PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

ELECTROSTATICS

Exercise

1. What is the basic difference between electrostatics and current electricity?

2. Give two examples of electric charges developed due to friction.

3. Name the different elementary particles of a matter?

4. Explain Most matter around us is electrically neutral.

▶ **Watch Video Solution**

5. Explain the process of charging by conduction with suitable example.

▶ **Watch Video Solution**

6. What do you mean by induction in electrostatics? How can we charge a conductor by induction?

▶ Watch Video Solution

7. Distinguish between additive property of charge and additive property of mass.

▶ Watch Video Solution

8. What is the magnitude of charge on an electron?

▶ Watch Video Solution

9. What are quarks?

▶ Watch Video Solution

10. Explain quantization of charge.

▶ Watch Video Solution

11. How much positive and negative charge is present in lgm of water? How many electrons are present in it? Given, molecular mass of water is 18.0 g.

12. State the law of conservation of charge.

13. Name the types of force experienced by charged objects when they are brought close to each other.

▶ **Watch Video Solution**

14. Which type of force do like charges exert on each other?

▶ **Watch Video Solution**

15. Which type of force do unlike charges exert on each other?

▶ **Watch Video Solution**

16. Name the fundamental law governing interaction between charges on any body

▶ **Watch Video Solution**

17. What is a point charge?

18. State Coulomb's law and write it in scalar form.

19. Define relative permittivity

OR

what is relative permittivity?

OR

Define dielectric constant of medium.

OR

Define specific inductive capacity.

20. Define unit of charge from Coulomb's law.

21. Charge on an electron is 1.6×10^{-19}. How many electrons are required to accumulate a

charge of one coulomb?

22. Express Coulomb's law in vector form.

23. State the similarities between gravitational and electrostatic forces.

24. Distinguish between gravitational force and electrostatic force

25. Calculate and compare the electrostatic and gravitational forces between two protons which are 10^{-15} m apart. Value of $G = 6.674 \times 10^{-11} Nm^2 / kg^2$ and mass of the proton is `1.67 xx 10^-27kg.

26. (i)Two small spheres 18 cm apart have equal negative charges and repel each other with the force of 6×10^{-8} N. Find the total charge on both spheres

27. (ii)A charge $+q$ exerts a force of magnitude -0.2N on another change $-2q$. If they are separated by 25..0 cm, determine the value of q.

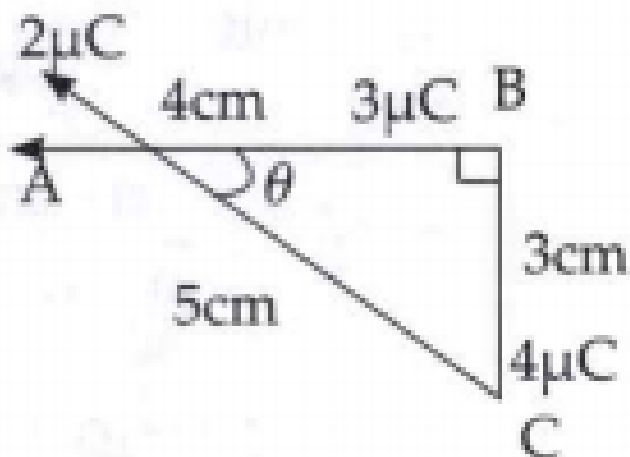**28.** State and explain the principle of superposition of interacting charges.

29. Three charges of $2\mu C, 3\mu C$ and $4\mu C$ are placed at points A, B and C respectively, as shown in Fig. a Determine the force on A due

to other charges.

