S.F.D.A.V. Public School,Muzaffarnagar

Class-XII

Subject-Physics

VERY SHORT ANSWER TYPE QUESTIONS

Q1. The force of attraction between two point - charges at a distance r apart is F. What should be the distance apart in the same medium so that the force becomes F/3 ?
What if force becomes 3F ?

Q2. How does the force between two point-charges change. if the dielectric constant of the medium in which they are kept, increases ?

Q3. Name the physical quantity which has joule coulomb as its unit. Is it a scalar or a vector quantity ?

Q4. Depict the equipotential surfaces for a system of a two identical positive point charges placed at a distance ' d' apart.

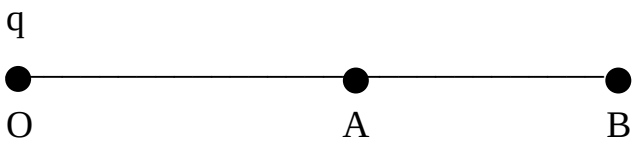
Q5. Can two equipotential surfaces intersect ?

Q6. What is the work done in moving a charge of 10 $_{u}$C between two points on an equipotential surface ?

Q7. What orientation of an electric dipole in a uniform electric field corresponds to its
(i) stable equilibrium (ii) unstable equilibrium ?

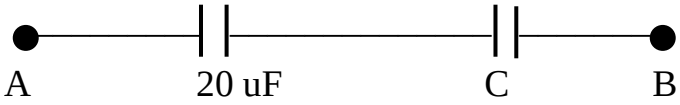
Q8. What is the electrostatic potential due to an electric dipole at an equatorial point ?

Q9. A point charge q is placed at point O in the figure below. Is the potential difference V_A - V_B positive, negative or zero, if q is ; (i) Positive, (ii) negative ?



Q10. What do you understand by ' dielectric constant' of a material medium ?

Q11. The equivalent capacitance of the combination between A and B in the given figure is 4 uF.



(i) Calculate capacitance of the capacitor C.

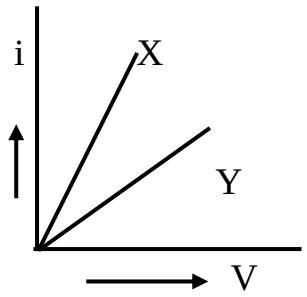
(ii) Calculate charge on each capacitor if a 12 v battery is connected across terminals A and B.

(iii) What will be the potential drop across each capacitor ?

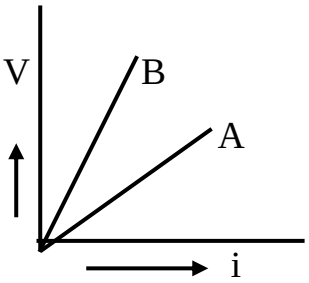
Q12. The potential difference between the plates of a parallel-plate capacitor is 200V. The area of each plate is 100 cm^2 and the distance between them is 1 mm. If the medium between them is air, then calculate the charge taken by the capacitor. If there is a medium of dielectric constant 2.5 between the plates, then what will be the potential difference for the same charge ?

Q13. Derive an expression for drift velocity of free electrons in a conductor in terms of electrons in a conductor in terms of relaxation time.

Q14. The voltage-current variations of two metallic wires X and Y at constant temperature are as shown. Assuming that the wires have the same length and the same diameter; explain which of the two wires has higher resistivity.



Q15. The voltage-current graphs for two resistors of the same material and same radii with lengths $\int_1$ and $\int_2$ are shown in the fig. If $\int_1$ `> $\int_2$, state with reason, which of these graphs represent voltage-current change for $\int_1$.



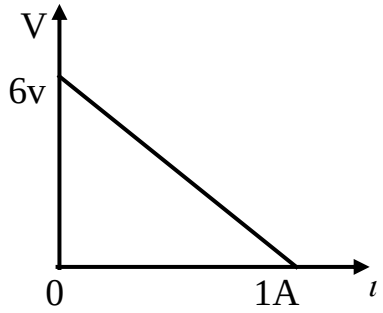
Q16. Define the terms 'resistivity' and 'conductivity', and stale their SI unit. Draw a graph showing the variation of resistivity with temperature of a typical semiconductor.

