PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA PHYSICS (GUJRATI ENGLISH)

ELECTRIC CHARGES AND FIELDS

Section A Questions Answers

1. Discuss the phenomena experienced due to electrostatics.

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2. Discuss the historical observation of frictional electrics.

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3. From what the name electricity is coined ? Explain its meaning.

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4. Discuss the types of electric charges by rubbing appropriate non-conductors. Which scientists gave their names ?

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5. How can you represent experimentally that (i) there are two types of charges and (ii) there is repulsion between two like charges and attraction between two unlike charges ?

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6. What are positive and negative charges ? Which type of charge does electron have ?

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Section A Questions Answers Higher Order Thinking Skills Hots Unification Of Electricity And Magnetism

1. Which is the instrument to detect the charge on the body ? Explain it with diagram.

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2. Write the activity to make simple electroscope.

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3. How does electroscope work ?

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4. Why does matter obtain electric charge ?

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5. How can the neutral body be charged electrically ?

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6. What is earthing or grounding in household electrical circuit ?

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Section A Questions Answers Conductors And Insulators

1. How conductors and non-conductors are different ? Why are they not charged b rubbing them with our hands ?

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Section A Questions Answers Charging By Induction

1. What is static electrical induction ?

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2. Mention types of methods of charging the body.

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3. How can the neutral body be charged electrically ?

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4. Discuss the method of charging of two spheres by without contact method.

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5. Why the light particles like pith balls attract towards charged rod

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Section A Questions Answers Basic Properties Of Electric Charge

1. What is point charge ?

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Section A Questions Answers Additivity Of Charges

1. What is the meaning of addition of charges?

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2. Give difference between charge and mass.

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Section A Questions Answers Charge Is Conserved

1. Write the law of conservation of charge. Give one example.

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2. What is quantization of charge ? What is the reason of quantization ?

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3. Mention the SI unit and value of fundamental charge. Write its smaller units.

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4. Why can we say that charge of any body is always an integral multiple of e ?

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5. Can we neglect the quantization of charge ? If yes, then mention the situation ?

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Section A Questions Answers Coulomb S Law

1. When the charge is considered as point ?

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2. Write Coulomb's law and explain its scalar form.

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3. How did Coulomb find the law of value of electric force between two point charges ?

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4. Write limitations of Coulomb's law.

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5. By using Coulomb's law, define unit charge.

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6. Explain vector form of Coulomb's law and its importance.

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7. Write some important points for vector form of Coulomb's law.

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Section A Questions Answers Forces Between Multiple Charges

1. Explain the superposition principle for static electric forces and write its general equation.

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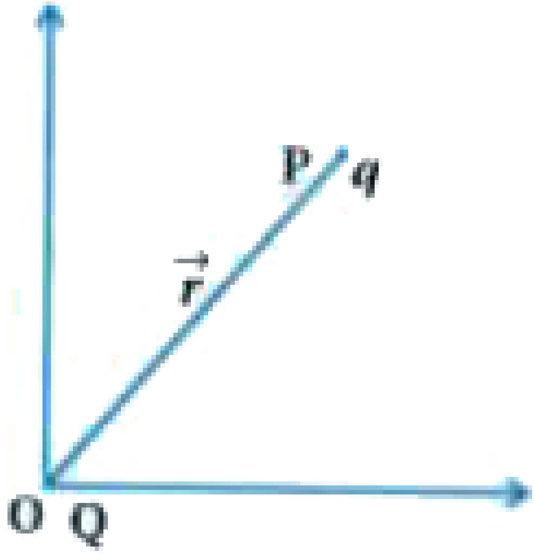
2. Explain electric field and also electric field is point charge.



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3. Mention characteristics of electric field

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4. Obtain the equation of electric field at a point by system of 'n' point charges.

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5. Give physical meaning of electric field.

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Section A Questions Answers Electric Field Lines

1. Explain the electric field lines and the magnitude of electric field.

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2. How field lines depend on area or on solid angle made by area ?

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3. Draw electric field lines of simple charge distribution.

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4. Give characteristics of electric field lines.

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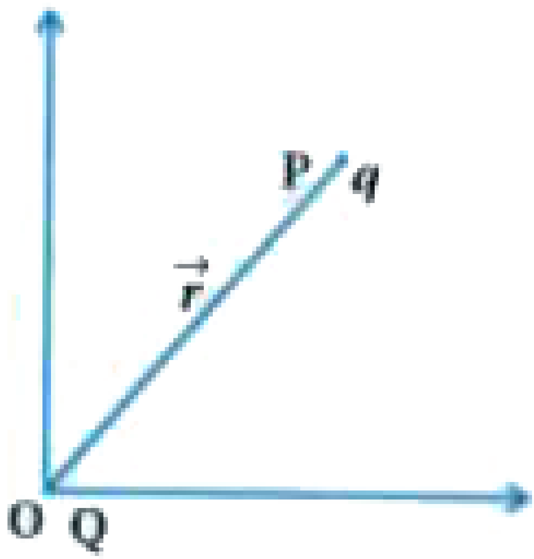
Section A Questions Answers Electric Flux

1. Explain electric field and also electric field is point charge.



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2. When the electric flux associated with closed surface becomes positive, zero or negative ?

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Section A Questions Answers Electric Dipole

1. What is electric dipole ? Write its SI unit.

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Section A Questions Answers The Field Of An Electric Dipole

1. What is point dipole?

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2. From which law and principle electric field by electric dipole can be obtained ?

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3. Obtain the equation of electric field by dipole at a point on axis of dipole.

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4. Obtain the equation of electric field by dipole at a point on equator of dipole.

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Section A Questions Answers Physical Significance Of Dipoles

1. Difference between electric field of point charge and electric field of a dipole.

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Section A Questions Answers Dipole In Uniform External Field

1. What are polar and non-polar molecules ? Give their examples.

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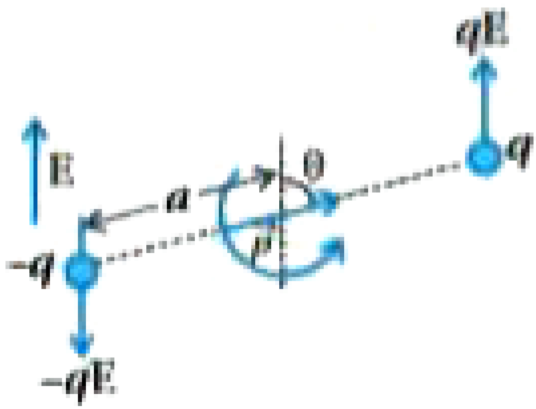
2. Obtain the expression of torque acting on electric dipole in uniform external electric field.



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3. Explain the force acting on electric dipole when it is placed parallel or anti parallel to electric field.

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4. Give reason : "Small and light pieces of papers are attracted by comb run through dry hair

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Section A Questions Answers Continous Charge Distribution

1. Explain linear charge density, surface charg density and volume charge density for uniformly charge distribution.

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2. Obtain the expression of electric field at any point by continuous distribution of charge on a line.

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3. Obtain the expression of electric field at any point by continuous distribution of charge on a surface.

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4. Obtain the expression of electric field at any point by continuous distribution of charge on a volume.

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Section A Questions Answers Gauss S Law

1. Obtain Gauss's law from the flux associated with a sphere of radius r and charge 'q' at centre.

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2. Give reason : "If net flux assocaited with closec surface is zero, then net charge enclosed b that surface is zero."

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3. Discuss some points about Gauss's law.

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Section A Questions Answers Application Of Gauss S Law

1. Mention applications of Gauss's law.

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Section A Questions Answers Field Due To An Infinitely Long Straight Uniformly Charged Wire

1. Obtain the expression of electric field by a straight wire of infinite length and with linear charge density λ.

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Section A Questions Answers Field Due To An Uniformly Charged Infinite Plane Sheet

1. Obtain the expression of electric field by a plane of infinite size and with uniform charge distribution.

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Section A Questions Answers Field Due To A Uniformly Charged Thin Spherical Shell

1. Obtain the expression of electric field by thir spherical shell with uniform charge distribution at a point outside it.

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2. Obtain the expression of electric field by thin spherical shell with uniform charge distribution at a point inside it.

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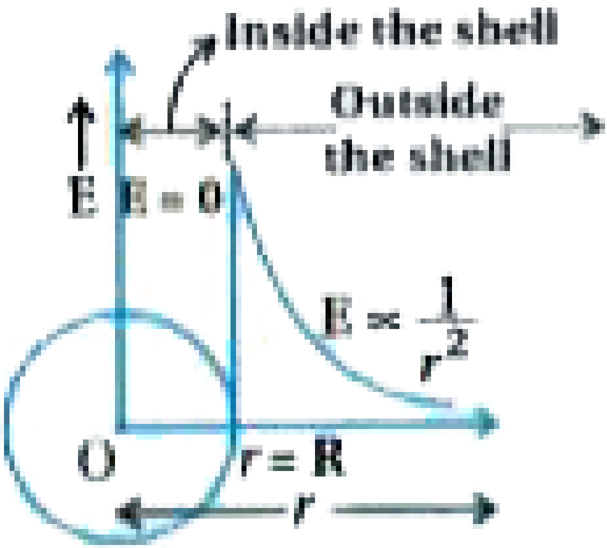
3. Explain by graph how the electric field by thin spherical shell depends on the distance of point from centre.



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4. Obtain the expression of electric field by thir spherical shell with uniform charge distribution at a point outside it.

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5. Obtain Gauss's law from Coulomb's law.

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6. Obtain Coulomb's law from Gauss's law.

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Section A Questions Answers Try Yourself

1. Why spark is seen while removal of synthetic clothes in dark in winter?

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2. What is called electrostatics?

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3. What was found by Thales of Miletus?

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4. What is Greek meaning of electrics?

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5. What is electric charge? Is it scalar or vector?

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6. Which scientist represented the types of charges?

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7. What are called electrically charged and electricially neutral bodies?

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8. What is called polarity of electric charge?

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9. Which is the instrument to detect the charge on the body ? Explain it with diagram.

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10. Why only electron can transfer from one body to another body in frictional electrics ?

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11. What type of charges are obtained on silk cloth and glass rod ?

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12. What are called conductors and non-conductors ?

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13. In which free electrons are more ? Conductor or non-conductor.

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14. Give examples of non-conductors.

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15. Give examples of conductors.

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16. Why the metal rods can't be charged by holding them in hands ?

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17. What is called earthing ?

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18. Give importance of earthing in wiring.

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19. Is the induced charge on the surface of metal or inside it ?

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20. Why charged particle attracts light particles ?

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21. What is called quantization of electric charge ?

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22. Write SI unit of electric charge.

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23. Mention the SI unit and value of fundamental charge. Write its smaller units.

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24. Who represented the quantization of electric charge first and on what basis ?

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25. Write definition of unit Coulomb.

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26. Can we neglect the quantization of charge ? If yes, then mention the situation ?

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27. Write Coulomb's law and explain its scalar form.

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28. Write value of Coulombian constant k in SI unit.

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29. Write limitations of Coulomb's law.

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30. Write expression of Coulombian force acting between two charges kept in medium.

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31. Why Coulombian force is called two body force ?

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32. Why Coulomb's law is associated with Newton's 3rd law ?

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33. Write principle of superposition and explain.

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34. Write general equation of Coulombian force on q_1 by system of charges q_1, q_2 and q_3

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35. What is called electric field ?

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36. What is called electric field intensity ? Write its SI unit.

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37. Write equation of electric field by point charge How does it depend on distance ?

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38. Draw electric field lines of positive charge.

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39. Draw electric field by negative charge.

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40. Write equation of electric field by system of 'n' charges.

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41. Is electric field scalar or vector ? Why ?

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42. Draw electric field lines of positive charge.

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43. What is the direction of electric field intensity ?

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44. How does the electric field lines depend on area ?

Watch Video Solution

45. How does the no. of electric field lines passing

Watch Video Solution

46. Draw electric field lines when two positive charges are near.

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47. Why do electric field lines not form closed loop ?

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48. Why do two electric field lines not intersect each other ?

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49. Give definition of electric flux.

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50. When electric flux is said to be positive, negative or zero ?

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51. Is electric field scalar or vector ? Why ?

Watch Video Solution

52. Write SI unit of electric flux

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53. What is called electric dipole moment ?

Watch Video Solution

54. What is called electric dipole moment ?

Watch Video Solution

55. What is net charge on electric dipole ? Why ?

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56. Mention direction of electric dipole moment.

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57. Write SI unit of electric dipole moment.

Watch Video Solution

58. Obtain the equation of electric field by dipole at a point on axis of dipole.

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59. Obtain the equation of electric field by dipole at a point on equator of dipole.

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60. What are polar and non-polar molecules ? Give their examples.

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61. What are polar and non-polar molecules ? Give their examples.

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62. Mention directions of electric field on axis and on equator by dipole.

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63. What is the force acting on electric dipole in uniform electric field ?

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64. When the torque acting on electric dipole in uniform electric field becomes zero ?

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65. When the torque acting on electric dipole ii uniform electric field becomes maximum ?

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66. Give definition of electric dipole moment by using equation of torque.

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67. What are linear, surface and volume distribution of charge ?

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68. Give SI units of linear surface and volume charge densities.

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69. If volume charge density is p, then what will be the charge on a V volume ?

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70. For what type of charge distribution, electric field can be obtained by using Coulomb's law and superposition principle ?

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71. Write Gauss's law and give its expression.

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72. What can be said for electric charge if electric flux assocaited with closed loop is zero ?

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73. What is called Gaussian surface ?

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Section B Numericals Numerical From Textual Illustrations

1. How can you charge a metal sphere positively without touching it ?

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2. If 10^9 electrons move out of a body to another body every second, how much time is required to get a total charge of 1 C on the other body ?

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3. How much positive and negative charge is there in a cup of water ?

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4. Coulomb's law for electrostatic force between two point charges and Newton's law for gravitational force between two stationary point masses, both have inverse-square dependence on the distance between the charges and masses respectively,

(a) Compare the strength of these forces by determining the ratio of their magnitudes (i) for an electron and a proton and (ii) for two protons.

(b) Estimate the accelerations of electron an proton due to the electrical force of the mutual attraction when they are $= 10^{-10} m$ apart?

$(m_p = 1.67 \times 10^{-27} kg, m_e = 9.11 \times 10^{-31} kg)$

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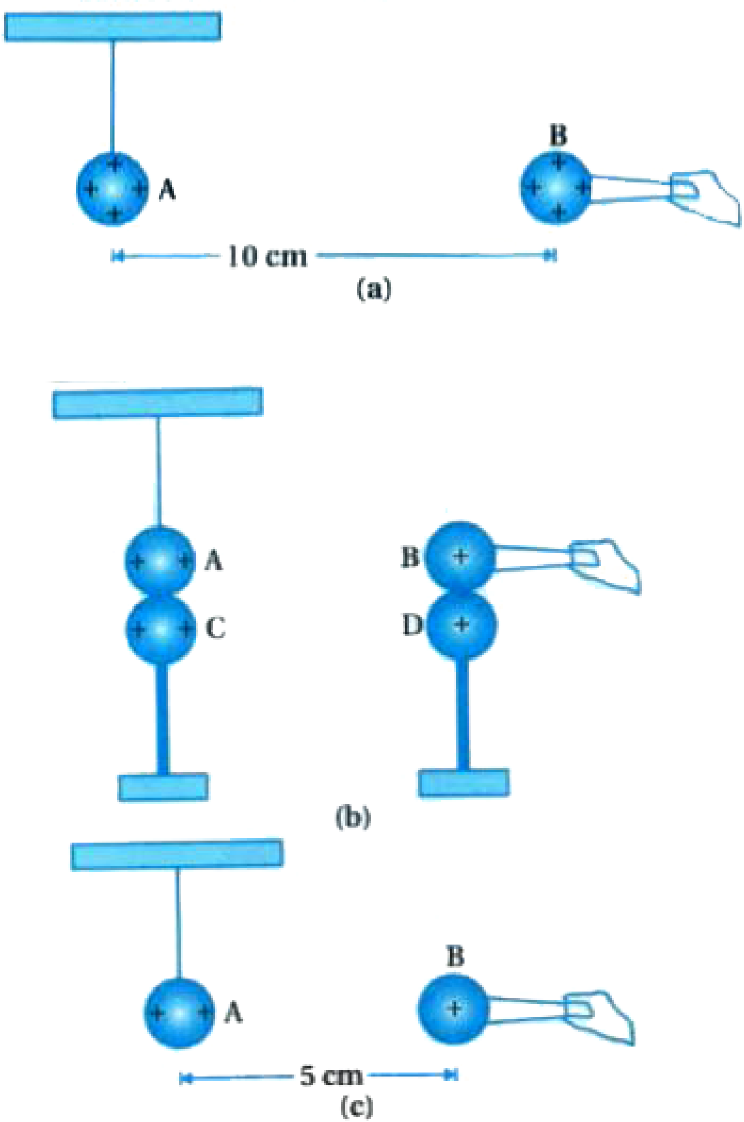
5. A charged metallic sphere A is suspended by a nylon thread. Another charged metallic sphere B held by an insulating handle is brought close to A such that the distance between their centres is 10 cm, as shown in figure (a). The resulting repulsion of A is noted (for example, by shining a beam of light and measuring the deflection of its shadow on a screen). Spheres A and B are touched by uncharged spheres C and D respectively, as shown in figure (b). C and D are then removed and B is brought closer to A to a distance of 5.0 cm between their centres, as shown in figure (c). What is the expected repulsion of A on the basis of Coulomb's law ? Spheres A and C and spheres B and D have identical sizes. Ignore the sizes of A and B in comparison to the separation between their centres.



