THE ICONIC SCHOOL

Summer Holiday Assignment

Session-2021-22

Grade –XII

Subject- Physics

General Instruction: Solve the questions in your Physics Notebook.

1. An electric dipole of dipole moment 20, X 10^{-6} Cm is enclosed by a closed surface. What is the net electric flux coming out of the closed surface? 1

2. In which orientation, a dipole placed in a uniform electric field is in (i) stable (ii) unstable equilibrium? 1

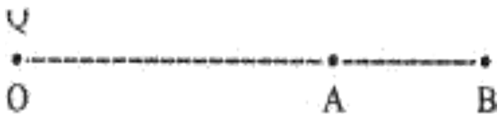
3. Name the physical quantity whose S.I. unit is JC^{-1}. Is it a scalar or a vector quantity? 1

4. Define electric dipole moment. Write its S.I. unit. 1

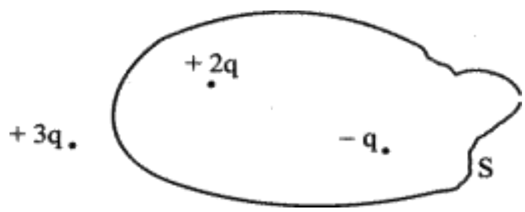
5. What is the electric flux through a cube of side 1 cm which encloses an electric dipole? 1

6. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 V. What is the potential at the centre of the sphere? 1

7. A point charge Q is placed at point O as shown in the figure. Is the potential difference $V_A - V_B$ positive, negative or zero, if Q is (i) positive (ii) negative? 1



8. Figure shows three point charges, + 2q, – q and + 3q. Two charges + 2q and – q are enclosed within a surface ‘S’. What is the electric flux due to this configuration through the surface ‘S’? 1

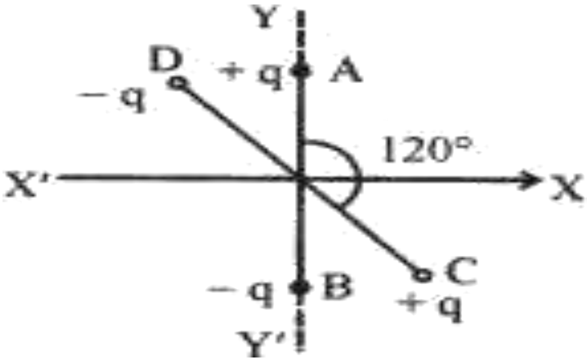


9. Two uniformly large parallel thin plates having charge densities $+\sigma$ and $-\sigma$ are kept in the X-Z plane at a distance'd' apart. Sketch an equipotential surface due to electric field between the plates. If a particle of mass m and charge '-q' remains stationary between the plates, what is the magnitude and direction of this field? 2

10. An electric dipole of length 10cm having charges $\pm 6\times10^{-3}\ C$, placed at 30^0 with respect to a uniform electric field, experiences a torque of magnitude $6\sqrt{3}$ Nm. Calculate (i) the magnitude of the electric field. (ii) the potential energy of the dipole. 2

11. Derive the expression for the energy stored in a parallel plate capacitor with air between the plates. How does the stored energy change if air is replaced by a medium of dielectric constant K? 3

12. Two small identical electrical dipoles AB and CD, each of dipole moment 'p' are kept at an angle of 120^o as shown in the figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field (E) directed along + X direction, what will be the magnitude and direction of the torque acting on this? 2

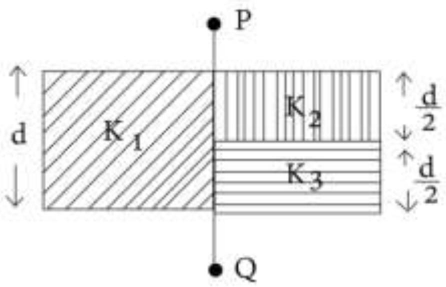


13. (a) Why does the electric field inside a dielectric decrease when it is placed in an external electric field? (b) A parallel plate capacitor with air between the plates has a capacitance of 8 PF. What will be the capacitance if the distance between the plates he reduced by half and the space between them is filled with a substance of dielectric constant K=6? 2

14. Define electric field lines and give its two important properties. 2

15. Derive an expression of electric field on the surface of a conductor. 2

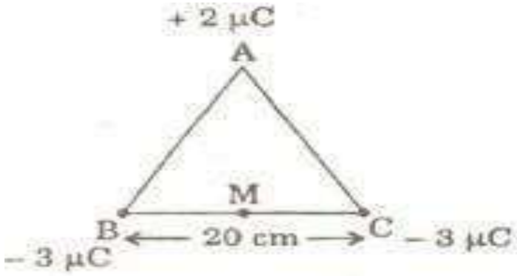
16. Calculate the equivalent capacitance between P & Q. 3



17. Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge. 2

18. State Lenz's rule. Give one example to illustrate it. "The Lenz's rule is a consequence of conservation of energy". Justify the statement. 3

19. There are three point charges 2μC, -3μC and -3μC are kept at the vertices A, B and C respectively of an equilateral triangle of side 20 cm as shown in the figure. What should be the sign and magnitude of the charge to be placed at the mid-point (M) of side BC so that the charge at A remains in equilibrium? 2



20. An electric dipole is held in a uniform electric field. (1) Using suitable diagram, show that it does not undergo any translatory motion, and (ii) derive an expression for the torque acting on it and specify its direction. 3

21. The electric field E due to a point charge at any point near it is defined as $\mathbf{E} = \lim_{q\to 0} \frac{F}{q}$ where q is the test charge and F is the force acting on it. What is the physical significance of $\lim_{q\to 0}$ in this expression? Draw the electric field lines of a point charge Q when (i) Q > 0 and (ii) Q < 0. 3

22. Define electric flux. Write its S.I. units. A spherical rubber balloon carries a charge that is uniformly distributed over its surface. As the balloon is blown up and increases in size, how does the total electric flux coming out of the surface change? Give reason. 3

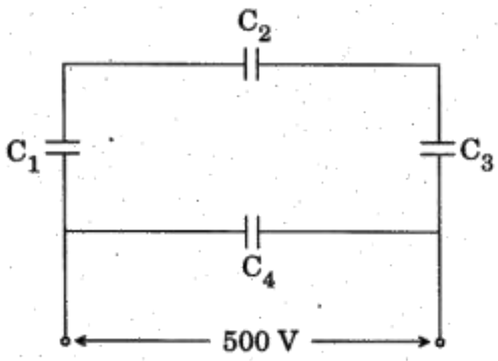
23. Deduce an expression for the electric potential due to an electric dipole at any point on its axis. Mention one contrasting feature of electric potential of a dipole at a point as compared to that due to a single charge. 3

24. A parallel plate capacitor, each with plate area A and separation *d*, is charged to a potential difference V. The battery used to charge it is then disconnected. A dielectric slab of thickness d and dielectric constant K is now placed between the plates. What change, if any, will take place in

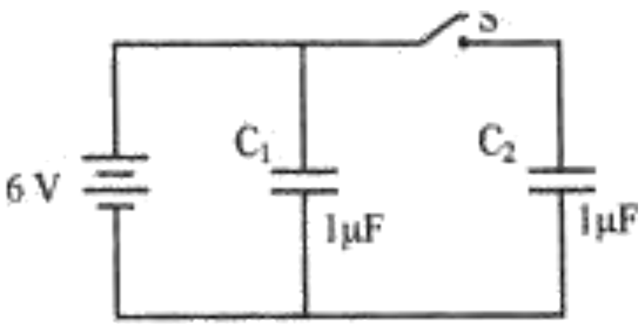
(i) charge on the plates (ii) electric field intensity between the plates

(iii) capacitance of each capacitor. Justify your answer. 3

25. A network of four capacitors each of 12 μF capacitance is connected to a 500 V supply as shown in the figure. Determine (a) equivalent capacitance of the network and (b) charge on each capacitor. 3



26. Figure shows two identical capacitors, C_1 and C_2, each of 1 F capacitance connected to a battery of 6 V. Initially switch 'S' is closed. After sometime 'S' is left open and dielectric slabs of dielectric constant K = 3 are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted? 3



27. Using Gauss's law obtain the expression for the electric field 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. 3

28. Two capacitors of unknown capacitances C_1 and C_2 are connected first in series and then in parallel across a battery of 100 V. If the energy stored in the two combinations is 0.045 J and 0.25 J respectively, determine the value of C_1 and C_2. Also calculate the charge on each capacitor in parallel combination. 3

29. Show that the total energy stored in series combination or parallel combination is equal to the sum of the energies stored in individual capacitors. 3

30. Explain, using suitable diagrams, the difference in the behaviour of a

(i) conductor and (ii) dielectric in the presence of external electric field. Define the terms polarization of a dielectric and write its relation with susceptibility.

(a) A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge Q/2 is placed at its centre C and an other charge +2Q is placed outside the shell at a distance *x* from the centre as shown in the figure.

Find (i) the force on the charge at the centre of shell and at the point A,

(ii) the electric flux through the shell. 5

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