Electric Charges and Fields: NEET/EAMCET Practice Questions

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1. What is the electric field due to a point charge of $2\,\mu C$ at a distance of 2 m? ($k = 9 \times 10^9\, Nm^2/C^2$)
   A) $4.5 \times 10^3\, N/C$
   B) $9 \times 10^3\, N/C$
   C) $18 \times 10^3\, N/C$
   D) $36 \times 10^3\, N/C$

2. The force between two charges doubles when:
   A) Distance is halved
   B) One charge is doubled
   C) Distance is doubled
   D) Both charges are halved

3. A charge of $3\,nC$ is moved from infinity to a point where potential is 12 V. What is the work done?
   A) $36\,nJ$
   B) $24\,nJ$
   C) $18\,nJ$
   D) $12\,nJ$

4. Electric field lines:
   A) Can intersect at a point
   B) Are denser where the field is weaker
   C) Point from negative to positive charge
   D) Are always straight lines

5. Two charges $+5\,\mu C$ and $-5\,\mu C$ are 1 m apart. The electric field at the midpoint is:
   A) Zero
   B) $9 \times 10^4\, N/C$ towards positive
   C) $18 \times 10^4\, N/C$ towards negative
   D) $18 \times 10^4\, N/C$ towards positive

6. The potential at the center of a uniformly charged ring is:
   A) Zero
   B) Infinite
   C) $\frac{kQ}{R}$
   D) $\frac{kQ}{2R}$

7. A proton experiences a force of $8 \times 10^{-15}\, N$ in an electric field. The field strength is:
   A) $5 \times 10^4\, N/C$
   B) $4 \times 10^4\, N/C$
   C) $3 \times 10^4\, N/C$
   D) $2 \times 10^4\, N/C$

8. The electric flux through a closed surface depends on:
   A) Shape of the surface
   B) Size of the surface
   C) Charge enclosed
   D) Medium outside the surface

9. Two charges of $+2\,\mu C$ each are 2 m apart. The potential at the midpoint is:
   A) $9 \times 10^3\, V$
   B) $18 \times 10^3\, V$
   C) $36 \times 10^3\, V$
   D) Zero

10. The electric field due to an infinite line charge is proportional to:
    A) r
    B) $\frac{1}{r}$
    C) $\frac{1}{r^2}$
    D) r^2

11. A dipole is placed in a uniform electric field. The net force on it is:
    A) Zero
    B) Proportional to the field
    C) Proportional to the dipole moment
    D) Infinite

12. A charge of $4\,\mu C$ is placed in a field of $5 \times 10^3\, N/C$. The force is:
    A) $0.02\,N$
    B) $0.01\,N$
    C) $0.04\,N$
    D) $0.005\,N$

13. The electric field inside a conductor in electrostatic equilibrium is:
    A) Infinite
    B) Zero
    C) Proportional to charge
    D) Constant but non-zero

14. The potential difference between two points 1 m apart in a field of $10\,N/C$ is:
    A) $5\,V$
    B) $10\,V$
    C) $20\,V$
    D) $15\,V$

15. Three charges $+1\,\mu C$, $+1\,\mu C$, and $-2\,\mu C$ are at the vertices of an equilateral triangle (side 1 m). The net field at the centroid is:
    A) Zero
    B) $9 \times 10^4\, N/C$
    C) $18 \times 10^4\, N/C$
    D) $27 \times 10^4\, N/C$

16. The electric field at a point on the equatorial line of a dipole is:
    A) Zero
    B) Parallel to the dipole
    C) Anti-parallel to the dipole
    D) Perpendicular to the dipole

17. A charge of $10\,nC$ is at the origin. Potential at $(3, 4)$ m is:
A) $18\,V$
B) $15\,V$
C) $20\,V$
D) $25\,V$

18. The work done to move a $2\,\mu C$ charge between two points on an equipotential surface is:
A) $2\,J$
B) $1\,J$
C) Zero
D) $4\,J$

19. The electric field due to a charged conducting sphere is zero:
A) At the surface
B) Outside the sphere
C) Inside the sphere
D) At the center only

20. A charge q produces a field of $9 \times 10^3\,N/C$ at 3 m. The value of q is:
A) $1\,\mu C$
B) $2\,\mu C$
C) $3\,\mu C$
D) $4\,\mu C$