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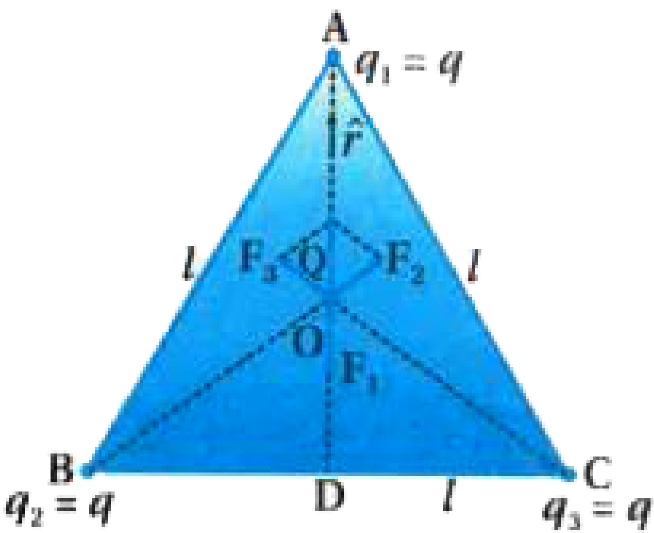
6. Consider three charges q_1, q_2, q_3 each equal to q at the vertices of an equilateral triangle of side l. What is the force on a charge Q (with the same sign as q) placed at the centroid of the triangle, as shown in figure ?



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7. Consider the charges q, q and -q placed at vertices of an equilateral triangle as shown it figure. What is the force on each charge ?

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8. An electron falls through a distance of 1.5cm in a uniform electric field of magnitude $2 \times 10^4 NC^{-1}$. The direction of the field is reversed keeping its magnitude unchanged and a proton falls through the same distance. Compute the time of fall in each case.

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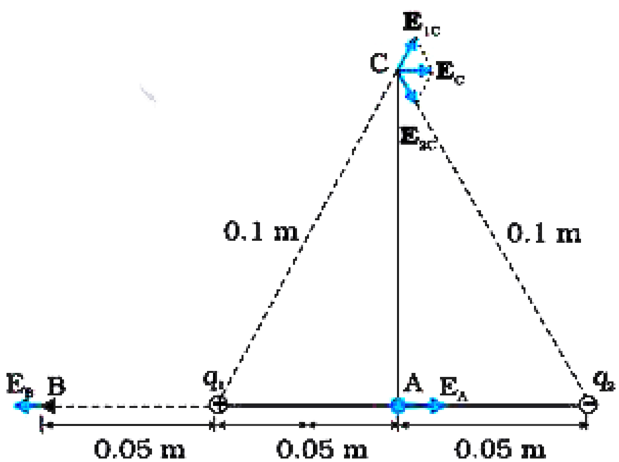
9. Two point charges q_1 and q_2 of magnitude + 10^{-8} c and -10^{-8} c respectively are placed 0.1 m apart calculate the electric fields at points a, b and c



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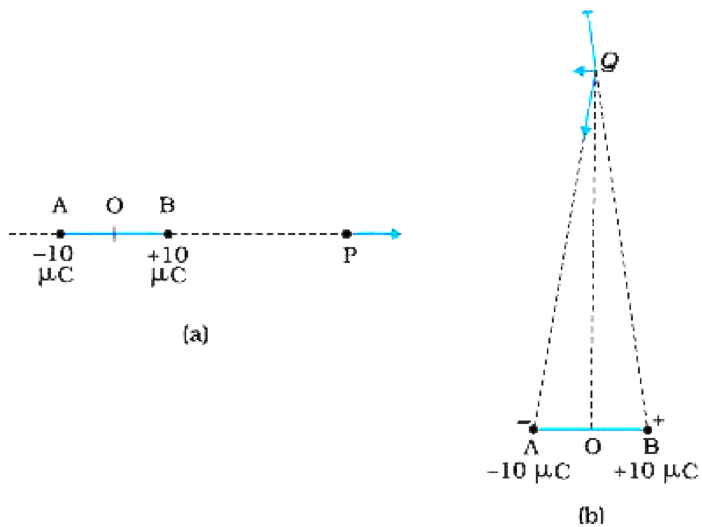
10. Tow charges $\pm 10\mu$ C are placed 5.0 mm apart determine the electric field at (a) a point p on the axis of the dipole 15 cm away from its centre o ont the side of the positive charge as (a) and (b) a point q 15 cm away from o on a line passing through o and normal to the axis of the dipole as



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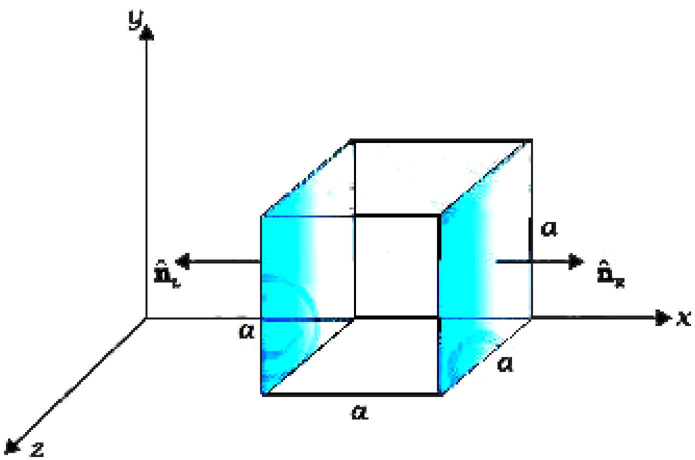
11. The electric field components are $E_x = ax^{-1/2}$, $E_y = E_z = 0$ in which a =800 N/C $m^{1/2}$ calculate (a) the flux through the cube and (b) the charge within the cube asume that a=0.1 m



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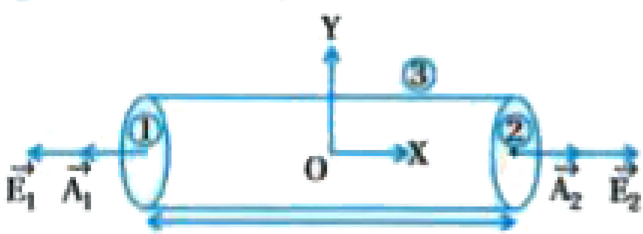
12. An electric field is uniform and in the positive x direction for positive x and uniform with the same magnitude but in the negative x direction for negative x. It is given that $E = 200\hat{i} N / C$ and $E = -200\hat{i}\frac{N}{C}$ for $x < 0$. A right circular cylinder of length 20 cm and radius 5 cm has its centre at the origin and its axis along the *-axis so that one face is at jc = + 10 cm and the other is at x = - 10 cm as shown in figure, (a) What is the net outward flux through each flat face ? (b) What is the flux through the side of the cylinder ? (c) What is the net outward flux through the cylinder ? (d) What is the net charge inside the cylinder ?



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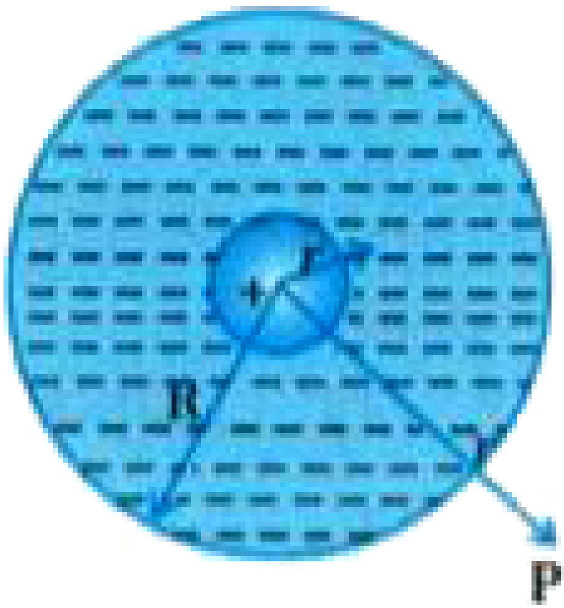
13. An early model for an atom considered it to have a positively charged point nucleus of charge Ze, surrounded by a uniform density of negative charge up to a radius R. The atom as a whole is neutral. For this model, what is the electric field at a distance r from the nucleus ?



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14. How can a metallic sphere be charged negatively without touching it ?

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15. If 10^{10} electrons move out of a body to another body every second, how much time is required to get a total charge of 1 C on the other body ?

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16. How much positive and negative charge is there in a 100 g water ? (Molar mass of water is 18).

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17. Charges on identical spheres A and B are equal. When the separation between them is 1 m, the repulsion between them is 80 N. Now, another identical and uncharged sphere C is brought in contact with A and then separated. Then, C is brought in contact with B and then separated. What will be the new force between A and B ?

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18. $+q, \ +q, \ -q$ and $-q$ are kept at vertices of square ABCD respectively. Find the force acting on Q at centre of square. Side of square is a.

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19. Four equal point charges of $16\mu C$ are kept at vertices of square of side 0.2 m. Find force acting at any one charge.

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20. An electron falls through a distance of 2 cm ir a uniform electric field of magnitude $6.0 \times 10^4 NC^{-1}$ figure (a). The direction of the field is reversed keeping its magnitude unchanged and a proton falls through the same distance figure (b). Compute the time of fall ir each case. Contrast the situation with that oi 'free fall under gravity'.

$m_e = 9.1 \times 10^{-31} kg, m_p = 1.7 \times 10^{-27} kg$

and $e = 1.6 \times 10^{-19}$ C

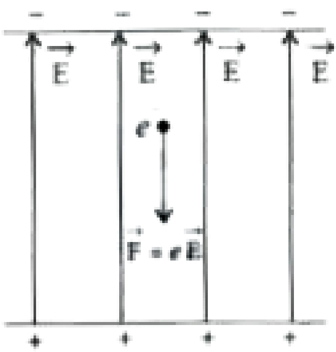

Figure (a)

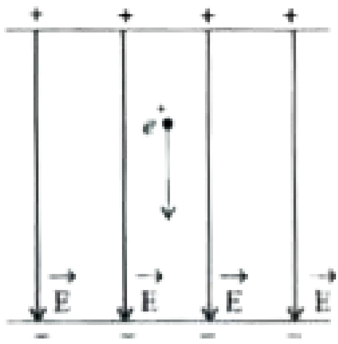

Figure (b)

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21. Two charges of dipole $\pm 10 \mu C$ are placed 1mm apart. Determine the electric field at a point on the axis of the dipole 10 cm away from its centre and at 10 cm away from centre on the equator of the dipole.

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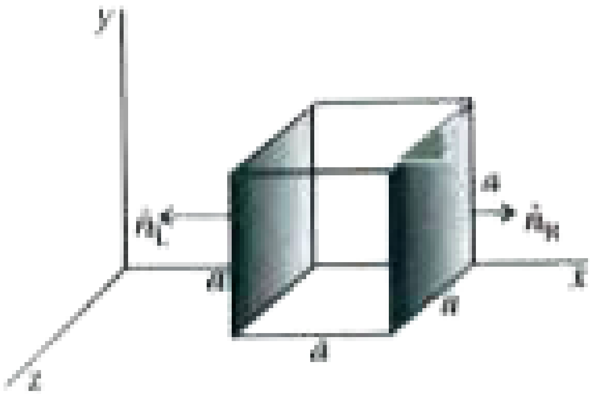
22. The electric field components in figure are $E_x = ax, E_y = E_z = 0$ in which a - 500 N/C m. Calculate (a) the flux through the cube and

(b) the charge within the cube, length of side is a $a = 0.1\text{m}$



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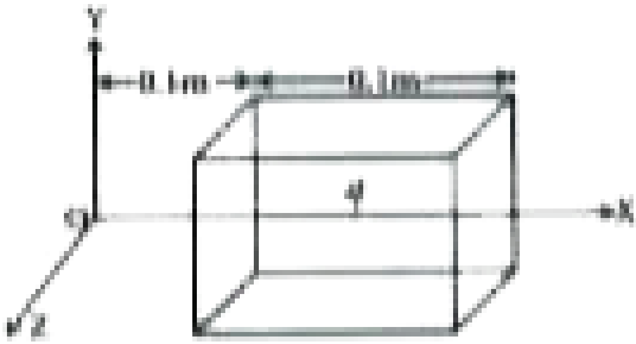
23. If the electric field components due to electric charge in cube shown in figure are $E_x = 600x^{\frac{1}{2}}$ and $E_y = 0$ and $E_z = 0$, then charge within the cube...........



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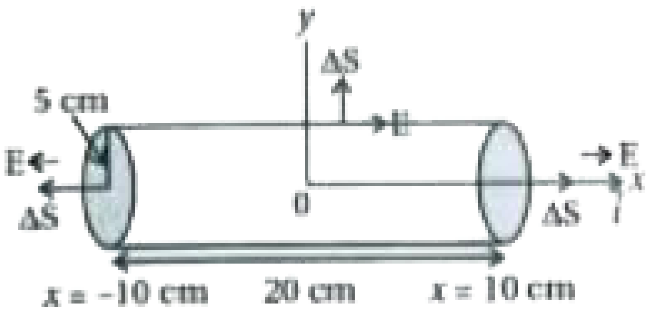
24. A hollow cylinder is kept in 3-dimensional coordinate system of Im length and 25 cm^2 cross sectional area. Electric field in this region is

$\overrightarrow{E} = 50x\hat{i}\frac{N}{C}$ where, x is in m, then find

(i) Net flux in cylinder.

(ii) Net charge enclose by cylinder.



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Section B Numericals Numerical From Textual Exercises

1. What is the force between two small charged spheres having charges of $2 \times 10^{-7} C$ and 3×10^{-7} C placed 30 cm apart in air ?

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2. The electrostatic force on a small sphere of charge $0.4 \mu C$ due to another small sphere of charge -0.8 uC in air is 0.2 N.

(a) What is the distance between the two spheres ?

(b) What is the force on the second sphere due to the first ?

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3. Check that the ratio $\frac{ke^2}{Gm_em_p}$ is dimensionless. Look up a table of physical constants and determine the value of this ratio. What does the ratio signify ?

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4. (a) explain the menaing of the statement electric charge of a body is quantised

(b) why can one ignore quantisation of electric charge when dealing with macrosocpic large scale charges

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5. When a glass rod is rubbed with a silk cloth, charges appear on both. A similar phenomenon is observed with many other pairs of bodies. Explain how this observation is consistent with the law of conservation of charge.

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6. Four point charges $q_A = 2\mu C, q_B = -5\mu C, q_C = 2\mu C,$ and $q_D = -5\mu C$ are located at the corners of a square ABCD of side 10 cm. What is the force on a charge of $1\mu C$ placed at the centre of the square ?

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7. (a) An electrostatic field line is a continuous curve. That is, a field line cannot have sudden breaks. Why not ?

(b) Explain why two field lines never cross each other at any point ?

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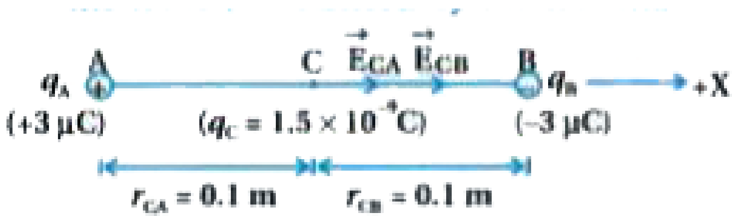
8. Two point charges $q_A = 3\mu C$ and $q_B = -3\mu C$ are located 20 cm apart in vacuum.

(a) What is the electric field at the midpoint O of the line AB joining the two charges ?

(b) If a negative test charge of magnitude 1.5×10^{-9} C is placed at this point, what is the force experienced by the test charge ?



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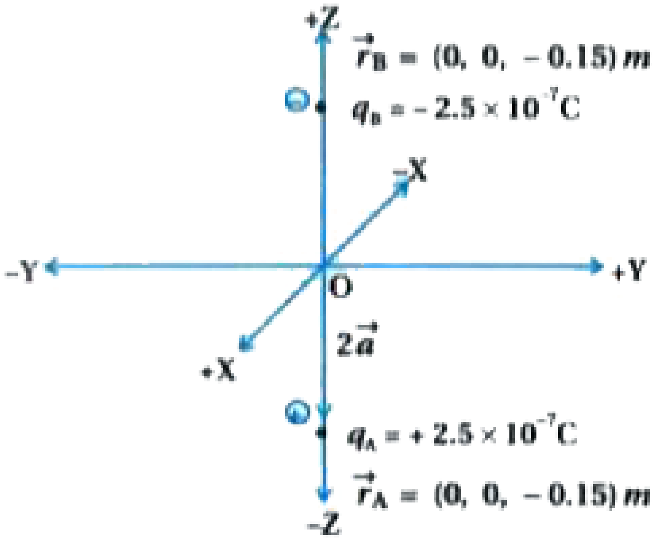
9. A system has two charges $q_A = 2.5 \times 10^{-7}$ C and $q_B = -2.5 \times 10^{-7}$ C located at points

A:(0, 0, -15 cm) and B : (0, 0, + 15 cm), respectively. What are the total charge and electric dipole moment of the system ?



