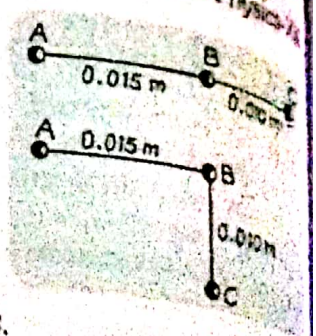
1. What is the force between two small charged spheres carrying charges of 2×10^{-7} C and 3×10^{-7} C placed 30 cm apart in air? **Ans.** 6×10^{-3} N (repulsive).
2. Calculate the Coulombian force between a proton and an electron separated by 0.8×10^{-15} m. **Ans.** 360 N (attractive).
3. Calculate the electrostatic force between two α-particles separated by 3.2×10^{-15} m. **Ans.** 90 N (repulsive).
4. The mutual electrostatic force of attraction between two small spheres carrying charges +0.4 μC and −0.8 μC in air is 0.2 N. What is the separation between the two spheres? **Ans.** 12 cm.
5. How far apart the two electrons be, if the force between them equals the weight of an electron? What in case of protons? **Ans.** 5.1 m, 0.117 m.
6. Two positive charges distant 0.1 m apart, repel each other with a force of 18 N. If the sum of the charges be 9 micro-coulomb (μC), then calculate their separate values. **Ans.** 5 μC, 4 μC.
7. The distance between two negatively-charged dust particles is 1 mm and they repel each other with a force of 4.0×10^{-5} N. If the charge on one particle is 4 times that of the other, then find out the number of electrons charging them separately. The charge on electron is $(5/3) \times 10^{-19}$ C. **Ans.** 2×10^{8}, 8×10^{8}.
8. Two point-charges of +2 μC and +6 μC repel each other with a force of 12 N. If each is given an additional charge of −4 μC, then what will be the new force? **Ans.** 4 N (attraction).
9. Two identical metallic balls A and B have charges +40 and −10 μC respectively. The distance between them is 2.0 m. What is the magnitude and type of force acting between them? They are touched to each other and again separated by a distance of 2.0 m from each other. Calculate the new force between them. What will be the force if one ball is connected to earth? **Ans.** 0.90 N (attraction), 0.51 N (repulsion), zero.
10. Two similarly and equally charged identical metal spheres A and B repel each other with a force of 2.0×10^{-5} N. A third identical, uncharged sphere C is touched with A and then placed at the mid-point between A and B. What is net electric force on C? **Ans.** 2.0×10^{-5} N, towards A.
11. Two conducting spheres A and B of the same size are situated at some distance apart. Each has a charge of $+q$ coulomb and they repel each other with a force of 10^{-5} N. A third conducting uncharged sphere C of same size is first touched with A and then with B and then placed exactly between A and B. Calculate the resultant force on C. **Ans.** 7.5×10^{-6} N, towards A.
12. In the adjoining figures are shown three particles A, B and C which are equally charged. The force acting on B due to A is 2.0×10^{-6} N. Find out in each Fig. (i) force exerted on B by C, (ii) net force on B.



Ans. (i) 4.5×10^{-6} N, towards A 4.5×10^{-6} N vertically upward (ii) 2.5×10^{-6} N (from B to A) 4.925×10^{-6} N at an angle θ from horizontal, $\theta = \tan^{-1}(2.25)$
13. Two point-charges of 1.0 μC and −0.25 μC are placed in air at a distance of 0.40 m from each other. Find out at which point on the line joining the two charges should a third charge be placed so that no force acts upon it? **Ans.** Outside the second charge at a distance of 0.40 m
14. Two point-charges $+9e$ and $+e$ are placed at a distance of 16 cm from each other. At what point between these charges should a third charge q be placed so that it remains in equilibrium? **Ans.** At a distance of 12 cm from the charge $+9e$
15. Three point-charges q_1, q_2, q_3 are in line at equal distances. q_2 and q_3 are opposite in sign. Find the magnitude and sign of q_1, if the net force on q_3 is zero. **Ans.** q_1 has a magnitude four times of q_2 and sign as of q_2
16. ABC is an equilateral triangle of side 10 m and D is the mid-point of BC. Charges of +100, −100 and +75 μC are placed at B, C and D respectively. Find the force on a +1 μC charge placed at A. **Ans.** $9\sqrt{2} \times 10^{-3}$ N, at 45° to a line parallel to BC
17. At each of the four corners of a square of side a, a charge $+q$ is placed freely. What charge should be placed at the centre of the square so that the whole system be in equilibrium? **Ans.** $(-q/4)(1 + 2\sqrt{2})$
18. An alpha particle is placed in an electric field of 15×10^{4} N C^{-1}. Calculate the force on the particle. **Ans.** 4.8×10^{-14} N
19. A body having an excess of 10^{6} electrons is placed in an electric field of 1000 N C^{-1} towards East. Find out the magnitude and direction of the force acting on the body. **Ans.** 1.6×10^{-10} N, towards West
20. What will be the intensity of an electric field in which an electron experiences an electric force equal to its weight? What in case of proton? **Ans.** 5.5×10^{-11} N/C vertically downward 1.04×10^{-7} N/C vertically upward
21. Calculate the intensity of the electric field due to helium nucleus at a distance of 1 Å from the nucleus

Hint : The helium nucleus has a positive charge equal to that on an α-particle. **Ans.** 2.88×10^{11} N-C^{-1}.

