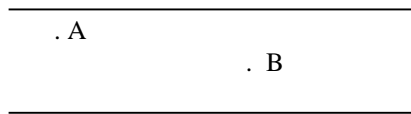


**BHARATIYA VIDYA BHAVAN'S V M PUBLIC SCHOOL, VADODARA**

**QUESTION BANK**

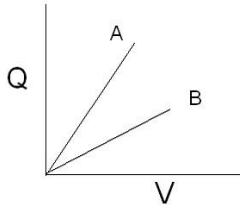
**ELECTROSTATICS**

- Q.1 why can one ignore quantization of charge when dealing with macroscopic charges?  
Q.2 what orientation of an electric dipole in a uniform electric field corresponds to stable equilibrium?  
Q.3 Name the physical quantity whose SI unit is  $JC^{-1}$ . Is it a scalar or a vector quantity?  
Q.4 what is the amount of work done in moving  $100 \mu C$  charge between two points 5 cm apart on an equipotential surface?  
Q.5 The distance of the field point on the axis of a small electric dipole is doubled. By what factor will the electric field due to the dipole change?  
Q.6 In a parallel plate capacitor the potential difference of  $10^2 V$  is maintained between the plates. What will be electric field at points A and B.?



- Q.7. A Gaussian surface encloses an electric dipole within it. What is the total flux across sphere? Q.8 What is the angle between the directions of electric field at any (i) axial point and (ii) equatorial point due to an electric dipole?  
Q9. The given graph shows that the variation of charge versus potential difference  $V$  for the two capacitors  $C_1$  &  $C_2$ . The two capacitors have same plate separation but the plate area of  $C_2$  is doubled than that of  $C_1$ .

Which of the line in the graph corresponds to  $C_1$  &  $C_2$  and why?



- Q10. A point charge  $q$  is placed at O as shown in the figure.



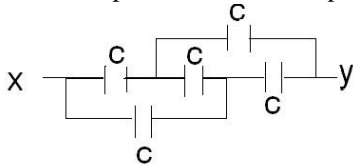
Is  $V_P - V_Q$  +ve or -ve when (i)  $q > 0$ , (ii)  $q < 0$ ? Justify your answer.

- Q11. Why does the electric field inside a dielectric decrease when it is placed in an external electric field?  
Q12. A charged particle is free to move in an electric field. Will it always move along an electric line of force?  
Q13. If  $V (=q/4\pi\epsilon_0 r)$  is the potential at a distance  $r$  due to a point charge  $q$ , then determine the electric field due to a point charge  $q$ , at a distance  $r$ .  
Q14. Draw an arrangement of three point charges separated by finite distances, that has zero electric Potential energy.  
Q15. Charge of  $2C$  is placed at the centre of a cube of volume  $8 \text{ cm}^3$ . What is the electric flux passing through one face? OR  
Three charges, each equal to  $+2C$  are placed at the corners of an equilateral triangle.  
If the force between any two charges be  $F$ , then what will be the net force on either Charge? Q16.  
A charged particle  $q$  is shot towards another charged particle  $Q$  which is fixed, with a speed  $v$ . It

approaches Q up to a closest distance  $r$  and then returns. If  $q$  were given a speed  $2v$ , then find the closest distance of approach.

Q17. Two capacitors of capacitance  $6\text{mF}$  and  $12\text{mF}$  are connected in series with the battery. The voltage across the  $6\text{mF}$  capacitor is  $2\text{ volt}$ . Compute the total battery voltage.

Q18. Five identical capacitors, each of capacitance  $C$  are connected between points X and Y as shown in the figure. If the equivalent capacitance of the combination between X and Y is  $5\text{mF}$ . Calculate the capacitance of each capacitor.

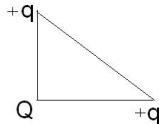


Q19. A parallel plate capacitor with air between the plates has a capacitance of  $8\text{ pF}$ . The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant  $5$ . Calculate the value of capacitance of parallel plate capacitor in second case.

Q20. A uniform electric field of  $2\text{ kNC}^{-1}$  is in the  $x$ -direction. A point charge of  $3\text{ }\mu\text{C}$  initially at rest at the origin is released. What is the kinetic energy of this charge at  $x = 4\text{m}$ ?

Q21. Two identical metal plates are given the charges  $Q_1$  and  $Q_2$  ( $Q_2 < Q_1$ ) respectively. If they are now brought close together to form a parallel plate capacitor with capacitance  $C$  then what is the potential difference between them?

Q22. Three charges  $Q$ ,  $+q$  and  $+q$  are placed at the vertices of a right angle isosceles triangle as shown. Find the magnitude of  $Q$  for which net electrostatic energy of the configuration is zero.



Q23. A charge  $Q$  is distributed over the two concentric hollow spheres of radii ' $r$ ' and ' $R$ ' ( $R > r$ ) such that the surface densities are equal. Find the potential at the common centre.

Q24. An electric dipole is held in a uniform electric field. Using suitable diagram, show that it doesn't undergo any translatory motion, and (ii) Derive an expression for torque acting on it and specify its direction.

Q25. The field potential inside a charged ball depends only on the distance from its centre as

$$V = ar^2 + b, \text{ where } a \text{ and } b \text{ are constants. Find the space charge distribution } \rho(r) \text{ inside the ball.}$$

Q26. Four charges each having charge ' $q$ ' are along  $x$ -axis at  $x=1\text{ cm}$ ,  $x=2\text{ cm}$ ,  $x=4\text{ cm}$ ,  $x=8\text{ cm}$ . Find the electric field at  $x=0$  due to these charges.

OR

A  $4\text{ }\mu\text{F}$  capacitor is charged by a  $200\text{V}$  supply. The supply is then disconnected and the charged capacitor is connected to another uncharged  $2\text{ }\mu\text{F}$  capacitor. How much electrostatic energy of the first capacitor is lost in the process of attaining the steady situation?

Q27. The electric field in a region is radially outward and varies with distance  $r$  as  $E = 250r\text{ Vm}^{-1}$ . Calculate the charge contained in a sphere of radius  $0.2\text{ m}$  centered at the origin.

Q28. How charge given to inner sphere transfers to outer sphere? Name the device where it is used. Explain with diagram working of that device

OR

State Gauss's theorem. Use it to find electric field due infinite line of charge. What is the effect on electric field, when charge density gets double and distance between point and line of charge is half.

Q29 There is an isolated parallel plate capacitor of capacitance  $C$  charged to a potential difference  $V$ . If the separation between the plates is doubled, how the following quantities will vary:

(i) Capacitance

(ii) Potential difference

(iii) Charge on the capacitor (iv)  
Electric field inside the plates (v)  
Energy stored.

OR

What is an electric field? Find an expression for electric field along the axial line of electric field. Give its SI unit.

Q.30 What is an electric polarization of a dielectric? What is the effect on capacitance of a capacitor when a dielectric of width 't' is placed between the two plates of parallel plate capacitor?

OR

What is electric potential? Give its SI unit. Find the expression for the electric potential at any point due to a point charge.