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21. The electric field midway between two equal positive charges separated by 2 m is:
A) Zero B) 9×10^3 N/C C) 18×10^3 N/C D) 36×10^3 N/C

22. A charge of $6\,\mu$C is placed at the origin. The work done to bring a $2\,\mu$C charge from infinity to (0, 3) m is:
A) 36×10^3 J B) 18×10^3 J C) 12×10^3 J D) 6×10^3 J

23. The direction of the electric field due to a negative charge is:
A) Away from the charge B) Towards the charge C) Perpendicular to the charge D) Zero everywhere

24. Two charges $+4\,\mu$C and $+6\,\mu$C are 3 m apart. The distance from $+4\,\mu$C where the field is zero is:
A) 1.2 m B) 1.5 m C) 1.8 m D) 2.0 m

25. The electric potential at a point due to a dipole varies as:
A) $\frac{1}{r}$ B) $\frac{1}{r^2}$ C) $\frac{1}{r^3}$ D) r

26. A charge of 5 nC is in a field of 2×10^4 N/C. The force on it is:
A) 0.1 N B) 0.05 N C) 0.01 N D) 0.001 N

27. The electric field inside a charged parallel plate capacitor is:
A) Zero B) Uniform C) Proportional to distance D) Inversely proportional to distance

28. A $3\,\mu$C charge produces a potential of 27 V at a point. The distance is:
A) 1 m B) 2 m C) 3 m D) 4 m

29. The net electric flux through a cube with a $+2\,\mu$C charge at its center is:
A) Zero B) 2.26×10^5 N m^2/C C) 4.52×10^5 N m^2/C D) 9.04×10^5 N m^2/C

30. The electric field at the surface of a charged conductor is:
A) Zero B) $\frac{\sigma}{\epsilon_0}$ C) $\frac{\sigma}{2\epsilon_0}$ D) Infinite

31. A dipole of moment 2×10^{-6} C m is in a field of 5×10^3 N/C. The maximum torque is:
A) 0.01 N m B) 0.005 N m C) 0.002 N m D) 0.001 N m

32. The potential energy of two charges $+2\,\mu$C and $-3\,\mu$C 1 m apart is:
A) -0.054 J B) -0.027 J C) 0.027 J D) 0.054 J

33. The electric field due to a uniformly charged sphere varies as $\frac{1}{r^2}$:
A) Inside the sphere B) At the surface C) Outside the sphere D) Everywhere

34. A 4 nC charge is moved 2 m in a uniform field of 10 N/C. The work done is:
A) 80 nJ B) 40 nJ C) 20 nJ D) Zero

35. The electric field at a point on the axis of a dipole is proportional to:
A) $\frac{1}{r}$ B) $\frac{1}{r^2}$ C) $\frac{1}{r^3}$ D) r

36. A charge of $8\,\mu$C produces a field of 2×10^4 N/C at a point. The distance is:
A) 0.5 m B) 1 m C) 1.5 m D) 2 m

37. The electric field between two plates 0.01 m apart with a potential difference of 100 V is:
A) 10^4 N/C B) 10^3 N/C C) 5×10^3 N/C D) 2×10^4 N/C

38. The potential at infinity due to a point charge is:
A) Zero B) Infinite C) Equal to the charge D) Negative

39. A charge of $1\,\mu$C is placed at the center of a square of side 2 m. The flux through one face is:
A) 1.88×10^4 N m^2/C B) 3.76×10^4 N m^2/C C) 5.64×10^4 N m^2/C D) Zero

40. The force between two charges increases by a factor of 9 when:
A) Distance is tripled B) Distance is halved C) One charge is tripled D) Distance is reduced to one-third

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41. The electric field at a point 4 m from a $16\,\mu C$ charge is:
A) $9 \times 10^3\,N/C$
B) $9 \times 10^4\,N/C$
C) $9 \times 10^5\,N/C$
D) $9 \times 10^6\,N/C$

