

CBSE & State Boards

UNSOLVED PAPERS

PHYSICS

CHAPTER WISE & SUB- TOPICWISE

Question Bank

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CBSE Board Physics

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Class-XII (2023-24)
PHYSICS (THEORY)

Time: 3 hrs

Max. Marks: 70

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	Chapter-14: Semiconductor Electronics: Materials, Devices and Simple Circuits		
Total		160	70

Syllabus

Unit I: Electrostatics

Chapter-1: Electric Charges and Fields

Electric charges, Conservation of charge, Coulomb's law-force between two- point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field.

Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside).

Chapter-2: Electrostatic Potential and Capacitance

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two-point charges and of electric dipole in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization,

Capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor (no derivation, formulae only).

Unit II: Current Electricity

Chapter–3: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity, temperature dependence of resistance, Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's rules, Wheatstone bridge.

Unit III: Magnetic Effects of Current and Magnetism

Chapter–4: Moving Charges and Magnetism

Concept of magnetic field, Oersted's experiment.

Biot - Savart law and its application to current carrying circular loop.

Ampere's law and its applications to infinitely long straight wire. Straight solenoid (only qualitative treatment), force on a moving charge in uniform magnetic and electric fields.

Force on a current-carrying conductor in a uniform magnetic field, force between two parallel current-carrying conductors-definition of ampere, torque experienced by a current loop in uniform magnetic field; Current loop as a magnetic dipole and its magnetic dipole moment, moving coil galvanometer- its current sensitivity and conversion to ammeter and voltmeter.

Chapter–5: Magnetism and Matter

Bar magnet, bar magnet as an equivalent solenoid (qualitative treatment only), magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis (qualitative treatment only), torque on a magnetic dipole (bar magnet) in a uniform magnetic field (qualitative treatment only), magnetic field lines.

Magnetic properties of materials- Para-, dia- and ferro - magnetic substances with examples, Magnetization of materials, effect of temperature on magnetic properties.

Unit IV: Electromagnetic Induction and Alternating Currents

Chapter–6: Electromagnetic Induction

Electromagnetic induction; Faraday's laws, induced EMF and current; Lenz's Law, Self and mutual induction.

Chapter–7: Alternating Current

Alternating currents, peak and RMS value of alternating current/voltage; reactance and impedance; LCR series circuit (phasors only), resonance, power in AC circuits, power factor, wattless current, AC generator, Transformer.

Unit V: Electromagnetic waves

Chapter–8: Electromagnetic Waves

Basic idea of displacement current, Electromagnetic waves, their characteristics, their transverse nature (qualitative idea only).

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit VI: Optics

Chapter–9: Ray Optics and Optical Instruments

Ray Optics: Reflection of light, spherical mirrors, mirror formula, refraction of light, total internal reflection and optical fibers, refraction at spherical

surfaces, lenses, thin lens formula, lens maker's formula, magnification, power of a lens, combination of thin lenses in contact, refraction of light through a prism.

Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Chapter–10: Wave Optics

Wave optics: Wave front and Huygen's principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width (No derivation final expression only), coherent sources and sustained interference of light, diffraction due to a single slit, width of central maxima (qualitative treatment only).

Unit VII: Dual Nature of Radiation and Matter

Chapter–11: Dual Nature of Radiation and Matter

Dual nature of radiation, Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light.

Experimental study of photoelectric effect Matter waves-wave nature of particles, de-Broglie relation.

Unit VIII: Atoms and Nuclei

Chapter–12: Atoms

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model of hydrogen atom, Expression for radius of nth possible orbit, velocity and energy of electron in nth orbit, hydrogen line spectra (qualitative treatment only).

Chapter–13: Nuclei

Composition and size of nucleus, nuclear force Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear fusion.

Unit IX: Electronic Devices

Chapter–14: Semiconductor Electronics: Materials, Devices and

Simple Circuits

Energy bands in conductors, semiconductors and insulators (qualitative ideas only) Intrinsic and extrinsic semiconductors- p and n type, p-n junction

Semiconductor diode - I-V characteristics in forward and reverse bias, application of junction diode -diode as a rectifier.

I. Electric Charge and Conductors and insulators

Section-A (Multiple Choice Questions)

1. S.I. unit of linear density of charge is
 (a) cm^{-1} (b) cm^{-2}
 (c) cm (d) cm^2

Bihar Board-2021

Ans. (a) :

2. A charge 'q' placed at the centre on the line joining two charges 'Q' will be in equilibrium if 'q' will be equal to

- (a) $\frac{Q}{2}$ (b) $-\frac{Q}{4}$
 (c) $-4Q$ (d) $+\frac{Q}{4}$

Bihar Board-2023

Ans. (b) :

3. A glass rod rubbed with a silk cloth acquires a charge of $+19.2 \times 10^{-18} \text{ C}$, then

- (a) number of protons gained by the glass rod is 120
 (b) number of electrons lost by the glass rod is 12
 (c) number of electrons lost by the glass rod is 120
 (d) number of electrons gained by the silk cloth is 120

Meghalaya Board-2014

Ans. (b) :

4. The expression for capacity of a spherical conductor is:

- (a) $C = \frac{1}{4\pi\epsilon_0 R}$ (b) $C = 4\pi\epsilon_0 R$
 (c) $C = 4\pi\epsilon_0 R^2$ (d) $C = 4\pi$

MP Board-2013

Ans. (b) :

5. A moving charge produces:

- (a) only electric field
 (b) only magnetic field
 (c) both electric and magnetic fields
 (d) neither the electric field nor the magnetic field

MP Board-2013

Ans. (c) :

6. The minimum charge on a proton is :

- (a) $1.6 \times 10^{-6} \text{ C}$ (b) $1.6 \times 10^{-10} \text{ C}$
 (c) $1.6 \times 10^{-19} \text{ C}$ (d) $6.02 \times 10^{23} \text{ C}$

MP Board-2022

Haryana Board-2018

Haryana Board-2016

Ans. (c) :

7. (a) In a charge system, charges q_1 and q_2 are at some distance. Another charge q_3 is brought near to this system. force offered by charge q_1 on q_2 will.

- (a) increase
 (b) decrease
 (c) remain unchanged
 (d) depend on the nature of charge q_3

UP Board-2021

Ans. (c) :

8. The charge on an electron is:

- (a) 0 C (b) 1 C
 (c) $-2.6 \times 10^{-19} \text{ C}$ (d) $-1.6 \times 10^{-19} \text{ C}$

Haryana Board-2018

Ans. (d) :

9. The charge on an atom is:

- (a) 0C (b) 1 C
 (c) $1.6 \times 10^{+19} \text{ C}$ (d) $1.6 \times 10^{-19} \text{ C}$

Haryana Board-2018

Ans. (a) :

10. (i) SI unit of electric charge is:

- (a) Ampere (b) Coulomb
 (c) Volt (d) None

Haryana Board-2017

Ans. (b) :

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

- (a) -1 C (b) 1 C
 (c) 1 mC (d) -1 mC

Gujarat Board- March, 2020

Ans. (b) :

12. How much charge should be placed on a spherical shell of radius 25 cm to have a surface charge density of $\frac{3}{\pi} \text{ C/m}^2$?

- (a) 0.57 c (b) 0.75 c
 (c) 0.25 c (d) 0.5 c

Gujarat Board-2023

Ans. (b) :

13. A plastic rod rubbed with wool is found to have a negative charge of $8 \times 10^{-7} \text{ C}$. The no. of electrons transferred (from which to which?) is. ____.

- (a) 5×10^{10} , from wool to plastic rod
 (b) 5×10^{11} , from plastic rod to wool
 (c) 5×10^{12} , from plastic rod to wool
 (d) 5×10^{12} , from wool to plastic rod

Gujarat Board-2023

Ans. (b) :

14. A positively charged body has
 (a) excess of electrons (b) deficit of electrons
 (c) excess of protons (d) deficit of protons

Jharkhand Board-2020

Ans. (b) :

15. A body has a positive charge of 8×10^{-19} C. It has
 (a) an excess of 5 electrons
 (b) a deficiency of 5 electrons
 (c) an excess of 8 electrons
 (d) a deficiency of 8 electrons

ISC-2012

Ans. (b) :

16. When 10^{20} electrons are removed from the surface of a neutral metal plate, the electric charge on it (in coulomb is)
 (a) +16 (b) -1.6
 (c) 10^{-19} (d) 10^{19}

Meghalaya Board-2017

Ans. (a) :

17. Unit of surface charge density (σ) is ———.

- (a) $\frac{C}{m^3}$ (b) $\frac{C}{m^2}$
 (c) $\frac{C}{m}$ (d) Cm

Gujarat Board- March, 2020

Ans. (b) :

Section-B (Very Short Answer)

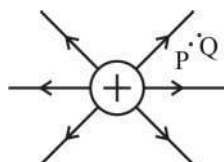
18. What is volume charge density? Write its SI unit.

Chhattisgarh Board-2020

Karnataka Board-March, 2014, 2015

19. There is 2.4×10^{-18} coulomb positive charge on a conductor. State how many electrons are decreased or increased on the conductor.
UP Board-2022
20. Charge resides only on the outer surface of a charged conductor. (True / False)
J&K Board-2022

21. The figure shows the field lines of a positive charge. Is the work done by the field is moving a small positive charge from Q to P positive or negative?



Foreign-2014

22. Does the charge given to a metallic sphere depend on whether it is hollow or solid?
 Give reason for your answer.

Delhi-2017

23. Write any two basic properties of charge.

Karnataka Board-March, 2019

24. A sphere of radius 5 cm has a charge of $31.41 \mu\text{C}$. Calculate the surface density of charge.

Bihar Board-2023

25. What is quantisation of charge?

J&K Board-2023

Assam Board-2015

26. What is the value of fundamental charge?

MP Board-2019

27. What is a fundamental charge? Write its value.

MP Board-2023

28. Calculate the charge on nucleus ${}_{7}\text{N}^{14}$ in coulomb.

UP Board-2023

29. Why can the interior of a conductor have no excess charge in the static situation?

CBSE-2019

30. Why is the direction of the electric field due to a charged conducting sphere at any point perpendicular to its surface?

