 117°C

24. If 2 A current is flowing in the shown circuit, then potential difference $(V_B - V_D)$ in balanced condition is

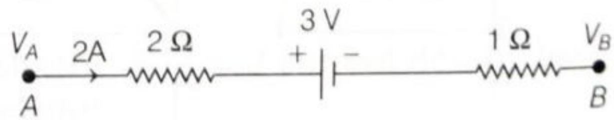


(a) 12 V (b) 6 V
(c) 4 V (d) zero

25. The drift velocity of the electrons in a copper wire of length 2 m under the application of a potential difference of 220 V is 0.5 ms^{-1}. Their mobility (in m^2 V^{-1} s^{-1})

(a) 2.5×10^{-3}
(b) 2.5×10^{-2}
(c) 5×10^{2}
(d) 5×10^{-3}

26. The potential difference $(V_A - V_B)$ between the points A and B in the given figure is

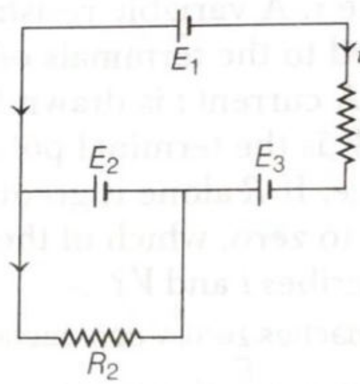


(a) −3 V (b) +3 V (c) +6 V (d) +9 V

27. Which of the following statement is correct when power delivered by a battery is maximum?

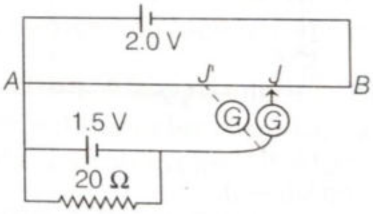
(a) Internal resistance is equal to external resistance.
(b) Internal resistance is greater than external resistance.
(c) Internal reistance is less than external resistance.
(d) None of the above

28. The currents i_1 and i_2 through the resistors R_1 (= 10 Ω) and R_2 (= 30 Ω) in the circuit diagram with $E_1 = 3$ V, $E_2 = 3$ V and $E_3 = 2$ V are respectively,



(a) 0.2 A, 0.1 A (b) 0.4 A, 0.2 A
(c) 0.1 A , 0.2 A (d) 0.2 A, 0.4 A

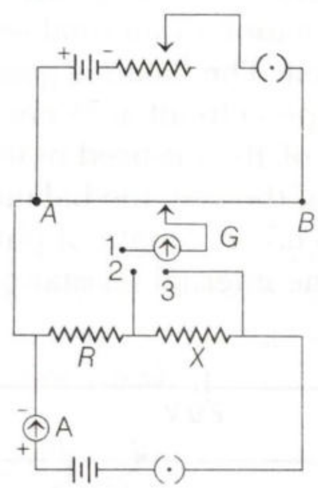
29. The figure below shows a 2.0 V potentiometer used for the determination of internal resistance of a 2.5 V cell. The balance point of the cell in the open circuit is 75 cm. When a resistor of 10 Ω is used in the external circuit of the cell, the balance point shifts to 65 cm length of potentiometer wire. The internal resistance of the cell is



(a) 2.5 Ω
(b) 2.0 Ω
(c) 1.54 Ω
(d) 1.0 Ω

30. A potentiometer circuit is set up as shown. The potential gradient across the potentiometer wire, is k volt/cm and the ammeter, present in the circuit, reads 1.0 A when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3, is plugged in, are found to be at lengths l_1 cm and l_2 cm, respectively.

The magnitudes of the resistors R and X in ohm, are then, respectively equal to



(a) $k(l_1 - l_2)$ and kl_2
(b) kl_1 and $k(l_2 - l_1)$
(c) $k(l_2 - l_1)$ and kl_2
(d) kl_1 and kl_2

Assertion reasoning MCQs

For question numbers 31 to 45, two statements are given one labeled as Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below

a) Both Assertion (A) and Reason (R) are true and reason is the correct explanation of assertion.
b) Both Assertion (A) and Reason (R) are true but reason is not the correct explanation of assertion.
c) Assertion (A) is true but Reason (R) is false.
d) Assertion (A) is false and Reason (R) is also false.

31 **Assertion** When we produce charge q_1 on a body by rubbing it against another body which gets a charge q_2 in the process, then $q_1 + q_2 = 0$.