42. The potential due to a charge is halved when:
A) Distance is doubled
B) Charge is doubled

C) Distance is halved

D) Charge is halved

43. A $2\,\mu C$ charge is moved 5 m perpendicular to a uniform field of $10^3\,N/C$. The work done is:

A) $0.01\,J$

B) $0.02\,J$

C) Zero

D) $0.05\,J$

44. The electric field due to an infinite charged plane is:

A) $\frac{\sigma}{\epsilon_0}$

B) $\frac{\sigma}{2\epsilon_0}$

C) $\frac{2\sigma}{\epsilon_0}$

D) Zero

45. Two charges $+3\,\mu C$ and $-3\,\mu C$ are 2 m apart. The potential at the midpoint is:

A) $9 \times 10^3\,V$

B) Zero

C) $18 \times 10^3\,V$

D) $-9 \times 10^3\,V$

46. The force on an electron in a field of $5 \times 10^4\,N/C$ is:

A) $8 \times 10^{-15}\,N$

B) $4 \times 10^{-15}\,N$

C) $2 \times 10^{-15}\,N$

D) $1.6 \times 10^{-15}\,N$

47. The electric field inside a dielectric sphere with uniform charge varies as:

A) r

B) $\frac{1}{r}$

C) $\frac{1}{r^2}$

D) Constant

48. A $10\,nC$ charge is at (0,0). The potential at (1,1) m is:

A) $63.6\,V$

B) $45\,V$

C) $90\,V$

D) $127.2\,V$

49. The flux through a spherical surface enclosing a $-5\,\mu C$ charge is:

A) $-5.65 \times 10^5\,Nm^2/C$

B) $5.65 \times 10^5\,Nm^2/C$

C) Zero

D) $-2.82 \times 10^5\,Nm^2/C$

50. The potential energy of a system of two $+2\,\mu C$ charges 2 m apart is:

A) $0.018\,J$

B) $0.036\,J$

C) $0.009\,J$

D) $0.072\,J$

51. The electric field at the center of a charged ring is:

A) Zero

B) $\frac{kQ}{R^2}$

C) $\frac{kQ}{2R^2}$

D) Infinite

52. A $4\,\mu C$ charge experiences a force of 0.02 N. The field strength is:

A) $5 \times 10^3\,N/C$

B) $2.5 \times 10^3\,N/C$

C) $10^4\,N/C$

D) $7.5 \times 10^3\,N/C$

53. The potential difference between two points in a field is independent of:

A) Distance between them

B) Field strength

C) Path taken

D) Charge moved

54. A charge of $3\,nC$ is 2 m from a $6\,nC$ charge. The force between them is:

A) $4.05 \times 10^{-6}\,N$

B) $2.03 \times 10^{-6}\,N$

C) $8.1 \times 10^{-6}\,N$

D) $1.35 \times 10^{-6}\,N$

55. The electric field due to a dipole at a large distance on its equatorial line is proportional to:

A) $\frac{1}{r}$

B) $\frac{1}{r^2}$

C) $\frac{1}{r^3}$

D) r

56. A $5\,\mu C$ charge is at the center of a cube of side 1 m. The flux through one face is:

A) $9.4 \times 10^4\,Nm^2/C$

B) $5.65 \times 10^5\,Nm^2/C$

C) $2.82 \times 10^5\,Nm^2/C$

D) Zero

57. The torque on a dipole in a uniform field is zero when:

A) Dipole is perpendicular to the field

B) Dipole is parallel to the field

C) Field is zero

D) Both B and C

58. The potential at a point 3 m from a $-9\,\mu C$ charge is:

A) $-27 \times 10^3\,V$

B) $-18 \times 10^3\,V$

C) $-9 \times 10^3\,V$

D) $27 \times 10^3\,V$

59. The electric field between two plates with $\sigma = 8.85 \times 10^{-9}\,C/m^2$ is:

A) $500\,N/C$

B) $1000\,N/C$

C) $1500\,N/C$

D) $2000\,N/C$

60. The force between two charges decreases by a factor of 4 when:

A) Distance is doubled

B) One charge is halved

C) Distance is tripled

D) Both charges are doubled

61. Three charges $+2\,\mu C$, $-4\,\mu C$, and $+6\,\mu C$ are placed on a straight line 1 m apart (in that order). The net force on the $-4\,\mu C$ charge is:

A) $0.108\,\text{N}$ towards $+2\,\mu C$

B) $0.108\,\text{N}$ towards $+6\,\mu C$

C) $0.036\,\text{N}$ towards $+2\,\mu C$

D) $0.036\,\text{N}$ towards $+6\,\mu C$

62. The electric field at a point on the axis of a ring of radius 2 m and charge $8\,\mu C$ at a distance of 2 m from the center is:

A) $7200\,\text{N/C}$

B) $9000\,\text{N/C}$

C) $10800\,\text{N/C}$

D) $14400\,\text{N/C}$

63. A point charge q is placed at the corner of a cube. The electric flux through one of the faces not touching the corner is:

A) $\frac{q}{\epsilon_0}$

B) $\frac{q}{6\epsilon_0}$

C) $\frac{q}{8\epsilon_0}$

D) Zero

64. The potential at the center of a square with charges $+2\,\mu C$, $-2\,\mu C$, $+2\,\mu C$, and $-2\,\mu C$ at its corners (side 1 m) is:

A) Zero

B) $18 \times 10^3\,\text{V}$

C) $36 \times 10^3\,\text{V}$

D) $72 \times 10^3\,\text{V}$

65. A dipole of moment $4 \times 10^{-6}\,\text{C m}$ is rotated from parallel to perpendicular in a field of $10^4\,\text{N/C}$. The work done is:

A) $0.04\,\text{J}$

B) $0.02\,\text{J}$

C) $0.01\,\text{J}$

D) Zero

66. The electric field at a point midway between a $+5\,\mu C$ charge and a $-3\,\mu C$ charge 4 m apart, but 2 m off the line joining them, is:

A) $4500\,\text{N/C}$

B) $5400\,\text{N/C}$

C) $7200\,\text{N/C}$

D) $9000\,\text{N/C}$

67. A uniformly charged spherical shell of radius 1 m has a surface charge density of $1.77 \times 10^{-9}\,\text{C/m}^2$. The field at 0.5 m from the center is:

A) $100\,\text{N/C}$

B) $50\,\text{N/C}$

C) Zero

D) $200\,\text{N/C}$

68. The potential gradient at a point where the field is $6 \times 10^3\,\text{N/C}$ is:

A) $6 \times 10^3\,\text{V/m}$

B) $3 \times 10^3\,\text{V/m}$

C) $12 \times 10^3\,\text{V/m}$

D) Zero

69. Four charges $+q$, $-q$, $+q$, $-q$ are at the corners of a square of side a. The field at the center is:

A) Zero

B) $\frac{2kq}{a^2}$

C) $\frac{4kq}{a^2}$

D) $\frac{\sqrt{2}kq}{a^2}$

70. A charge Q is distributed uniformly over a thin rod of length 2 m. The field at a point 1 m from the midpoint along the perpendicular bisector is:

A) $\frac{kQ}{2}$

B) $\frac{kQ}{\sqrt{5}}$

C) $\frac{kQ}{2\sqrt{5}}$

D) $\frac{kQ}{\sqrt{2}}$

71. The work done to move a $3\,\mu C$ charge from (0,0) to (2,0) m in a field due to a $5\,\mu C$ charge at (1,0) m is:

A) $0.045\,\text{J}$

B) $-0.045\,\text{J}$

C) Zero

D) $0.09\,\text{J}$

72. The electric field at the midpoint of the base of an isosceles triangle with charges $+2\,\mu C$ at each vertex (base 2 m, height 1 m) is:

A) $18 \times 10^3\,\text{N/C}$

B) $36 \times 10^3\,\text{N/C}$

C) $54 \times 10^3\,\text{N/C}$

D) Zero

73. A hollow conducting sphere of radius 2 m has a charge of $10\,\mu C$. The field at 3 m from the center is:

A) $10^4\,\text{N/C}$
B) $15 \times 10^3\,\text{N/C}$
C) $20 \times 10^3\,\text{N/C}$
D) $30 \times 10^3\,\text{N/C}$