Q17. Derive an expression for the resistivity of a wire in terms of its material's parameter; density of free electrons and collision time.

Q18. Define the term resistivity of a conductor. Give its SI unit. Show that the resistance R of a conductor is given by $\frac{m\int}{ne^2\tau A}$, where symbols have their usual meanings.

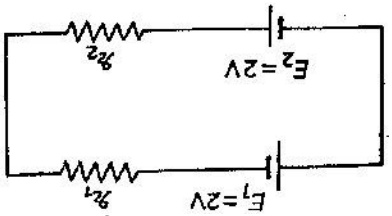
Q19. A wire of 15 Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 3.0 V battery. Find the current drawn from the battery.

Q20. The plot of the variation of potential difference across a combination of three identical cells in series, versus a combination of three identical cells in series, versus current is as shown in figure what is the emf of each cell ?



Q21. A resistance R is connected across a cell of emf E and internal resistance r. A potentiometer now measures the potential difference between the terminals of the cell as V. write the expression for 'r' in terms of E, V and R.

Q22. State Kirchhoff rules. Use Kirchhoff rules to show that no current flows in the given circuit.



Q23. Calculative the current drawn from the battery in the given network.

Q24. What types of fields are produced by a moving electron ? By a stationary electron ?

Q25. Does a neutron moving in a magnetic field experience force ?

Q26. An electron is moving parallel to a long, straight current-carrying wire. Does it experience any force ?

Q27. Write an expression for the potential energy of a magnet in a uniform magnetic field. When is the magnet in stable and unstable equilibrium ?

Q28. What is curie temperature ?

Q29. Write two characteristics of a material used for making permanent magnets.

Q30. Why should the material used for making permanent magnets have high coercivity ?

Q31. Why is the core of an electromagnet made of ferromagnetic materials ?

Q32. The permeability of a magnetic material is 0.9983. Name the type of magnetic material it represents.

Q33. Why is soft iron considered more suitable than steel for making the core of a transformer ?

Q34. Define 1 Henry ?

Q 35. What is wattles current ?

Q36. In which situation is there is a displacement current but not conduction current ?

Q37 Give two difference between interference and diffraction of light ?

Q38. How does the fringe width change in an interference pattern when kept in water ?

Q.39 How is the working of telescope different from that of microscope ?

Q.40 Define the term stopping potential in relation to photoelectric effects

Q41.State three properties of nuclear forces.

Q42.How does one understand the temperature dependence of resistivity of semiconductor.

Q43.In which bias LED operate?

Q44. Which basic electronic device used in Amplifier ?

Q45.Name the essential components of communication system.

Q46.What is sky wave propagation ?

Q46 What is meant by modulation?

Q47.Explain the function of a repeater in communication system.

Q48.Which basic modes of communication is used for telephonic communication?

Q49Mention the function of

(I) Transducer

(II) Amplifier

Q50Define Modulation index?

SHORT ANSWER TYPE QUESTIONS

Q1. Why is it necessary that the field lines from a point charge placed in the vicinity of a conductor must be normal to the surface of the conductor at every point ?

Q2. A positive point charge (+q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines originating from the point on to the surface of the plate. Drive the expression for the electric field at the surface of a charged conductor.

Q3. Define the term 'electric dipole moment'. Is it scaler or vector ? Deduce an expression for the electric field at a point on the equatorial plane of an electric dipole of length 2 a.

Q4. Define electric dipole moment and write its SI unit.

Q5. Using Gauss's law obtain the expression for the electric find due to a uniformly charged thin spherical shell of radius R at a point outside the shell. Draw a graph showing the variation of electric field with r, for r > R and r > R.

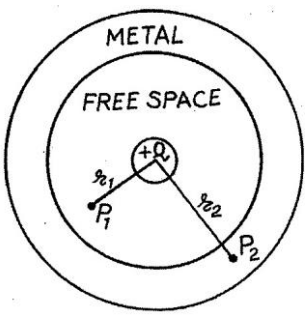
Q6. A charge 'q' is placed at the centre of a cube of side $\int$. What is the electric flux passing through two opposite faces of the cube ?