Reason Charge on an isolated system remains constant.

32 **Assertion** At the centre of the line joining two equal and opposite charges, $E = 0$.

Reason At the centre of the line joining two equal and similar charge, $E \neq 0$.

33 **Assertion** **E** in outside vicinity of a conductor depends only on the local charge density σ and it is independent of the other charges present anywhere on the conductor.

Reason **E** in outside vicinity of a conductor is given by $\frac{2\sigma}{\varepsilon_0}$.

34 **Assertion** At macroscopic level, quantisation of charge has no practical consequence and can be ignored.

Reason 1 μC charge contains 10^{15} times electronic charge e approximately.

35 **Assertion** Electric lines of force cross each other.

Reason Electric field at a point does not superimposes to give one resultant electric field.

36 **Assertion** Acceleration of charged particle in non-uniform electric field does not depend on velocity of charged particle.

Reason Charge is an invariant quantity.

37 **Assertion** Due to two point charges, electrical field and electric potential cannot be zero at same point simultaneously.

Reason Field is a vector quantity and potential a scalar quantity.

38 **Assertion** The expression of potential energy $U = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r_{12}}$, is unaltered whatever way the charges are brought to the specified locations.

Reason Path-independence of work for electrostatic force.

39 **Assertion** An electron moves from a region of lower potential to a region of higher potential.

Reason An electron has a negative charge.

40 **Assertion** Five charges $+q$ each are placed at five vertices of a regular pentagon. A sixth charge $-Q$ is placed at the centre of pentagon, then net electrostatic force on $-Q$ is zero.

Reason Net electrostatic potential at the centre is zero.

41 **Assertion** A capacitor can be given only a limited quantity of charge.

Reason Charge stored by a capacitor depends on the shape and size of the plates of capacitor and the surrounding medium.

42 **Assertion** Electric field is always normal to equipotential surfaces and along the direction of decreasing order of potential.

Reason Negative gradient of electric potential is electric field.

43 **Assertion** A wire carrying an electrical current has no electric field inside it.

Reason Rate of flow of electrons in one direction is equal to the rate of flow of protons in opposite direction.

44 **Assertion** Charge carriers do not move with acceleration but with a steady drift velocity.

Reason Charge carriers undergo collisions with ions and atoms during transit.

45 **Assertion** The drift velocity of electrons in a metallic wire decreases, when temperature of the wire increases.

Reason On increasing temperature, conductivity of metallic wire decreases.

46. **Assertion** A potentiometer is preferred over a voltmeter for measurement of a cell.

Reason Potentiometer does not draw any current from the cell.

47 **Assertion** Bulb generally get fused when they are switched ON or OFF.

Reason When we switch ON or OFF, a circuit current changes it rapidly.

48. **Assertion** If we bend an insulating wire, the resistance of the wire increases.

Reason The drift velocity of electron in bended wire does not remains same.

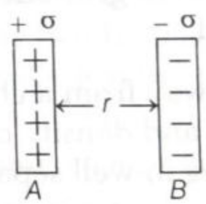
Case-based MCQs

Case Study 1

Charge between Parallel Plates

Surface charge density is defined as the charge per unit surface area of surface charge distribution. i.e. $\sigma = \frac{dq}{dS}$

Two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite signs having magnitude of 17.0×10^{-22} Cm^{-2} as shown below



The intensity of electric field at a point is

$$E = \frac{\sigma}{\varepsilon_0}$$

where, ε_0 = permittivity of free space.

Read the passage carefully and answer the questions (49 to 53) in the following case.

Q 49.

E in the outer region of the first plate is

(a) 17×10^{-22} N/C (b) 1.5×10^{-15} N/C
(c) 1.9×10^{-10} N/C (d) zero

Q 50.

E in the outer region of the second plate is

(a) 17×10^{-22} N/C (b) 1.5×10^{-15} N/C
(c) 1.9×10^{-10} N/C (d) zero

Q 51.

E between the plates is

(a) 17×10^{-22} N/C (b) 1.5×10^{-15} N/C
(c) 1.9×10^{-10} N/C (d) zero

Q 52.

The ratio of **E** from right side of plate **B** at distances 2 cm and 4 cm, respectively is

(a) 1 : 2 (b) 2 : 1
(c) 1 : 1 (d) 1 : $\sqrt{2}$

Q 53.