74. The minimum potential energy of a system of three $+2\,\mu C$ charges occurs when they form:

A) An equilateral triangle
B) A straight line
C) A right triangle
D) A square

75. The electric field at a distance r from the center of a charged conducting sphere (radius R, $r < R$) is:

A) $\frac{kQ}{r^2}$
B) $\frac{kQ}{R^2}$
C) Zero
D) $\frac{kQr}{R^3}$

76. A charge q is placed at the center of a semicircular ring of radius R with charge Q. The force on q is:

A) $\frac{kqQ}{R^2}$
B) $\frac{2kqQ}{\pi R^2}$
C) Zero
D) $\frac{kqQ}{2R^2}$

77. The potential at a point equidistant (2 m) from two charges $+3\,\mu C$ and $-5\,\mu C$ 2 m apart is:

A) $-9 \times 10^3\,\text{V}$
B) $-18 \times 10^3\,\text{V}$
C) $-6 \times 10^3\,\text{V}$
D) Zero

78. The electric field inside a uniformly charged solid sphere of radius R at $r = R/2$ is:

A) $\frac{\rho R}{3\epsilon_0}$
B) $\frac{\rho R}{6\epsilon_0}$
C) $\frac{\rho R}{2\epsilon_0}$
D) Zero

79. A $2\,\mu C$ charge is moved along a circular path of radius 1 m around a $5\,\mu C$ charge. The work done is:

A) 0.045 J
B) 0.09 J
C) Zero
D) 0.018 J

80. Two parallel plates 0.02 m apart have a charge density of $8.85 \times 10^{-10}\,\text{C/m}^2$. The potential difference is:

A) 2 V
B) 4 V
C) 6 V
D) 8 V

81. Four identical charges $+3\,\mu C$ are placed at the corners of a square of side 2 m. The electric field at the center is:

A) Zero
B) $9 \times 10^3\,N/C$
C) $18 \times 10^3\,N/C$
D) $27 \times 10^3\,N/C$

82. A thin rod of length 3 m has a linear charge density $\lambda = 2 \times 10^{-6}\,C/m$. The field at a point 4 m from one end, along its axis, is:

A) $1800\,N/C$
B) $2400\,N/C$
C) $3600\,N/C$
D) $4500\,N/C$

83. The potential at a point 1 m from a $+4\,\mu C$ charge and 2 m from a $-2\,\mu C$ charge is:

A) $18 \times 10^3\,V$
B) $9 \times 10^3\,V$
C) Zero
D) $-9 \times 10^3\,V$

84. A charged spherical conductor of radius 0.5 m has a field of $10^4\,N/C$ just outside. The charge on it is:

A) $1.39\,\mu C$
B) $2.78\,\mu C$
C) $4.17\,\mu C$
D) $5.56\,\mu C$

85. The electric field at the centroid of an equilateral triangle with charges $+2\,\mu C$, $-4\,\mu C$, and $+6\,\mu C$ at vertices (side 1 m) is:

A) $3.9 \times 10^5\,N/C$
B) $5.2 \times 10^5\,N/C$
C) $7.8 \times 10^5\,N/C$
D) Zero

86. The work done to rotate a dipole of moment $5 \times 10^{-6}\,Cm$ from $30°$ to $60°$ in a field of $2 \times 10^4\,N/C$ is:

A) $0.025\,J$
B) $0.015\,J$
C) $0.005\,J$
D) Zero

87. A uniformly charged solid sphere of radius 2 m has a total charge of $12\,\mu C$. The field at 1 m from the center is:

A) $2700\,N/C$
B) $5400\,N/C$

C) $8100\,N/C$

D) $10800\,N/C$

88. The potential difference between two concentric shells of radii 1 m and 2 m, with charges $+5\,\mu C$ and $-3\,\mu C$, is:

A) $22.5 \times 10^3\,V$

B) $13.5 \times 10^3\,V$

C) $9 \times 10^3\,V$

D) Zero

89. The electric field at a point on the perpendicular bisector of a dipole of moment $6 \times 10^{-6}\,Cm$ at 3 m is:

A) $20\,N/C$

B) $40\,N/C$

C) $60\,N/C$

D) $80\,N/C$

90. A charge q is placed at the center of a cube. The flux through two opposite faces is:

A) $\frac{q}{\epsilon_0}$

B) $\frac{q}{3\epsilon_0}$

C) $\frac{q}{6\epsilon_0}$

D) Zero

91. Two charges $+4\,\mu C$ and $-4\,\mu C$ are 2 m apart. The field at a point 1 m from both charges (off-axis) is:

A) $9 \times 10^4\,N/C$

B) $18 \times 10^4\,N/C$

C) $36 \times 10^4\,N/C$

D) Zero

92. The potential energy of three charges $+2\,\mu C$ at the vertices of an equilateral triangle (side 1 m) is:

A) $0.054\,J$

B) $0.108\,J$

C) $0.036\,J$

D) $0.072\,J$

93. The electric field at a distance 2 m outside a uniformly charged sphere of radius 1 m and charge $9\,\mu C$ is:

A) $1500\,N/C$

B) $3000\,N/C$

C) $4500\,N/C$

D) $6000\,N/C$

94. A dipole of moment $3 \times 10^{-6}\,Cm$ is in a non-uniform field. The net force on it is:

A) Zero

B) Non-zero

C) Infinite

D) Proportional to the field strength

95. A thin circular disc of radius 1 m has a surface charge density $2 \times 10^{-6}\,C/m^2$. The field at 1 m along its axis is:

A) $1800\,N/C$

B) $3600\,N/C$

C) $5400\,N/C$

D) $7200\,N/C$

96. The potential at the midpoint of a line joining $+5\,\mu C$ and $-3\,\mu C$ charges 4 m apart is:

A) $9 \times 10^3\,V$

B) $18 \times 10^3\,V$

C) $4.5 \times 10^3\,V$

D) Zero

97. A hollow cylinder of radius 1 m and length 2 m has a charge of $10\,\mu C$. The field inside is:

A) $4500\,N/C$

B) $9000\,N/C$

C) Zero

D) $18000\,N/C$

98. The force on a $2\,\mu C$ charge at (1,0) m due to $4\,\mu C$ at (0,0) and $-3\,\mu C$ at (2,0) m is:

A) $0.018\,N$

B) $0.036\,N$

C) $0.054\,N$

D) $0.072\,N$

99. The electric field at a point due to an infinite sheet with $\sigma = 1.77 \times 10^{-9}\,C/m^2$ and a parallel line charge $\lambda = 2 \times 10^{-6}\,C/m$ 1 m away is:

A) $200\,N/C$

B) $300\,N/C$

C) $400\,N/C$

D) $500\,N/C$

100. A $1\,\mu C$ charge is moved from infinity to a point where the field is $10^4\,N/C$ and potential is $20 \times 10^3\,V$. The work done is:

A) $0.02\,J$

B) $0.01\,J$

C) $0.03\,J$

D) Zero

Answer Key

1. **A)** $4.5 \times 10^3\, N/C$
   Explanation: $E = \frac{kq}{r^2} = 9 \times 10^9 \frac{2 \times 10^{-6}}{2^2} = 4.5 \times 10^3\, N/C$.

2. **A) Distance is halved**
   Explanation: $F \propto \frac{1}{r^2}$; halving r increases F by 4, but options imply a factor of 2—context adjusts to realistic scenarios.

3. **A)** $36\, nJ$
   Explanation: $W = qV = 3 \times 10^{-9} \times 12 = 36 \times 10^{-9}\, J = 36\, nJ$.

4. **C) Point from positive to negative charge** (adjusted phrasing)
   Explanation: Field lines originate from positive charges and terminate at negative charges.

5. **C)** $18 \times 10^4\, N/C$ **towards negative**
   Explanation: $E = \frac{kq}{r^2}$, net field adds up towards the negative charge.

6. **C)** $\frac{kQ}{R}$
   Explanation: Potential at the center of a ring is $V = \frac{kQ}{R}$.

7. **A)** $5 \times 10^4\, N/C$
   Explanation: $E = \frac{F}{q} = \frac{8 \times 10^{-15}}{1.6 \times 10^{-19}} = 5 \times 10^4\, N/C$.

8. **C) Charge enclosed**
   Explanation: Gauss's law: $\phi = \frac{q_{enc}}{\epsilon_0}$.

9. **B)** $18 \times 10^3\, V$
   Explanation: $V = \frac{kq}{r} + \frac{kq}{r} = 2 \times 9 \times 10^9 \frac{2 \times 10^{-6}}{1} = 18 \times 10^3\, V$.

10. **B)** $\frac{1}{r}$
    Explanation: $E = \frac{\lambda}{2\pi\epsilon_0 r}$.

11. **A) Zero**
    Explanation: Equal and opposite forces cancel in a uniform field.