CBSE-2019

31. Two metallic spheres A and B kept on insulating stands are in contact with each other. A positively charged rod P is brought near the sphere A as shown in the figure. The two spheres are separated from each other, and the rod P is removed. What will be the nature of charges on spheres A and B ?



A metal sphere is kept on an insulating stand. A negatively charged rod is brought near it, then the sphere is earthed as shown. On removing the earthing, and taking the negatively charged rod away, what will be the nature of charge on the sphere? Give reason for your answer.



CBSE-2019

32. Draw the equipotential surfaces due to an isolated point charge.

CBSE-2019

33. What do you mean by conservation of electric charge?

J&K Board-2018

34. Why do two parallel conductors carrying current exert force on each other ?

J&K Board-2016, 2017, 2018, 2023

35. The size of soap bubble increases on charging. Why? Write the relation between charge density and radius of bubble.

Rajasthan Board-2011

36. Derive an expression for electric potential due to a point charge. How do electric potential vary with distance 'r' for a point charge ?

Nagaland Board-2020

37. Define surface charge density and volume charge density of an electric charge. Also state its unit.

Gujarat Board- March, 2019

38. Why is it safer to be inside a car than standing under a tree during lightning?

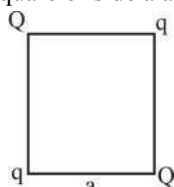
Tamil Nadu Board-2017

Section-C (Short Answer)

39. Two small conducting balls A and B of radius r_1 and r_2 have charges q_1 and q_2 respectively. They are connected by a wire. Obtain the expression for charges on A and B, in equilibrium.

CBSE-2023

40. Four point charges Q, q, Q and q are placed at the corners of a square of side a as show in figure.



Find the

- (a) resultant electric force on a charge Q and
(b) potential energy of this system.

CBSE-2019

41. Give three properties of electric charge.

Karnataka Board-July, 2014, 2018

42. Two spheres of radii 3cm and 8cm are charged with $4 \times 10^{-9}\text{C}$ and $16 \times 10^{-9}\text{C}$ of electricity respectively. If they are joined by a wire, how much charge will flow from one to the other sphere?

Assam Board-2016

43. State and explain the law of conservation of charge.

J&K Board-2017, 2016

Section-D (Long Answer)

44. Two point charges $q_A = 5\mu\text{C}$ and $q_B = -5\mu\text{C}$ are located at A and B separated by 0.2 m in vacuum.

- (a) What is the electric field at the mid point O of the line joining the charges?
(b) If a negative test charge of magnitude 2nC is placed at O, what is the force experienced by the test charge?

Karnataka Board-March, 2020

45. Three charges each equal to $+4\text{nC}$ are placed at the three corners of a square of side 2cm. Find the electric field at the fourth corner.

Karnataka Board-July, 2018

46. Two charges $3 \times 10^{-8}\text{C}$ & $-2 \times 10^{-8}\text{C}$ are located 15 cm apart. At what point on the line joining the two charges is the electric potential zero? Take the potential infinity to be 0.

Karnataka Board-July, 2014

47. (c) Explain the meaning of the statement "electric charge is quantised".

Meghalaya Board-2021

II. Coulomb's Law, and Force between Multiple Charges

Section-A (Multiple Choice Questions)

48. The law, governing the force acting between two electric charges know as
(a) Ampere's law (b) Ohm's law
(c) Faraday's law (d) Coulomb's law

Bihar Board-2023

Ans. (d) :

49. The electrostatic force between two charge distance r apart in vacuum is F. The force between the same charges distance r/2 apart in a medium of dielectric constant 2 is
(a) $F/2$ (b) $2F$
(c) $F/4$ (d) $4F$

Odisha Board-2020

Ans. (b) :

50. The law regarding the electrostatic force between two point charges is
(a) Ampere's law (b) Gauss's law
(c) Coulomb's law (d) Faraday's law

Odisha Board-2022

Ans. (c) :

51. Unit of surface charge density is.

- (a) Coulomb/metre² (b) Newton/metre
(c) Coulomb/Volt (d) Coulomb-metre

Bihar Board-2019

Ans. (a) :

52. Electric force between two charged particles situated at any distance is F newton. If the distance between two becomes half then the value of electric force will be

- (a) $4F$ (b) $2F$
(c) $\frac{1}{4}F$ (d) $\frac{1}{2}F$

Bihar Board-2022

Ans. (a) :

53. S.I. unit of permittivity is

- (a) $\text{N}^{-1}\text{C}^{-1}\text{m}^2$ (b) NC^2m^2
(c) NC^{-2}m^2 (d) $\text{C}^2\text{N}^{-1}\text{m}^{-2}$

Bihar Board-2023

Tamil Nadu Board-March, 2011, 2016

Ans. (d) :

54. The force between two equal point charges separated by a certain distance is F . If the distance between them is doubled and their individual charge are also doubled, then the force between them is

(a) F (b) $2F$
(c) $F/2$ (d) $F/4$

Meghalaya Board-2019

Ans. (a) :

55. The electrostatic force between two electrons separated by a distance of 4.8×10^{-15} m in vacuum is

(a) 9×10^9 N (b) 4.8 N
(c) 10 N (d) 1.6×10^{-19} N

Meghalaya Board-2013

Ans. (c) :

56. Electric force between two stationary charges becomes $1/10^{\text{th}}$ when space between them is filled by a dielectric medium. Relative permittivity of the medium is :

(a) 1 (b) 10
(c) 100 (d) 1.1

NIOS-2018

Ans. (b) :

57. At which point, the intensity of electric field will be proportional to r^0 among the following?

(a) Point charge
(b) Electric dipole
(c) Infinite plane sheet of charge
(d) Linearly charged wire.

UP Board-2019

Ans. (d) :

58. Relative permittivity of water is 81. If ϵ_w and ϵ_0 are permittivities of water and vacuum respectively, then

(a) $\epsilon_0 = 9\epsilon_w$ (b) $\epsilon_0 = 81\epsilon_w$
(c) $\epsilon_w = 9\epsilon_0$ (d) $\epsilon_w = 81\epsilon_0$

ISC-2013

Ans. (d) :

59. An isolated point charge particle produces an electric field $\vec{E}$ at a point 3 m away from it. The distance of the point at which the field is $\frac{\vec{E}}{4}$ will be

(a) 2 m (b) 3 m (c) 4 m (d) 6 m

CBSE-2023

Ans. (d) :

60. The SI value of permittivity of free space or vacuum is

(a) $9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ (b) $9 \times 10^{-9} \text{ Nm}^2\text{C}^{-2}$
(c) $8.854 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$
(d) $8.854 \times 10^{+12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$

Rajasthan Board-2023

Ans. (c) :

61. Two charges $+1\mu\text{C}$ and $+8\mu\text{C}$ are situated at a distance in air. The ratio of forces acting on them is:

(a) 1 : 8 (b) 8 : 1
(c) 1 : 1 (d) 1 : 16

Haryana Board-2022

Ans. (c) :

62. When the distance between two charged particles is doubled, the force between them becomes:

(a) one-fourth (b) half
(c) double (d) four times

Haryana Board-2018

Ans. (d) :

63. When the distance between two charged particles is made one-fourth, the force between them becomes:

(a) one-fourth (b) one-third
(c) half (d) sixteen times

Haryana Board-2018

Ans. (d) :

64. _____ C is the number of positive charge for cup having 180g water.

(a) 1.34×10^6 (b) 0.963×10^7
(c) 1.34×10^7 (d) 0.963×10^6

Gujarat Board- August, 2020

Ans. (b) :

65. The Coulombian repulsive force between two alpha particles kept at a distance of 3 cm in air is _____ N.

(a) 1.024×10^{-27} (b) 1.024×10^{-25}
(c) 1.024×10^{-24} (d) 1.024×10^{-23}

Gujarat Board-2023

Ans. (d) :

66. The number of electrons for two coulombs of charge is

(a) 1.25×10^{18} (b) 1.25×10^{19}
(c) 1.25×10^{21} (d) 1.25×10^{23}

Jharkhand Board-2023

Ans. (b) :

67. Two point charges of $+3\mu\text{C}$ and $+4\mu\text{C}$ repel each other with a force of 10 N. If each is given an additional charge of $-6\mu\text{C}$, then the new force is

(a) 2 N (b) 4 N
(c) 5 N (d) 7.5 N

Jharkhand Board-2019

Ans. (c) :

68. The electrostatic force between two point charges kept at a distance 'd' apart, in a medium, $\epsilon_r = 6$, is 0.3 N. The force between them at the same separation in vacuum is :

(a) 20 N (b) 0.5 N
(c) 1.8 N (d) 2 N

Tamil Nadu Board-September, 2016

Ans. (c) :

69. Point charges q_1 and q_2 are placed in air at a distance 'r'. The ratio of the force on charge q_1 by charge q_2 and force on charge q_2 by charge q_1 is :

- (a) $\frac{q_1}{q_2}$ (b) $\frac{q_2}{q_1}$
(c) 1 (d) $\left(\frac{q_1}{q_2}\right)^2$

Tamil Nadu Board-2017

Ans. (c) :

Section-B (Very Short Answer)