30. Three equal charges of 10×10^{-8} C respectively, each located at the comers of a right triangle whose sides are 15cm, 20cm and

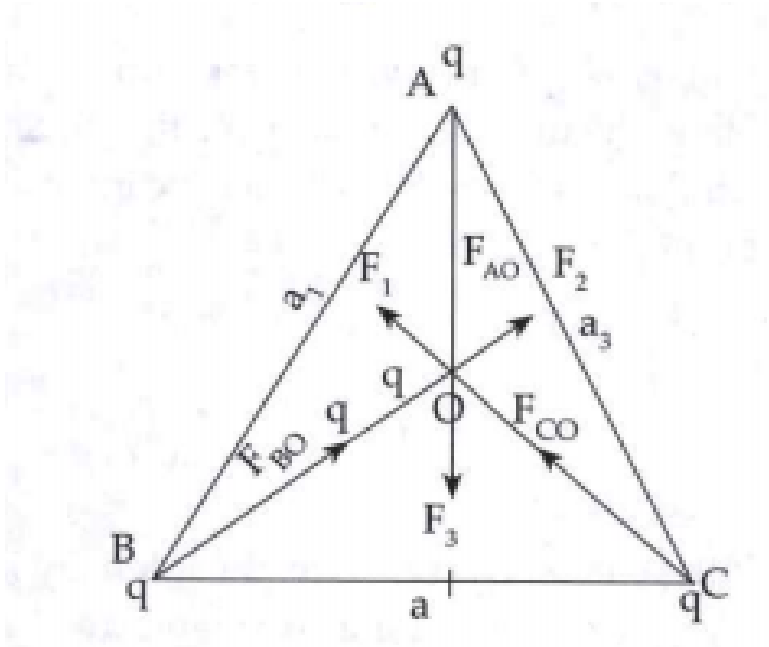25cm respectively. Find the force exerted on the charge located at $90°$ angle.

31. Three charges, q each, are placed at the vertices of an equilateral triangle. What will be the resultant force on charges Q placed at the

centroid of the triangle?

32. Four charges of $+6x10^{-8}C$ each are placed at the comers of a square whose sides are 3cm each. Calculate the resultant force on

each charge and shows in direction an a

diagram drawn to scale.
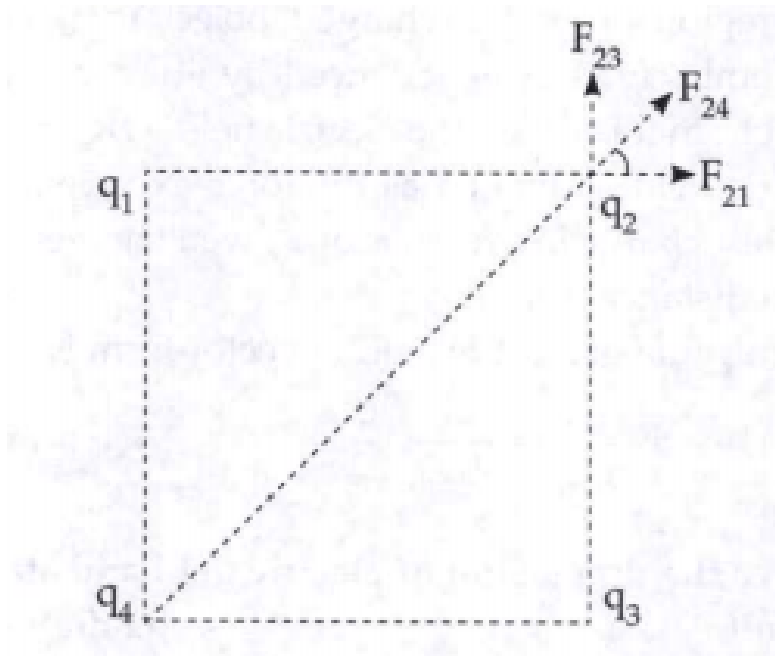
33. What is a test charge ?