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10. An electric dipole with dipole moment 4×10^{-9} Cm is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^4 NC^{-1}$. Calculate the magnitude of the torque acting on the dipole.

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11. A polythene piece rubbed with wool is found to have a negative charge of 3×10^{-7} C.

(a) Estimate the number of electrons transferred (from which to which ?)

(b) Is there a transfer of mass from wool to polythene ?

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12. (a) Two insulated charged copper spheres a and b have their centres separated by a distance of 50 cm what is the nutual force of electrostatic repulsion if the charge on each is 6.5×10^{-7} c the radii of a and b negligible compared to the distance of separation

(b) what is the force of repuslion if each spere is charged double the above amount andf the distance between them is haved

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13. Suppose the spheres A and B in Exercise 1.12 have identical sizes. A third sphere of the same size but unchanged is brought in contact with the first , then brought in contact with the second, and finally removed from both. What is the new force of repulsion between A and B ?

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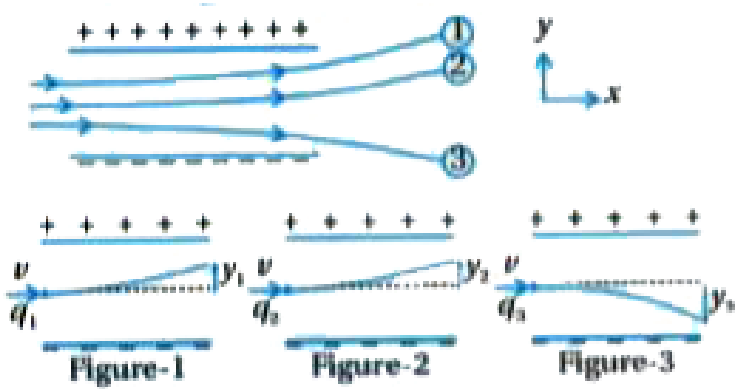
14. Figure shows tracks of three charged particles in a uniform electrostatic field. Give the signs of the three charges. Which particle

has the highest charge to mass ratio ?



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15. Consider a uniform electric field E=$3 \times 10^{3}\hat{i}$ N/C (a) what is the flux of this field thriought a square of 10 cm on a side whose plane is parallel to the yz plane (b) hwhat is the flux through the same a 60° m angle with the x axis

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16. What is the net flux of the uniform electric field of exercise through a cube of side 20 cm oriented so that its faces are parallel to the coordinate planers

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17. 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 $8.0 \times 10^3 Nm^2 / C$.

(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 ?

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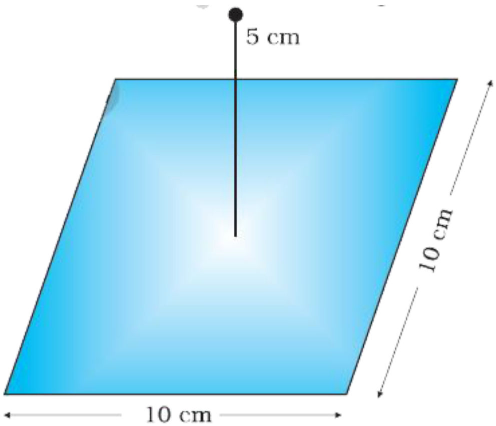
18. A point charge $+\mu$ c is a distance 5 cm directly above the centre of a square of side 10 cm as what is the magnitude of the electric flux through the square



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19. A point charge of $2.0\mu C$ is at the centre of a cubic Gaussian surface 9.0 cm on edge. What is the net electric flux through the surface ?

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20. A point charge causes an elelctric flux of $-1.0 \times 10^3 N\frac{m^2}{C}$ to pass through a spherical gaussioan of 10.0 cm radius centred on the charge (a) if the radius of the gaussian surface wrere doubled how much flux would pas through the surface (b) what is the value of the point charge

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21. A conducting sphere of radius 10 cm has an unknown charge if the electric field 20 cm from the centre of the sphere is 1.5×10^3 N/C and points radialy inward what is the net charge on the sphere

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22. A uniformly charged conducting sphere of 2.4 m diameter has a (a) find the charge on the sphere (b) what is the total eletric fluxd leaving the surface of the sphere

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

Watch Video Solution

24. Two large thin metal plates are parallel and close to each other on their inner faces the plates have surface charges densites of opposite region of the first plate (b) in the outer region of the second plate and (c) between the plates

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Section B Numericals Additonal Exercise

1. An oil drop of 12 excess electrons is held stationary under a constant electric field of $2.55 \times 10^4 NC^{-1}$. (Millikan's oil drop experiment). The density of the oil is $1.26 gcm^{-3}$. Estimate the radius of the drop, $\left(g = 9.81 ms^{-2}, e = 1.60 \times 10^{-19C}\right)$.

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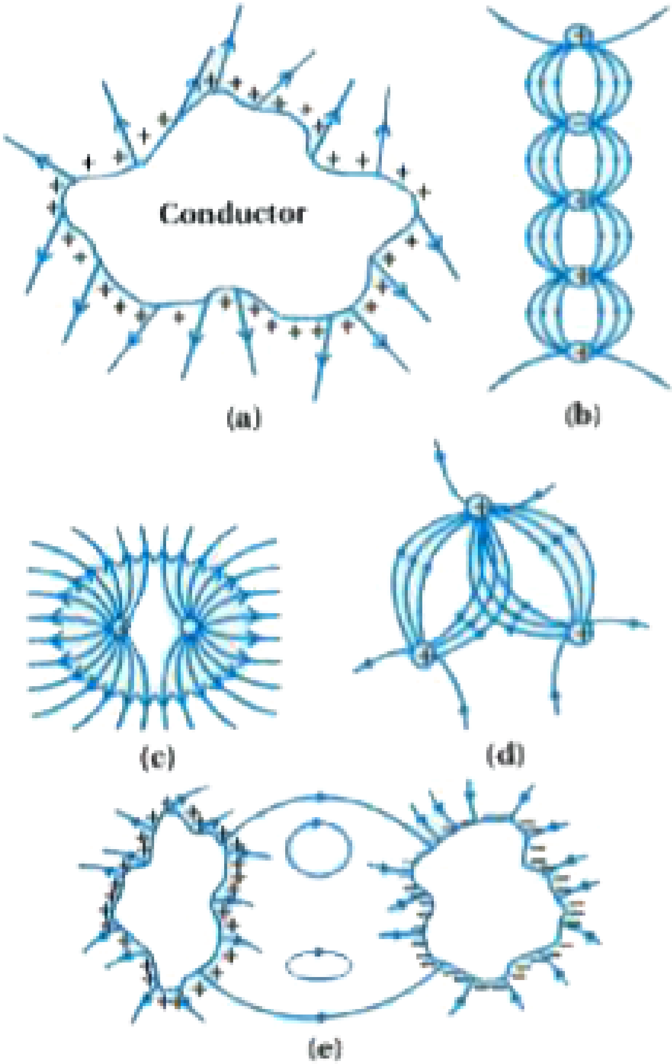
2. Which among the curves shown in figure cannot possibly represent electrostatic field lines ?



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3. 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 meter. 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 ?

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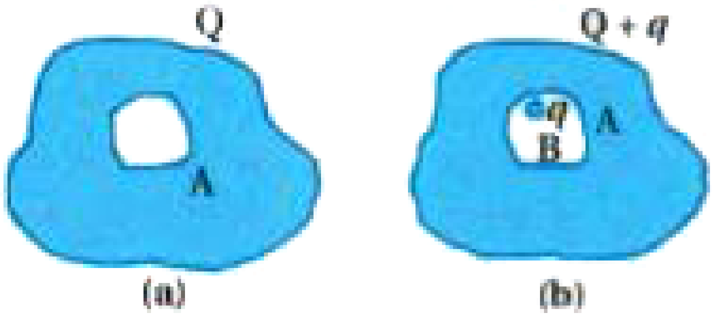
4. (a) A conductor A with a cavity as shown in figure (a) is given a charge Q. Show that the entire charge must appear on the outer surface of the conductor.

(b) Another conductor B with charge q is inserted into the cavity keeping B insulated from A. Show that the total charge on the outside surface of A is $Q+q$ figure (b)

(C) A sensitive instruments is to be shielded from the strong electrostatic fields in its environment. Suggest a possible way.



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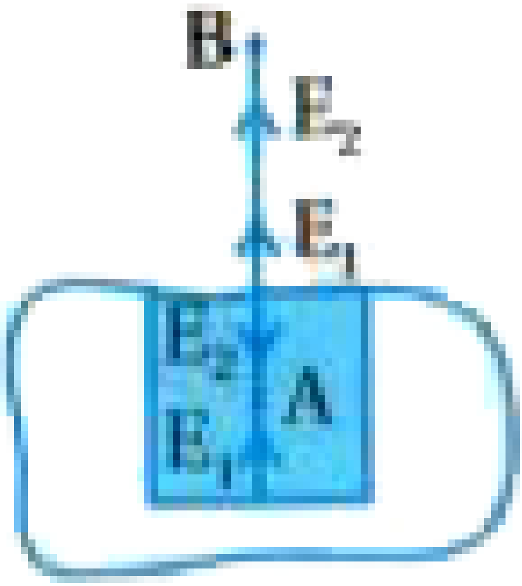
5. A hollow charged conductor has a tiny hole cut into its surface. Show that the electric field in the hold is $\frac{\sigma}{2\pi\varepsilon_0}\hat{n}$ where $\hat{n}$ is the unit vector in the outward normal direction, and a is the surface charge density near the hole.



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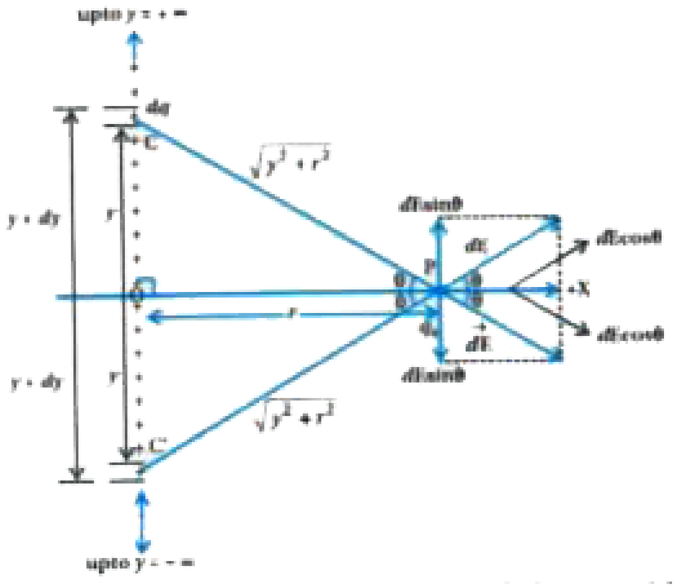
6. Obtain the formula for the electric field due to a long thin wire of uniform linear charge density E without using Gauss's law. (Hint: Use

Coulomb's law directly and evaluate the necessary integral.)



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7. It is now believed that protons and neutrons (which constitute nuclei of ordinary matter)

are themselves built out of more elementary units called quarks. A proton and a neutron consist of three quarks each. Two types of quarks, the so called 'up' quark (denoted by u) of charge $+\frac{2}{3}$e and the down quark denoted by d) of charge $\left(-\frac{1}{3}e\right)$, together with electrons build up ordinary matter. (Quarks of other types have also been found which give rise to different unusual varieties of matter.) Suggest a possible quark composition of a proton and neutron.

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8. (a) 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.

(b) Verify this result for the simple configuration of two charges of the same magnitude and sign placed a certain distance apart.

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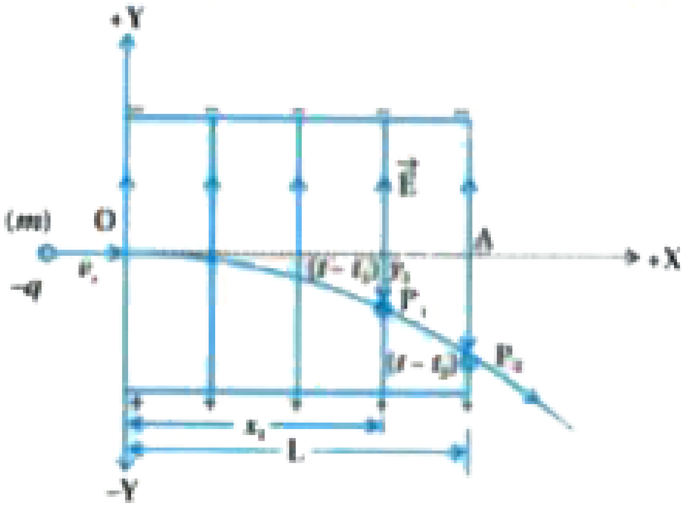
9. A particle of mass m and charge (-q) enters the region between the two charged plates initially moving along x-axis with speed v_x (like particle 1 in figure. The length of plate is L and an uniform electric field E is maintained between the plates. Show that the vertical deflection of the particle at the far edge of the plate is $qEL^2 / \left(2mv_x^2\right)$.

Compare this motion with motion of a projectile in gravitational field discussed in

Section 4.10 of Class XI Textbook of Physics.



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10. Suppose that the particle in Exercise in 1.33 is an electron projected with velocity $v_x = 2.0 \times 10^6 ms^{-1}$. If E between the plates separated by 0.5 cm is 9.1×10^2 N/C, where will the electron strike the upper plate ?

$$(|e| = 1.6 \times 10^{-19} C, m_e = 9.1 \times 10^{-31} kg)$$

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Section B Numericals Numerical For Darpan Based On Textbook

1. Two spheres of copper, having mass 1 g each, are kept 1 m apart. The number of electrons in them are 1 % less than the number of protons. The electrical force between them is Atomic wt. of copper is 63.54 g/mol, atomic number is 29, Avogadro's number $N_A = 6.023 \times 10^{23} mol^{-1}$ and $k = 9 \times 10^9$ SI

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2. Charge Q is uniformly distributed over a body. How should the body be divided into two parts, so that force acting between the two parts of body is maximum for a separation between them ?

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3. A circle, having radii 'a' has line charge distribution over its circumference having linear charge density $\lambda = \lambda_0 \cos^2 \theta$. Calculate the total electric charge residing on the circumference of the circle.

[Hint: $\int_0^{2\pi} \cos^2 d\theta = \pi$]

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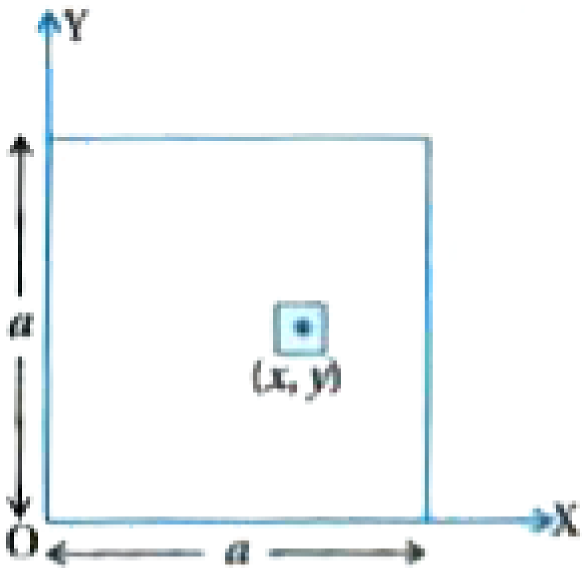
4. As shown in the figure a square having length a has electric charge distribution of surface charge density $\sigma = \sigma_0 xy$. The total electric charge on the square will be......(The cartesian coordinate system is shown in figure.)



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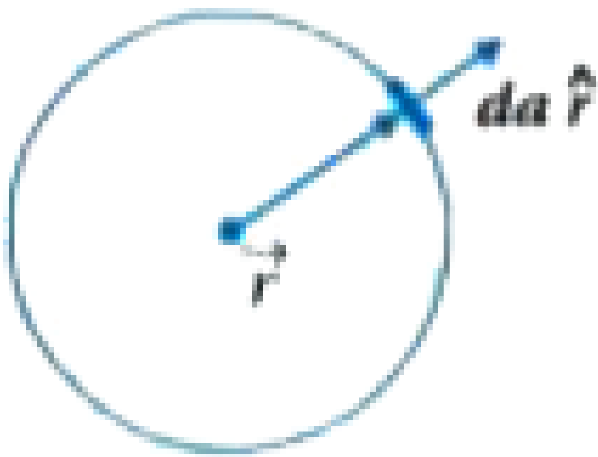
5. An electric field prevailing in a region depends only on x and y coordinates according to an equation $\vec{E} = b\frac{x\hat{i} + y\hat{j}}{x^2 + y^2}$ where & is a constant. Flux passing through a sphere of radius r whose centre is on the origin of the coordinate system is..............