70. Define the linear charge density, surface charge density. Also give their units.
Gujarat Board- May, 2021
71. State and explain Coulomb's law in electrostatics.
Karnataka Board-March, 2014, 2020
Bihar Board-2015
72. Write coulomb's law in vector form. Explain the terms.
Gujarat Board-July, 2022
Karnataka Board-March, 2015
Assam Board-2014
ISC-2008
73. What is the nature of force between two parallel conductors carrying currents in the same direction?
Karnataka Board-March, 2014
74. Two point charges $+9e$ and $+e$ are located at a distance of 16 cm from each other. Where should a charge q be placed between them so that it is in equilibrium?
Uttarakhand Board-2023
75. Give Coulomb's law about the force between two point charges.
Uttarakhand Board-2019
76. State and explain Coulomb's inverse square law in electricity.
AP Board-2023
77. Calculate the force between two small charged spheres having charges of $+1 \times 10^{-7}$ C and -1×10^{-7} C placed 30 cm apart in air.
(b) (i) Name the two forces with their nature acting between two protons.
Assam Board-2023
78. (a) We hear a crackle when we take off our synthetic cloths or sweater particularly in dry season. It happens because of _____.
(b) The mathematical expression given below is known as _____ principle.

$$\vec{F}_1 = \frac{q_1}{4\pi\epsilon_0} \sum_{i=2}^n \frac{q_i}{r_{1i}^2} \hat{r}_{1i}$$

Assam Board-2023

79. Three electric point charges q_0 , q_1 , and q_2 are at distances $\vec{r}_0$, $\vec{r}_1$ and $\vec{r}_2$ respectively with respect to same origin. What is the force on charge q_0 in the field of charges q_1 and q_2 ?
Assam Board-2017

80. Fill in the blanks:
"The force between two point charges is directly proportional to the product of and inversely proportional to the of the distance between them."
Kerala Board-2021

81. What is the force between two small charged spheres having charges of 2×10^{-7} and 3×10^{-7} C placed 30 cm apart in air?
MP Board-2021

82. Write the nature of the force acting between two point charges q_1 and q_2 if $q_1 q_2 < 0$.
Chhattisgarh Board-2023

83. A charge Q is placed at the centre of the line joining two equal charges q and q . Calculate the value of Q when the system of three charges are in equilibrium.
UP Board-2018

84. Explain the statement, relative permittivity of water is 81.
ISC-2009

85. Can 8.6×10^{-19} coulomb of charge be given to a conductor? Explain.
ISC-2006

86. Two identical conducting balls A and B have charges $-Q$ and $+3Q$ respectively. They are brought in contact with each other and then separated by a distance d apart. Find the nature of the Coulomb force between them.
CBSE-2019

87. Five point charges, each of charge $+q$ are placed on five vertices of a regular hexagon of side ' l '. Find the magnitude of the resultant force on a charge $-q$ placed at the centre of the hexagon.
CBSE-2019

88. What is the force between two small charged spheres having charges 2×10^{-7} C and 3×10^{-7} C placed 30 cm apart in air?
Gujarat Board- August, 2020

89. Deduce the expression for the electric field E due to a system of two charges q_1 and q_2 with position vectors $\vec{r}_1$ and $\vec{r}_2$ at a point $\vec{r}$ with respect to common origin.
CBSE Delhi-2010C

90. Two identical metallic spherical shells A and B having charges $+4Q$ and $-10Q$ are kept a certain distance apart. A third identical uncharged sphere C is first placed in contact with sphere A and then with sphere B, then spheres A and B are brought in contact and then separated. Find the charge on the spheres A and B.
CBSE All India-2011C

91. Plot a graph showing the variation of Coulomb force (F) versus $1/r^2$, where r is the distance between the two charges of each pair of charges ($1\ \mu\text{C}$, $2\ \mu\text{C}$) and ($1\ \mu\text{C}$, $-3\ \mu\text{C}$). Interpret the graphs obtained.

CBSE All India-2011C

92. Two concentric metallic spherical shells of radii R and $2R$ are given charge Q_1 and Q_2 respectively. The surface charge densities on the outer surfaces of the shells are equal. Determine the ratio $Q_1 : Q_2$.

CBSE Foreign-2014

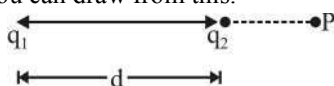
93. Point out whether the following statement is right or wrong.
The mutual forces between two charges not get affected by the presence of other charges.

CBSE All India-2010

94. The point charges having equal charges separated by 1m distance experience a force of 8N . What will be the force experienced by them, if they are held in water at the same distance?
(Given, $K_{\text{water}} = 80$)

CBSE All India-2010C

95. Two point charges q_1 and q_2 are placed at a distance d apart as shown in the figure. The electric field intensity is zero at the point P on the line joining them as shown. Write two conclusions that you can draw from this.



CBSE Delhi-2014 C

96. Two equal balls having equal positive charge q coulombs are suspended by two insulating strings of equal length. What would be the effect on the force when a plastic sheet is inserted between the two?

CBSE All India-2014

97. An infinite line charge produces a field of $9 \times 10^4\ \text{NC}^{-1}$ at a distance of 2 cm . Calculate the linear charge density.

Tamil Nadu Board-September, 2016

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



CBSE Delhi-2011, 2016

CBSE Foreign-2016

Section-C (Short Answer)

99. Calculate the magnitude of electrostatic force between a proton and an electron separated by a distance $0.5\text{ \AA}$. Given that magnitude of charge of proton and electron to be $1.6 \times 10^{-19}\text{ C}$ each and $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9\text{ N-m}^2.\text{C}^{-2}$.

Assam Board-2015

100. State Coulomb's law for force between stationary charges. Write its vector form and hence define one coulomb of charge in terms of force. What are the SI units of k (constant of proportionality) in the expression for Coulomb's law?

NIOS-2012

101. What are three basic properties of charges? State Coulomb's law of charges. Define the SI unit of charge with its help in terms of force. How many electronic charges are contained in this unit?

NIOS-2014

102. Two point charges $+9e$ and $+e$ are at a distance ' a ' apart. For the equilibrium position, where would a third point charge ' q ' be placed on the line joining the two charges?

UP Board-2022

103. Two point charges of $+1.5\ \mu\text{C}$ and $+2.5\ \mu\text{C}$ are placed 30 cm apart. Calculate the magnitude of electric potential and electric field at the mid-point of the line joining the two charges.

Nagaland Board-2018

104. Obtain an expression for the electrostatic potential energy of a system of two point charges.

Nagaland Board-2017

Section-D (Case-Based Questions)

105. Two point charges of $+1\ \mu\text{C}$ and $+4\ \mu\text{C}$ are kept 30 cm apart. How far from the $+1\ \mu\text{C}$ charge on the line joining the two charges, will the net electric field be zero?

CBSE-2020

Section-E (Long Answer)

106. State and explain Coulomb's law in vector form: Hence defines unit charge.

J&K Board-2021

107. ABCD is square of side 1m . Charges of $+3\text{nC}$, -5nC and $+3\text{nC}$ are placed at the corners A, B and C respectively. Calculate the work done transferring a charge of $12\ \mu\text{C}$ from D to the point of intersection of the diagonals?

Karnataka Board-July, 2019

108. Charges of $2\ \mu\text{C}$, $4\ \mu\text{C}$ and $6\ \mu\text{C}$ are placed at corners A, B and C respectively of a square ABCD of side $x\text{ metre}$. Find, what charge must be placed at the fourth corner so that the total potential at the center of the square is zero.

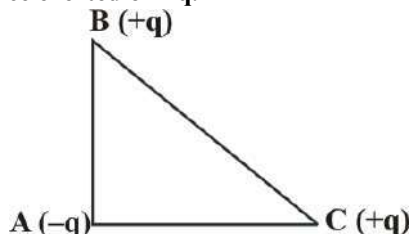
Karnataka Board-July, 2016

109. ABCD is square of side 2m . Charges of 5nC , $+10\text{nC}$ and -5nC are placed at corners A, B and C respectively. What is the work done in transferring a charge of 5nC from 'D' to the point of intersection of the diagonals?

Karnataka Board-July, 2015

110. (a) State Coulomb's law in electrostatics. Write it in its vector form. What is the importance of expressing it in vector form?

(b) Point charges each of magnitude q are placed at the three corners of a right-angled triangle BAC as shown in the figure, where $AB = AC$. Find the magnitude and direction of the force exerted on $-q$.



NIOS-2013

111. Two charges A (charge q) and B (charge $2q$) are located at points $(0, 0)$ and (a, a) respectively. Let $\hat{i}$ and $\hat{j}$ be the unit vectors along x-axis and y-axis respectively. Find the force exerted by A on B, in terms of $\hat{i}$ and $\hat{j}$

CBSE-2023

118. (a). (i) State Coulomb's law in electrostatics and write it in vector form, for two charges.

CBSE-2023

112. (a) Write expression for electric field intensity due to a point charge at distance r from it.
(b) What are electric lines of force? Give their main properties.

Haryana Board-2016

113. State Coulomb's law, explain its vector form and define S.I unit of electric charge. State two limitations of Coulomb's law.

Punjab Board-2018

III. Electric Field, Electric Flux and Electric Field Lines

Section-A (Multiple Choice Questions)

114. An electric dipole consisting of charges $+q$ and $-q$ separated by a distance r , is kept symmetrically at the centre of an imaginary sphere of radius R ($> r$). Another point charge Q is also kept at the centre of the sphere. The net electric flux coming out of the sphere will be

- (a) $\frac{-(2q+Q)}{4\pi\epsilon_0}$ (b) $\frac{Q}{\epsilon_0}$
(c) $\frac{2q+Q}{\epsilon_0}$ (d) $\frac{-Q}{\epsilon_0}$

CBSE-2020

Ans. (b) :

115. Which of the following is correct for electric flux in S.I. unit over a closed spherical surface having charge $(Q - q)$ inside it ?

