

Problems are from Tipler Chapter 23:

(1) 5 In what directions can you move relative to an electric field so that the electric potential does not change?

(2) 14 True or false:

(a) If the electric field is zero in some region of space, the electric potential must also be zero in that region.

(b) If the electric potential is zero in some region of space, the electric field must also be zero in that region.

(c) If the electric potential is zero at a point, the electric field must also be zero at that point.

(d) Electric field lines always point toward regions of lower potential.

(e) The value of the electric potential can be chosen to be zero at any convenient point.

(f) In electrostatics, the surface of a conductor is an equipotential surface

(g) Dielectric breakdown occurs in air when the potential is 3×10^6 V.

(3) 20 When you touch a friend after walking across a rug on a dry day, you typically draw a spark of about 2 mm. Estimate the potential difference between you and your friend before the spark.

(4) 24 The distance between the K^+ and Cl^- ions in KCl is 2.80×10^{-10} m. Calculate the energy required to separate the two ions to an infinite distance apart, assuming them to be point charges initially at rest. Express your answer in eV.

(5) 29 Three point charges are on the x-axis: q_1 is at the origin, q_2 is at $x = 3$ m, and q_3 is at $x = 6$ m. Find the potential at the point $x = 0, y = 3$ if (a) $q_1 = q_2 = q_3 = +2 \mu C$, (b) $q_1 = q_2 = +2 \mu C$ and $q_3 = -2 \mu C$ and (c) $q_1 = q_3 = +2 \mu C$ and $q_2 = -2 \mu C$

(6) 36 The potential due to a particular charge distribution is measured at several points along the x-axis, as shown in Figure 23-28. For what value(s) in the range $0 < x < 10$ m is $E_x = 0$?

(7) 42 An electric field is given by $E_x = 2x^3$ kN/C. Find the potential difference between the points on the x-axis at $x = 1$ m and $x = 2$ m.

(8) 44 A charge of $q = 10^{-8}$ C is uniformly distributed on a spherical shell of radius 12 cm. (a) What is the magnitude of the electric field just outside and just inside the shell? (b) What is the magnitude of the electric potential just outside and just inside the shell? (c) What is the electric potential at the center of the shell? What is the electric field at that point?

(9) 54 - clarified A conducting spherical shell of inner radius b and outer radius c is concentric with a small metal sphere of radius $a < b$. The metal sphere has a positive charge $+Q$. The total charge on the spherical conducting shell is $-Q$ (a) What is the potential of the spherical shell for radius $r > b$? (b) What is the potential of the metal sphere at radius $r = a$?

(10) 64 Charge is placed on two conducting spheres that are very far apart and connected by a long

thin wire. The radius of the smaller sphere is 5 cm and that of the larger sphere is 12 cm. The electric field at the surface of the larger sphere is 200 kV/m. Find the surface charge density on each sphere.