MPVM GANGA GURUKULAM
HOLIDAY HOMEWORK
CLASS – XII SESSION 2020-2021

PHYSICS :

1. Which orientation of an electric dipole in a uniform electric field would correspond stable equilibrium?

2. An electric dipole is held in a uniform electric field.
(i) Show that the net force acting it is zero.
(ii) The dipole is aligned to the field. Find the work done in rotating it through the angle of 180.

3. An early model for an atom considered it to have a positively charged point nucleus of charge Ze, surrounded by a uniform density of negative charge up to a radius R. The atom as a whole is neutral. For this model, what is the electric field at a distance r from the nucleus?

4. (a) Explain the meaning of the statement 'electric charge of a body is quantised'.
(b) Why can one ignore quantisation of electric charge when dealing with macroscopic i.e., large scale charges?

5. 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 andirection of this field?

6. A system has two charges $q_A = 2.5 \times 10^{-7}$ C and $q_B = -2.5 \times 10^{-7}$ C located at points A: (0, 0, – 15 cm) and B: (0,0, +15 cm), respectively.What are the total charge and electric dipole moment of the system?

7. Two insulated charged copper spheres A and B if identical size have charges q_A and q_B respectively. A third sphere C of the same size but uncharged is brought in contact with the first and then in contact with the second and finally removed from both. What are the new charges on A and B?

8. State and prove Gauss's theorem. Apply Gauss's theorem to calculate electric field due to an Infinite plane sheet of charge.

9. Careful measurement of the electric field at the surface of a black box indicates that the net outward flux through the surface of the box is 8.0×10^3 Nm^2/C.
(a) What is the net charge inside the box?
(b) If the net outward flux through the surface of the box were zero, could you conclude that there were no charges inside the box? Why or Why not?

10. A point charge of 2.0 μC is at the centre of a cubic Gaussian surface 9.0 cm on edge. What is the net electric flux through the surface?

11. A point charge causes an electric flux of -1.0×10^3 Nm^2/C to pass through a spherical Gaussian surface of 10.0 cm radius centred on the charge. (a) If the radius of the Gaussian surface were doubled, how much flux would pass through the surface? (b) What is the value of the point charge?

12. An infinite line charge produces a field of 9×10^4 N/C at a distance of 2 cm. Calculate the linear charge density.

13. 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 and of magnitude 17.0×10^{-22} C/m^2. What is **E**: (a) in the outer region of the first plate, (b) in the outer region of the second plate, and (c) between the plates?

14. An oil drop of 12 excess electrons is held stationary under a constant electric field of 2.55×10^4 NC^{-1} in Millikan's oil drop experiment. The density of the oil is 1.26 g cm^{-3}. Estimate the radius of the drop. (g=9.81 m s^{-2}; e=1.60×10^{-19}C).

15. In a certain region of space, electric field is along the z-direction throughout. The magnitude of electric field is, however, not constant but increases uniformly along the positive z-direction, at the rate of 10^5 NC^{-1} per metre. What are the force and torque experienced by a system having a total dipole moment equal to 10^{-7} Cm in the negative z-direction

16. A hollow charged conductor has a tiny hole cut into its surface. Show that the electric field in the hole is $(\sigma/2\varepsilon 0)$ $\hat{\mathbf{n}}$, where $\hat{\mathbf{n}}$ is the unit vector in the outward normal direction, and σ is the surface charge density near the hole.

17. Obtain the formula for the electric field due to a long thin wire of uniform linear charge density λ without using Gauss's law.

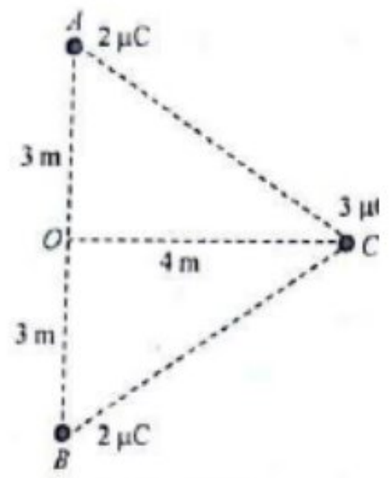
18. Consider an arbitrary electrostatic field configuration. A small test charge is placed at a null point (i.e., where **E** = 0) of the configuration. Show that the equilibrium of the test charge is necessarily unstable.

19. A particle of mass m and charge $(-q)$ enters the region between the two charged plates initially moving along x-axis with speed v_x.The length of plate is L and an uniform electric field E is maintained between the plates. Show that the vertical deflection of the particle at the far edge of the plate is

$qEL^2/(2m\ vx^2)$.

20. Charges of +5 μC , 10 μC and -10 μC are placed in air at the corner A, B and C of an equilateral triangle ABC, having each side equal to 5 cm . Determine the resultant force on the charge A .

21. Two equal positive charges each of 2 μC interact with a third positive charge of 3 μC situated as shown in fig. Find the magnitude and direction of the experience by the charge 3 μC.



22. Five point charge each values q coulomb placed on five vertex of regular hexagon of side 'L' meter. Find magnitude of force on charge –q placed at the centre of hexagon.

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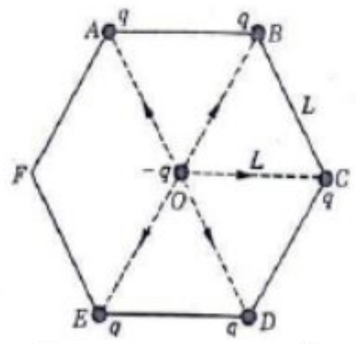

23.A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-29} C m. A mole of this substance is polarised (at low temperature) by applying a strong electrostatic field of magnitude 10^6 V m^{-1}. The direction of the field is suddenly changed by an angle of 60º. Estimate the heat released by the substance in aligning its dipoles along the new direction of the field. For simplicity, assume 100% polarisation of the sample.

24. A charge of 8 mC is located at the origin. Calculate the work done in taking a small charge of -2×10^{-9} C from a point P (0, 0, 3 cm) to a point Q (0, 4 cm, 0), via a point R (0, 6 cm, 9 cm).

25. i) If two similar large plate, each of area A having surface charge densities $+\sigma$ and $-\sigma$ are separated by distance d in air, find the expression for

(a) Field at point between the two plate and on outer side of the plate .Specify the direction of the field In each case .

(b) The potential difference between the plates.

(ii) Two metallic sphere of radii R and 2R are charged so that both of these have same surface surface charge density σ .If they are connected to each other with a conducting wire , in which direction with charge flow and why ?

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