- (a) $\frac{Q-q}{\epsilon_0}$ (b) $(Q-q)\epsilon_0$
(c) $\frac{\epsilon_0}{(Q-q)}$ (d) $\frac{1}{4\pi\epsilon_0}(Q-q)$

Bihar Board-2021

Ans. (a) :

116. Electric field lines provide information about

- (a) field strength (b) direction
(c) nature of charge (d) all of these

Bihar Board-2023

Ans. (d) :

117. The force, acting on per unit charge is called

- (a) Electric current (b) Electric potential
(c) Electric field (d) Electric space

Bihar Board-2023

Ans. (c) :

118. The total electric flux coming out from stationary unit positive charge in air is

- (a) ϵ_0 (b) $(\epsilon_0)^{-1}$
(c) $4\pi\epsilon_0$ (d) $(4\pi\epsilon_0)^{-1}$

Bihar Board-2023

Ans. (b) :

119. Find out the incorrect options from the following:

- (a) Inside a conductor, electrostatic field can never be zero.
(b) At the surface of a charged conductor, electrostatic field must be normal to the surface at every point.
(c) The interior of a conductor can have excess charge in the static situation.

Assam Board-2023

Ans. (b) :

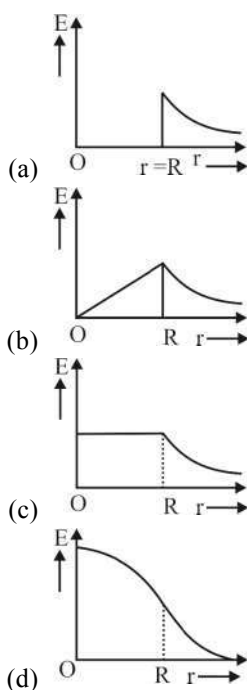
120. A charge q is enclosed in a cube. What is the electric flux through any of its two faces?

- (a) $\frac{q}{3\epsilon_0}$ (b) $\frac{q}{4\epsilon_0}$
(c) $\frac{q}{12\epsilon_0}$ (d) $\frac{q}{8\epsilon_0}$

Meghalaya Board-2017

Ans. (c) :

121. Which graph best represents the variation of electric field intensity as a function of distance from the centre of a uniformly charged spherical shell of radius R ?



Meghalaya Board-2014

Ans. (a) :

122. The intensity of electric field E due to charge Q at distance r :

- (a) $E \propto r$ (b) $E \propto \frac{1}{r^2}$
(c) $E \propto \frac{1}{r}$ (d) $E \propto \frac{1}{r^3}$

MP Board-2013

Ans. (b) :

123. The unit of electric flux is

- (a) newton/coulomb (b) volt $\times$ metre
(c) volt/metre (d) $\frac{\text{newton} \times \text{metre}}{\text{coulomb}}$

UP Board-2018, 2020

Ans. (b) :

124. A charge Q is placed at the centre of a cube. The electric flux through one of its face is

- (a) $\frac{Q}{\epsilon_0}$ (b) $\frac{Q}{6\epsilon_0}$
(c) $\frac{Q}{8\epsilon_0}$ (d) $\frac{Q}{3\epsilon_0}$

CBSE-2023

Ans. (b) :

125. An infinitely long uniformly charged wire produces an electric field of $18 \times 10^4 \text{ NC}^{-1}$ at a distance of 1.0 cm. The linear charge density on the wire is-

- (a) $1.12 \times 10^{-14} \text{ Cm}^{-1}$ (b) $3.08 \times 10^{-15} \text{ Cm}^{-1}$
(c) $1.0 \times 10^{-9} \text{ Cm}^{-1}$ (d) $1.0 \times 10^{-7} \text{ Cm}^{-1}$

CBSE-2023

Ans. (d) :

126. An electron experiences a force $(1.6 \times 10^{-16} \text{ N}) \hat{i}$ in an electric field $\vec{E}$. The electric field $\vec{E}$ is:

- (a) $\left(1.0 \times 10^3 \frac{\text{N}}{\text{C}}\right) \hat{i}$ (b) $-\left(1.0 \times 10^3 \frac{\text{N}}{\text{C}}\right) \hat{i}$
(c) $\left(1.0 \times 10^{-3} \frac{\text{N}}{\text{C}}\right) \hat{i}$ (d) $-\left(1.0 \times 10^{-3} \frac{\text{N}}{\text{C}}\right) \hat{i}$

CBSE-2023

Ans. (b) :

127. The magnitude of the electric field due to a point charge object at a distance of 4.0 m is 9 N/C. From the same charged object the electric

field of magnitude, $16 \frac{\text{N}}{\text{C}}$ will be at a distance

of

- (a) 1m (b) 2m
(c) 3m (d) 6m

CBSE-2023

Ans. (c) :

128. The electric flux through a closed Gaussian surface depends upon

- (a) Net charge enclosed and permittivity of the medium
(b) Net charge enclosed, permittivity of the medium and the size of the Gaussian surface
(c) Net charge enclosed only
(d) Permittivity of the medium only

CBSE-2020

Ans. (a) :

129. The electric flux emerging out from 1 C charge is

- (a) $\frac{1}{\epsilon_0}$ (b) 4π
(c) $\frac{4\pi}{\epsilon_0}$ (d) ϵ_0

CBSE-2020

Ans. (c) :

130. If the net electric flux through a closed surface is zero, then we can infer

- (a) no net charge is enclosed by the surface.
(b) uniform electric field exists within the surface
(c) electric potential varies from point to point inside the surface
(d) charge is present inside the surface.

CBSE-2020

Ans. (a) :

131. The SI unit of electric flux is-

- (a) NC^{-1}m^2 (b) $\text{NC}^{-1}\text{m}^{-2}$
(c) $\text{N}^{-1}\text{C}^{-1}\text{m}^{-2}$ (d) $\text{N}^{-1}\text{C}^1\text{m}^2$

Rajasthan Board-2022

Ans. (a) :

132. There exist 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) 10 Vm (b) 2.0 Vm
 (c) 1.0 Nm²/c (d) 4.0Nm²/c

Gujarat Board- May, 2021

Ans. (c) :

133. The number of electric field lines emerged out from 1C charge is _____.
 ($\epsilon_0 = 8.85 \times 10^{-12}$ MKS)
 (a) 1.13×10^{11} (b) 8.85×10^2
 (c) 9×10^9 (d) infinite

Gujarat Board- May, 2021

Ans. (d) :

134. Two metallic spheres of radii R_1 and R_2 are charged. Now they are brought into contact with each other with a conducting wire and then are separated. If the electric fields on their surfaces are E_1 and E_2 respectively $\frac{E_1}{E_2} = \dots\dots\dots$

- (a) $\frac{R_1}{R_2}$ (b) $\frac{R_2}{R_1}$
 (c) $\frac{R_2^2}{R_1^2}$ (d) $\frac{R_1^2}{R_2^2}$

Gujarat Board- March, 2019

Ans. (b) :

135. The dimensional formula of electric flux is _____.
 (a) $M^1 L^{-3} T^{-3} A^{-1}$ (b) $M^1 L^3 T^{-3} A^{-1}$
 (c) $M^{-1} L^3 T^{-3} A^{-1}$ (d) $M^1 L^3 T^3 A^{-1}$

Gujarat Board-, 2022, 2023

Ans. (b) :

136. The number of electric field lines coming out of charge _____, kept in a vacuum is 1.13×10^{11}
 ($\epsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2}$)
 (a) 2 C (b) 1 mC
 (c) 2 mC (d) 1 C

Gujarat Board-March, 2022

Ans. (d) :

137. An electric field line is a curve drawn in such a way that the tangent drawn at any point on the curve gives _____ at that point.
 (a) Magnitude of the electric field
 (b) Direction of the electric field
 (c) both magnitude and direction of electric field
 (d) None of the given choices

Gujarat Board-March, 2022

Ans. (b) :

138. If σ is the surface charge density and ϵ_0 is the permittivity of free space. Then the magnitude of the electric field at the surface of a charged conductor is _____.

- (a) $\frac{\sigma}{\epsilon_0}$ (b) $\frac{2\sigma}{\epsilon_0}$
 (c) $\frac{\sigma}{2\epsilon_0}$ (d) $\frac{5\sigma}{3\epsilon_0}$

Gujarat Board- July, 2022

Ans. (c) :

139. Which one of the following property is not true for electric field lines?
 (a) Electric field lines can be taken to be continuous curves without any breaks
 (b) Two field lines can never cross each other
 (c) Electric field lines form closed loops
 (d) The tangent drawn at any point of the field lines represents direction of $\vec{E}$

Gujarat Board- July, 2022

Ans. (a) :

140. Electric field due to a uniformly charged infinite plane sheet at a distance r _____.
 (a) is proportional to r
 (b) is proportional to $\frac{1}{r^2}$
 (c) is proportional to r^2
 (d) does not depend on r

Gujarat Board- July, 2022

Ans. (d) :

141. Dimensional formula of ϵ_0 is
 (a) $[M^1 L^2 T^{-4} A^{-2}]$ (b) $[M^{-1} L^{-3} T^4 A^2]$
 (c) $[M^1 L^3 T^{-4} A^{-2}]$ (d) $[M^{-1} L^{-2} T^4 A^2]$

Jharkhand Board-2023

Ans. (b) :

142. The electric field at a point outside the plates of two oppositely charged plane sheets of charge density ' σ ' is:
 (a) $\frac{\sigma}{\epsilon_0}$ (b) $\frac{+\sigma}{2\epsilon_0}$
 (c) Zero (d) $\frac{-\sigma}{2\epsilon_0}$

Tamil Nadu Board-2018

Ans. (c) :

143. Two point charges + 4q and + q are placed 30 cm apart. At what point on the line joining them the electric field is zero?
 (a) 15 cm from the charge + q
 (b) 7.5 cm from the charge + q
 (c) 20 cm from the charge + 4q
 (d) 5 cm from the charge + q

Tamil Nadu Board-September, 2016

Ans. (c) :

144. Electric field intensity is 400 Vm^{-1} at a distance of 2m from a point charge. It will be 100 vm^{-1} at distance:

(a) 50 cm (b) 4 cm
(c) 4 m (d) 1.5 m

Tamil Nadu Board-2015

Ans. (c) :

145. The unit of the number of electric lines of force passing through a given area is:

(a) No unit (b) NC^{-1}
(c) Nm^2C^{-1} (d) Nm

Tamil Nadu Board-2015

Ans. (c) :

Section-B (Very Short Answer)

146. Show the electric field lines due to a single positive charge ($q > 0$)

Rajasthan Board-2023

147. A dipole with its charge $-q$ and $+q$ located at the points $(0, -b, 0)$ and $(0, +b, 0)$ is present in a uniform electric field E . The equipotential surfaces of this field are planes parallel to the YZ -plane.