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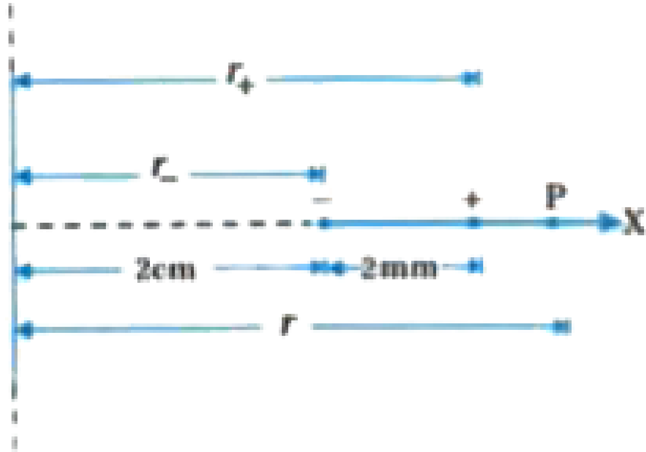
6. An electric dipole is prepared by taking two electric charges of 2×10^{-8} C separated by distance 2 mm. This dipole is kept near a line charge distribution having density 4×10^{-4} C/m in such a way that the negative electric charge of the dipole is at a distance 2 cm from the wire as shown in the figure. Calculate the force acting on the dipole.

[Take $k = \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2C^{-2}$]



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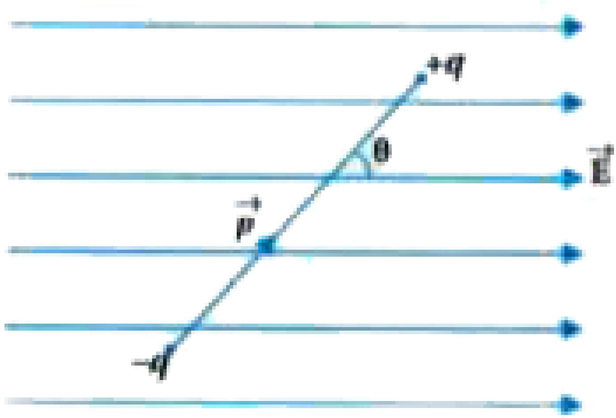
7. An electric dipole of momentum $\vec{p}$ is placed in a uniform electric field. The dipole is rotated through a very small angle θ from equilibrium and is released. It executes simple harmonic motion with frequency $f = \frac{1}{2\pi}\sqrt{\frac{pE}{I}}$ where,

I= moment of interia of the dipole.



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8. In the hydrogen atom, an electron revolve around a proton in a circular orbit of radiu 0.53 A. The radial acceleration and the angular velocity of the electron are......and............

$(m_e = 9.1 \times 10^{-31} kg, e = 1.6 \times 10^{-19}$C)

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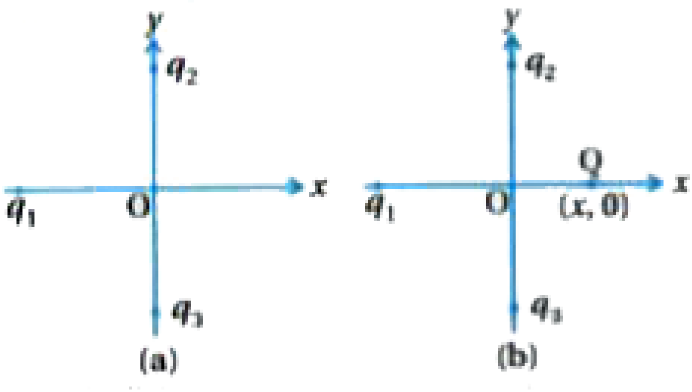
Section C Ncert Exemplar Solution Multiple Choice Questions Mcqs

1. In figure, two positive charges q_2 and q_3 fixed along the y-axis, exert a net electric force in the + x direction on a charge q_1 fixed along the x-axis. If a positive charge Q is added at (x, 0), the force on q_1



A. shall increase along the positive x-axis.

B. shall decrease along the positive x-axis

C. shall point along the negative x-axis.

D. shall increase but the direction changes

because of the intersection of Q with q_2

and

Answer: A

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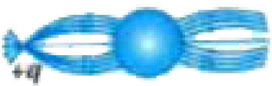
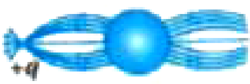
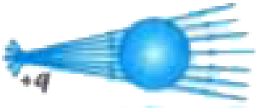
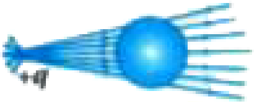
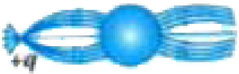
2. A point positive charge is brought near an isolated conducting sphere as shown in figures. The electric field is best given by:

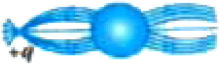
(i) 

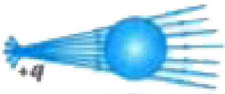
(ii) 

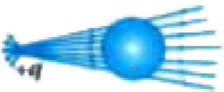
(iii) 

(iv) 

A. 

B. 

C. 

D. 

Answer: A

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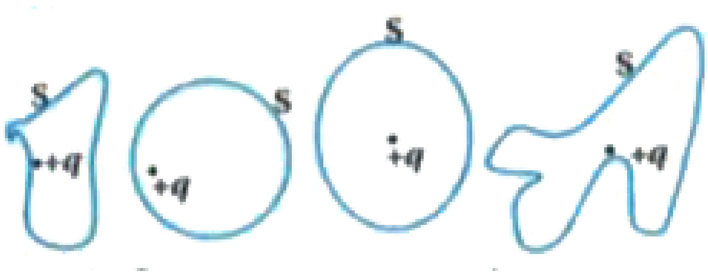
3. The Electric flux through the surface:



A. (A) in figure (iv) is the largest.

B. (B) in figure (iii) is the least.

C. (C) in figure (ii) is same as figure (iii) but

is smaller than figure (iv).

D. (D) is the same for all the figures.

Answer: D

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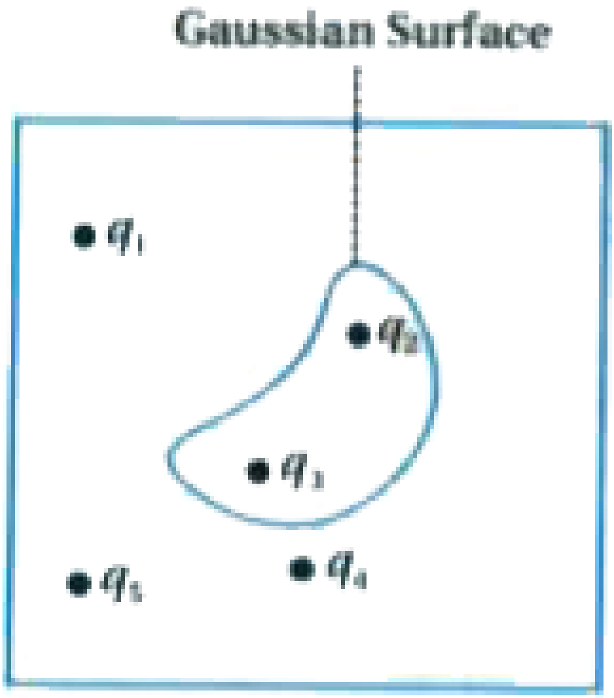
4. Five charges $q_1 q_2, q_3, q_4$, and q_5 are fixed at their positions as shown in figure. S is a Gaussian surface. The Gauss's law is given by $\int_S \overrightarrow{E} \cdot \overrightarrow{ds} = \frac{q}{\varepsilon_0}$. Which of the following

statements is correct?



A. $\vec{E}$ on the LHS of the above equation will have a contribution from q_1, q_5 and q_3 while q on the RHS will have a contribution from q_2 and q_4 only.

B. $\overrightarrow{E}$ on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_2 and q_4 only.

C. $\overrightarrow{E}$ on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_1, q_3 and q_5 only.

D. Both $\overrightarrow{E}$ on the LHS and q on the RHS will have contributions from q_2 and q_4

only.

Answer: B

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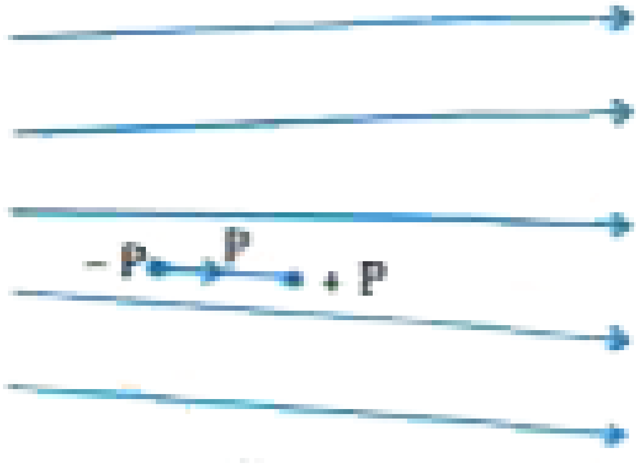
5. Figure shows electric field lines in which an electric dipole P is placed as shown. Which of the following statements is correct ?



A. The dipole will not experience any force.

B. The dipole will experience a force toward right

C. The dipole will experience a force toward left

D. The dipole will experience a force upwards

Answer: C

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6. A point charge +q, is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is

A. directed perpendicular to the plane and away from the plane.

B. directed perpendicular to the plane but towards the plane.

C. directed radially away from the point charge.

D. directed radially towards the point charge.

Answer: A

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7. A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed

A. perpendicular to the diameter

B. parallel to the diameter

C. at an angle tilted towards the diameter

D. at an angle tilted away from the diameter

Answer: A

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Section C Ncert Exemplar Solution Multiple Choice Questions More Than One Option

1. If $\oint_s \overrightarrow{E} \, . \, \overrightarrow{d} \, S = 0$ over a surface, then

A. the electric field inside the surface and on it is zero.

B. the electric field inside the surface is necessarily uniform.

C. the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

D. all charges must necessarily be outside the surface.

Answer: C::D

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2. The Electric field at a point is

A. always continuous.

B. continuous if there is no charge at that point.

C. discontinuous only if there is a negative charge at that point.

D. discontinuous if there is a charge at that point.

Answer: B::D

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3. If there were only one type of charge in the universe, then

A. $\oint_S \overrightarrow{E} . d\overrightarrow{S} \neq 0$ on any surface

B. $\oint_s \overrightarrow{E} . d\overrightarrow{S} = 0$ if the charge is outside the surface,

C. $\oint_s \overrightarrow{E} . d\overrightarrow{S}$ could not be defined

D. $\oint_S \overrightarrow{E} . d\overrightarrow{S} = \frac{q}{\varepsilon_0}$ if charges of magnitude q were inside the surface.

Answer: C::D

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4. Consider a region inside which there are various types of charges but the total charge is zero. At points outside the region

A. the electric field is necessarily zero.

B. the electric field is due to the dipole moment of the charge distribution only.

C. the dominant electric field is $\propto \frac{1}{r^3}$ for large r, where r is the distance from a origin in this region.

D. the work done to move a charged particle along a closed path, away from the region, will be zero.

Answer: C::D

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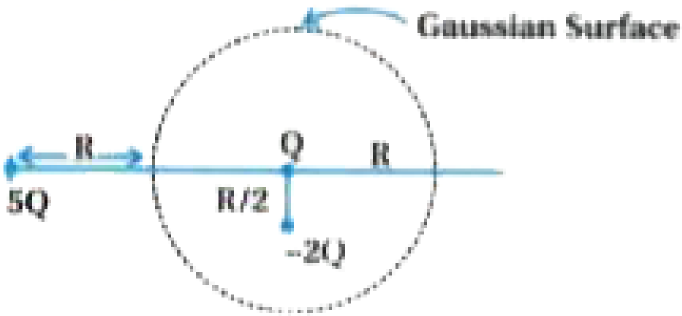
5. Refer to the arrangement of charges in shown figure and a Gaussian surface of radius R with Q at the centre. Then:



A. total flux through the surface of the sphere is $\frac{-Q}{4\pi\varepsilon_0 R^2}$

B. field on the surface of the sphere is

C. flux through the surface of sphere due to 5Q is zero.

D. field on the surface of sphere due to -2Q is same everywhere.

Answer: A::C

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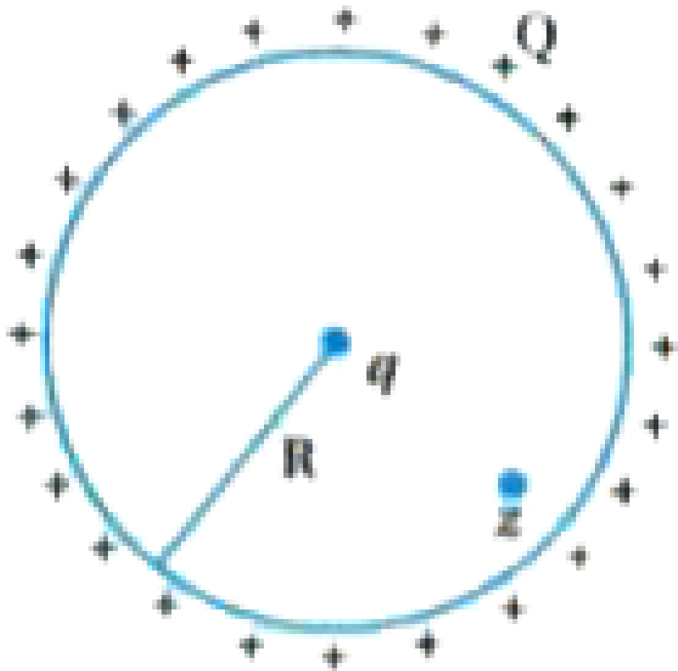
6. A positive charge Q is uniformly distribut along a circular ring of radius R. A small tc charge q is placed at the centre of the ring per figure, Then



A. If q gt 0 and is displaced away from th

centre in the plane of the ring, it will b

pushed back towards the centre.

B. If q lt 0 and is displaced away from the centr in the plane of the ring, it will never return ti the centre and will continue moving till I hits the ring.

C. If q lt 0, it will perform SHM for smai displacement along the axis.

D. q at the centre of the ring is in an unstabh equilibrium within the plane of the ring fo q gt 0

Answer: A::B::C

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Section C Ncert Exemplar Solution Very Short Answer Type Questions

1. An arbitrary surface encloses a dipole. What is the electric flux through this surface ?

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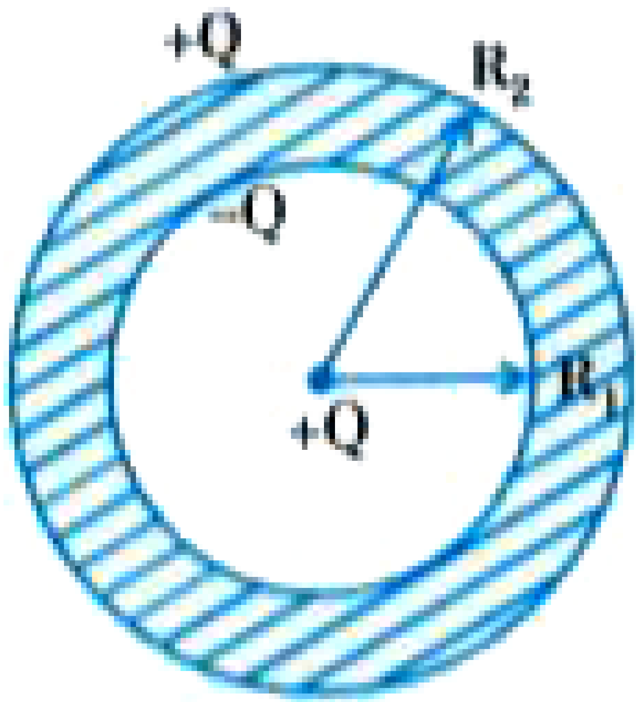
2. A metallic spherical shell has an inner radius R j and outer radius R_2. A charge Q is placed at the centre of the spherical cavity. What will be surface charge density on (i) the inner surface, and (ii) the outer surface ?



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3. The dimensions of an atom are of the order of an Angstrom. Thus there must be large electric fields between the protons and electrons. Why, then is the electrostatic field inside a conductor zero ?

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4. If the total charge enclosed by a surface is zero, does it imply that the electric field everywhere on the surface is zero ? Conversely, if the electric field everywhere on a surface is zero, does it imply that net charge inside is zero.