Q7. Define electric flux. Write it S.I. unit. A charge q is enclosed by a spherical surface of radius R. If the radius is reduced to half, how would the electric flux through the surface change ?

Q8. A thin conducting spherical shell of radius R has charge Q spread uniformly over its surface. Using Gauss's law, derive an expression for an electric field at a point outside the shell.

Draw a graph of electric field E(r) with distance r from the center of the shell for $0 \leq r \leq \infty$.

Q9. A small metal sphere carrying a charge + Q is located at the center of a spherical cavity in a large uncharged metal sphere, as shown. Use Gauss' theorem to find electric field at points $P^1$and P^2.



Q10. Use Gauss's law to derive the expression for the electric field between two uniformly charged large parallel sheets with surface charge densities σ and -σ respectively.

Q11. Draw three equipotential surface corresponding to a field that uniformly increases in magnitude but remains constant along Z-direction. How are these surface different from that of a constant electric field along Z-direction ?

Q12. Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why ?

Q13. How will the magnetic field intensity at the center of a circular coil carrying current change, if the current through the coil is double and the radius of the coil is halved ?

Q14. What are the dimensions of 1/ $\sqrt{u_o \varepsilon_o}$?

Q15. State Biot-savart law.

Q16. An electron does not suffer any deflection while passing through a region of uniform magnetic field. What is the direction of the magnetic field ?

Q17. A beam of a-particles projected alone positive x-axis experiences a force due to a magnetic field along positive Y-axis. What is the direction of the magnetic field ?

Q18. An electron and a proton, moving parallel to each other in the same direction with equal momenta, enter into a uniform magnetic field which is at right angles to their velocities. Trace their trajectories in the magnetic field.

Q19. A particle of mass m and charge q moves at right angles at a uniform magnetic field B. Plot a graphs showing the variation of the radius of the circular path described by it with the increase in its (a) charge, (b) kinetic energy, in each case other factors remain constant. justify your answer.

Q20. A rectangular loop of size l x b carrying a steady current i is placed in a uniform magnetic field $\vec{B}$. Prove that the torque $\vec{\tau}$ acting on the loop is given by $\vec{\tau} = \vec{m} \times \vec{B}$, where $\vec{m}$ is the magnetic moment of the loop.

Q21. Under what condition an electron (or proton) moving through a magnetic field $\vec{B}$ with velocity $\vec{V}$ does experience maximum force ?

Q22. Define magnetic moment of a magnet (dipole) and give its SI unit. Is it a vector or a scalar quantity ?

Q23. Steel is preferred for making permanent magnets whereas soft-iron for making electromagnets. Give reason.

Q24. Write any two characteristics of a magnetic substance if it is to be used a make a permanent magnet. Give an example of such a material.

Q25. What is paramagnetism ? Explain it on the basis of electron theory.

Q26. Distinguish between diamagnetism and paramagnetism. Why is the magnetism of a paramagnetic substance lost on heating ?

Q27. Prove that the potential energy of a magnet in a uniform magnetic field is U = - $\vec{m}$. $\vec{B}$.

Q28. Write an equation of Lorentz force $\vec{F}$ acting on a charged particle having charge q moving in a magnetic field $\vec{B}$ with a velocity $\vec{V}$ in vector form.

Q29. Under what condition an electron (or proton) moving through a magnetic field $\vec{B}$ with velocity $\vec{v}$ does experience maximum force ?

Q30. Is magnetic flux a scalar or vector ? Magnetic flux density ?

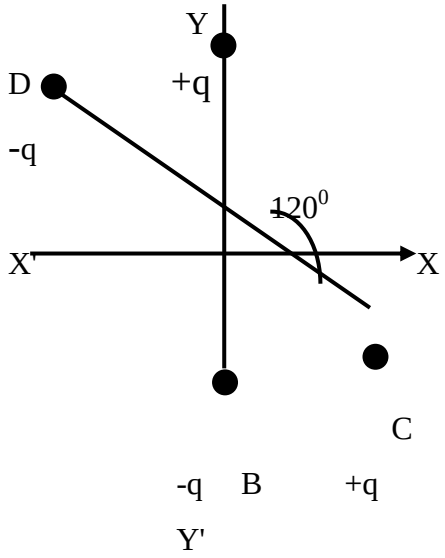
Q31. An electron moving with velocity $\vec{V}$ along + X-axis enters a uniform magnetic field $\vec{B}$ directed along + Y-axis. What is the magnitude and direction of the force on the electron ?