- (i) What is the direction of the electric field E ?
(ii) How much torque would the dipole experience in this field?

CBSE Delhi-2010C

148. Two charged conducting sphere of radii r_1 and r_2 connected to each other by a wire. Find the ratio of electric field at the surfaces of the two spheres.

CBSE Delhi-2011C

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

CBSE Delhi-2011

150. Why are electric field lines perpendicular at a point on an equipotential surface of a conductor?

CBSE All India-2015C

151. Write the SI unit of electric flux.

Karnataka Board-March, 2020

152. Write two properties of electric field lines.

Gujarat Board-2020, 2022

Uttarakhand Board-2020

Tamil Nadu Board-2016, 2018

Karnataka Board-March, 2016, 2017, 2018

Karnataka Board-July, 2015, 2019, 2020

153. Sketch the electric lines of force due to a point charge q . If i) $q < 0$ and $q > 0$.

Karnataka Board-July, 2016

154. Write the SI unit of electric field.

Karnataka Board-July, 2016

155. What is the electric field inside a thin charged spherical shell?

Karnataka Board-July, 2020

156. Establish a relation for electric field intensity due to a uniformly charged spherical shell at a point outside the shell.

Uttarakhand Board-2020

157. Derive an expression for intensity of electric field due to a uniformly charged infinite plane sheet at a point near it.

2

Uttarakhand Board-2019

158. What is the value of electric field intensity at any point inside a solid charged conducting sphere? **1**

Uttarakhand Board-2019

159. Define electric flux. Write its SI unit.

CBSE-2023

Chhattisgarh Board-2019

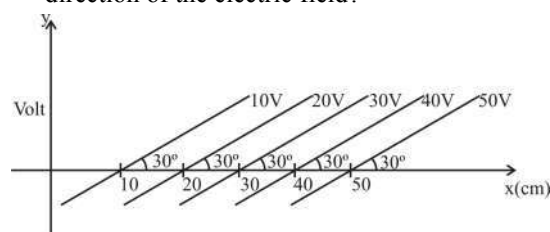
Bihar Board-2019

160. What is electrostatic shielding? How can it be achieved?

Bihar Board-2022

Assam Board-2013

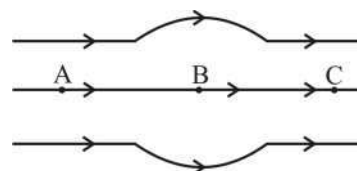
161. Some equipotential surfaces are shown in the figure. What can you say about the magnitude and direction of the electric field?



Kerala Board-2013

162. The region around a charge where its effect can be felt is called the electric field.

- (a) The electric field lines corresponding to an electric field is shown below.

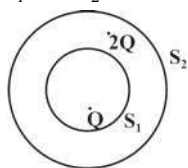


The figure suggests that

- (i) $E_A > E_B > E_C$
(ii) $E_A = E_B = E_C$
(iii) $E_A < E_B < E_C$
(iv) $E_A = E_C > E_B$
(v) $E_A = E_C < E_B$

Kerala Board-2013

163. S_1 and S_2 are two parallel concentric spheres enclosing charges Q and $2Q$ respectively as shown in the figure below. What is the ratio of electric flux through S_1 and S_2 ?



Meghalaya Board-2018

164. Write the mathematical expression and SI unit of electric flux.

Meghalaya Board-2013

165. Show that the electric flux passing through a surface parallel to the electric field is zero.

MP Board-2022

166. A particle of mass m and charge q traverses distance d from the rest in a uniform electric field E . Prove that the velocity (v) attained by the particle is $v = \sqrt{\frac{2qEd}{m}}$.

UP Board-2023

167. A charged oil drop weighing 1.6×10^{-15} N is found to remain suspended in a uniform electric field of intensity 2×10^3 NC $^{-1}$. Find the charge on the drop.

ISC-2016

168. Two point charges $Q_1 = 400 \mu\text{C}$ and $Q_2 = 100 \mu\text{C}$ are kept fixed, 60cm apart in vacuum. Find intensity of the electric field at mid-point of the line joining Q_1 and Q_2 .

ISC-2016

169. A point charge of 5×10^{-6} C experiences a force of 2×10^{-3} N when kept in a uniform electric field of intensity E . Then, find the value of E .

ISC-2012

170. Draw (at least three) electric lines of force due to an electric dipole.

ISC-2008

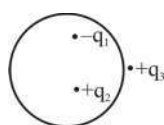
171. Draw a pattern of electric field lines due to two positive charges placed a distance d apart.

CBSE-2019

172. A proton released from rest in an electric field, will start moving towards a region of _____ potential in the field.

CBSE-2020

173. Electric flux through a spherical surface shown in the figure, is _____.



CBSE-2020

174. Give the properties of electric line of forces.

J&K Board-2014, 2015

175. Charge density of an infinite linear charge is 2 microcoulomb/metre.

Determine the value of electric field intensity at a point which is 5 cm away perpendicularly from this linear charge in air.

Rajasthan Board-2011

176. What are electric field lines? Mention any two of its properties.

Jharkhand Board-2020

177. An infinite line charge produces an electric field of 1.8×10^5 NC $^{-1}$ at a distance of 2 cm. Calculate the linear charge density :

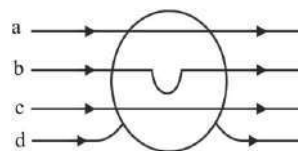
Jharkhand Board-2020

178. Point charge ($+Q$) is kept in the vicinity of uncharged conducting plate. Sketch electric field lines between the charge and the plate.

CBSE Foreign-2014

179. A metallic sphere is placed in a uniform electric field as shown in the figure.

Which path is followed by electric field lines and why?



CBSE Foreign-2010

180. A proton is placed in a uniform electric field directed along the positive X-axis. In which direction will it tend to move?

CBSE Delhi-2011 C

181. Draw a plot showing the variation of electric field (E) with distance r due to a point charge q .

CBSE Delhi-2012

182. Why must electrostatic field at the surface of a charged conductor be perpendicular to every point on it?

CBSE Foreign-2014

CBSE Delhi-2012

183. Why do the electric field lines never cross each other?

CBSE All India-2014

184. Why do the electrostatic field lines not form closed loop?

CBSE All India-2014

CBSE Delhi-2012

185. Draw the pattern of electric field lines due to an electric dipole.

CBSE All India-2019

186. Draw a pattern of electric field lines due to two positive charges placed a distance d apart.

CBSE All India-2019

187. Draw the pattern of electric field lines, when a point charge-Q is kept near an uncharged conducting plate.

CBSE Delhi-2019

188. If the electric flux entering and leaving a closed surface in air are ϕ_1 and ϕ_2 respectively, the net electric charge enclosed within the surface is _____.

CBSE-2020

189. A thin straight infinitely long conducting wire having charge density λ is enclosed by a cylindrical surface of radius r and length l , its axis coinciding with the length of the wire. Find the expression for the electric flux through the surface of the cylinder.

CBSE All India-2011

190. Show that the electric field at the surface of a charged conductor is given by $E = \frac{\sigma}{\epsilon_0} \hat{n}$ where σ

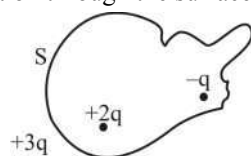
is the surface charge density and $\hat{n}$ is a unit vector normal to the surface in the outward direction.

CBSE All India-2010

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

CBSE All India-2015

192. Figure shows three point charges, $+2q$, $-q$ and $+3q$. Two charges $+2q$ and $-q$ are enclosed within a surface S . What is the electric flux due to this configuration through the surface S ?



CBSE Delhi-2010

Section-C (Short Answer)

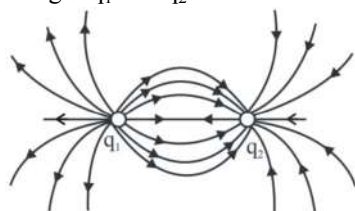
193. Explain why two lines of force in an electric field cannot intersect each other

Odisha Board-2023

194. If $\vec{E} = (3\hat{i} + 6\hat{j} + 4\hat{k}) \frac{N}{C}$, calculate the electric flux through a surface of area 20cm^2 in Y-Z plane.

Assam Board-2014

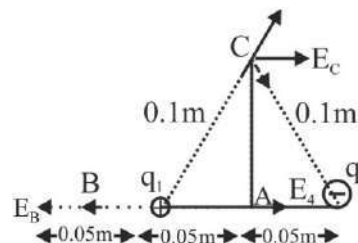
195. (a) Write any two properties of electric field lines.
(b) Observe the figure and write the signs of the charges q_1 and q_2 .



Kerala Board-2021

196. Electric field is an important way of characterizing the electrical environment of a system of charges.

Two point charges q_1 and q_2 of $+10^{-8}\text{C}$ and -10^{-8}C respectively are placed 0.1 m apart. Calculate the electric fields at points A, B and C shown in the figure.



Kerala Board-2014

197. What is meant by electric flux? Write its S.I. unit and dimensional formula.

MP Board-2013

198. Define electric field due to a point charge. Write the mathematic expression for it in the vector form. What is the SI unit of electric field? Draw the electric field lines due to (a) an isolated positive charge, (b) an isolated negative charge and (c) an electric dipole.

