INDIAN SCHOOL AL WADI AL KABIR

CLASS-12

SAMPLE PAPER PHYSICS-4- (042)

DEPARTMENT OF SCIENCE (21-22)

uestions 1 to 20 are multiple choice questions. Choose the correct option.

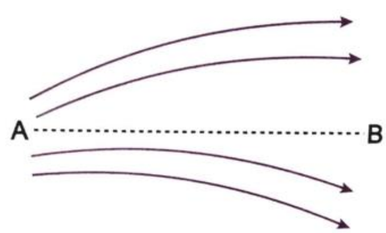
1. Four charges + 8Q, – 3Q + 5Q and –10Q are kept inside a closed surface. What will be the outgoing flux through the surface?

(*a*) 26 V-m (*b*) 0 V-m (*c*) 10 V-m (*d*) 8 V-m

2. Due to the presence of a point charge at the centre of a spherical Gaussian surface of diameter *a*, 10^6 Nm^2/C amount of electric flux passes through it. Keeping the point charge at the centre, the Gaussian surface is changed to a cubical Gaussian surface of side *a*. The flux through the new Gaussian surface will be

(*a*) $\sqrt{2} \times 10^6$ Nm^2/C (*b*) $\frac{10^6}{\sqrt{2}}$ Nm^2/C (*c*) 10^6 Nm^2/C (*d*) $2\sqrt{2} \times 10^6$ Nm^2/C

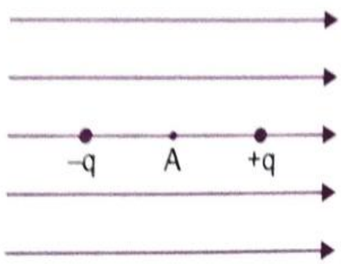
3. The figure shows the electric lines of force emerging from a charged body. If the electric fields at *A* and *B* are E_A and E_B respectively and if the distance between *A* and *B* is *r*, then



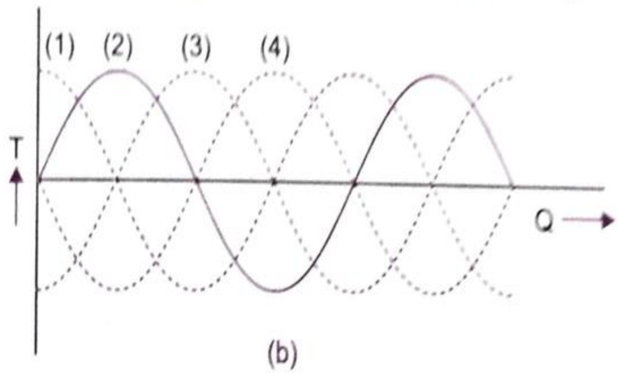
(*a*) $E_A < E_B$ (*b*) $E_A > E_B$

(c) $E_A = \frac{E_B}{r}$ (*d*) $E_A = \frac{E_B}{r^2}$

4. An electric dipole is situated in an electric field as shown in Fig. (a). The dipole and the electric field are both in the plane of the paper. The dipole is rotated anticlockwise about an axis perpendicular to the plane of the paper at the point A. If the angle of rotation is measured with respect to the direction of the electric field, then the torque experienced by the dipole for different values of the angle of rotation θ will be represented in the Fig. (b) by



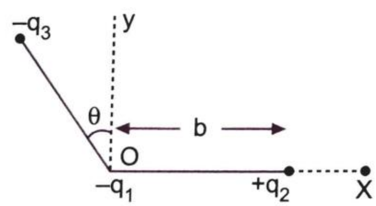
(a)



(b)

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

5. **Three charges $-q_1$, $+q_2$ and $-q_3$ are placed as shown in figure. The x component of the force on $-q_1$ is proportional to**



(a) $\frac{q_2}{b^2}+\frac{q_3}{a^2}\cos\theta$ (b) $\frac{q_2}{b^2}-\frac{q_3}{a^2}\sin\theta$

(c) $\frac{q_2}{b^2}-\frac{q_3}{a^2}\cos\theta$ (d) $\frac{q_2}{b^2}+\frac{q_3}{a^2}\sin\theta$

6. **The shape of equipotential surface in uniform electric field will be**

(a) spherical normal to electric field (b) random.