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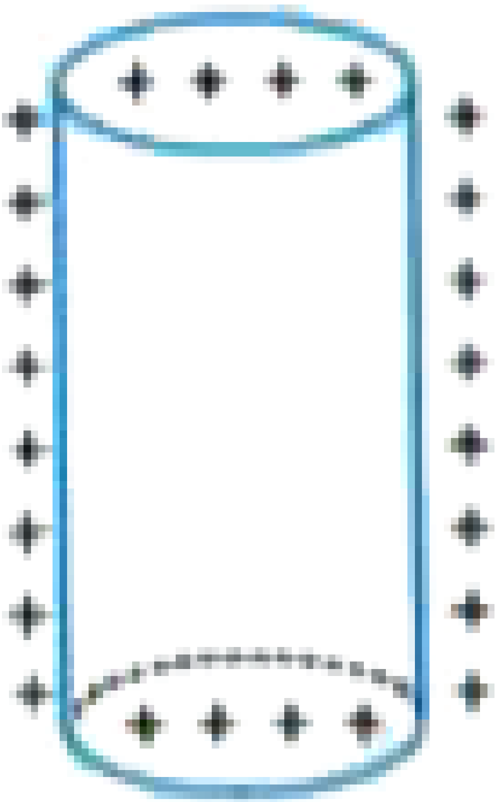
5. Sketch the electric field lines for a uniformly charged hollow cylinder shown in figure.



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6. What will be the total flux through the faces of the cube as in figure with side of length a if

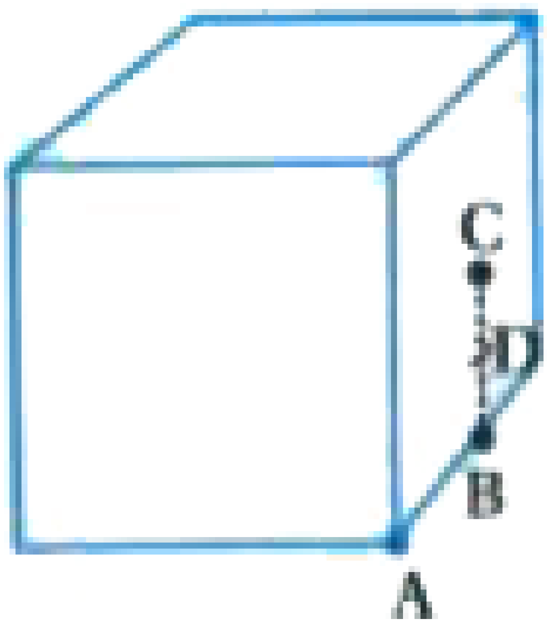
a charge q is placed at ?

(a) A: a corner of the cube.

(b) B : midpoint of an edge of the cube.

(c) C: centre of a face of the cube.

(d) D : midpoint of B and C.



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Section C Ncert Exemplar Solution Short Answer Type Questions

1. A paisa coin is made up of Al-Mg alloy and weighs 0.75 g. It has a square shape and its diagonal measures 17 mm. It is electrically neutral and contains equal amounts of positive and negative charges.

Treating the paisa coins made up of only Al, find the magnitude of equal number of positive and negative charges. What conclusion do you draw from this magnitude ?

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2. Consider a coin of Question 20. It is electrically neutral and contains equal amounts of positive and negative charge of magnitude 34.8 kC. Suppose that these equal charges were concentrated in two point charges separated by:

(i) 1 cm $\left(-\frac{1}{2}\right) \times$ displacement of the one paisa coin)

(ii) 100 m (-length of a long building)

(iii) 10^6 m (radius of the earth).

Find the force on each such point charge in each of the three cases. What do you conclude from these results ?

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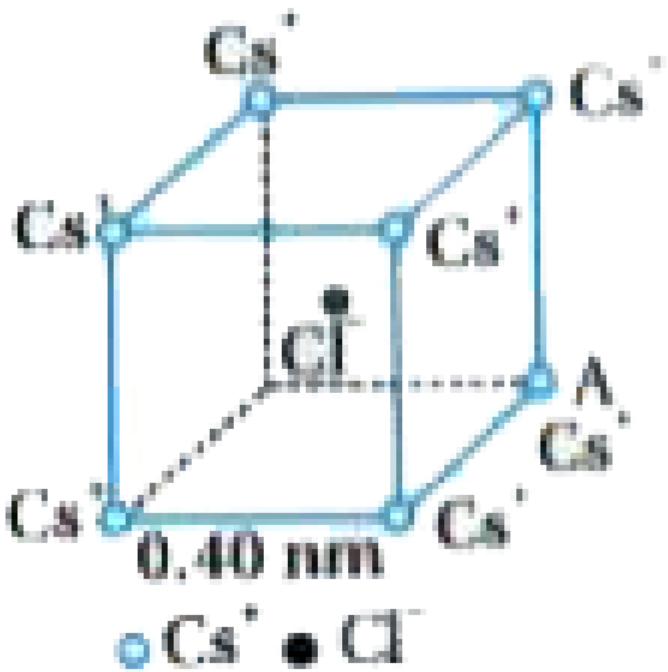
3. Figure represents a crystal unit of cesium chloride, CsCl. The cesium atoms, represented by open circles are situated at the corners of a cube of side 0.40nm, whereas a Cl atom is situated at the centre of the cube. The Cs atoms are deficient in one electron while the

Cl atom carries an excess electron.

(i) What is the net electric field on the Cl atom due to eight Cs atoms ?

(ii) Suppose that the Cs atom at the corner A is missing. What is the net force now on the Cl atom due to seven remaining Cs atoms ?



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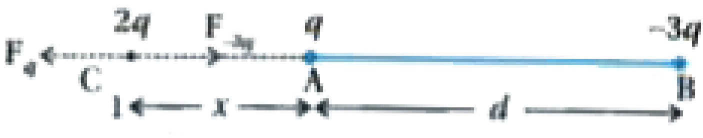
4. Two charges q and - 3q are placed fixed on x-axis separated by distance'd'. Where should a third charge 2q be placed such that it will not experience any force ?



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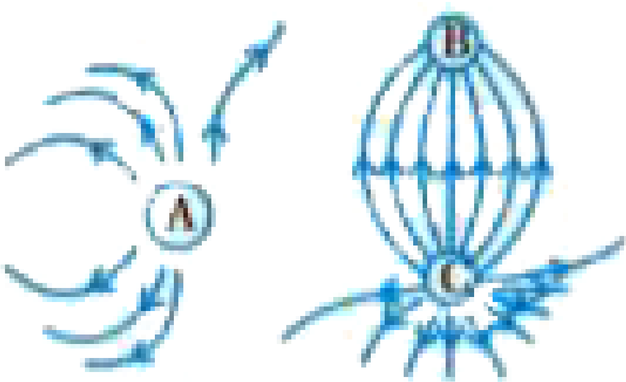
5. Figure shows the electric field lines around three point charges A, B and C.



(a) Which charges are positive ?

(b) Which charge has the largest magnitude ? Why ?

In which region or regions of the picture could the electric field be zero ? Justify your answer.

(i) Near A, (ii) Near B

(iii) Near C, (iv) Nowhere

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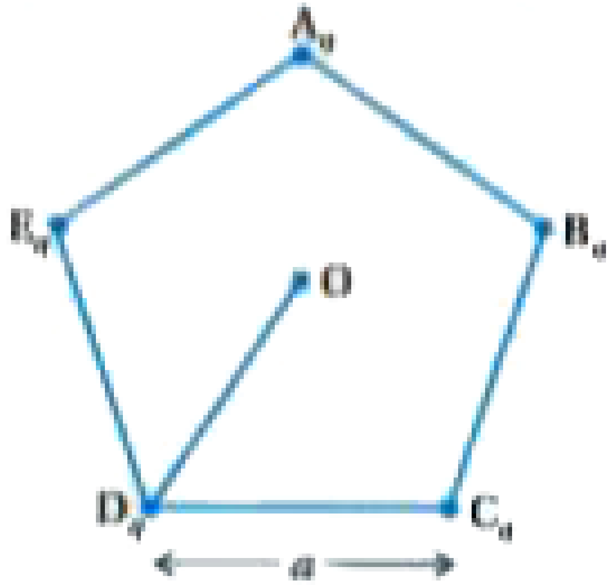
6. Five charges, q each are placed at the corners of a regular pentagon of side 'a' as in figure:



(a) (i) What will be the electric field at O, the centre of the pentagon ?

(ii) What will be the electric field at O if the charge from one of the corners (say A) is removed ?

(iii) What will be the electric field at O if the charge q at A is replaced by -q ?

(b) How would your answer to (a) be affected if pentagon is replaced by n-sided regular polygon with charge q at each of its corners ?

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Section C Ncert Exemplar Solution Long Answer Type Questions

1. In 1959 Lyttleton and Bondi suggested that the expansion of the Universe could be explained il matter carried a net charge.

Suppose that the Universe is made up of hydrogen atoms with a number density N, which is maintained a constant. Let the charge on the proton be : $e_p = -(1+y)e$ where e is the electronic charge.

(a) Find the critical value of y such that expansion may start.

(b) Show that the velocity of expansion is proportional to the distance from the centre.

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2. Consider a sphere of radius R with charge density distributed as :

$\rho(r) = kr, r \leq R$

$= 0$ for $r > R$

(a) Find the electric field at all points r.

(b) Suppose the total charge on the sphere is 2e where e is the electron charge. Where can two protons be embedded such that the force on each of them is zero. Assume that the introduction of the proton does not alter the negative charge distribution.

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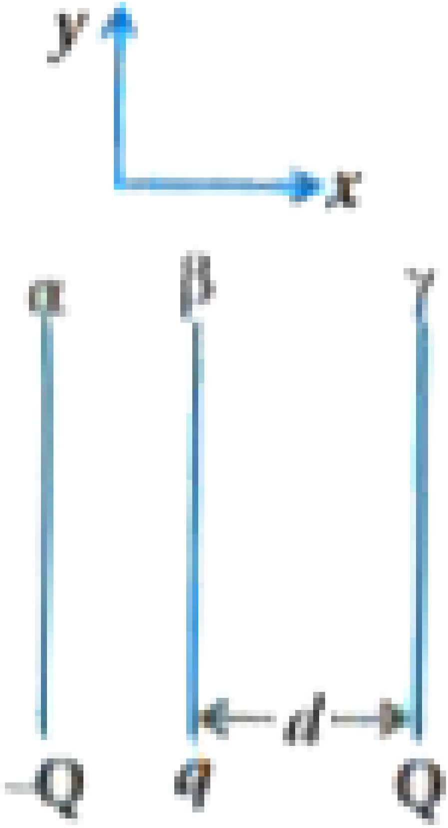
3. Two fixed, identical conducting plates (a and (3), each of surface area S are charged to - Q and q, respectively, where Q > q > 0. A third identical plate (λ), free to move Is located on the other side of the plate with charge q at a distance d as per figure. The third plate is released and collides with the plate f_3 . Assume the collision is elastic and the time of collision is sufficient to redistribute charge amongst β and γ.



(a) Find the electric field acting on the plate γ before collision.

(b) Find the charges on β and γ after the collision.

(c) Find the velocity of the plate γ after the collision and at a distance d from the plate β

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4. There is another useful system of units, besides the SI/mKs. A system, called the cgs (centimeter-gram-second) system. In this system Coloumb's law is given by $\overrightarrow{F} = \frac{Qq}{r^2} . \hat{r}$ where the distance is measured in cm (=10^{-2} m), F in dynes (=10^{-5} N) and the charges in electrostatic units (es units), where 1 es unit of charge $\frac{1}{3} \times 10^{-9}C$.

The number [3] actually arises from the speed of light in vacuum which is now taken to be exactly given by $c = 2.99792458 \times 10^{8}$ m/s. An approximate value of c then is $c = [3] \times 10^{8}$ m/s.

(i) Show that the coloumb law in cgs units yields 1 esu of charge = 1 (dyne) 1/2 cm. Obtain the dimensions of units of charge in terms of mass M, length L and time T. Show that it is given in terms of fractional powers of M and L.

(ii) Write 1 esu of charge = x C, where x is a dimensionless number. Show that this gives:

$$\frac{1}{4\pi\varepsilon_0} = \frac{10^{-9}}{x^2}\frac{Nm^2}{C^2}$$ with $x = \frac{1}{3} \times 10^{-9}$, we have $$\frac{1}{4\pi\varepsilon_0} = [3]^2 \times 10^9 \frac{Nm^2}{C^2}$$ or $$\frac{1}{4\pi\varepsilon_0} = (2.99792458)^2 \times 10^9 \frac{Nm^2}{C^2}$$ (exactly).

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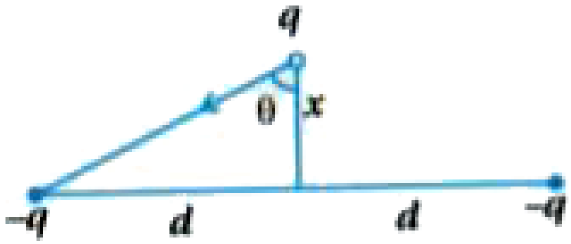
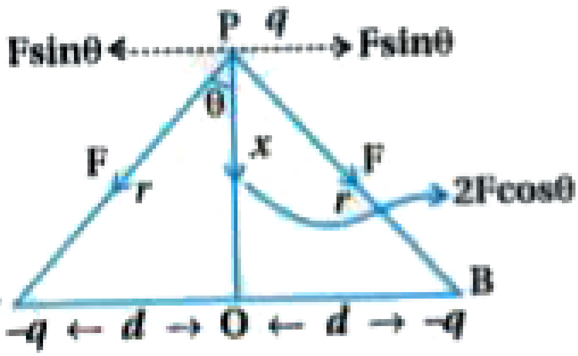
5. Two charges -q each are fixed separated by distance 2d. A third charge q of mass m placed at the midpoint is displaced slightly by x (x < < d) perpendicular to the line joining the two fixed charged as shown in figure. Show that q will perform simple harmonic oscillation of time period. $T = \left[\frac{8\pi^3\varepsilon_0 m d^3}{q^2}\right]^{1/2}$





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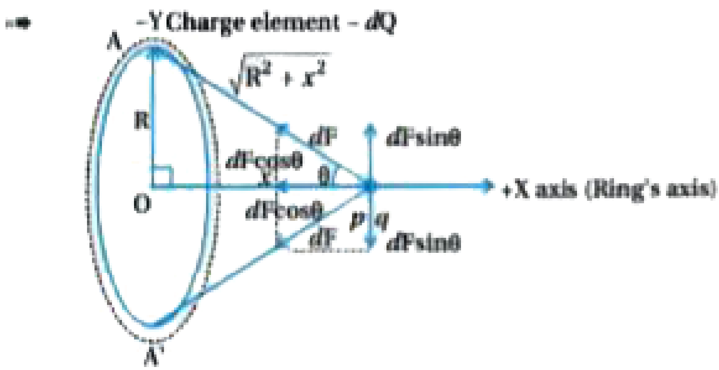
6. Total charge - Q is uniformly spread along length of a ring of radius R. A small test charge +q of mass m is kept at the centre of the ring and is given a gentle push along the axis of the ring.

(a) Show that the particle executes a simple harmonic oscillation.

(b) Obtain its time period.



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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Electrostatic Electric Charge And Frictional Electrical Charge

1. When any neutral conductor is made charged, its mass ....

A. will increase

B. will decrease

C. may increase or decrease

D. will remain constant

Answer: C

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2. Static electricity is produced due to.......

A. friction

B. induction

C. electric current

D. both (A) and (B)

Answer: D

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3. A comb rubbed with dry hair, can attract small pieces of paper because......

A. comb is a conductor.

B. paper is a conductor.

C. atoms of paper get polarised by charged comb.

D. comb attains the property of magnetism.

Answer: C

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4. Electric force is exerted between two separated charges because electric charge is ...... Of matter.

A. external

B. not a property at all

C. internal

D. electric

Answer: C

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5. When some charge is placed on a good conductor,

A. it remains at the same position.

B. it goes at the centroid of a conductor.

C. it remains at the surface of a good conductor.

D. none of above.

Answer: C

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6. ...... no. of electrons have charge equal to 1 coulomb.

A. 6.25×10^{19}

B. 6.25×10^{18}

C. 6.25×10^{20}

D. 1.6×10^{19}

Answer: B

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7. In nature, amount of electric charge, possessed by an isolated system is always............

A. zero

B. equal to multiple of square-root of fundamental charge.

C. equal to integer multiple of fundamental charge.

D. equal to multiple of square of fundamental electric charge.

Answer: C

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8. When a positively charged rod is brought near to electrically neutral good conductor, then that good conductor,

A. will become positively charged.

B. will become negatively charged

C. will remain neutral only.

D. none of above.

Answer: C

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9. For making any neutral body positively charged, we have to......

A. deposit electrons on its surface.

B. remove electron from its surface.

C. remove protons from it.

D. remove neutrons from it.

Answer: B

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10. Write SI unit of electric charge.

A. Coulomb

B. Newton

C. volt

D. $\frac{\text{Coulomb}}{\text{volt}}$

Answer: A

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11. A spherical shell and a solid sphere, made up of same material and having same radii, are charged to their maximum capacity. If charges on their surfaces are respectively, q_1 and q_2 then ......