34. What will happen if a test charge is kept beyond the electric field due to a certain charge?

35. Define electric field write its formula vector form.

36. Derive the dimension eleic field state its unit.

37. Explain the uniform electric field and non uniform electric field with suitable diagram

38. Derive an expression for electric field intensity due to a point charge in a material medium.

▶ Watch Video Solution

39. Calculate the electric field due to a charge of -8.0×10^{-8} C at a distance of 5.0 cm from it

▶ Watch Video Solution

40. Define electric potential.

41. Define potential gradient and state its units and formula.

42. Derive the relation between electric field intensity and electric potential

OR

show that $E = \dfrac{-dv}{dx}$

43. Two charge $5\mu C$ and $-4\mu C$ are kept 5.0 m apart at points A and B respectively. How much work will have to be done to move the charge at A through a distance of 5.0 m further away from point B along the line BA

44. A potential difference of 5000 volt is applied between two parallel plates 5cm apart a small oil drop having a charge of $9.6 \times 10^{-19} C$ falls between the plates. Find (a) electric field intensity between the plates and (b) the force on the oil drop.

45. Gap between two electrodes of the spark-plug used in an automobile engine is 1.25 mm. If the potential of 20 V is applied across the

gap, what will be the magnitude of electric field between the electrodes?

46. Three point charges are placed at the vertices of a right isosceles triangle as shown in the Fig. a. What is the magnitude and direction of the resultant electric field at point P which is the mid point of its hypotenuse?

$C + 10\mu_c$

$\bar{E}_B$

$\bar{E}$

$\bar{E}_A P$

$45°$

$\bar{E}_C$

5cm

$45°$ $45°$

B   5cm $A + 10\mu_c$

$\bar{E}_A$ $\bar{E}_B$

P

$\bar{E}_C$
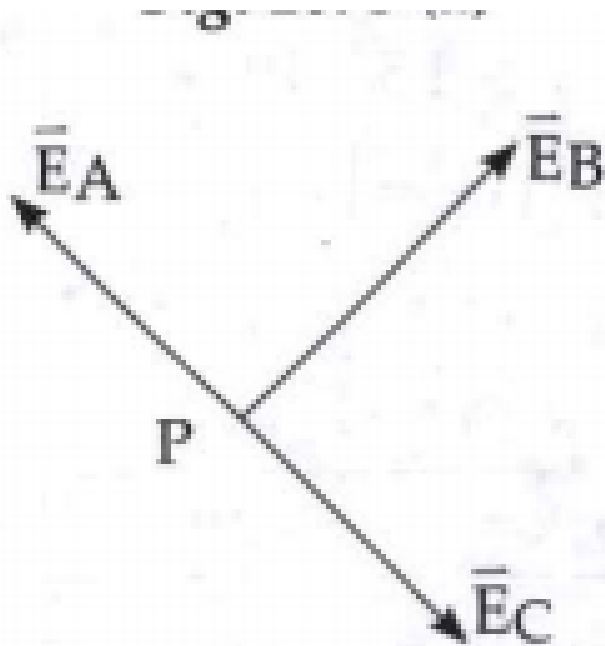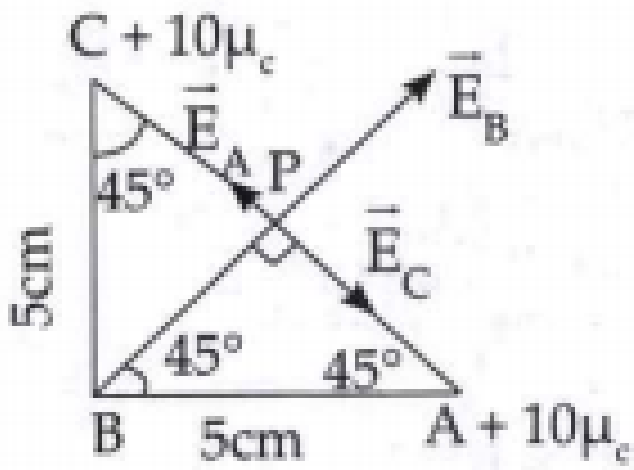
Watch Video Solution

47. A simplified model of hydrogen atom consists of an electron revolving about a proton at a distance of 5.3×10^{-1} 1m. The charge on a proton is $+1.6 \times 10^{-19}$ C. Calculate the intensity of the electric field due to proton at this distance.