Q32. Write the relation connecting the angle of dip, horizontal and vertical components of magnetic field of each at a place.

Q33. Give the position of a magnet held in a magnetic field when its potential energy is `minimum.

LONG ANSWER TYPE QUESTIONS

Q1. Two small identical electrical dipoles AB and CD, each of dipole moment 'P' are kept at an angle of 120^0 as shown in the figure. What is the resultant dipole moment of this combination ? If this system is subjected to an electric field ($\vec{E}$) directed along +X direction, what will be the magnitude and direction of the torque acting on this ?



Q2. Obtain an expression for intensity of electric field in end on position, i.e., axial position of an electric dipole.

Q3. An electric dipole is held in a uniform electric field.

(a) Show that the net force acting on it is zero.

(b) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle of 180^0.

Q4. A spherical conducting shell of inner radius r_1 and outer radius r_2 has a charge 'Q'. A charge q is placed at the center of the shell

(a) What is surface charge density on the (i) inner surface and (ii) outer surface

(b) Write expression for the electric field at a point $x > r^2$ from the center of the shell.

Q5. An electric dipole of length 4 cm, when placed with its axis making an angle of 30^0 with a uniform electric field experiences a torque of 4 N m. Calculate the

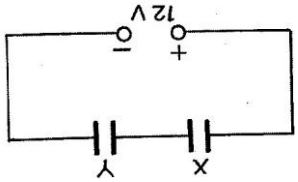
(i) magnitude of the electric field, (ii) potential energy of the dipole, if the dipole has charges of $\pm$ 10 nC.

Q6. Two charges – q and + q are located at points A (0,0,-a) and B (0,0,+ a) respectively. How much work is done in moving a test charge from point P (7,0,0) to Q (-3,0,0) ?

Q7. A parallel-plate capacitor is to be designed with a voltage rating 1 kV, using a material of dielectric constant 3 and dielectric strength 10^7 v m^{-1}. If the field is not to exceed

10% of the dielectric strength find the minimum area of the plate required to have a capacitance of 50 pF.

Q8. Two parallel plate capacitors. X and Y, have the same area of plates and same separation between them. X has air between the plates while Y contains a dielectric medium of $\varepsilon_r = 4$.



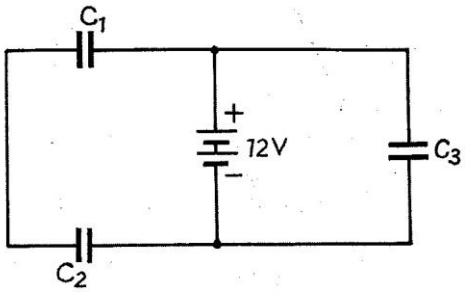
(i) Calculate capacitance of each capacitor if equivalent capacitance of the combination is 4 uF.

(ii) Calculate the potential difference between the plates of X and y.

(iii) What is the ratio of electrostatic energy stored in X and Y ?

Q9. A parallel-plate capacitor is charged by a battery which is then disconnected. A dielectric slab is then inserted to fill the space between the plates. Explain the changes, if any, that occur in the values of (i) charge on the plates, (ii) capacitance, (iii) p.d. between the plates, (iv) electric field between the plates, (v) energy stored in the capacitor. Suppose, the capacitor plates are horizontal and the dielectric slab is released after inserting it at one end of the capacitor. Describe its motion.

Q10. Three identical capacitors C_1, C_2 and C_3 of capacitance 6 uF each are connected to a 12 v battery as shown.



Find :

(i) the charge on each capacitor

(ii) equivalent capacitance o the network

(iii) energy stored in the network of capacitors.

Q11. On charging a parallel plate capacitor to a potential V, the spacing between the plates it halved, and a dielectric medium of $\varepsilon_r = 10$ is introduced between the plates, without disconnecting the d.c. source. Explain, using suitable expression, how the (i) capacitance, (ii) electric field and (iii) energy density of the capacitor charge.

Q12. Derive the expression for the energy stored in a parallel-plate capacitor of capacitance C with air as medium between its plates having charges Q and –Q.