A. $q_1 < q_2$

B. $q_1 > q_2$

C. $q_1 = q_2$

D. nothing can be said

Answer: C

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12. Positive charge inside 2^{He} atom is.............

A. 1.6×10^{-19} C

B. $2 \times 1.6 \times 10^{-19}$ C

C. $4 \times 1.6 \times 10^{-19}$ C

D. zero coulomb

Answer: B

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13. Coulombian force between two charges ....

A. is always attractive.

B. is always repulsive.

C. may be attractive or repulsive.

D. is always zero.

Answer: C

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14. Quark composition of proton is......

A. uuu

B. uud

C. udd

D. ddd

Answer: B

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15. Quark composition of neutron is ....

A. uuu

B. uud

C. udd

D. ddd

Answer: C

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16. Discuss the types of electric charges by rubbing appropriate non-conductors. Which scientists gave their names ?

A. positive charge is produced.

B. negative charge is produced.

C. no new charge is produced.

D. none of above.

Answer: C

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17. One body has 2.5×10^{13} protons. Now if i carries $-2\mu c$ charge then how many electron are there on this body ?

A. (A) 1.25×10^{13}

B. (B) 2.5×10^{13}

C. (C) 3.75×10^{13}

D. (D) none of above.

Answer: C

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18. By rubbing comb in dry hairs ......

A. (A) dry hairs gain electrons.

B. (B) dry hairs lose electrons

C. (C) electrons are removed from comb.

D. (D) none of these.

Answer: B

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19. When glass rod is rubbed against silk, silk becomes negatively charged of 320 nC, then how much electrons lost by the glass rod ?

A. (A) 2×10^{10}

B. (B) 2×10^{11}

C. (C) 2×10^{12}

D. (D) 5.12×10^{-26}

Answer: C

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20. The charge on 1 microgram (g) electron will be......(mass of an electron = 9.11×10^{-31} kg)

A. 1.76×10^{-3} C

B. 176×10^{0} C

C. 176×10^{3} C

D. 176×10^{5} C

Answer: B

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21. What will be the change in mass of object if it is charged by rubbing ?

A. doesn't change

B. increases slightly

C. decreases slightly

D. increases or decreases slightly

Answer: D

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22. There are two identical spheres A and B. Now charge Q is established on each sphere. There is a third identical neutral sphere C. Now sphere C is first brought in contact with A and separated then brought in contact with B and separated. After this what will be charge on C ?

A. Q

B. $\frac{Q}{2}$

C. $\frac{3Q}{4}$

D. $\frac{Q}{4}$

Answer: C

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23. There are 5×10^{21} atoms in a object of 1 g. If one electron is removed from 0.01% atom, what will be the charge on the sphere ?

A. $+0.08$

B. 0.8

C. -0.008

D. -0.8

Answer: A

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24. Charge on electrons having total mass of 75 kg is ......C.

A. -1.32×10^{13}

B. -6.25×10^{18}

C. -1.25×10^{13}

D. -1.6×10^{19}

Answer: A

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25. 80 microC charge is given on sphere of 4 cm radius and $40\mu C$ charge is given on sphere of 6 cm radius. If they are connected by a conducting wire, then charge transferred from sphere of 4 cm radius to sphere of 6 cm radius will be......

A. $48\mu C$

B. $72\mu C$

C. $32\mu C$

D. $36\mu C$

Answer: C

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26. Two copper spheres A and B have equal radii. If sphere A has 100 electrons and sphere B has 400 protons then what will be the electric charge on each of them when they are brought in contact and separated ?

A. 4.8×10^{-17} C

B. 2.4×10^{-17} C

C. 1.6×10^{-17}

D. 6.4×10^{-17} C

Answer: B

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27. Net charge on object having 9×10^{13} protons and 6×10^{13} electrons is ......

A. $-4.8 \mu C$

B. $4.8 \mu C$

C. $4.8 C$

D. $3 \times 1.6 \times 10^{-19}$ C

Answer: B

28. What will be the change in the radius of a soap bubble if it is given positive charge ?

A. The radius will decrease

B. The radius will remain unchanged

C. The radius may increase or decrease

D. The radius will increase

Answer: D

29. To know the presence of charge on a substance......is used.

A. stethoscope

B. gyroscope

C. electroscope

D. microscope

Answer: C

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30. Charges of upquark and downquark are ...... and......respectively.

A. $-\frac{2}{3}e, \; -\frac{1}{3}e$

B. $\frac{2}{3}e, \; -\frac{1}{3}e$

C. $\frac{2}{3}e, \frac{1}{3}e$

D. $-\frac{2}{3}e, \frac{1}{3}e$

Answer: B

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31. if a negatively charged rod is brought nearer to a neutral conducting sphere, then ......

A. it will become positively charged.

B. it will become negatively charged.

C. will remain neutral.

D. both (A) and (B).

Answer: C

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32. Coulomb's Law, Superposition Law

Coulomb's law supports ....

A. Lenz's law

B. Newton's 3rd law of motion

C. Laws of Maxwell

D. Faraday's law

Answer: B

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33. There will be ...... between two like charge and......between two unlike charges.

A. repulsion, attraction

B. repulsion, repulsion

C. attraction, repulsion

D. attraction, attraction

Answer: A

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34. In which of the following case, attraction is maximum between two charged spheres separated by 2 mm distance ?

A. +2q and -2q

B. $+2q$ and +2q

C. $-2q$ and -2q

D. $-1q$ and +4q

Answer: A

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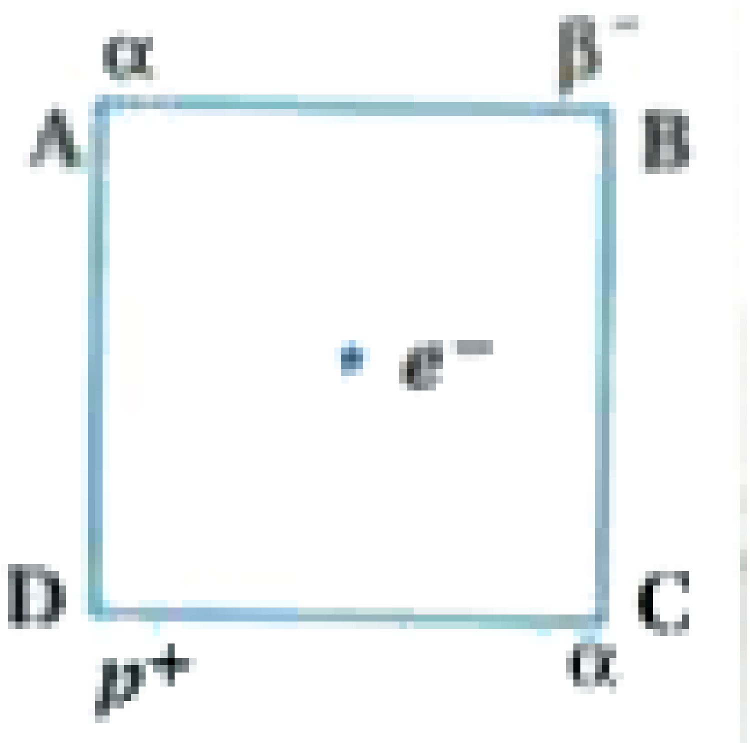
35. As shown in figure, four electric charges are placed on vertices of a square and there is a free electron on it. Where this free electron will move ?



A. it will move toward A.

B. it will move toward B

C. it will move toward C.

D. it will move toward D.

Answer: D

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36. Value of Coulombian constant in CGS unit is

A. 8.98×10^{9}

B. 8.85×10^{-12}

C. 9×10^{9}

D. 1

Answer: D

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37. If Coulomb's law is represented by $F = kq_1q_2r^n$, then n = ...

A. $\frac{1}{2}$

B. $-\frac{1}{2}$

C. 2

D. -2

Answer: D

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38. Coulomb's law is correct for......distance.

A. all

B. less than 10^{-15}m

C. greater than 10^{-15}m and less than 10^{18} m

D. greater than 10^{18}m

Answer:

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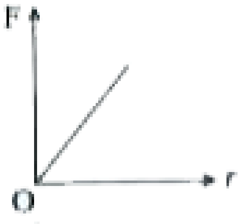
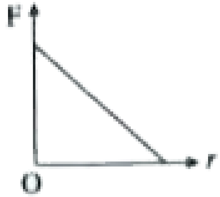
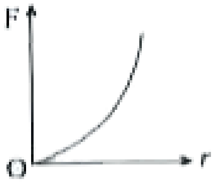
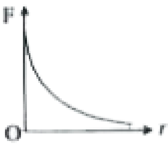
39. The graph which represents the correct relation between Coulomb force versus distance between two point charges is............

A. 

B. 

C. 

D. 

Answer:

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40. Electric force on alpha-particle placed in electric Field of 20×10^4 N/C is ....

A. 3.2×10^{-14} N

B. 1.6×10^{-14} N

C. 6.4×10^{-14} N

D. 12.8×10^{-14} N

Answer: C

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41. Value of dielectric constant of metal is.......

A. infinite

B. zero

C. 1

D. none of these

Answer: A

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42. S.I. unit of permittivity (e0) ......

A. $C^2N^{-1}M^{-2}$

B. $N^1M^2C^{-1}$

C. $N^1M^2C^{-2}$

D. $A^1M^{-1}C^0$

Answer: A

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43. The value of permittivity of vaccum is $8.85 \times 10^{-12}C^2N^{-1}m^{-2}$ and the dielectric constant of water is 81. So the permittivity of water will be.........$C^2 N^{-1} m^{-2}$.

A. $81 \times 8.86 \times 10^{-12}$

B. 8.86×10^{-12}

C. $\dfrac{8.86 \times 10^{-12}}{81}$

D. $\dfrac{81}{8.86 \times 10^{-12}}$

Answer: A

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44. Two spheres carrying charge q are hanging from a same point of suspension with the help of threads of length 1 m, in a space free from gravity. The distance between them will be........

A. 0

B. 0.5

C. 2m

D. can not be determined

Answer: C

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45. If two opposite electric charges having same magnitude are 10 cm away from each other, they experience 0.9N attractive force then magnitude of electric charges will be......

A. $1pC$

B. 1 nC

C. $1\mu C$

D. 1 mC

Answer: C

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46. A proton is 1836 times heavier than an electron. If the repulsive force between two protons is F for given distance, then the electric force between two electrons at same distance will be.........N.

A. F

B. $-F$

C. $\dfrac{F}{(1836)^2}$

D. $(1836)^2 F$

Answer: A

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47. The position vectors of two point charges of 2 nC each are $\left(2\hat{i} + 3\hat{j} - \hat{k}\right)$m and $\left(3\hat{i} + 5\hat{j} + \hat{k}\right)$m respectively. Magnitude of the coulombian force acting between them is........

A. 4×10^{-3} N

B. 4×10^{-9} N

C. 4×10^{-6} N

D. 10^{-3} N

Answer: A

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48. The force of repulsion between two like or point charges + 2C and + 6C is 12 N, when charge q is added to both, the force of attraction between them will be 4 N, so q =......C.

A. $+4$

B. -4

C. $+1$

D. -1

Answer: B

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49. The force of repulsion between two charges +1 and 6C is 12N. A third charge -4C add between them, now the force between them will be ...

A. 4 N repulsive

B. 4 N attractive

C. 8 N repulsive

D. 8 N attractive

Answer: B

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50. Two particles of equal mass m and charge t are placed at a distance 16 cm. They do no experience any force. The value of $\frac{q}{m}$ is........

A. 1

B. $\sqrt{4\pi\varepsilon_0 G}$

C. $\sqrt{\frac{\pi\varepsilon_0}{G}}$

D. $\sqrt{\frac{G}{4\pi\varepsilon_0}}$

Answer: B

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51. Three identical charges are placed on three vertices of a square. If the force acting between q_1 and q_2 is F_{12} and between q_1 and q_3 is F_{13}, then = ...

A. $\frac{1}{\sqrt{2}}$

B. 2

C. $\frac{1}{2}$

D. $\sqrt{2}$

Answer: C

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52. The radius of a conducting spherical shell is 10 mm and a $100\mu C$ charge is spread on it. The force acting on a $10\mu C$ charge placed at its centre is......... $(k = 9 \times 10^9)$ MKS

A. 10^3 N

B. 10^2 N

C. zero

D. 10^5 N

Answer: C

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53. An electron falls freely in electric field of $9.1 \times 10^3 NC^{-1}$, then acceleration of electron is ....

A. $1.6 \times 10^{13} ms^{-2}$

B. $1.6 \times 10^{15} cm / s^2$

C. $1.6 \times 10^{15} ms^{-2}$

D. $1.6 \times 10^{11} ms^{-2}$

Answer: B

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54. One conducting metal sphere contains 10^{23} atoms. If from 0.1 % atoms one electrons are removed, then electric charge deposited on sphere is ....

A. 16 C

B. 0.16 C

C. 0.016 C

D. 1.6 C

Answer: A

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55. Two charged particles of equal charges are placed 1 m apart. The initial acceleration of each of them is ms^{-2}. If their equal mass is 10^{-3} gm, find the charge on each of them.

A. $\sqrt{1.1} \times 10^{-8}$ C

B. 1.1×10^{-8} C

C. 11×10^{8} C

D. $\sqrt{2} \times 10^{-8}$ C

Answer: A

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Lectric Field And Electric Dipole

1. Electric dipole moment is......quantity.

A. (A) scalar

B. (B) vector

C. (C) tenser

D. (D) dimensionless

Answer: B

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2. What is net charge on electric dipole ? Why ?

A. $-q$

B. $+q$

C. 2q

D. zero

Answer: D

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3. Flux associated with any point in electric field is......

A. zero

B. negative

C. positive

D. zero, negative or positive

Answer: A

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4. Unit and dimensional formula of linear charge density are.......

A. $Cm, M^0L^1A^1T^1$

B. $Cm^{-1}, M^0L^{-1}A^1T^1$

C. $C^{-1}m, M^0L^1A^1T^1$

D. $Cm^{-1}, M^0L^1A^1T^{-1}$

Answer: B

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5. Unit and dimensional formula of surface charge density are.......

A. $Cm^2, M^0L^2A^1T^1$

B. $Cm^{-2}, M^0L^2A^1T^{-1}$

C. $Cm^{-2}, M^0L^{-2}A^1T^1$

D. $C^{-1}m^2, M^0L^{-2}A^1T^1$

Answer: C

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6. Unit and dimensional formula of volume charge density are.......

A. $Cm^{-3}, M^0L^{-3}T^1A^1$

B. $Cm^{-3}, M^0L^3T^1A^1$

C. $Cm^{-3}, M^0L^3A^{-1}T^{-1}$

D. $Cm^3, M^0L^{-3}T^1A^1$

Answer: A

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7. ....are deflected in electric field.

A. X - rays

B. Neutrons

C. α - particles

D. γ - rays

Answer: C

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8. Write SI unit of electric dipole moment.

A. Cm^{-1}

B. Cm

C. Cm^{-2}

D. Cm^{2}

Answer: B

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9. An electric dipole is placed in an uniform electric field of a point charge, then ....

A. the resultant force acting on the dipole is always zero.

B. the resultant force acting on the dipole may be zero.

C. torque acting on it may be zero.

D. torque acting on it is always zero.

Answer: A

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10. In electric dipole is placed in an electric field of a point charge, then........

A. (A) the resultant force acting on the dipole is always zero.

B. (B) the resultant force acting on the dipole may be zero.

C. (c) torque acting on it may be zero.

D. (D) torque acting on it is always zero.

Answer: C

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11. When an electron and a proton are both placed in an electric field ....

A. (A) the electric forces acting on them are equal in magnitude as well as direction.

B. (B) only magnitudes of forces are same.

C. (C) accelerations produced in them are same.

D. (D) magnitudes of accelerations produced in them are same.

Answer: B

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12. 2.25 N force is acting on 15×10^{-4}C charge placed at a point in a uniform electric field. So, intensity of this electric field is......

A. 150 N

B. 15 N

C. $1500N/C$

D. $0.15N/C$

Answer: C

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13. An α-particle is in electric field of 15×10^4 V/m So, the force experienced by it is......N.

A. (A) 4.8×10^{-12}

B. (B) 4.8×10^{-13}

C. (C) 4.8×10^{-14}

D. (D) 4.8×10^{-18}

Answer: C

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14. R_1 and $R_2 (R_1 < R_2)$ are radii of two isolated sphere A and B respectively having same surface density. Hence the intensity of electric field at the surface is ....

A. more on sphere A

B. more on sphere B

C. same on both spheres

D. depends on the distance between A and B

Answer: C

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15. If force acting on a point charge 6.4×10^{-3} C placed in uniform electric field is 0.128N, then electric field at point is ...... N/C.

A. 2

B. 0.2

C. 20

D. 200

Answer: C

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16. Two metal plates having a potential difference of 800 V are 0.02 m apart horizontally. A particle of mass 1.96×10^{-15} kg is suspended in equilibrium between the plates. If e is the elementary charge, the charge on the particle is

A. (A) 6e

B. (B) e

C. (C) 8e

D. (D) 3e

Answer: D

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17. The intensity of the electric field required to keep a water drop of radius 10^{-5} cm just suspend in air when charged with one electron is approximately.