(c) circular normal to electric field (d) equidistant planes normal to electric field

7. **The potential at a point x (measured in μm) due to some charges situated on the x-axis is given by**

$$V(x)=\frac{20}{x^2-4}\text{ volt}$$

The electric field E at x = 4 μm is given by

(a) $\frac{5}{3}$ V/μm and is in positive x-direction. (b) $\frac{10}{9}$ V/μm and is in negative x-axis.

(c) $\frac{10}{9}$ V/μm and is in positive x-direction. (d) $\frac{5}{3}$ V/μm and is in negative x-direction.

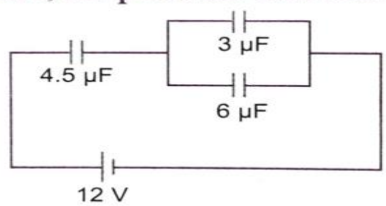
8. **Three point charges $-Q$, $-q$ and $2Q$ are placed, one at each corner of the equilateral triangle. The relation between Q and q for which the potential at the centre of the triangle is zero is**

(*a*) $Q = \frac{1}{2} q$ (*b*) $Q = -q$ (*c*) $Q = -\frac{1}{2} q$ (*d*) $Q = q$

9. **The equivalent capacitance of two capacitors when joined in parallel is 16 μF and when joined in series is 3 μF. The capacitances of the capacitors are**

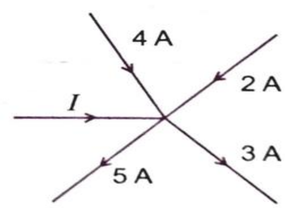
(*a*) 8 μF and 8 μF (*b*) 4 μF and 12 μF
(*c*) 6 μF and 10 μF (*d*) 2 μF and 14 μF

10. **In the circuit shown in the figure, the potential difference across the 4.5 μF capacitor is**



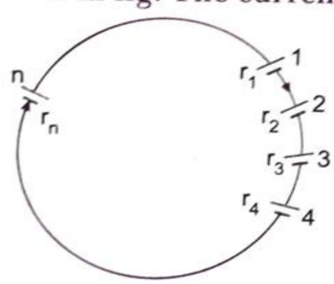
(*a*) 8 V (*b*) 6 V (*c*) $\frac{48}{13}$ V (*d*) 8/3 V

11. **In the given current distribution what is the value of I ?**



(*a*) 3 A (*b*) 8 A (*c*) 2 A (*d*) 5 A

12. **A group of n cells whose emf varies directly with the internal resistance as per equation $E_n = 1.5\ r_n$ are connected as shown in fig. The current I in the circuit is**



(*a*) 1.5 A (*b*) 0.15 A (*c*) 5.1 A (*d*) 0.51 A

13. **Assume that each atom of copper contributes one free electron. If the current flowing through a copper wire of 1 mm diameter is 1.1 A, the drift velocity of electrons will be (Density of Cu = 9×10^3 kg/m^3, At. wt. of Cu = 63, Avogadro number = 6.02×10^{26}/kg-atom).**

(*a*) 0.3 mm/s (*b*) 0.5 mm/s (*c*) 0.1 mm/s (*d*) 0.2 mm/s

14. **Two identical batteries each of emf 2 V and internal resistance 1 Ω are available to produce heat in a resistance $R = 0.5\ \Omega$, by passing current through it. The maximum Joulean power that can be developed across R using these batteries is**

(*a*) $\frac{8}{9}$ W (*b*) 1.28 W (*c*) 2.0 W (*d*) 3.2 W

15. **The magnetic force acting on a charged particle of charge $-3\mu C$ moving with velocity $(2\hat{i} + 4\hat{j}) \times 10^6$ ms^{-1} in a magnetic field of 6 T directed in y-direction is**

(*a*) 44 N in z-direction
(*b*) 36 N in y-direction
(*c*) 48 N in z-direction
(*d*) 36 N in negative z-direction

