Problem 20.1 Table salt (sodium chloride) is a crystal with a simple cubic structure with Na^+ ions and Cl^- ions alternating at adjacent lattice sites. The distance between ions is $a = 2.82 \times 10^{-10}$ m $= 0.282$ nm (1 nm $= 10^{-9}$ m). (a) What force does an Na^+ ion experience due to one of its nearest Cl^- neighbors? (b) What force does a Cl^- ion experience due to a neighboring Na^+? (c) What force does an Na^+ ion at the origin experience due to Cl^- ions at $(a, 0, 0)$ and $(0, a, 0)$? (d) What is the weight of an Na^+ ion of mass 3.82×10^{-26} kg?

Problem 20.2 A charge $q_1 = +4\,\mu$C ($1\,\mu$C $= 10^{-6}$ C) is positioned at the origin. A charge $q_2 = +9\,\mu$C is positioned on the x axis at $x = 4$ m. Where on the x axis can a negative charge q_3 be placed so that the force on it is zero? Is there any position off the x axis where the force on q_3 will be zero?

Problem 20.3 Two identical Styrofoam spheres, each of mass 0.030 kg, are each attached to a thread 30 cm long and suspended from a point. Each sphere is given a charge q (perhaps by rubbing it on a piece of cloth), and the two spheres repel each other and hang with each thread making an angle of 7 degrees with vertical. What is the charge on each sphere?

Problem 20.5 Four identical positive charges $+q$ are placed at the corners of a square of side L. Determine the magnitude and direction of the electric field due to them at the midpoint of one side of the square.