In order to estimate the electric field due to a thin finite plane metal plate, the gaussian surface considered is

(a) spherical (b) cylindrical
(c) straight line (d) None of these

Case Study 2

Electrostatic Potential Energy

Electrostatic potential energy of a system of point charges is defined as the total amount of work done in bringing the different charges to their respective positions from infinitely large mutual separations.

By definition, work done in carrying charge from ∞ to any point is

$$W = \text{Potential} \times \text{Charge}$$

This work is stored in the system of two point charges in the form of electrostatic potential energy U of the system.

Read the passage carefully and answer the questions (54 to 58) in the following case.

Q 54.

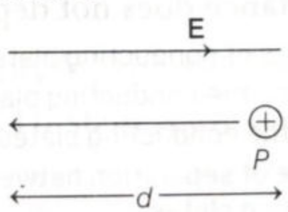
Work done in moving a charge from one point to other inside a uniformly charged conducting sphere is

(a) always zero
(b) non-zero
(c) may be zero
(d) None of these

Q 55.

In the figure, proton moves a distance d in a uniform electric field E as shown in the figure.

The work done on the proton by electric field is



(a) negative
(b) positive
(c) zero
(d) None of the above

Q 56.

A positively charged particle is released from rest in an uniform electric field. The electric potential energy of the charge

(a) remains a constant because the electric field is uniform
(b) increases because the charge moves along the electric field
(c) decreases because the charge moves along the electric field
(d) decreases because the charge moves opposite to the electric field

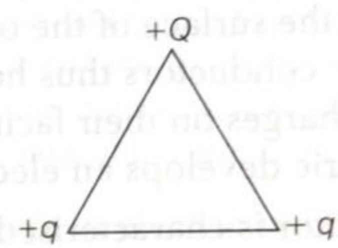
Q 57.

Two similar positive point charges each of 1 μC have been kept in air at 1m distance from each other. What will be the potential energy?

(a) 1 J (b) 1 eV (c) 9×10^{-3} J (d) zero

Q 58.

Three charges are placed at the vertex of an equilateral triangle of side l as shown in figure. For what value of Q, the electrostatic potential energy of the system is zero?



(a) $-q$
(b) $q/2$
(c) $-2q$
(d) $-q/2$

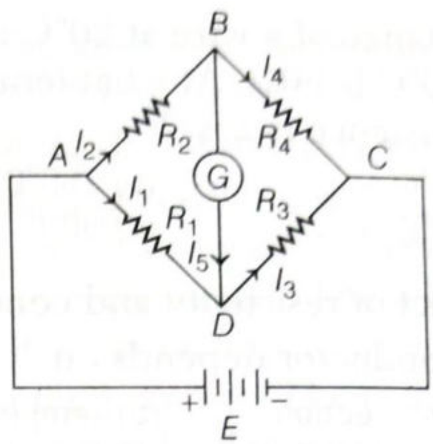
Case Study 3

Wheatstone Bridge

In 1845 by German physicist Gustav Kirchhoff described Kirchhoff's circuit laws which are two equalities that deal with the current and potential difference (commonly known as voltage) in the lumped element model of electrical circuits.

As an application of these laws, consider the circuit shown below, which is called the Wheatstone bridge. This bridge consists of four resistors R_1, R_2, R_3 and R_4. Across one pair of diagonally opposite points (A and C in the figure) a source is connected.

This (i.e., AC) is called the battery arm. Between the other two vertices, B and D, a galvanometer G (which is a device to detect currents) is connected. This line, shown as BD in the figure, is called the galvanometer arm. Of special interest, is the case of a balanced bridge where the resistors are such that $I_g = 0$.



Read the passage carefully and answer the questions (59 to 63) in the following case.

Q 59.

Wheatstone bridge can help us to determine the resistance of a

(a) known resistor (b) unknown resistor

(c) Both (a) and (b) (d) None of these

Q 60.

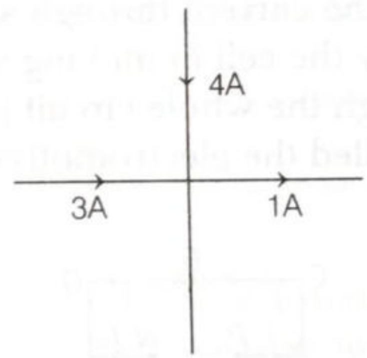
Kirchhoff's junction rule is a consequence of conservation of

(a) momentum (b) mass

(c) energy (d) charge

Q 61.