16. **A rectangular coil of length 0.12 m and width 0.1 m having 50 turns of wire is suspended vertically in a uniform magnetic field of strength 0.2 Weber/m^2. The coil carries a current of 2 A. If the plane of the coil is inclined at an angle of 30° with the direction of the field, the torque required to keep the coil in stable equilibrium will be**

(*a*) 0.24 Nm (*b*) 0.12 Nm (*c*) 0.15 Nm (*d*) 0.20 Nm

17. **Currents of 10 A and 2 A are flowing in opposite directions through two parallel wires A and B respectively. If the wire A is infinitely long and wire B is 2 m long, then force on wire B which is situated at 10 cm from A, is**

(*a*) 4×10^{-5} N (*b*) 8×10^{-5} N (*c*) 6×10^{-5} N (*d*) 2×10^{-5} N

18. **The vertical component of earth's magnetic field is zero at**

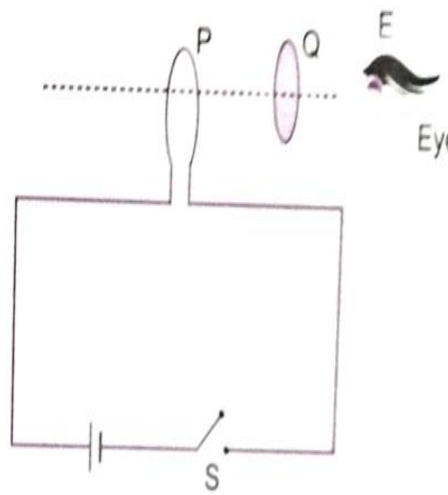
(*a*) magnetic poles
(*b*) geographical poles
(*c*) every place
(*d*) magnetic equator

(*d*) magnetic equator

19. **A bar magnet of magnetic moment m is cut into two parts of equal length. The magnetic moment of either part is**

(*a*) m (*b*) $2m$ (*c*) $m/2$ (*d*) zero

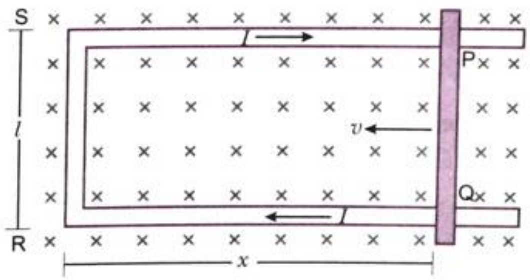
20. **As shown in figure, P and Q are two co-axial conducting loops separated by some distance. When switch S is closed, a clockwise current I_P flows in P (as seen by eye E) and an induced current I_{Q_1} flows in Q. The switch S remains closed for a long time. When S is opened, a current I_{Q_2} flows in Q. Then the directions of (as seen by eye E) are:**



(*a*) respectively clockwise and anticlockwise
(*b*) both clockwise
(*c*) both anticlockwise
(*d*) respectively anticlockwise and clockwise

Case-based Question–I : MOTIONAL EMF FROM FARADAY'S LAW

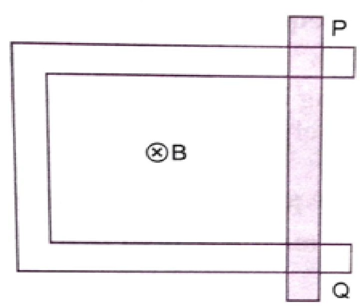
The Faraday's law of induction is basic law of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (emf). Emf is induced by change of area of the coil linked with the magnetic field. The emf induced across the ends of a conductor due to its motion in a magnetic field is called motional emf. As shown in figure, consider a conductor PQ of length l free to move on U-shaped conducting rails situated in a uniform and time independent magnetic field B, directed normally into the plane of paper. The conductor PQ is moved inwards with a speed v. As the conductor slides towards left, the area of the rectangular loop $PQRS$ decreases. This decreases the magnetic flux linked with the closed loop. Hence an emf is set up across the ends of conductor PQ because of which an induced current flows in the circuit along the path $PQRS$. The direction of induced current can be determined by using Fleming's right hand rule.