NIOS-2012

199. Define electric lines of force (field lines). State their six properties.

NIOS-2014

200. A uniformly charged straight wire of infinite length has linear charge density of 10×10^{-8} coulomb/metre. Calculate the electric field intensity at a perpendicular distance of 2 cm from the wire

UP Board-2020

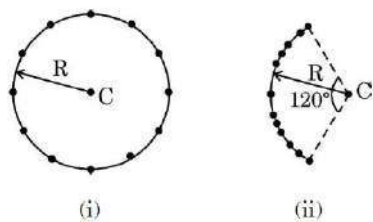
201. (a) Draw equipotential surface corresponding to the electric field that uniformly increases in magnitude along with the z-directions.
(b) Two charges $-q$ and $+q$ are located at points $(0, 0, -a)$ and $(0, 0, a)$. What is the electrostatic potential at the point $(0, 0, \pm z)$ and $(x, y, 0)$?

CBSE-2019

202. Twelve negative charges of same magnitude are equally spaced and fixed on the circumference of a circle of radius R as shown in Fig. (i). Relative to potential being zero at infinity, find the electric potential and electric field at the centre C of the circle.

CBSE-2023

203. If the charges are unequally spaced and fixed on an arc of 120° of radius R as shown in Fig. (ii), find electric potential at the centre C .



CBSE-2023

204. (b) A particle of charge $2 \mu\text{C}$ and mass 1.6 g is moving with a velocity $4\hat{i} \text{ ms}^{-1}$. At $t = 0$ the particle enters in a region having an electric field $\vec{E}$ (in NC^{-1}) $= 80\hat{i} + 60\hat{j}$. Find the velocity of the particle at $t = 5\text{s}$.

CBSE-2020

205. (a) Two electric field lines cannot cross each other. Also, they cannot form closed loops. Give reasons.

CBSE-2020

206. Derive an expression for electric field intensity E near a thin uniformly charged infinite plane sheet.

Haryana Board-2018

207. What is electric flux? State Gauss's law for electric flux. Write important points regarding this law.

Haryana Board-2018

208. In a certain region the electric potential is given by the formula $V(x,y,z) = 2x^2y + 3y^3z - 4z^4x$. Find the components of electric field and the vector electric field at point $(1, 1, 1)$ in this field.

Gujarat Board- May, 2021

209. An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude $2 \times 10^4 \text{ NC}^{-1}$. 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.

Gujarat Board- March, 2020

210. Derive an expression for the electric field due to an infinitely long straight uniformly charged wire.

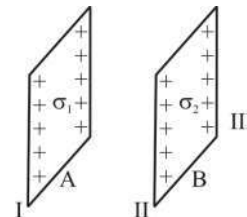
Gujarat Board-March, 2022

Section-D (Case-Based Questions)

211. Derive an expression for the magnitude of electric field intensity at a point on the equatorial line of an electric dipole. Also write the expression in vector form. Show that at a given distance from the centre of a short electric dipole, the magnitude of electric field intensity on the axial line is twice that of the equatorial line.

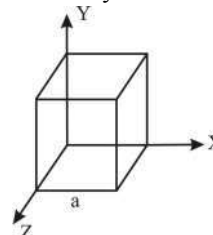
Meghalaya Board-2015

212. Two infinitely large plane thin parallel sheets having surface charge densities σ_1 and σ_2 ($\sigma_1 - \sigma_2$) are shown in the figure. Write the magnitudes and directions of the net fields in the regions marked II and III.



CBSE Foreign-2014

213. Given the electric field in the region $E = 2x\hat{i}$, find the net electric flux through the cube and the charge enclosed by it.



CBSE All India-2015

CBSE Delhi-2015

Section-E (Long Answer)

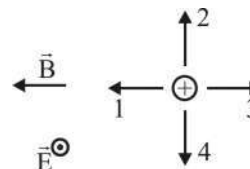
214. What is meant by Electric Flux? State the Gauss's law in electrostatics and using this, find the expression for electric field intensity due to a uniformly charged infinite plane sheet.

Uttarakhand Board-2022

215. Explain the concept of electric field. Express electric flux through a surface in terms of electric field intensity. Show that the electric flux through a cylindrical surface with its axis parallel to a uniform electric field is zero.

Assam Board-2015

216. The figure shows four directions for the velocity vector $\vec{v}$ of a positively charged particle. It is moving through a uniform electric field $\vec{E}$ directed normally out of the page and a uniform magnetic field $\vec{B}$ as shown:



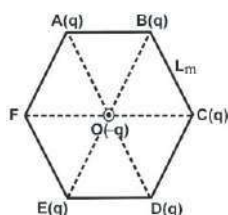
- Which direction of motion will give the particle the greatest net force?
- Motion in which direction may result in net force zero on the particle.
- Write the equation of the speed of the charged particle when it moves undeflected in the field.

Goa Board-2023

217. What are electric field lines? State their three properties. Draw electric field lines for
(a) single positive point charge; and (b) electric dipole.

NIOS-2021

218. (a) Define electric field at a point. State its SI unit. Explain why test charge q_0 should be infinitesimally small. Show the direction of the electric field due to isolated (i) +ve and (ii) -ve charge.
(b) Five point charges each of magnitude q C are placed on five vertices of a regular hexagon of side L metre. Find the magnitude of force on a charge $-q$ C, placed at the centre of the hexagon.



NIOS-2013

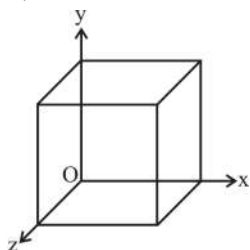
219. Derive an expression for the electric field at a point on the equatorial plane of an electric dipole consisting of charges q and $-q$ separated by a distance $2a$.

CBSE-2023

220. A thin circular ring of radius r is charged uniformly so that its linear charge density becomes λ . Derive an expression for the electric field at a point P at a distance x from it along the axis of the ring. Hence, Prove that at large distance ($x \gg r$), the ring behaves as a point charge.

CBSE-2020

221. A cube of side 20 cm is kept in a region as shown in the figure. An electric field $\vec{E}$ exists in the region such that the potential at a point is given by $V = 10x + 5$, where V is in volt and x is in m.



Find the

- (i) electric field $\vec{E}$, and
(ii) total electric flux through the cube.

CBSE-2020

222. Two identical metallic spheres A and B having charges $+4Q$ and $-10Q$ are kept a certain distance apart. A third identical uncharged sphere C is first placed in contact with sphere A and then with sphere B. then, spheres A and B are brought in contact and then separated. Find the charges on the spheres A and B.

CBSE All India-2011 C

223. (i) Define electric flux. Write its SI unit.
(ii) Using Gauss' law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of distance from it. How is the field directed if
(a) the sheet is positively charged?
(b) negatively charged?

CBSE Delhi-2012

224. Define electric flux. Write its SI unit.

CBSE Delhi-2012C

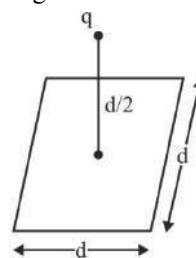
225. Define electric flux. Write its SI unit, Gauss' law in electrostatics is true for any closed surface, no matter what its shape or size is. Justify this statement with the help of a suitable example.

CBSE Delhi-2015

226. An infinitely large thin plane sheet has a uniform surface charge density $+\sigma$. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point, distant r , in front of the charged plane sheet.

CBSE All India-2017

227. Define electric flux. Is it a scalar or a vector quantity? A point charge q is at a distance of $d/2$ directly above the centre of a square of side d , as shown in the figure.



Use Gauss' law to obtain the expression for the electric flux through the square.

CBSE-2018

228. If the point charge is now moved to a distance d from the centre of the square and the side of the square is doubled, explain how the electric flux will be affected.

CBSE-2018

229. Why two electric lines of force / field cannot intersect each other?

Punjab Board-2018

IV. Electric Dipole and Dipole in a Uniform External Field

Section-A (Multiple Choice Questions)

230. Which of the following relations is correct for torque ($\vec{\tau}$) acting on an electric dipole of dipole moment $\vec{P}$ placed in electric field intensity $\vec{E}$?

- (a) $\vec{\tau} = \vec{P} \times \vec{E}$ (b) $\vec{\tau} = \vec{P} \cdot \vec{E}$
(c) $\tau = PE$ (d) $\tau = P/E$

Bihar Board-2021

Ans. (a) :

231. The electric potential in equatorial position of an electric dipole is

- (a) $\frac{1}{4\pi\epsilon_0} \frac{p \cos \theta}{r^2}$ (b) $\frac{1}{4\pi\epsilon_0} \frac{p}{r^2}$
(c) $\frac{1}{4\pi\epsilon_0} \frac{p}{r}$ (d) zero

Bihar Board-2022

Ans. (a) :

232. What is the angle between the electric dipole moment $\vec{P}$ and the electric field strength $\vec{E}$ when the dipole is in a stable equilibrium?

- (a) $\frac{\pi}{4}$ (b) π
(c) $\frac{\pi}{2}$ (d) 0

Bihar Board-2023

Ans. (d) :

233. An electric dipole of moment p is lying along a uniform electric field E . The work done in rotating the dipole by 90° is

- (a) pE (b) $\sqrt{2}pE$
(c) $p \frac{E}{2}$ (d) $2pE$

Meghalaya Board-2015

Ans. (d) :

234. A dipole of electric dipole moment p is placed in a uniform electric field of strength E . If θ is the angle between positive direction of p and E , then the potential energy of the electric dipole is minimum when θ is

- (a) 90° (b) 0°
(c) 45° (d) 180°

Meghalaya Board-2013

Ans. (b) :

235. The angle at which maximum torque is exerted by the external uniform electric field on the electric dipole is ____.

- (a) 0° (b) 30°
(c) 45° (d) 90°

Maharashtra Board-2022

Ans. (d) :

236. The angle between electric field and dipole moment of an axial position of the electric dipole.

- (a) 0° (b) 180°
(c) 90° (d) 270°

MP Board-2020

Ans. (b) :

237. An electric dipole of length 2 cm is placed at an angle of 30° with an electric field 2×10^5 N/C. If the dipole experiences a torque of 8×10^{-3} Nm, the magnitude of either charge of the dipole, is

- (a) $4 \mu\text{C}$ (b) $7 \mu\text{C}$
(c) 8 mC (d) 2 mC

CBSE-2023

Ans. (a) :

238. An electric dipole of dipole moment 2×10^{-8} C-m in a uniform electric field experiences a maximum torque of 6×10^{-4} N-m. The magnitude of electric field is

- (a) $2.2 \times 10^3 \text{ Vm}^{-1}$ (b) $1.2 \times 10^4 \text{ Vm}^{-1}$
(c) $3.0 \times 10^4 \text{ Vm}^{-1}$ (d) $4.2 \times 10^3 \text{ Vm}^{-1}$

CBSE-2023

Ans. (c) :

239. A point charge situated at a distance 'r' from a short electric dipole on its axis, experiences a force $\vec{F}$. If the distance of the charge is '2r', the force on the charge will be:

- (a) $\frac{\vec{F}}{16}$ (b) $\frac{\vec{F}}{8}$
(c) $\frac{\vec{F}}{4}$ (d) $\frac{\vec{F}}{2}$

CBSE-2023

Ans. (b) :

240. A point charge is situated at an axial point of a small electric dipole at a large distance from it. The charge experiences a force F . If the distance of the charge is doubled, the force acting on the charge will become .