Three wires meet at a node as given in figure. The current in the fourth wire will be



(a) 2A, incoming (b) 2A, outgoing

(c) 6A, incoming (d) 6A, outgoing

Q 62.

Which instrument is used as the null detector in the Wheatstone bridge?

(a) Voltmeter

(b) Ammeter

(c) Galvanometer

(d) Multimeter

Q 63.

The value of X when the Wheatstone network is balanced if $R_1 = 500\,\Omega$, $R_2 = 800\,\Omega$, $R_3 = X + 400\,\Omega$, $R_4 = 1000\,\Omega$ would be

(a) $200\,\Omega$ (b) $220\,\Omega$

(c) $225\,\Omega$ (d) $240\,\Omega$

O. P. JINDAL SCHOOL, RAIGARH (CG) 496 001

Phone: 07762-227042, 227293, 227001 (Extn. 49801, 49802, 49804, 49806); Fax: 07762-262613; website: www.opjsrgh.in; e-mail:opjsraigarh@jspl.com

Question Bank (Class – XII, Physics, Set – 2)

Chapter 4: Magnetic Effect of Current

Chapter 5: Magnetism

Number of Questions: 44

1. Biot-Savart's law may be represented in vector form as

(a) $d\mathbf{B} = \frac{\mu_0}{4\pi} I \frac{d\mathbf{l} \times \mathbf{r}}{r^3}$ (b) $d\mathbf{B} = \frac{\mu_0}{4\pi} I\, d\mathbf{l} \times \mathbf{r}$

(c) $d\mathbf{B} = \frac{\mu_0}{4\pi} I \frac{d\mathbf{l} \times \mathbf{r}}{r^2}$ (d) $d\mathbf{B} = \frac{\mu_0}{4\pi} I \frac{d\mathbf{l} \times \mathbf{r}}{r}$

2. A circular coil of wire consisting of 100 turns, each of radius 8.0 cm carries a current of 0.40 A. What is the magnitude of the magnetic field B at the centre of the coil?

(a) $\pi \times 10^{-3}$ T (b) $2\pi \times 10^{-4}$ T

(c) $\pi \times 10^{-4}$ T (d) Zero

3. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns/cm is halved, the new value of the magnetic field is

(a) 2B (b) 4B

(c) B/2 (d) B

4. Two toroids 1 and 2 have total number of turns 200 and 100 respectively with average radii 40 cm and 20 cm, respectively. If they carry same current i, the ratio of the magnetic fields along the two loops is

(a) 1: 1 (b) 4: 1

(c) 2: 1 (d) 1: 2

5. When a current carrying conductor of length l is placed parallel to the magnetic field, the magnitude of force due to current carrying conductor is equal to

(a) zero (b) I Bl

(c) I Bl^2 (d) -I Bl

6. A current carrying square loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is F, then the net force on the remaining three arms of the loop is

(a) 3F (b) –F (c) –3F (d) F

7. The magnitude of the magnetic field inside a long solenoid is increased by

(a) decreasing its radius

(b) decreasing the current through it

(c) increasing its area of cross-section

(d) introducing a medium of higher permeability

8. Time period of a charged particle undergoing a circular motion in a uniform magnetic field is independent of

(a) speed of the particle

(b) mass of the particle

(c) charge of the particle

(d) magnetic field

9. The current in the windings on a toroid is 2.0 A. There are 400 turns and the mean circumferential length is 40 cm. If the inside magnetic field is 1.0 T, the relative permeability is near about

(a) 100 (b) 200

(c) 300 (d) 400

10. If the velocity of charged particle has both perpendicular and parallel components while moving through a magnetic field, what is the path followed by a charged particle?

(a) Circular (b) Elliptical

(c) Linear (d) Helical

11. 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 force between them

d) magnetic force between them

12. The full scale deflection current of a galvanometer of resistance 1W is 5 mA. What is the value of resistance R, which is connected in series to convert it into a voltmeter of range 5 V?