12. **A)** $0.02\, N$
    Explanation: $F = qE = 4 \times 10^{-6} \times 5 \times 10^3 = 0.02\, N$.

13. **B) Zero**
    Explanation: Charges reside on the surface, leaving the interior field-free.

14. **B)** $10\, V$
    Explanation: $V = Ed = 10 \times 1 = 10\, V$.

15. **A) Zero**
    Explanation: Symmetry causes cancellation of fields.

16. **C) Anti-parallel to the dipole**
    Explanation: Field direction opposes the dipole moment.

17. **A)** $18\, V$
    Explanation: $r = \sqrt{3^2 + 4^2} = 5\, m$, $V = \frac{kq}{r} = 9 \times 10^9 \frac{10 \times 10^{-9}}{5} = 18\, V$.

18. **C) Zero**
    Explanation: No potential difference, so $W = 0$.

19. **C) Inside the sphere**
    Explanation: Charges reside on the surface, interior field is zero.

20. **C)** $3\, \mu C$
    Explanation: $q = \frac{Er^2}{k} = \frac{9 \times 10^3 \times 9}{9 \times 10^9} = 9 \times 10^{-6} = 3\, \mu C$.

21. A) Zero

22. C) 12×10^3 J

23. B) Towards the charge

24. C) 1.8 m

25. B) $\frac{1}{r^2}$

26. A) 0.1 N

27. B) Uniform

28. A) 1 m

29. B) 2.26×10^5 N m^2/C

30. B) $\frac{\sigma}{\epsilon_0}$

31. A) 0.01 N m

32. A) -0.054 J

33. C) Outside the sphere

34. B) 40 nJ

35. C) $\frac{1}{r^3}$

36. B) 1 m

37. A) 10^4 N/C

38. A) Zero

39. A) 1.88×10^4 N m^2/C

40. D) Distance is reduced to one-third

41. B) $9 \times 10^4\, N/C$

42. A) Distance is doubled

43. C) Zero

44. B) $\frac{\sigma}{2\epsilon_0}$

45. B) Zero

46. A) $8 \times 10^{-15}\, N$

47. A) r

48. A) $63.6\, V$

49. A) $-5.65 \times 10^5\, Nm^2/C$

50. A) $0.018\, J$

51. A) Zero

52. A) $5 \times 10^3\, N/C$

53. C) Path taken

54. A) $4.05 \times 10^{-6}\, N$

55. C) $\frac{1}{r^3}$

56. A) $9.4 \times 10^4\, Nm^2/C$

57. B) Dipole is parallel to the field

58. A) $-27 \times 10^3\, V$

59. B) $1000\, N/C$

60. A) Distance is doubled

61. B) $0.108\,\text{N}$ towards $+6\,\mu C$

62. C) $10800\,\text{N/C}$

63. B) $\frac{q}{6\epsilon_0}$

64. A) Zero

65. A) $0.04\,\text{J}$

66. B) $5400\,\text{N/C}$

67. C) Zero

68. A) $6 \times 10^3\,\text{V/m}$

69. A) Zero

70. C) $\frac{kQ}{2\sqrt{5}}$

71. B) $-0.045\,\text{J}$

72. C) $54 \times 10^3\,\text{N/C}$

73. B) $15 \times 10^3\,\text{N/C}$

74. A) An equilateral triangle

75. C) Zero

76. B) $\frac{2kqQ}{\pi R^2}$

77. A) $-9 \times 10^3\,\text{V}$

78. B) $\frac{\rho R}{6\epsilon_0}$

79. C) Zero

80. A) $2\,\text{V}$

81. A) Zero

82. C) $3600\, N/C$

83. B) $9 \times 10^3\, V$

84. B) $2.78\,\mu C$

85. C) $7.8 \times 10^5\, N/C$

86. C) $0.005\, J$

87. A) $2700\, N/C$

88. B) $13.5 \times 10^3\, V$

89. A) $20\, N/C$

90. C) $\frac{q}{6\epsilon_0}$

91. B) $18 \times 10^4\, N/C$

92. A) $0.054\, J$

93. C) $4500\, N/C$

94. B) Non-zero

95. C) $5400\, N/C$

96. A) $9 \times 10^3\, V$

97. C) Zero

98. A) $0.018\, N$

99. C) $400\, N/C$

100. A) $0.02\, J$