22. Two point charges $q_1 = 400$ μC and $q_2 = 100$ μC are kept fixed, 60 cm apart in vacuum. Find intensity of the electric field at mid-point of the line joining q_1 and q_2. ***(ISC 2016)*** **Ans.** 3.0×10^7 N C^{-1}.

23. Two point-charges $q_1 = +0.2$ C and $q_2 = +0.4$ C are 0.1 m apart. Find the electric field at (i) mid-point between the charges, (ii) a point on the line joining q_1 and q_2 such that it is 0.05 m away from q_2 and 0.15 m away from q_1. **Ans.** (i) 7.20×10^{11} N-C^{-1} towards q_1, (ii) 1.52×10^{12} N-C^{-1} away from q_1 and q_2 both.

24. Two point-charges $+q$ and $+4q$ are separated by a distance $6a$. Find the point joining the two charges where the electric field is zero.

Ans. At a distance $2a$ from $+q$.

25. Electric charges ± 1000 μC are placed at points A and B, respectively at a distance of 2 m from each other. Calculate the electric fields at (i) mid-point of the line AB and (ii) at a point at equal distances of 4 m from each charge. **Ans.** (i) 1.8×10^7 N C^{-1}, along AB ; (ii) 2.8×10^5 N C^{-1}, parallel to AB.

26. A stationary oil drop between two parallel plates has a charge of 3.2×10^{-19} C and a weight of 1.6×10^{-14} N. Find the electric field acting on the drop. **Ans.** 5.0×10^4 N C^{-1}.

27. A charged drop of oil of radius 2.76 μm and density 920 kg m^{-3} is held stationary in a vertically downward electric field of 1.65×10^6 NC^{-1}. (i) Find the magnitude and sign of the charge on the drop. (ii) If the drop captures two electrons in the same electric field, what would be its acceleration? Ignore viscous drag.

Ans. (i) -4.8×10^{-19} C, (ii) 6.5 ms^{-2}.

28. Two charges, one +5 μC and other −5 μC are placed 1 mm apart. Calculate the dipole moment.

Ans. 5×10^{-9} C-m.

29. A system has two charges $q_A = +0.25$ μC and $q_B = -0.25$ μC at points A (0, 0, −15 cm) and B (0, 0, +15 cm) respectively. Find the total charge and electric dipole moment of the system.

Ans. Zero; 7.5×10^{-8} C-m along −Z-axis

30. Two charges of +2.4μC and −2.4μC are at a distance 2.5×10^{-3} m apart from each other. Determine the magnitude of the electric field in the broad-side-on position at a distance of 0.30 m from this dipole. If the dipole be rotated through 90°, then what will be the intensity of the field?

Ans. 2.0×10^3 N-C^{-1}, 4.0×10^3 N-C^{-1}

31. Two point-charges of +1μC and −1μC are kept a distance of 2 cm. They form an electric dipole. This dipole is situated in a uniform electric field 1×10^5 N-C^{-1}, with dipole moment vector $\vec{p}$ making an angle of 30° with the field. Calculate (i) the magnitude of electric dipole moment and (ii) the torque acting on the dipole. (iii) When would be the torque maximum? How much?

Ans. (i) 2×10^{-8} C-m, (ii) 1×10^{-3} N-m, (iii) torque is maximum when the dipole is normal to the field ($\theta = 90°$), 2×10^{-3} N-

32. An electric dipole, when held at 30° with respect to a uniform electric field of 10^4 N/C, experiences a torque of 9×10^{-26} N-m. Calculate the moment of the dipole. **Ans.** 1.8×10^{-29} C-

33. Two point-charges of 100 μC and −100 μC are 2.0×10^{-3} m apart. Find (i) dipole moment of the electric dipole formed, (ii) electric fields at 0.50 m from the centre of the dipole in the end-on and broad side-on positions, (iii) if the electric dipole be placed in a uniform electric field of 1.0×10^6 N-C^{-1}, rotated through 60° from the direction of the field, then calculate the moment of the force acting on it.

Ans. (i) 2.0×10^{-7} C-m, (ii) 2.88×10^4 N-C^{-1}, 1.44×10^4 N-C^{-1}, (iii) 0.1732 N

FOR DIFFERENT COMPETITIVE EXAMINATIONS