48. What is the electric of force?

49. Diagrams of lines force.

50. Lines of force are imaginary, can they have any practical use?

51. State the characteristics of lines of force.

52. If two lines of force interest on one point, what does it mean?

53. Define electric flux state its formula and units.

54. Derive an expression for the electric flux passing through a given area.

55. State conditions in which electric flux will be maximum and minimum.

56. The electric field in a region is given by $\vec{E} = 5.0N/C$. Calculate the electric flux Through a square of side 10.0 cm in the following cases:

(i) The square is along the XY plane.

▶ Watch Video Solution

57. The electric field in a region is given by $\vec{E} = 5.0N/C$. Calculate the electric flux Through a square of side 10.0 cm in the

following cases:

(ii) The square is along XZ plane.

58. The electric field in a region is given by $\overrightarrow{E} = 5.0 N/C$. Calculate the electric flux Through a square of side 10.1 cm in the following cases:

(iii) The normal to the square makes an angle of $45°$ with the Z axis.

59. State Gaus's law.

60. Show that the total flux passing through a sphere is independent of the radius of sphere.

61. State and prove Gauss' law in electrostatics.

Define.

▶ **Watch Video Solution**

62. Define electric dipole.

▶ **Watch Video Solution**

63. What is the called dipole axis?

▶ **Watch Video Solution**

64. What is called axial line of dipole?

▶ **Watch Video Solution**

65. What is called equatorial line of dipole?

▶ **Watch Video Solution**

66. How do we measure strength of a dipole?

▶ **Watch Video Solution**

67. Define dipole moment of electric dipole.

▶ **Watch Video Solution**

68. Write the expression for dipole moment in vector form

▶ **Watch Video Solution**

69. State the unit of dipole moment of electric dipole.

70. State the dimension of dipole moment.

71. How can we induce a dipole in non polar molecules ?

72. Distinguish between polar molecules and non-polar molecules

73. Derive the expression for the couple acting on the electric dipole in uniform electric field

74. Derive the expression for electric intensity at a point on the axis of a dipole

75. Derive an expression for electric field intensity of a point on the equatorial line.

76. Define Linear charge density. State its formula and units.

> ▶ **Watch Video Solution**

77. Define Surface charge density. State its formula and unit.

> ▶ **Watch Video Solution**

78. Define Volume charge density. State its formula and units.

▶ **Watch Video Solution**

79. Give suitable examples showing that static charge can be useful.

▶ **Watch Video Solution**

80. Give suitable examples showing that static charge can be harmful.

▶ **Watch Video Solution**

81. Mention the precautions to be taken against static charge.

▶ **Watch Video Solution**

82. Two point charges, each of $4\mu C$ when placed in vacuum, repel each other with a force of 1.6 Newton. Calculate the distance between the two charges.

83. Find the value of the electric intensity at a point at a distance of 15 cm in air from a point charge of 450 μC.

84. How many electrons need be removed from a metal sphere of 0.05 m radius so that it acquires a charge of 4×10^{-15} C ? $e = 1.6 \times 10^{-19}$ C.

▶ Watch Video Solution

85. What charge placed 9 cm from a charge of $100\mu C$ will produce a force of $1/9$ N in air?

▶ Watch Video Solution

86. Two point charges whose magnitudes are in the ratio $3:2$ repel each other with a force 135×10^{14} N when they are 4 cm apart in air. Find the magnitude of each charge.

87. Two small insulated metal spheres placed 5 cm apart in air carry charges of 5 and 0.5 micro- coulomb respectively. Find the force between them. What would the force be if the

spheres are in a medium of dielectric constant 3?

88. The mutual force of repulsion between two point charges kept a fixed distance apart is 9×10^{-5} N when in vacuum and 4×10^{-5} N when placed in a dielectric medium. What is the value of dielectric constant of the medium?

89. The force exerted by an electric field on a charge of 5 micro-coulomb is 10×10^{-4} N. What is the electric intensity of the field at the point?

▶ **Watch Video Solution**

90. The potential at a point A is -160 volt and the potential at a point B is + 240 volt. How much work is done by an external force to move a charge of $-25\mu C$ from B to A?