A. (A) 130V/cm

B. (B) 26V/m

C. (C) 130 N/C

D. (D) 260 N/C

Answer: D

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18. If the magnitude of intensity of electric field at a distance x on axial line and at a distance y on equatorial line on a given dipole are equal, then x : y is

A. $\sqrt[3]{2} : 1$

B. $1:2$

C. $1:\sqrt{2}$

D. $1:1$

Answer: A

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19. A non-uniform electric field is represented by $\overrightarrow{E} = 5x\hat{i}Vm^{-1}$. An electric dipole having moment. $P = 20 \times 10^{-20}$ cm is placed at an angle of 60° with the field. The net force on the dipole is.........N.

A. $10^{-19}\hat{i}$

B. $100 \times 10^{-19}\hat{i}$

C. zero

D. $5 \times 10^{-19}\hat{i}$

Answer: D

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20. An electric dipole is placed parallel to a uniform electric field. Find the correct one of the following statements :

A. (A) net force is maximum, but torque is zero.

B. (B) net force and torque both are maximum.

C. (C) net force and torque are zero.

D. (D) net force is zero, but torque is maximum.

Answer: C

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21. The electric dipole moment of an HCl atom is 3.4×10^{-30} Cm. The charges on both atoms are unlike and of same magnitude. Magnitude of this charge is ....The distance between the charges is 1 A.

A. 1.7×10^{-20} C

B. 3.4×10^{-20} C

C. 6.8×10^{-20} C

D. 3.4×10^{-10} C

Answer: B

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22. Some of the electric field lines of an electric dipole are given in figure. Select the correct statement from the following.

A. (A) They are two closed loops.

B. (B) They are three closed loops.

C. (C) They form closed loops.

D. (D) They do not form closed loops.

Answer: D

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23. When NaCl molecule is formed, one electron is transferred from Na atom to CI atom. The equilibrium internuclear distance between Na+ and Cl^{-} ions is 2.75×10^{-10}m. The dipole moment of NaCl molecule is

A. 2.75×10^{-19} cm

B. 4.4×10^{-29} cm

C. 2.75×10^{-29} cm

D. 4.4×10^{-19} cm

Answer: B

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24. Which of the following is unit of electric field intensity ?

A. (A) $N^{-1}C$

B. (B) NC

C. (C) NC^{-1}

D. (D) $N^{-1}C^{-1}$

Answer: C

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25. On axis of electric dipole, angle between dipole moment and electric field is.......

(i) 0°

(ii) 45°

(iii) 90°

(iv) 180°

A. 0°

B. 45°

C. 90°

D. 180°

Answer: D

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26. Which of the following is not a characteristic of electric field lines ?

(a) Field lines are continuous curves.

(b) Two field lines never intersect each other.

(c) Field lines form closed loops.

(d) Field lines start from positive charge and end to negative charge.

A. Field lines are continuous curves.

B. Two field lines never intersect each other.

C. Field lines form closed loops.

D. Field lines start from positive charge and end to negative charge.

Answer: C

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Continuous Distribution Of Charge And Electric Flux

1. Electric flux is......quantity.

(a) Vector

(b) Scalar

(c) Dimensionless

(d) Tenser

A. vector

B. scalar

C. dimensionless

D. tenser

Answer: B

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2. Write SI unit of electric flux

A. Vm^{-1}

B. Vm^2

C. Vm^{1}

D. $Nm^{2}C^{-1}$

Answer: D

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3. Dimensional formula of electric flux is.......

A. $M^{1}L^{2}T^{-3}A^{-1}$

B. $M^{1}L^{3}T^{-2}A^{-1}$

C. $M^{1}L^{3}T^{-3}A^{1}$

D. $M^{1}L^{3}T^{-3}A^{-1}$

Answer: D

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4. If a charge q is placed at centre of cube, then flux associated with each edge is ....

A. $\frac{q}{\varepsilon_0}$

B. $\frac{q}{8\varepsilon_0}$

C. $\frac{q}{12\varepsilon_0}$

D. $\frac{q}{2\varepsilon_0}$

Answer: C

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5. $400\mu C$ charge is uniformly spread over the surface of a spherical shell and surface density is $0.314cm^{-2}$. What is the radius of this shell ?

A. 31.4 m

B. $\frac{1}{31.4}m$

C. 3.184 m

D. 0.01 m

Answer: D

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6. 10×10^{-6} C charge is uniformly spread over the cube of face length 1 mm. The density of charge will be ....Cm^{-3}

A. 10^{-4}

B. 10^4

C. 10^{-1}

D. 10

Answer: B

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7. The linear charge density of $10\mu C$ charge, uniformly distributed on the ring of 1m radius, will be ....

A. $6.28Cm^{-1}$

B. $6.28 \times 10^5 cm^{-1}$

C. $1.59 \times 10^{-6} cm^{-1}$

D. $10^5 cm^{-1}$

Answer: C

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8. If $0.1\mu C$ total charge is uniformly distributed over long straight wire of having

$10^{-5} cm^{-1}$ linear charge density, then length of the wire would be...........

A. 1 m

B. 10 cm

C. 1 cm

D. 10^{-2} cm

Answer: C

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9. There exists an electric field of 100 N/C along Z-direction. The flux passing through a square of 10 cm sides placed on XY plane inside the electric field is.......

A. $1.0 Nm^2/C$

B. 2.0 Vm

C. 10 Vm

D. $4.0 Nm^2/C$

Answer: A

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10. The electric field in the region of the space is $\vec{E} = \left(5\hat{i} + 2\hat{j} + 3\hat{k}\right) NC^{-1}$. The electric flux passing through a surface of area $50 m^2$ placed in X-Y plane inside the electric field is.......

A. 250 Nm^2C^{-1}

B. $150 Nm^2C^{-1}$

C. $100 Nm^2C^{-1}$

D. $200 Nm^2C^{-1}$

Answer: B

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11. A cylinder of radius r and length L is placed in a uniform electric field in such a way that its axis remains parallel to the electric field. The electric flux passing through the surface of cylinder is

A. zero

B. $\frac{\pi r^2}{E}$

C. $2\pi r^2 E$

D. $\dfrac{2\pi r^2}{E}$

Answer: A

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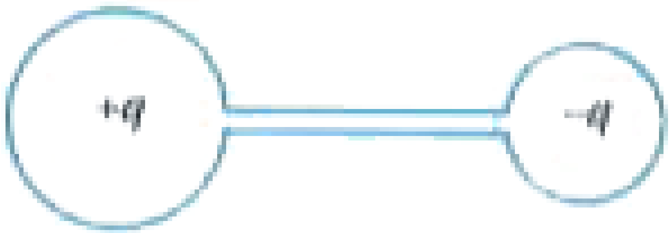
12. On two hollow spheres (shells) charges -q and +q are placed, so the flux on each is ϕ. Now, both are connected as shown in the figure, so total flux is............



(a) $\frac{\phi}{2}$

(b) 2ϕ

(c) zero

(d) Uncertain

A. $\frac{\phi}{2}$

B. 2ϕ

C. zero

D. Uncertain

Answer: C

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13. the number of electric field lines leaving the positive 0.5 C charge placed in the medium of dielectric constant K = 10 are ....

A. 5.65×10^{9}

B. 1.13×10^{11}

C. 9×10^{9}

D. 8.85×10^{-12}

Answer: A

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14. flux associated with the metal piece of $3\hat{j}m^2$ cross-section placed in electric field of $2\hat{i}N/C$ is...........

A. 1.5

B. 3

C. 6

D. zero

Answer: D

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15. linear charge density of current carrying wire of infinite length is $4\frac{\mu C}{m}$. Electric field intensity at distance 3.6 cm from wire is ....

$$\left[\therefore \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 SI\right]$$

A. 2×10^6 V/m

B. 10^6 V/m

C. 10^5 V/m

D. 2×10^5 V/m

Answer: A

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16. When a $10\mu C$ charge is enclosed by a closed surface, the flux passing through the surface is ϕ. Now another $-10\mu C$ charge is placed inside the closed surface, then the flux passing through the surface is.........

A. 2ϕ

B. ϕ

C. 4ϕ

D. Zero

Answer: D

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17. An electric dipole is placed at the centre of a sphere. The flux passing through the surface of the sphere is..........

A. Infinity

B. Zero

C. Cannot be found

D. $\frac{2q}{\varepsilon_0}$

Answer: B

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18. When the electric flux linked with the surface will be positive.

A. $\theta > 90^{\circ}$

B. $\theta < 90^{\circ}$

C. $\theta = 90^{\circ}$

D. $\theta \geq 90^{\circ}$

Answer: B

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19. The number of electric field lines emerged out from $1\mu C$ charge is ....

A. 1.13×10^{11}

B. 1.13×10^{5}

C. 9×10^{9}

D. 9×10^{-8}

Answer: B

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20. Linear charge densities of two parallel wires of infinite length is λ_1 and λ_2 . Distance between two wires is R. Force acting on any one wire per unit length is ......

A. $k\frac{\lambda_1\lambda_2}{R}$

B. $k\frac{\lambda_1\lambda_2}{R^2}$

C. $\frac{2k\lambda_1\lambda_2}{R}$

D. $\frac{2\lambda_1\lambda_2}{R^2}$

Answer: C

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21. A rectangular frame of 25 cm x 15 cm is placed normal to $2 \times 10^4 NC^{-1}$ uniform field. If this frame is formed in circular shape, then flux associated will be......Nm^2C^{-1}.

(a) 750

(b) 1019.1

(c) 800

(d) 2015.5

A. 750

B. 1019.1

C. 800

D. 2015.5

Answer: B

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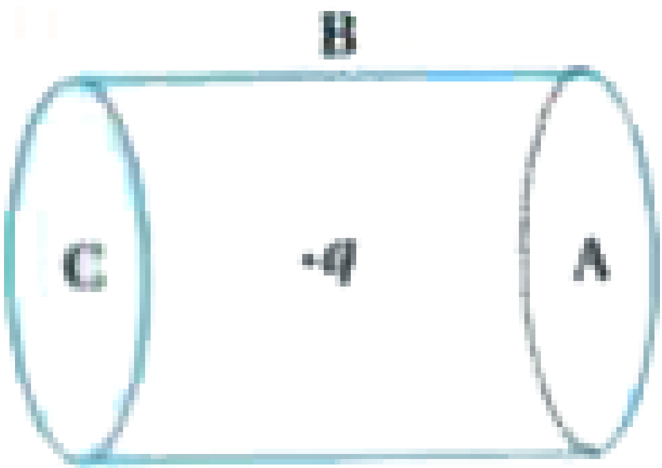
22. Charge q is inside a hollow cylinder. If flux associated with its curved surface B is ϕ, then flux associated with surface A is ......



A. $\frac{1}{2}\left(\frac{q}{\varepsilon_0}-\phi\right)$

B. $\frac{q}{2\varepsilon_0}$

C. $\frac{\phi}{3}$

D. $\frac{q}{\varepsilon_0}-\phi$

Answer: A

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23. The flux associated with surface shown in figure is......

A. $\frac{4e}{\varepsilon_0}$

B. $\frac{2e}{\varepsilon_0}$

C. $\frac{e}{\varepsilon_0}$

D. 0

Answer: D

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Miscellaneous Mcqs

1. An electron moving with the speed 5×10^6 m per second is shooted parallel to the electric field of intensity 1×10^3 N/C. Field is responsible for the retardation of motion of electron. Now evaluate the distance travelled by the electron before coming to rest for an instant, (mass of $e = 9.1 \times 10^{-31}$kg)

A. 0.7 cm

B. 0.7 mm

C. 7 m

D. 7 cm

Answer: D

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2. On which points the electric field intensity of the dipole is parallel to the line joining the two charges of the electric dipole ?

A. On charge -q

B. Only on the line joining the two charges

C. On perpendicular bisector of the line joining two charges and also on this line

D. On charge +q

Answer: C

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3. Radius of spherical shell is 0.5 m. It is charged. Now imagine spherical surface of radius 2 m and 3 m concentric with spherical shell of 0.5 m radius. If electric field on these surfaces are E_1 and E_2 respectively, then

A. $E_1 = \frac{3}{2} E_2$

B. $E_2 = \frac{9}{4} E_1$

C. $E_1 = \frac{9}{4}E_2$

D. $E_1 = E_2$

Answer: C

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4. σ and ρ are surface and volume charge densities respectively of a charged sphere, so,......

A. $\rho = 0, \sigma = 0$

B. $\rho = 0, \sigma \neq 0$

C. $\rho \neq 0, \sigma = 0$

D. $\rho \neq 0, \sigma \neq 0$

Answer: B

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5. An electron and a proton are in a uniform electric field the ratio of their acceleration will be ....

A. zero

B. 1

C. $\frac{m_p}{m_e}$

D. $\frac{m_e}{m_p}$

Answer: C

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6. R_1 and $R_2(R_1 < R_2)$ are radii of two isolated sphere A and B respectively having same surface density. Hence the intensity of electric field at the surface is ....

A. more 'on sphere A

B. more on sphere B

C. same on both spheres

D. depends on the distance between A and B

Answer: C

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Assertion And Reason Type Mcqs

1. (A): If two charges are kept in a conductor medium, then electric force acting between them is zero.

R: $F = \frac{F_0}{k}$, For conductors $k = \infty$

$$\therefore F = \frac{F_0}{\infty} = 0$$

A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not correct explanation of the Assertion.

C. Assertion is true, but the Reason is false.

D. Both Assertion and Reason are false.

Answer: A

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2. A : Electric field lines intersect each other.

R : Electric field lines are parallel in uniform electric field.

A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not correct explanation of the Assertion.

C. Assertion is true, but the Reason is false.

D. Both Assertion and Reason are false.

Answer: B

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3. A : The accelerations of electron and proton are different in same electric field.

R : Electric force acting on unit positive charge is independent of mass.

A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not correct explanation of the Assertion.

C. Assertion is true, but the Reason is false.

D. Both Assertion and Reason are false.

Answer: B

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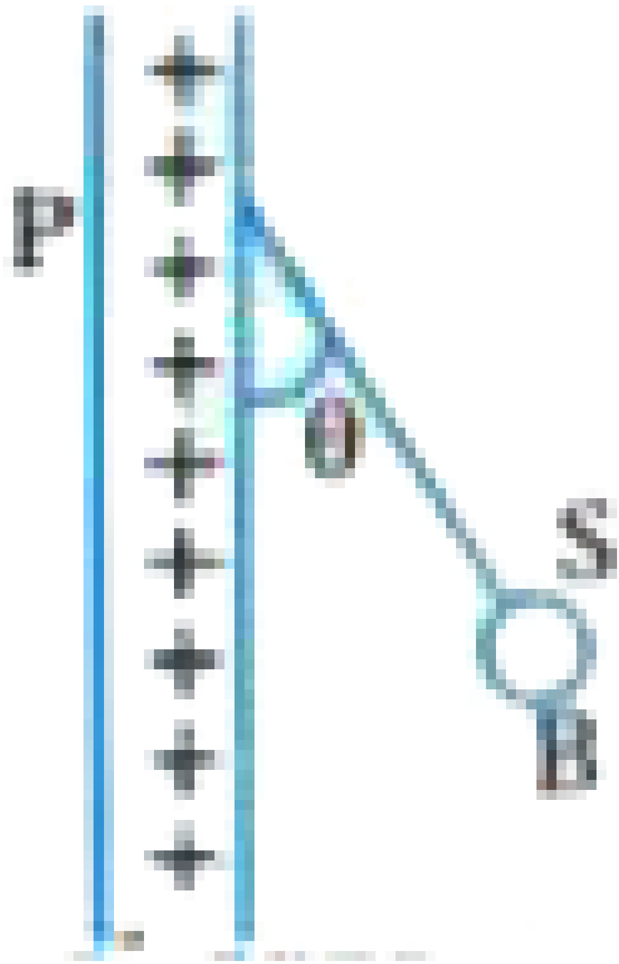
Section D Mcqs Asked In Competitive Exames Mcqs Asked In Aieee And Jee Mains

1. A charged ball B hangs from a silk thread S. Which makes an angle 0 with a large charge conducting sheet P as shown in the figure. The surface charge density σ of the sheet is proportional to



A. $\cos\theta$

B. $\tan\theta$

C. $\sin\theta$

D. $\cot\theta$

Answer: B

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2. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in the region. The path of the particle will be a.......