Show that this energy can be expressed in terms of electric field as $\frac{1}{2}\varepsilon_0 E^2$ (Ad), where A is the area of each plate and d is the separation between the plates.

Q13. A steady current flows in a metallic conductor of non-uniform cross-section. Which of the following quantity/quantities is/are constant along the conductor : current, current density, electric field, drift speed ?

Q14. Two conducting writes X and Y of same diameter but different materials are joined in series across a battery. If the number density of electrons in X is twice that in Y, find the ratio of drift velocity of electrons in the two wires.

Q15. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons ? Use this relation to deduce the relation for electrical resistivity of the material.

Q16. Draw a neat labeled diagram of a potentiometer used to compare the emf of two cells and explain briefly its principle.

Q17. Explain with diagram, the principle of a potentiometer. How can its sensitivity be increased ? Why is it superior to a voltmeter ?

Q18. State the principle of a potentiometer. With the help of a circuit diagram, describe the method for the determination of internal resistance of a cell using a potentiometer. Derive the formula to be used.

Q19. State Biot-savart law, giving the mathematical expression for it.
Use this law to derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis. How does a circular loop carrying current behave as a magnet ?

Q21. Derive an expression for the force experienced by a current-carrying straight conductor placed in a uniform magnetic field. State the rule to find the direction of this force. Write the condition for which this force will have
(i) Maximum (ii) Minimum value.

Q22. Derive the relation for the force per unit length between two infinity-long, parallel, straight conductors carrying current. Hence define one ampere.

Q23. Draw a schematic sketch of a cyclotron. Explain briefly how it is used to accelerate the charged particles.

Q24. With the help of a cyclotron. Explain clearly how it works to accelerate the charged particles. Show that cyclotron frequency is independent of energy of particle. is there any upper limit of energy acquired by the particle ? Give reason.

Q25. A circular coil of 200 turns and radius 10 cm is placed in a uniform magnetic field of 0.5 T, normal to the plane of the coil. If the current in the coil is 3.0A, calculate the (i) total torque on the coil. (ii) total force on the coil, (iii) average force on each electro in the coil, due to the magnetic field. Assume the area of cross-sections of the wire to be 10^{-5} m^2 and the free electron density is 10^{29} per m^3.

Q26. Explain giving reason the basic difference in converting a galvanometer into (i) a voltmeter and (ii) an ammeter.

Q27. A circular coil of N turns and radius R carries a current i. It is unwound and rewound to make another coil of radius R/2, current i remaining the same Calculate the radio of the magnetic moments of the new coil and the original coil.

Q28. A circular coil of closely wound N turns and radius r carries a current i. Write the expression for the following :

(i) the magnetic field at its centre,

(ii) the magnetic moment of this coil.

Q29. A magnetic needle free to rotate in a vertical place parallel to the magnetic meridian has its north tip down at 60^0 with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.4G. Determine the magnetic of the earth's magnetic field at the place.

Q30. Define the terms magnetisation (M) and magnetic susceptibility (X_m) .

Q31. What is relative oermeability of a magnetic material ? How is it related to magnetic suceptibility ?

Q32. Why do magnetic lines of force prefer to pass through ferromagnetic substances than through air ?

Q34. Draw magnetic field lines when a (i) diamagnetic, (ii) paramagnetic substance, is placed in a external magnetic field. Which magnetic property distinguishes this behavior of the field lines due to the two substances ?

Q35. The given figure shows the variation of intensity of magnetization M versus the applied magnetic field intensity H for two magnetic materials A and B :

(a) Identify the material A and B.

Draw the variation of susceptibility with temperature for B.

Q36 Write The generalized expression for the Ampere, circuital law in terms of conduction current.

Q37. Draw a ray Diagram showing image formation in a compound microscope define the term limit of resolution and name the factors on which its depend?

Q38 How is a wavefront define ? Distinguish between a plane Wavefront and a spherical wavefront using Huygens ,s constructions draw a figure showing the propagation of a plane Wave refracting at a plan surface separating two media. Hence verify Snell , s law of refraction?

Q39.In young double slit experiment deduce the condition for (I) constructive and (II) destructive interference at a point on the screen ?