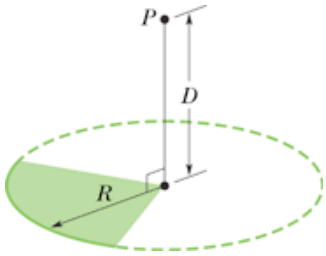
Chapter 25 – Problem Day

6. Two large, parallel, conducting plates are 12 cm apart and have charges of equal magnitude and opposite sign on their facing surfaces. An electrostatic force of 3.9×10^{-15} N acts on an electron placed anywhere between the two plates. (a) Find the electric field at the position of the electron. (b) What is the potential difference between the plates?

26. A Gaussian sphere of radius 4 cm is centered on a ball that has a radius of 1 cm and a uniform charge distribution. The total electric flux through the surface of the Gaussian sphere is $+5.6 \times 10^{4}$ N·m^2/C. What is the electric potential 12 cm from the center of the ball?

29. A plastic disk of radius R = 64 cm is charged on one side with a uniform surface charge density σ = 7.73 fC/m^2, and then three quadrants of the disk are removed. The remaining quadrant is shown. With V = 0 at infinity, what is the potential due to the remaining quadrant at point P, which is on the central axis of the original disk at distance D = 25.9 cm from the original center?



36. Two large parallel metal plates are 1.5 cm apart and have charges of equal magnitudes but opposite signs on their facing surfaces. Take the potential of the negative plate to be zero. If the potential halfway between the plates is then +5.0 V, what is the electric field in the region between the plates?

39. What is the magnitude of the electric field at the point $3\hat{i} - 2\hat{j} + 4\hat{k}$ if the electric potential is given by $V = 2xyz^2$, where V is in volts and x, y, and z are in meters?

43. A particle of charge +7.5 μC is released from rest at the point x = 60 cm on an x-axis. The particle begins to move due to the presence of a charge Q that remains fixed at the origin. What is the kinetic energy of the particle at the instant it has moved 40 cm if (a) Q = +20 μC and (b) Q = –20 μC?

57. An electron is projected with an initial speed of 3.2 × 10^5 m/s directly toward a proton that is fixed in place. If the electron is initially a great distance from the proton, at what distance from the proton is the speed of the electron instantaneously equal to twice the initial value?

65. Two metal spheres, each of radius 3.0 cm, have a center-to-center separation of 2.0 m. Sphere 1 has charge +10 nC; sphere 2 has charge -30 nC. Assume that the separation is large enough for us to assume that the charge on each sphere is uniformly distributed (the spheres do not affect each other). With V = 0 at infinity, calculate (a) the potential at the point halfway between the centers and the potential on the surface of (b) sphere 1 and (c) sphere 2.

Chapter 25 Answers

6a) 2.4×10^4 V/m
6b) 2.9×10^3 V

26) 3.71×10^4 V

29) 4.71×10^{-5} V

36) 667 V/m

39) 150 V/m

43a) 0.9 J
43b) 4.5 J

57) 1.6×10^{-9} m

65a) -180 V
65b) 2863 V
65c) -8954 V