(a) 99 W (b) 999 W

(c) 1000 W (d) 100 W

13. Magnetic field in a region is produced only by -
(a) static charges
(b) moving charges
(c) oscillatory charges
(d) Both (b) and (c)

14. A galvanometer has a resistance of 100 W. A potential difference of 100 mV between its terminals gives a full scale deflection. The shunt resistance required to convert it into an ammeter reading upto 5 A is
(a) 0.01 W (b) 0.02 W
(c) 0.03 W (d) 0.04 W

15. If the magnet is cut into four equal parts, such that their lengths and breadths are equal, then pole strength of each part is
(a) m (b) 2m
(c) 4m (d) 6m

16. The angle of dip at a certain place on the earth is 60° and the magnitude of the earth's horizontal component of magnetic field is 0.26 G. The magnetic field at the place on the earth is -
(a) 0.13 G (b) 0.26 G
(c) 0.52 G (d) 0.65 G

17. Which of the following statement (s) is/are correct with respect of magnetic lines of forces?
(a) Magnetic lines of forces are discontinuous curves.
(b) Magnetic lines of forces do not intersect to each other.
(c) Magnetic lines of forces always enter into south pole from its outside region.
(d) Both (b) and (c)

18. The North-pole of a long horizontal bar magnet is being brought closer to a vertical conducting plane along the perpendicular direction. The direction of induced current in the conducting plane will be
(a) horizontal
(b) vertical
(c) clockwise
(d) anti-clockwise

19. The earth behaves as a magnet with magnetic field pointing approximately from the geographic
(a) North to South
(b) South to North
(c) East to West
(d) West to East

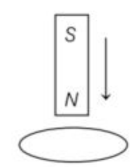
20. A charged particle enters a magnetic field B with its initial velocity making an angle of 45° with B. The path of the particle will be –
(a) straight line (b) a circle
(c) an ellipse (d) a helix

21. Magnetic lines of force due to a bar magnet do not intersect, because
(a) a point always has a single net magnetic field
(b) the lines have similar charges and so repel each other
(c) the lines always diverge from a single point
(d) None of the above

22. Angle of dip is maximum at
(a) pole
(b) equator
(c) Both (a) and (b)
(d) Neither (a) nor (b)

23. The presence of magnetic monopoles is ruled out by
(a) Gauss's law of electrostatics
(b) Gauss's law for magnetism
(c) Faraday's law
(d) Ampere's circuital law with Maxwell's addition

24. The North-pole of a magnet is falling on a metallic ring as shown in the figure. The direction of induced current, if looked from upside, in the ring will be



(a) clockwise or anti-clockwise depending on metal of the ring
(b) non induced current
(c) anti-clockwise
(d) clockwise

25. Which of the following independent quantities is not used to specify the earth's magnetic field?
(a) Magnetic declination (θ).
(b) Magnetic dip (δ).
(c) Horizontal component of earth's field (B_H).
(d) Vertical component of earth's field (B_V).

26. Magnetic moment for solenoid and corresponding bar magnet is
(a) equal for both
(b) more for solenoid
(c) more for bar magnet
(d) none of these

Assertion reasoning MCQs

For question numbers 27 to 35, two statements are given one labeled as Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below

a) Both Assertion (A) and Reason (R) are true and reason is the correct explanation of assertion.
b) Both Assertion (A) and Reason (R) are true but reason is not the correct explanation of assertion.
c) Assertion (A) is true but Reason (R) is false.
d) Assertion (A) is false and Reason (R) is also false.

27 **Assertion:** When a charged particle moves in a region of magnetic field such that its velocity is at some acute angle with the direction of field, its trajectory is a helix.
Reason: Perpendicular component of velocity causes a rotating centripetal force and parallel component of velocity does not produces any force.

28 **Assertion:** Two infinitely long wires A and B carry unequal currents in inward direction. Then, there is only one point (excluding the points at infinity), where net magnetic field is zero.
Reason: That point lies between points A and B.

29 **Assertion:** The magnetic field produced by a current carrying solenoid is independent of its length and cross-sectional area.
Reason: The magnetic field inside the solenoid is uniform

30 **Assertion:** A proton and an alpha particle having the same kinetic energy are moving in circular paths in a uniform magnetic field. The radii of their circular paths will be equal.
Reason: Any two charged particles having equal kinetic energies and entering a region of uniform magnetic field B in a direction perpendicular to B, will describe circular trajectories of equal radii.

31 **Assertion:** Basic difference between an electric line and magnetic line of force is that former is discontinuous and the latter is continuous or endless.
Reason: No electric lines of forces exist inside a charged conductor but magnetic lines do exist inside a magnet.