- (a) $2F$ (b) $F/2$
(c) $F/4$ (d) $F/8$

CBSE-2020

Ans. (d) :

241. An electric dipole is placed in a uniform field. The resultant force acting on it—.

- (a) never be zero
(b) depends on its relative moment
(c) always be zero
(d) depends on its dipole moment

Gujarat Board- May, 2021

Ans. (c) :

242. Electric field due to dipole at large distance (r) falls off as —.

- (a) $\frac{1}{r}$ (b) $\frac{1}{r^2}$
(c) $\frac{1}{r^3}$ (d) $\frac{1}{r^4}$

Gujarat Board- March, 2020

Ans. (c) :

243. An electric dipole with dipole moment 4×10^{-9} cm is aligned at 30° with the direction of a uniform electric field of magnitude 5×10^4 NC⁻¹. The magnitude of the torque on the dipole is J.

- (a) 10^2 (b) 10^{-2}
(c) 10^4 (d) 10^{-4}

Gujarat Board- July, 2022

Ans. (d) :

244. The electric field and the potential of an electric dipole vary with distance r as

- (a) $\frac{1}{r}$ and $\frac{1}{r^2}$ (b) $\frac{1}{r^2}$ and $\frac{1}{r}$
(c) $\frac{1}{r^2}$ and $\frac{1}{r^3}$ (d) $\frac{1}{r^3}$ and $\frac{1}{r^2}$

Jharkhand Board-2023

Ans. (d) :

245. A dipole is placed in a uniform electric field with its axis parallel to the field. It experiences :

- (a) Both a net force and torque
(b) Only a net force
(c) Neither a net force nor a torque
(d) Only a torque

Tamil Nadu Board-2016, 2018

Ans. (c) :

246. A given charge situated at a certain distance from an electric dipole of very small length along its axial line experiences a force F. If the distance of the charge is doubled, the force on the charge will become.

- (a) 2F (b) F/2
(c) F/4 (d) F/8

Meghalaya Board-2018

Ans. (d) :

Section-B (Very Short Answer)

247. Write the value of electric field due to an electric dipole at a point on its axis.

Rajasthan Board-2023

248. Torque acting on an electric dipole placed in an electric field is maximum when the angle between the electric field and the dipole moment is _____.

CBSE-2020

249. Draw equipotential surfaces for an electric dipole.

CBSE Delhi-2019

250. An electric dipole of dipole moment 4×10^{-9} C-m is inclined at an angle 30° to a uniform electric field of magnitude 5×10^4 N/C. Calculate the torque applied on electric dipole.

Uttarakhand Board-2020

251. Write the formula for the intensity of electric field at a point in the axial position of a electric dipole, giving the meaning of the symbols used.

Uttarakhand Board-2022

252. Derive an expression for the intensity of the electric field at a point on the equatorial plane of an electric dipole.

AP Board-2021

253. Derive an expression for the intensity of the electric field at a point on the axial line of an electric dipole.

AP Board-2022

Tamil Nadu Board-2016, 2018

254. Write the definition and S.I. unit of electric dipole moment.

Bihar Board-2021

255. What is an electric dipole? Find an expression for the torque acting on an electric dipole placed in an external uniform electric field.

Assam Board-2013

256. (a) (i) What is an electric dipole ? An electric dipole with dipole moment 4×10^{-9} cm is aligned at 30° with the direction of a uniform electric field of magnitude 5×10^4 NC⁻¹. Calculate the magnitude of the torque.

Assam Board-2023

257. Prove that the electric potential at a point in broad side on position due to an electric dipole is zero.

MP Board-2015

258. Write SI unit and dimensional formula of electric dipole moment.

Chhattisgarh Board-2022

259. Whether electric dipole moment is a vector or a scalar quantity?

Write the SI unit of electric dipole moment

Chhattisgarh Board-2021

260. How will an electric dipole behave when placed in a non-uniform electric field ?

NIOS-2022

261. Maximum torque acting on an electric dipole of moment 3×10^{-29} Cm in a uniform electric field E is 6×10^{-25} Nm. Find the value of E.

ISC-2017

262. What will be the net electric force acting on an electric dipole placed in a uniform electric field?

ISC-2007

263. Draw the pattern of electric field lines due to an electric dipole.

CBSE-2019

264. An electric dipole of dipole moment ($\vec{p}$) is kept in a uniform electric field $\vec{E}$. Show graphically the variation of torque acting on the dipole (τ) with its orientation (θ) in the field. Find the orientation in which torque is (i) zero and (ii) maximum.

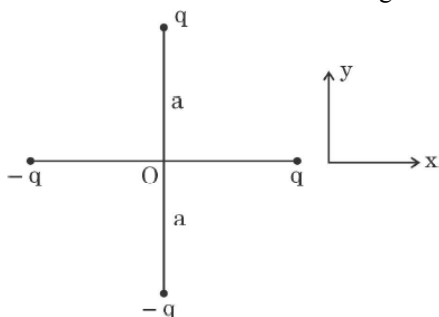
CBSE-2023

265. Depict the orientation of an electric dipole in (a) stable and (b) unstable equilibrium in an external uniform electric field.

Write the potential energy of the dipole in each case.

CBSE-2023

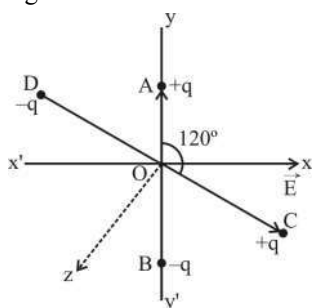
266. Two identical dipoles are arranged in x-y plane as shown in the figure. Find the magnitude and the direction of net electric field at the origin O



CBSE-2023

267. Two small identical electric dipoles AB and CD, each of dipole moment $\vec{p}$ are kept at an angle of 120° to each other in an external electric field $\vec{E}$ pointing along the x-axis as shown in the figure. Find the

- (a) dipole moment of the arrangement, and
(b) magnitude and direction of the net torque acting on it.



CBSE-2020

268. Establish an expression for the electric field at a point along the axial line of an electric dipole.

Meghalaya Board-2021

Nagaland Board-2018, 2021

273. Derive the formula for the electric potential energy of an electric dipole in a uniform electric field.

Gujarat Board- May, 2021

269. Derive an expression for the electric potential at a point in axial position due to an electric dipole.

Jharkhand Board-2020

270. A dipole with a dipole moment of magnitude p is in stable equilibrium in an electrostatic field of magnitude E . Find the work done in rotating this dipole to its position of unstable equilibrium.

CBSE All India-2010C

271. A dipole is present in an electrostatic field of magnitude 10^6 NC^{-1} . If the work done in rotating it from its position of stable equilibrium to its position of unstable equilibrium is $2 \times 10^{-23} \text{ J}$, then find the magnitude of the dipole moment of this dipole.

CBSE All India-2010C

272. Calculate the amount of work done in turning an electric dipole of dipole moment $3 \times 10^{-8} \text{ C} \cdot \text{m}$ from its position of unstable equilibrium in a uniform electric field of intensity 10^3 NC^{-1}

CBSE Foreign-2011

273. An electric dipole of length 4cm when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of $4\sqrt{3} \text{ N-m}$. Calculate the potential energy of the dipole if it has charge $\pm 8 \text{ nC}$

CBSE Delhi-2014

274. An electric dipole of length 2 cm when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of $8\sqrt{3} \text{ N-m}$. Calculate the potential energy of the dipole if it has charge of $\pm 4 \text{ nC}$.

CBSE Delhi-2014

275. An electric dipole of length 1cm when placed with its axis making an angle of 60° with uniform electric field, experiences a torque of $6\sqrt{3} \text{ N-m}$. Calculate the potential energy of the dipole, if it has charge $\pm 2 \text{ nC}$.

CBSE Delhi-2014

276. An electric dipole is placed in a uniform electric field E with its dipole moment p parallel to the field. Find

- (i) the work done in turning the dipole till its dipole moment points in the direction opposite to E .
(ii) the orientation of the dipole for which the torque acting on it becomes maximum.

CBSE All India-2014C

277. Derive an expression for the electric field due to a dipole of dipole moment p at a point on its perpendicular bisector.

CBSE Delhi-2019

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

CBSE Delhi-2011

279. Define dipole moment of an electric dipole. Is it a scalar quantity or a vector quantity?

CBSE Foreign-2012

CBSE All India-2011

280. Derive an expression for the torque acting on the electric dipole when placed in a uniform electric field.

Nagaland Board-2017, 2020

Tamil Nadu Board-2016

281. What is an electric dipole? Define electric dipole moment.

J&K Board-2023

Tamil Nadu Board-2011, 2017

Section-C (Short Answer)

282. Derive the expression for electric field intensity at a point on equatorial plane due to electric dipole.

Uttarakhand Board-2019

283. An electric dipole consists of two opposite charges each of magnitude $1\mu\text{C}$, separated by 2 cm. The dipole is placed in an external electric field of 10^5 N/C .