A. Circle

B. Helix

C. Ellipse

D. Straight line

Answer: D

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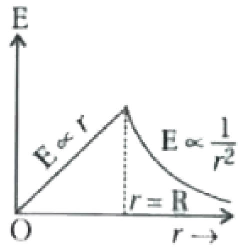
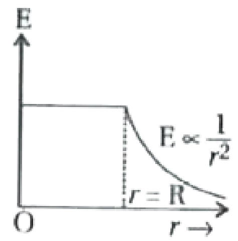
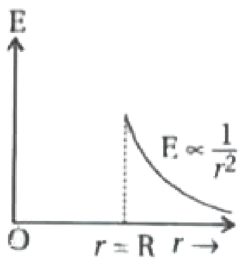
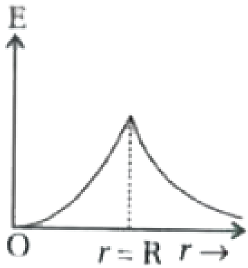
3. Which of the following is the graph of electric field versus distance r from the centre of charged spherical shell ? R is the radius of

tr sphere shell, 'O' is centre of shell

A. 

B. 

C. 

D. 

Answer: C

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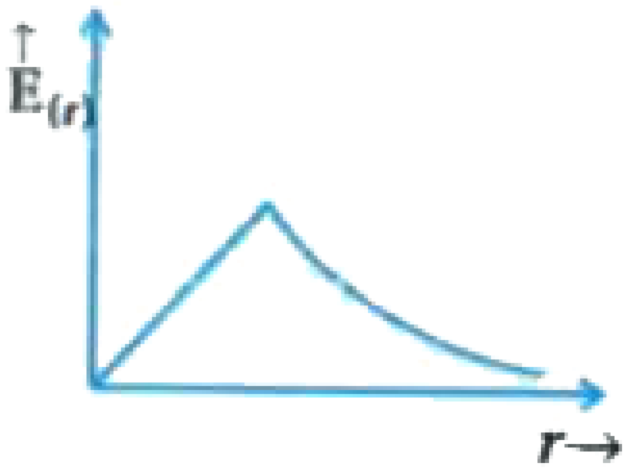
4. In figure there is graph of electric field E_r at point against the distance of that point from centre of the body so....



A. The body should be solid conductor having electric charge.

B. This body should be solid sphere having uniform volume charge density.

C. This body should be solid only.

D. This body should be solid sphere having uniform volume charge density.

Answer: B

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5. Suppose $[\varepsilon_0]$ is permittivity of free sapce. If M = mass, L = length, T = time and A = electric current, then.........

A. $|\varepsilon_0| = [M^{-1}L^{-3}T^2A]$

B. $|\varepsilon_0| = [M^{-1}L^{-3}T^4A^2]$

C. $|\varepsilon_0| = [M^{-1}L^{-3}T^4A^2]$

D. $|\varepsilon_0| = [M^{-1}L^2T^{-1}A^{-2}]$

Answer: B

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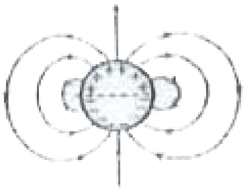
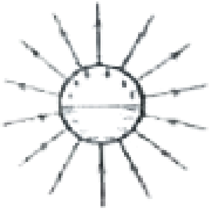
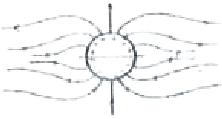
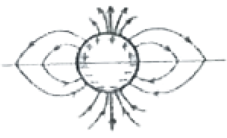
6. A long cylindrical shell carries positive surface charge a in the upper half and negative surface charge -a in the lower half. The electric field lines around the cylinder will look like figure given in :

(Figures are schematic and not drawn to scale)

A. 

B. 

C. 

D. 

Answer: A

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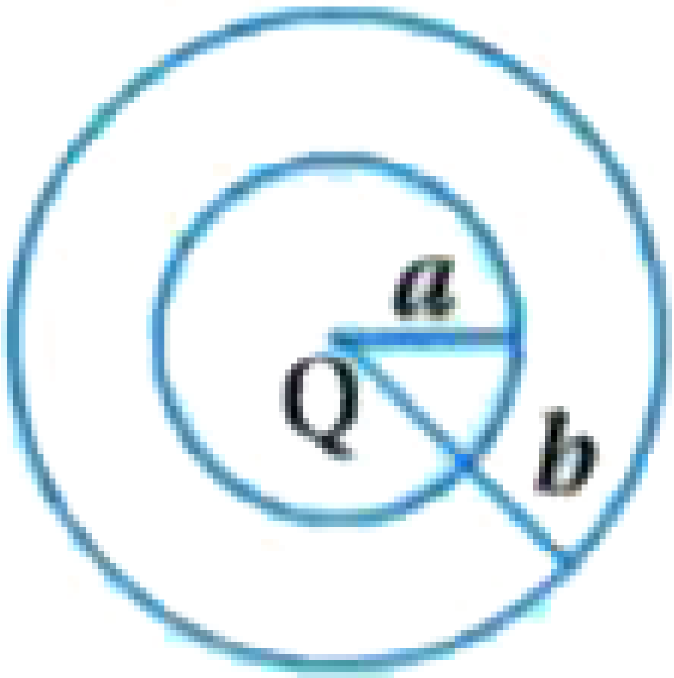
7. The region between two concentric spheres of radii 'a' and 'b', respectively (see figure), has volume charge density $\rho = \frac{A}{r}$, where A is a constant and r is the distance from the centre. At the centre of the spheres is a point charge Q. The value of A such that the electric field in the region between the spheres will be constant is :



A. $\dfrac{2Q}{\pi a^2}$

B. $\dfrac{Q}{2\pi a^2}$

C. $\dfrac{Q}{2\pi(b^2 - a^2)}$

D. $\dfrac{2Q}{\pi(a^2 - b^2)}$

Answer: B

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8. An electric dipole has a fixed dipole moment $\overrightarrow{p}$ which makes angle 9 with respect to X-axis. When subjected to an electric field $\overrightarrow{E}_1 = Ej\hat{i}$, it experience a torque $\overrightarrow{T}_1 = \tau \overrightarrow{k}$ When subjected to another electric field $\overrightarrow{E}_2 = \sqrt{3}E_1\hat{j}$ it experiences a torque $\overrightarrow{T}_2 - \overrightarrow{T}_1$. The angle θ is:

A. 60°

B. 90°

C. 30°

D. 45°

Answer: A

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9. Consider a coil of wire carrying current I, forming a magnetic dipole placed in an infinite plane. If ϕ_1 is the magnitude of magnatic flux through the inner region and ϕ_0 is magnitude of magnetic flux through outer region then which of the following is correct ?

A. $\phi_1 < \phi_0$

B. $\phi_1 > \phi_0$

C. $\phi_1 = -\phi_0$

D. $\phi_1 = \phi_0$

Answer: C

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10. A loop ABCDEFA of straight edges has a six corner points A(0, 0, 0), B(5, 0, 0), C(5, 5, 0), D(0, 5, 0), E(0, 5, 5), F(0, 0, 5). The magnetic field in this region is $\vec{B} = \left(3\hat{i} + 4\hat{k}\right)T$. The quantity of the flux through the loop ABCDEFA (in Wb) is ......

A. 350

B. 175

C. 100

D. 75

Answer: B

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11. Two infinite planes each with uniform surfao charge density $+\sigma \frac{C}{m^2}$ are kept in such a wa m that the angle between them is 30°. Th electric field in the region shown between then is given by:

A. $\frac{\sigma}{2\varepsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y}-\frac{1}{2}\widehat{x}\right]$

B. $\frac{\sigma}{2\varepsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right)\hat{y}-\frac{1}{2}\widehat{x}\right]$

C. $\frac{\sigma}{2\varepsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right]\hat{y}+\frac{1}{2}\widehat{x}\right]$

D. $\frac{\sigma}{2\varepsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y}+\frac{1}{2}\widehat{x}\right]$

Answer: B

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12. A particle of mass m and charge q has an initial velocity $\overrightarrow{v}=v_0\hat{j}$. If an electric field $E=E_0\hat{i}$ and $B=B_0\hat{i}$ magnetic field act on the particle, its speed will double after a time

A. $t = \frac{\sqrt{3}mv_0}{qE}$

B. $t = \frac{\sqrt{2}mv_0}{qE}$

C. $t = \frac{mv_0}{qE}$

D. $t = \frac{mv_0}{2qE}$

Answer: A

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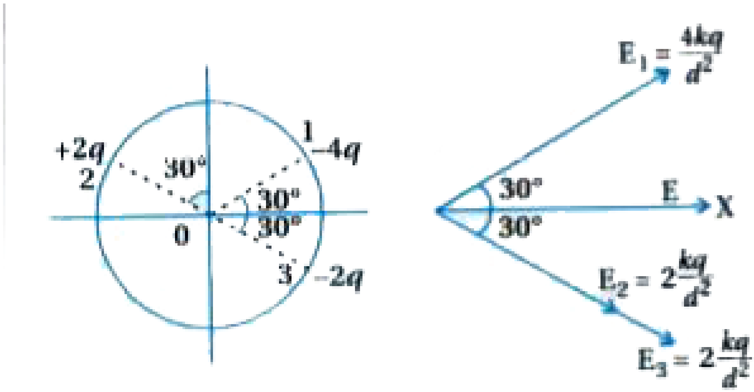
13. Three charges are placed on the circumference of a circle of radius d as shown in the figure. Find the electric field along x-axis at the centre of the circle :



Electric field due to $-4q\vec{E}_1 = \frac{4kq}{d^2}$ electric field due to $+2q$ and $-2q\vec{E}_{23} = \frac{4kq}{d^2}$

A. $\frac{q}{4\pi\varepsilon_0 d^2}$

B. $\frac{q\sqrt{3}}{4\pi\varepsilon_0 d^2}$

C. $\frac{q\sqrt{3}}{\pi\varepsilon_0 d^2}$

D. $\frac{q\sqrt{3}}{2\pi\varepsilon_0 d^2}$

Answer: C

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Section D Mcqs Asked In Competitive Exames Mcqs Asked In Cbse Pmt Aipmt Neet

1. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are

A. Zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$

B. $\frac{Q}{4\pi\varepsilon_0 R}$ and zero

C. $\frac{Q}{4\pi\varepsilon_0 R}$ and $\frac{Q}{4\pi\varepsilon_0 R^2}$

D. Both are zero

Answer: B

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2. The electric field in a certain region is acting radially outward and is given by E = Ar. A charge contained in a shepere of radius 'a' centred at the origin of the field, will be given by :

A. $A\varepsilon_0 a^2$

B. $4\pi\varepsilon_0 A a^3$

C. $\varepsilon_0 A a^3$

D. $4\pi\varepsilon_0 A a^2$

Answer: B

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3. An electric dipole is at 30° with uniform electric field of 2×10^5 N/C. The torque acting on it is 4 Nm. If length of dipole is 2 cm, then what will be the charge at one end of dipole ?

A. 5 mC

B. $7 \mu C$

C. 8mC

D. 2mC

Answer: D

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4. Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance $d(d < < l)$ apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. Then v varies as a function of the distance x between as:

A. $v \propto x^{-\frac{1}{2}}$

B. $v \propto x^{-1}$

C. $v \propto x^{-2}$

D. $v \propto x$

Answer: A

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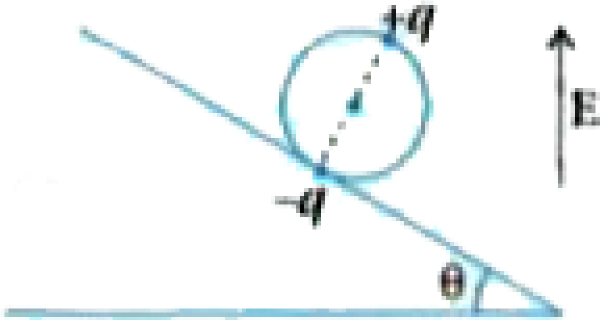
5. A wheel having mass m has charges + q and - q on diametrically opposite points. It remains in equilibrium on a rough inclined plane in the presence of a vertical electric field E. Then value of E is ......



A. $\dfrac{mg\tan\theta}{q}$

B. $\dfrac{mg}{q}$

C. $\dfrac{mg}{2q}$

D. $\dfrac{mg\tan\theta}{2q}$

Answer: C

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6. An electron falls from rest through a vertical distance h in a uniform and vertically upward directed electric field E. The direction of electric field is now reversed, keeping its magnitude the same. A proton is allowed to fall from rest in it through the same vertical distance h. The time of fall of the electron, in comparison to the time of fall of the proton is

A. equal

B. smaller

C. 10 times greater

D. 5 times greater

Answer: B

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7. A hollow metal sphere of radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre

A. increases as r increases for r lt R and for

r gt R

B. zero as r increases for r lt R, decreases as

r increases for r gt R.

C. zero as r increases for r lt R, increases as

r increases for r gt R.

D. decreases as r increases for r lt R and for

r gt R.

Answer: C

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8. Two parallel infinite line charge with linear charge densities $+\lambda C/m$ and $-\lambda C/m$ are placed at a distance of 2R in free space. What is the electric field mid-way between the two line charges ?

A. $\frac{\lambda}{2\pi\varepsilon_0 R}\frac{N}{C}$

B. zero

C. $\frac{2\lambda}{\pi\varepsilon_0 R}\frac{N}{C}$

D. $\frac{\lambda}{\pi\varepsilon_0 R}\frac{N}{C}$

Answer: D

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Section D Mcqs Asked In Competitive Exames Mcqs Aksed In Board Exam And Gujcet

1. When air is replaced by dielectric medium of constant K, the maximum force of attraction between two charges separated by distance d, ...

A. becomes K_2 times

B. becomes K^{-1} times

C. becomes K times

D. remains unchanged

Answer: B

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2. An electric dipole coincides on Z-axis and its mid point is on origin of the co-ordinate system. The electric field at an axial point at a distance z from origin is $\overrightarrow{E}_z$ and electric field at an equatorial point at a distance y from origin is $\overrightarrow{E}_y$

Here, $z = y > > a$, so $\frac{\left|\overrightarrow{E}_x\right|}{\left|\overrightarrow{E}_y\right|} =$ ....

A. 3

B. 2

C. 1

D. 4

Answer: B

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3. A circle of radius 'a' has charge density given by $\lambda = \lambda_0 \cos^2 \theta$ on its circumference. What will be the total charge on the circle ?

A. $\pi a \lambda_0$

B. Zero

C. $2\pi a$

D. None of these

Answer: A

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4. The relation between the intensity of t electric field of an electric dipole at a distan r from its centre on its axis and the distance is....... (where r » 2a)

A. $E \propto \frac{1}{r^4}$

B. $E \propto \frac{1}{r^3}$

C. $E \propto \frac{1}{r}$

D. $E \propto \frac{1}{r^2}$

Answer: B

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5. If F is the force between two point charge submerged in a medium of dielectric constant K, then on withdrawing the mediun the force between the charges becomes.......

A. $F\sqrt{K}$

B. FK

C. $\frac{F}{\sqrt{K}}$

D. $\frac{F}{K}$

Answer: B

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6. Two point like charges having magnitude $= 16\mu C$ and $-9\mu C$ are separated by a distance 10 cm in air. The resultant electric field will bt zero at distance......from $-9\mu C$ charge.

A. 30 cm

B. 20 cm

C. 10 cm

D. 40 cm

Answer: A

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7. The dimensional formula of electric field intensity is ......

A. $M^{1}L^{1}T^{-1}A^{-1}$

B. $M^1L^2T^{-3}A^{-1}$

C. $M^1L^1T^{-3}A^{-1}$

D. $M^1L^0T^{-3}A^{-1}$

Answer: C

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8. Electric field produced due to an infinitely long straight uniformly charged wire at perpendicular distance of 2 cm is

$3 \times 10^8 NC^{-1}$. Then linear charge density on the wire is.......

A. $333 \frac{\mu C}{m}$

B. $666 \frac{\mu C}{m}$

C. $3.33 \frac{\mu C}{m}$

D. $6.66 \frac{\mu C}{m}$

Answer: A

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9. When two spheres having 4Q and - 2Q charge are placed at a certain distance, the force acting between them is F. Now they are connected by a conducing wire and again separated from each other. Now they are kept at a distance half of the previous one. The force acting between them is.......

A. F

B. $\frac{F}{4}$

C. $\frac{F}{2}$

D. $\frac{F}{8}$

Answer: C

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10. $1\mu C$ charge is placed on each vertex of a regular hexagon. Side of hexagon is 1 m, then electric field at its centre is.......

A. $\frac{5}{6} \times 10^{-6} k$

B. $5 \times 10^{-6} k$

C. $\frac{6}{5} \times 10^{-6}$k

D. 10^{-6}k

Answer: D

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11. If electric dipole is placed in non-uniform electric field, then......

A. resultant force on dipole is 0.

B. torque on dipole may be 0.

C. resultant force on dipole may be 0.

D. torque on dipole is 0.

Answer: B

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12. The charge equivalent to 6×10^{18} electrons is

A. 1C

B. $-1C$

C. 1mC

D. $-1mC$

Answer: B

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13. The ratio of electric force and gravitational force between a proton and an electron at a certain distance is......

A. 10^{41}

B. 2.4×10^{41}

C. 2.4×10^{39}

D. 3.9×10^{24}

Answer: C

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14. Unit of surface charge density (σ) is.......

A. $\frac{C}{m^2}$

B. $\frac{C}{m^3}$

C. $\frac{C}{m}$

D. Cm

Answer: A

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