32 **Assertion:** According to Gauss's law for magnetism, the net magnetic flux through any closed surface is zero.
Reason: The number of magnetic field lines leaving the surface is balanced by the number of lines entering it.

33 **Assertion:** The magnetic field produced by a current carrying solenoid is independent of its length and cross-sectional area.
Reason: The magnetic field inside the solenoid is uniform.

34 **Assertion:** To convert a galvanometer into an ammeter a small resistance is connected in parallel with it.
Reason: The small resistance increases the combined resistance of the combination.

35 **Assertion :** A charge, whether stationary or in motion produces a magnetic field around it.
Reason : Moving charges produce only electric field in the surrounding space.

Case-based MCQs

Case Study 1

Moving Coil Galvanometer Moving coil galvanometer operates on Permanent Magnet Moving Coil (PMMC) mechanism and was designed by the scientist D'arsonval. Moving coil galvanometers are of two types (i) Suspended coil (ii) Pivoted coil type or tangent galvanometer. Its working is based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque. This torque tends to rotate the coil about its axis of suspension in such a way that the magnetic flux passing through the coil is maximum.

Read the passage carefully and answer the questions (36 to 40) in the following case.

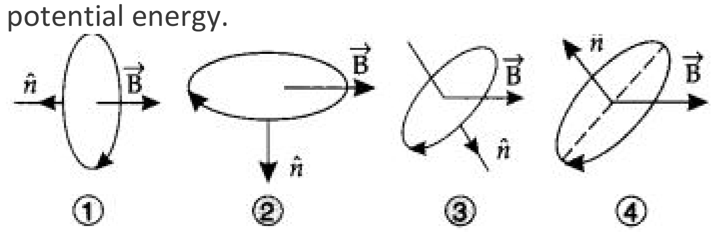
36. A moving coil galvanometer is an instrument, which
(a) is used to measure emf of cell
(b) is used to measure potential difference
(c) is used to measure resistance
(d) is a deflection type instrument that gives a deflection when a current flows through its coil

37. To make the field radial in a moving coil galvanometer,
(a) number of turns of coil is kept small
(b) magnet is taken in the form of horse-shoe
(c) poles are of very strong magnets
(d) poles are cylindrically cut

38. The deflection in a moving coil galvanometer is
(a) directly proportional to torsional constant of spring
(b) directly proportional to the number of turns in the coil
(c) inversely proportional to the area of the coil
(d) inversely proportional to the current in the coil

39. To increase the current sensitivity of a moving coil galvanometer, we should decrease
(a) strength of magnet
(b) torsional constant of spring
(c) number of turns in coil
(d) area of coil

40. A current carrying loop is placed in a uniform magnetic field in four different orientations as shown in figure. Arrange them in the decreasing order of potential energy.

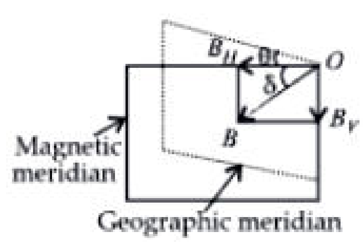


(a) 4, 2, 3,1 (b) 1, 4, 2, 3
(c) 4, 3, 2,1 (d) 1, 2, 3, 4

Case Study 2

Elements of the Earth's Magnetic Field

The earth's magnetic field at a point on its surface is usually characterised by three quantities: (a) declination (b) inclination or dip and (c) horizontal component of the field. These are known as the elements of the earth's magnetic field. At a place, angle between geographic meridian and magnetic meridian is defined as magnetic declination, whereas angle made by the earth's magnetic field with the horizontal in magnetic meridian is known as magnetic dip.



Read the passage carefully and answer following questions in the following case.

(i) In a certain place, the horizontal component of magnetic field is $\frac{1}{\sqrt{3}}$ times the vertical component. The angle of dip at this place is

(a) zero (b) $\pi/3$ (c) $\pi/2$ (d) $\pi/6$

(ii) The angle between the true geographic north and the north shown by a compass needle is called as

(a) inclination (b) magnetic declination

(c) angle of meridian (d) magnetic pole.

(iii) The angles of dip at the poles and the equator respectively are

(a) 30°, 60° (b) 0°, 90° (c) 45°, 90° (d) 90°, 0°

(iv) A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It

(a) will become rigid showing no movement

(b) will stay in any position

(c) will stay in north-south direction only

(d) will stay in east-west direction only.