Calculate the:

- Maximum torque experienced by the dipole and
- Work done by the external field to turn the dipole through 180° .

Maharashtra Board-2023

284. Prove that potential at point on transverse (equatorial) position of electric dipole is zero.

MP Board-2014

285. What is meant by an electric dipole? Derive an expression for electric field intensity due to an electric dipole in axial position at a point.

MP Board-2018

286. What is meant by the electric dipole? Obtain expression for the intensity of electric field at a point in end and off position due to an electric dipole.

MP Board-2020

287. Find the magnitude and direction of the electric field intensity due to an electric dipole of moment 10^{-10} C-m at a point 20cm from each charge. Dipole length is 10cm.

NIOS-2019

288. Derive the formula for the work done to rotate the electric dipole in electric field.

UP Board-2019

289. An electric dipole of dipole moment p is placed in a uniform electric field E with its axis inclined to the field. Write an expression for the torque τ

experienced by the dipole in vector form. Show diagrammatically, show the dipole should be kept in the electric field so that the torque acting on it is

- Maximum
- Zero

ISC-2014

290. (i) Write an expression (derivation not required) for intensity of electric field in

- axial position.
- broadside position of an electric dipole, in terms of its length (2a) dipole moment (p) and distance l .

- (ii) What is the ratio of these two intensities i.e. $E_1 : E_2$, for a short electric dipole ?

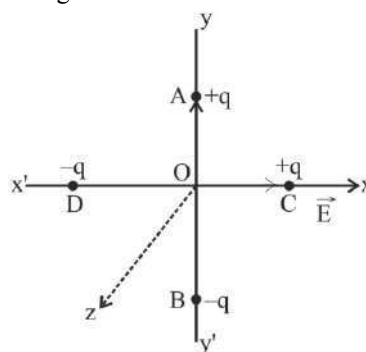
ISC-2013

291. An electric dipole is placed in a uniform external electric field E . Show that the torque acting on the dipole is given by $\tau = p \times E$, where p is the dipole moment.

ISC-2005

292. Two small identical electric dipoles AB and CD, each of the dipole moment $\vec{p}$ are kept at an angle of 90° to each other in an external electric field $\vec{E}$ pointing along the x-axis as shown in the figure. Find the

- dipole moment of the arrangement, and
- magnitude and direction of the net torque acting on it.



CBSE-2020

293. Define electric dipole moment. Derive an expression for the electric field at a point on equatorial (broad-side-on) position of an electric dipole.

Jharkhand Board-2018, 2023

294. (i) Derive the expression for electric field at a point on the equatorial line of an electric dipole.
(ii) Depict the orientation of the dipole in (a) stable, (b) unstable equilibrium in a uniform electric field.

CBSE Delhi-2017

CBSE All India-2014

295. (i) Obtained the expression for the torque τ experienced by an electric dipole of dipole moment p in uniform electric field, E .
 (ii) What will happen, if the field were not uniform?

CBSE Delhi-2017

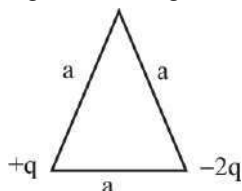
296. A charge is distributed uniformly over a ring radius a . Obtain an expression for the electric field intensity E at a point on the axis of the ring. Hence, show that for points at large distances from the ring, it behaves like a point charge.

CBSE Delhi-2016

297. An electric dipole of dipole moment p is placed in a uniform electric field E . Obtained the expression for the torque τ experienced by the dipole. Identify two pairs of perpendicular vector in the expression.

CBSE Delhi-2015C

298. Two point charges $+q$ and $-2q$ are placed at the vertices B and C of the an equilateral $\triangle ABC$ of side a as given in the figure. Obtain the expression for



- (i) the magnitude and
 (ii) the direction of the resultant electric field at the vertex A due to these two charges.

CBSE All India-2014C

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

CBSE All India-2013

300. An electric dipole is kept in a uniform electric field. Derive an expression for the net torque acting on it and write its direction. State the conditions under which the dipole is in

- (i) stable equilibrium
 (ii) unstable equilibrium.

CBSE Delhi-2012C

301. Sketch the pattern of electric field lines due to
 (i) a conducting sphere having negative charge it.
 (ii) an electric dipole.

CBSE All India-2011C

302. What is an electric dipole? Derive an expression for the electric field due to an electric dipole at a point on the equatorial line.

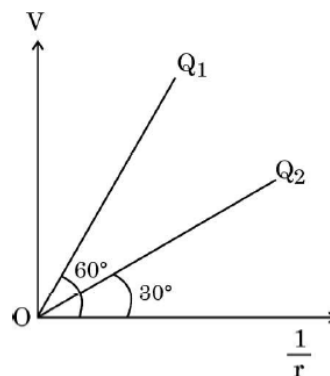
Tamil Nadu Board-2015

Section-D (Case-Based Questions)

303. Electrostatics deals with the study of forces, fields and potentials arising from static charges. Force and electric field, due to a point charge is basically determined by Coulomb's law. For symmetric charge configurations, Gauss's law, which is also based on Coulomb's law, helps us to find the electric field. A charge/a system of charges like a dipole experience a force/torque in an electric field. Work is required to be done to provide a specific orientation to a dipole with respect to an electric field.

Answer the following questions based on the above :

- (a) Consider a uniformly charged thin conducting shell of radius R . Plot a graph showing the variation of $|\vec{E}|$ with distance r from the centre, for points $0 \leq r \leq 3R$.
 (b) The figure shows the variation of potential V with $\frac{1}{r}$ for two point charges Q_1 and Q_2 , where V is the potential at a distance r due to a point charge. Find $\frac{Q_1}{Q_2}$.



- (c) An electric dipole of dipole moment of $6 \times 10^{-7} \text{ C-m}$ is kept in a uniform electric field of 10^4 N/C such that the dipole moment and the electric field are parallel. Calculate the potential energy of the dipole.

OR

- (c) An electric dipole of dipole moment $\vec{p}$ is initially kept in a uniform electric field $\vec{E}$ such that $\vec{p}$ is perpendicular to $\vec{E}$. Find the amount of work done in rotating the dipole to a position at which $\vec{p}$ becomes anti-parallel to $\vec{E}$.

CBSE-2023

Section-E (Long Answer)

- 304.** Show that the magnitude of the electric field at an axial point far away from a short electric dipole is inversely proportional to the cube of its distance from the centre of the dipole

Meghalaya Board-2013

- 305.** Define electric dipole and dipole moment. Derive an expression for electric field intensity at a point on the axial line of an electric dipole.

Assam Board-2015

- 306.** Derive an expression for the electric potential at any point at a distance r from the centre of an electric dipole. Hence find the potential if the point lies on (i) axial line and (ii) equatorial line.

Meghalaya Board-2019

- 307. (b)** Why two electric lines of force cannot intersect each other ?

Meghalaya Board-2021

- 308.** Obtain an expression for the electric field due to an electric dipole at a point on the line passing through the centre of the dipole and perpendicular to the dipole axis. Express the result in vector form.

Meghalaya Board-2017, 2023

- 309.** What is an electric dipole? Establish an expression for finding electric field intensity of an electric dipole for equatorial position.

MP Board-2022

- 310.** Derive an expression for potential due to an electric dipole at any point (r, θ) . How is this expression modified when the point lies on the equatorial line of the dipole?

NIOS-2012

- 311.** Derive an expression for potential due to an electric dipole at a point (r, θ) , What will be the expression for the potential for special cases, when the point lies—

- on the axial line but on the side of positive charge.
- on the axial line but on the side of negative charge.
- on the equatorial line of dipole?

NIOS-2014

- 312.** In the following, if the distance of observation point from the centre of source becomes half, then how much electric field be changed and why ?

- a point charge
- an electric dipole
- an infinite charged sheet

UP Board-2018

- 313.** Obtain the expression for moment of couple acting on electric dipole placed in a uniform electric field. Define electric dipole moment on its basis.

UP Board-2022

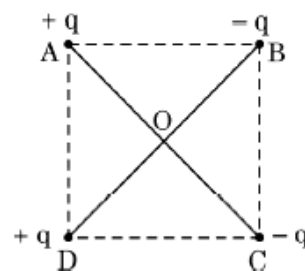
- 314.** Derive an expression for intensity of electric field at a point in broadside position or on an equatorial line of an electric dipole.

ISC-2015

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

ISC-2011

- 316.** Two identical electric dipoles are placed along the diagonals of a square ABCD of side $\sqrt{2}$ m as shown in the figure. Obtain the magnitude and direction of the net electric field at the centre (O) of the square.



CBSE-2023

- 317.** The distance of a far off point on the equatorial plane of an electric dipole is halved. How will the electric field be affected for the dipole?

CBSE-2023

- 318. (a)** An electric dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$ at an angle θ with it. Derive the expression for torque ($\vec{\tau}$) acting on it. Find the orientation of the dipole relative to the electric field for which torque on it is (i) maximum, and (ii) half of maximum.

- (b)** Two point charges $q_1 = +1 \mu\text{C}$ and $q_2 = +4 \mu\text{C}$ are placed 2 m apart in air. At what distance from q_1 along the line joining the two charges, will the net electric field be zero?

CBSE-2020

- 319.** Deduce the expression for the torque acting on a dipole of dipole moment p in the presence of uniform electric field E .

CBSE All India-2014

- 320.** An electric dipole of dipole moment p consists of point charges $+q$ and $-q$ separated by a distance $2a$ apart.

Deduce the expression for the electric field E due to the dipole at a distance x from the centre of the dipole on its axial line in terms of the dipole moment p . Hence, show that in the limit $x \gg a$, $E \rightarrow 2p / (4\pi\epsilon_0 x^3)$.

CBSE All India-2015

CBSE Delhi-2015