91. Two positive charges of $20\mu C$ and $8\mu C$ are 20 cm apart, find the work done in bringing them 5 cm closer

92. Three Charge of +10, -10 and $+5\mu C$ are placed at the corners A, B and C of an equilateral triangle ABC having each side 1m

long. Find the resultant force on the charge at C.

93. A positively charged glass rod is brought close to a metallic rod isolated from ground, the charge on the side of the metallic rod away from the glass rod will be____

A. same as that on the glass rod and equal in quantity

B. opposite to that on the glass of and equal

in quantity

C. same as that on the glass rod but lesser in

quantity

D. same as that on the glass rod but more in

quantity

A. same as that on the glass rod and equal

in quantity

B. opposite to that on the glass of and

equal in quantity

C. same as that on the glass rod but lesser

in quantity

D. same as that on the glass rod but more

in quantity

Answer:

▶ **Watch Video Solution**

94. An electron is placed between two parallel

plates connected to a battery. If the battery is

switched on, the electron will

A. be attracted to the + ve plate

B. be attracted to the -ve plate

C. remain stationary

D. move parallel to the plates

Answer:

▶ **Watch Video Solution**

95. A charge of $+7\mu C$ is placed at the centre

of two concentric spheres with radius 2.0 cm

and 4.0 cm respectively. The ratio of the flux

through them will be.

A. $1 : 4$

B. $1 : 2$

C. $1 : 1$

D. $1 : 16$

Answer:

▶ **Watch Video Solution**

96. Two charges of 1.0 C each are placed one meter apart in free space.The force between them will be.

A. 1.0 N

B. 9×10^9 N

C. 9×10^{-9} N

D. 10 N

Answer:

97. Two point charges of $+5\mu C$ are so placed that they experience a force of 8×10^{-3} N. They are then moved apart, so that the force is

now 2×10^{-3} N. The distance between them is now

A. 1/4 the previous distance

B. double the previous distance

C. four times the previous distance

D. half the previous distance

Answer:

 Watch Video Solution

98. A metallic sphere A isolated from ground is charged to $+50\mu C$. This sphere is brought in contact with other isolated metallics sphere B of half the radius of sphere A.The charge on the two sphere will be now in the ratio.

A. $1:2$

B. $2:1$

C. $4:1$

D. $1:1$

Answer:

99. Which of the following produces uniform electric field?

    A. point charge

    B. linear charge

    C. two parallel plates

    D. charge distributed an circular any

Answer:

100. Two point charges of $A = +5.0\mu C$ and $B = -5.0\mu C$ are separated by 5.0 cm. A point charge $C = 1.0\mu C$ is placed at 3.0 cm away from the centre on the perpendicular bisector of the line joining the two point charges. The charge at C will experience a force directed towards

A. point A

B. point B

C. a direction parallel to line AB

D. a direction along the perpendicular bisector

A. point A

B. point B

C. a directtion parallel to line AB

D. a direction along the perpendicular bisector

Answer:

▶ **Watch Video Solution**

101. The number of electrons removed from a body in order to produce positive charge of 5×10^{-19} coulomb on it, will be

A. 3

B. 5

C. 7

D. 9

Answer:

▶ **Watch Video Solution**

102. On being negatively charged, a soap bubble

    A. expands

    B. contracts

    C. neither expands nor contracts

    D. none of these

Answer:

▶ **Watch Video Solution**

103. The Coulomb's repulsive force between two point charges placed at distance d apart, is F. If the distance is increased to 2d then the repulsive force between the charges as compared to its previous value, will become

A. $1/4$ the previous distance

B. $1/2$

C. $3/4$

D. same

   A. $1/4$ the previous distance

   B. $1/2$

C. $3/4$

D. same

Answer:

> ▶ **Watch Video Solution**

---

104. When a glass rod is rubbed with silk it gains positive charge, because

  A. electrons are removed from it

  B. protons are removed from it

C. protons are added to it

D. electron are added to it

Answer:

105. An electric dipole consists of two equal and opposite charges of magnitude $2\mu C$ placed 0.03 m apart. It is lying in an electric field of intensity $2 \times 10^5 N/C$. The maximum torque acting on the dipole will be

A. 2.4 Nm

B. 1.2 Nm

C. 1.2×10^{-2} Nm

D. 2.4×10^{-2} Nm

Answer:

▶ **Watch Video Solution**

106. Which of the following quantities is a vector quantity?

A. intensity of electric field

B. electric charge density

C. electric charge

D. electric potential

    A. intensity of electric field

    B. electric charge density

    C. electric charge

    D. electric potential

Answer:

▶ **Watch Video Solution**

107. Two point charges of 2 coulomb and 6 coulomb repel each other with a force of 12 newton. If each charge is given an additional charge of -2 coulomb then the force between them will become

    A. 4N attractive

    B. 4N repulsive

    C. 8N attractive

    D. zero

Answer:

108. Static electricity can be produced by

A. only induction

B. only friction

C. only chemical reaction

D. induction and friction

Answer:

109. The electric potential while moving along the lines of force

    A. decreases

    B. increases

    C. remain same

    D. becomes infinite

Answer:

▶ **Watch Video Solution**

110. The Coulomb's law is valid for the charges which are

A. stationary and point charges

B. moving and point charges

C. both 'a' and 'b'

D. none of these

Answer:

▶ Watch Video Solution

111. The unit of intensity of electric field is

A. newton // coulomb

B. joule // coulomb

C. coulomb // newton

D. none of these

Answer:

▶ Watch Video Solution

112. Dielectric constant is

    A. dimensionless quantity

    B. universal constant

    C. conversion factor

    D. none of these

Answer:

▶ **Watch Video Solution**

113. If a dielectric is placed between two charges in place of vacuum or air, then the force between the charges will

A. decrease

B. increase

C. remain unchanged

D. none of these

Answer:

114. If a body is charged by rubbing, its weight

A. decreases slightly

B. increases slightly

C. Remains constant

D. may increase or decrease slightly

Answer:

115. The unit of dipole moment is

A. coulomb-m

B. coulomb-m^2

C. metre // coulomb

D. coulomb//m

Answer:

▶ **Watch Video Solution**

116. Two positive charges of same magnitude are kept 20 cm apart. A point between the charges will have zero intensity is at

A. 5 cm from first charge

B. 5 cm from second charge

C. midway between two charges

D. can not be predicted

Answer:

▶ Watch Video Solution

117. The electric intensity at a point at 10 cm from point charge is $5N/C$.The potential atsame point will be

    A. 5 volt

    B. 1 volt

    C. 0.5 volt

    D. 0.05 volt

Answer:

118. Coulomb's force between two point charges separated by certain distance in air is F. If the charges are situated in medium at same place then Coulomb's force reduces to $F/4$. The dielectric constant of medium will be

    A. 2

    B. 4

    C. 5

    D. 6

Answer:

---

119. The permittivity of medium is $26.55 \times 10^{-12} C^2 / Nm^2$. The dielectric constant of medium will be

A. 2

B. 3

C. 4

D. 5

Answer:

120. The charge on conductor is +1.6 Coulomb, then it has

A. excess of 10^{19} electrons

B. shortage of 10^{19} electrons

C. excess of 10^{20} electrons

D. shortage of 10^{20} electrons

Answer:

121. If the distance between two point charges is doubled and magnitude of charges are also doubled, the Coulomb's force between them will be

A. same

B. half

C. two-times

D. four times

Answer:

▶ **Watch Video Solution**

---

122. Two identical metallic spheres A and B of exactly equal masses m are taken. A is given a +ve charge of q coulomb and B is given an equal negative charge. If m_A and m_B are the mass of A and B after charging then

A. $m_A = m_B$

B. $m_B > m_A$

C. $m_B < m_A$

D. none of these

Answer:

▶ **Watch Video Solution**

---

123. A charged spherical conductor of radius R carries a charge + Q. A point test charge $+q_0$ is placed at a distance x from the surface of

the sphere. The force experienced by the test change will be proportional to

A. X^2

B. $(R + X)^2$

C. $\dfrac{1}{(R - X)^2}$

D. $\dfrac{1}{(R + X)^2}$

Answer:

▶ Watch Video Solution

124. An electric dipole consisting of two opposite charges of 2×10^{-6} each separated by a distance of 3 cm is placed in all electric field of 2×10^5 newton/coulomb. The maximum torque acting on the dipole in S.I. unit will be

    A. 12×10^{-1}

    B. 12×10^{-2}

    C. 12×10^{-3}

    D. 24×10^{-3}

Answer: 24×10^{-3}

> ▶ **Watch Video Solution**

---

125. Electric lines of force about a negative point charge are

    A. circular, clockwise

    B. circular, anticlockwise

    C. radial, inward

    D. radial, outward

Answer:

126. Which of the following is inverse square law ?

    A. Newton'slaw of universal gravitation

    B. Ohm's law

    C. Coulomb's law

    D. both (a) and (c)

Answer:

---

127. SI unit of electric intensity is

A. A.m

B. `V//m.

C. Nm^2/C^2

D. $C^2/N.\,m^2$

Answer:

128. A charge of 6 pCexperiencesforce of 0.24 N in an electric field. The potential gradient at this point is

A. $4 \times 10^5 V/m$

B. $4 \times 10^6 V/m$

C. $4 \times 10^4 V/m$

D. $4 \times 10^3 V/m$

Answer:

129. A p.d.of 200 volt ismaintained acrosstwo parallel plates of a parallel plate capacitor. Distance between the two platesis 4 mm.Calculate electric field intensity between the two plates

A. $5 \times 10^5 V/m$

B. $5 \times 10^4 V/m$

C. zero

D. $2 \times 10^4 V/m$

Answer:

▶ **Watch Video Solution**

130. Static electricity is produced due to

A. conduction

B. radiation

C. convection

D. friction and induction

Answer:

131. Every charge q that exists on the surface of a body can be represented by (where n = 1,2, 3...) e $\rightarrow$ electric charge

A. n^2/e

B. n.e

C. e/n

D. n/e

Answer:

132. If 'R' is radius of a sphere and Q is charge supplied to it, then the surface charge density (σ) is given by

A. $\sigma = \dfrac{Q}{2\pi R}$

B. $\sigma = \dfrac{Q}{\left(\frac{4}{3}\pi R^2\right)}$

C. $\sigma = \dfrac{Q}{4\pi R^2}$

D. $\sigma = \dfrac{Q}{\pi R^2}$

Answer:

▶ **Watch Video Solution**

133. The branch of physics which deals with the study of static chargesis

    A. Current electricity

    B. Electronics

    C. Electrostatics

D. Modem physics

Answer:

134. The bodies get charged when rubbed with

each other due to transfer of

A. atoms

B. molecules

C. electrons

D. protons

Answer:

▶ **Watch Video Solution**

135. If an isolated metallic conductor is positively bcharged then its mass will

A. decrease

B. increase

C. remains the same

D. become double

Answer:

▶ **Watch Video Solution**

136. Two equal and opposite charges separated by a short distance is called an

A. electric pole

B. electric dipole

C. electric dipole moment

D. electric torque

Answer:

---

137. What is the electric of force?

    A. are parallel lines of force

    B. are perpendicular to each other

    C. are intersecting lines

    D. do not cross each other

Answer:

138. To charge a body to +1C

   A. one electron has to be removed from it

   B. one electron has to be added to it

   C. 6.25×10^{18} electrons are to be added to it

D. $\dfrac{1}{1.6 \times 10^{-19}}$ electrons are to be

removed from it

Answer:

▶ **Watch Video Solution**

139. An electric line of force is the path

followed by

A. An electron

B. A neutron

C. A unit positive charge

D. A unit negative charge

Answer:

▶ **Watch Video Solution**

---

140. The SI unit of linear charge density is

A. C/cm

B. C/m

C. C/m^2

D. C/m^3

Answer:

141. The SI unit of surface charge density is

A. C/cm^2

B. C/m

C. C/m^3

D. C/m^4

Answer:

142. The SI unit of volume charge density is

A. C/cm^3

B. C/m

C. C/m^2

D. C/m^3

Answer:

143. The uniform charge distribution along the length of the thin rod or wire is called the

A. Linear charge density

B. Surface charge density

C. Volume charge density

D. Superficial charge density

Answer:

144. The uniform charge distribution over the entire area of a plane is called the

A. Linear charge density

B. Surface charge density

C. Volume charge density

D. Cubical charge density

Answer:

145. The permittivity of medium is $26.55 \times 10^{-12} C^2/Nm^2$. The dielectric constant of the medium will be

A. 2

B. 3

C. 4

D. 5

Answer:

▶ Watch Video Solution

146. Two protons in a nucleus of U^{238} are 6×10^{-15} m apart. Their mutual electrostatic potential energy is

    A. $3.4 \times 10^5 eV$

    B. $2.4 \times 10^5 eV$

    C. $3.84 \times 10^{-14} eV$

    D. $3.84 \times 10^5 eV$

Answer:

147. An electric dipole of length 2 cm is placed with its axis making angle of $30°$ to a uniform electric field of $10^5 N/C$. It experiences a torque of 17.32 Nm. The magnitude of charge on the dipole is

A. $1.732 \times 10^{-3} C$

B. 1.414×10^{-2} C

C. 1.732×10^{-2} C

D. 10^{-2} C

Answer:

148. An electric dipole consist of two opposite charges each of magnitude $1\mu C$ separated by distance 2 cm. The dipole is placed in an external field of $10^5 N/C$. The maximum torque acting on the dipole is

A. 2×10^{-3} Nm

B. 5×10^{-3} Nm

C. 3×10^{-3} Nm

D. 4×10^{-3} Nm

Answer:

▶ **Watch Video Solution**

149. Select and write the most appropriate answer from the given alternative for questions 1, 2, 3

Two positive charges are placed a certain distance apart.A slab of dielectric medium

isintroduced between them. As a result, the repulsion between two charges

A. decreases

B. remains constant

C. increases

D. changes to attraction

Answer:

▶ **Watch Video Solution**

150. Two identical metallic spheres A and B of exactly equal masses m are taken. A is given a +ve charge of q coulomb and B is given an equal negative charge. If m_A and m_B are the mass of A and B after charging then

A. $m_A < m_B$

B. $m_A = m_B$

C. $m_A > m_B$

D. none of the above

Answer:

151. Two point charges of 2 coulomb and 6 coulomb repel each other with a force of 12 newton. If each charge is given an additional charge of -2 coulomb then the force between them will become

A. zero

B. 4 N repulsive

C. 4 N attractive

D. 8 N attractive

Answer:

▶ **Watch Video Solution**

152. State the law of conservation of charge.

▶ **Watch Video Solution**

153. Name the fundamental law governing interaction between charges on any body

154. What will be the no. of electrons removed from a body in order to produce a positive charge of 48×10^{-20} coulomb on it?

155. Define Surface charge density. State its formula and unit.

156. State the characteristics of lines of force.

▶ **Watch Video Solution**

157. Distinguish between polar molecules and

non polar molecules (Any 2 points)

▶ **Watch Video Solution**

158. State one similarity and one difference between gravitational force and electrostatic force

159. What charge placed at 9 cm from a charge of $100\mu c$ will experience a force of $\dfrac{1}{9}$N in air?

160. Derive an expression for torque acting on an electric dipole in uniform electric field.

161. Show that the total flux passing through a sphere is independent of the radius of sphere.

162. Three Charge of +10, -10 and $+5\mu C$ are placed at the corners A, B and C of an equilateral triangle ABC having each side 1m long. Find the resultant force on the charge at C.

163. Derive an expression for the electric intensity due to an electric dipole at a point on the axis of dipole. When a point charge of

5×10^{-9} C is taken from point A to point B, the work done is 10^{-6} J. Find the potential difference between points A and points B.