21. The current passing through a choke of self inductance 5 H is decreased at the rate of 2 A/s. The induced emf developed across the coil is

(*a*) 10 V
(*b*) –10 V
(*c*) 2.5 V
(*d*) –2.5 V

22. A 50 cm long bar *PQ* is moved with a speed of 4 m/s in a uniform magnetic field B = 0.01 T as shown in fig., the emf generated is



(*a*) 0.04 V
(*b*) 0.03 V
(*c*) 0.02 V
(*d*) 0.01 V

23. A copper rod of length (l) is rotated about the end perpendicular to the uniform magnetic field (B) with constant angular velocity (ω). The induced emf between the two ends is

(*a*) $\frac{1}{4}B\omega l^2$
(*b*) $\frac{1}{2}B\omega l^2$
(*c*) $B\omega l^2$
(*d*) $2B\omega l^2$

24. The magnetic flux linked with a coil (in Wb) is given by the equation, $\phi = 5t^2 + 3t + 16$. The induced emf in the coil in the fourth second will be

(*a*) 10 V
(*b*) –10 V
(*c*) 43 V
(*d*) –43 V

25. A transformer is an electrical device used for

(*a*) producing alternate current
(*b*) producing direct current
(*c*) changing *ac* voltages
(*d*) changing *dc* into *ac*

26. For step down transformer, conditions are

(*a*) $i_S > i_P$ and $N_S < N_P$
(*b*) $i_S < i_P$ and $N_S > N_P$
(*c*) $i_S = i_P$ and $N_S = N_P$
(*d*) none of these

27. A transformer has 20 turns of primary and 100 turns of secondary coil. If the two ends of the primary are connected to a 220 V *dc* supply the voltage across the secondary will be

(*a*) 0 V
(*b*) 11 V
(*c*) 220 V
(*d*) 1100 V

28. A step up transformer is used in a 120 V line to provide a potential difference of 2400 V. If the primary coil has 75 turns, the number of turns in the secondary coil is

(*a*) 150
(*b*) 1200
(*c*) 1500
(*d*) 1575

For question numbers 29 to 35, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

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

29. Assertion (A) : Coulomb force and gravitational force follow the same inverse-square law.
Reason (R) : Both laws are same in all aspects.

30. Assertion (A) : The surface of a conductor is always an equipotential surface.
Reason (R) : A conductor contains free electrons which can move freely to equalise the potential.

31. Assertion (A) : Material used in construction of a standard resistance is constantan.
Reason (R) : The temperature coefficient of resistance of constantan is negligible.

32. Assertion (A) : Two parallel conducting wires carrying currents in same direction, come close to each other.
Reason (R) : Parallel currents attract and anti parallel currents repel.

33. Assertion (A) : The magnetic field lines do not intersect.
Reason (R) : The tangent to the magnetic field line at a given point represents the direction of the net magnetic field B at the point.

34. Assertion (A) : Only a change of magnetic flux will maintain an induced current in the coil.
Reason (R) : The presence of a large magnetic flux will maintain an induced current in the coil.

35. Assertion (A) : In series LCR resonance circuit, the impedance is equal to the ohmic resistance.
Reason (R) : At resonance, the inductive reactance exceeds the capacitive reactance.

1. (*b*)	**2.** (*c*)	**3.** (*b*)	**4.** (*b*)	**5.** (*d*)	**6.** (*b*)	**7.** (*c*)	**8.** (*c*)
9. (*d*)	**10.** (*b*)	**11.** (*c*)	**12.** (*a*)	**13.** (*c*)	**14.** (*c*)	**15.** (*d*)	**16.** (*d*)
17. (*b*)	**18.** (*d*)	**19.** (*c*)	**20.** (*d*)	**21.** (*b*)	**22.** (*c*)	**23.** (*b*);	**24.** (*b*)
25. (*c*)	**26.** (*a*)	**27.** (*a*)	**28.** (*c*)	**29.** (*c*)	**30.** (*a*)	**31.** (*a*)	**32.** (*a*)
33. (*a*)	**34.** (*c*)	**35.** (*c*)					