Home Work 3

3-1 Figure 24-43 shows a thin plastic rod of length L = 12.0 cm and uniform positive charge Q = 56.1 fC lying on an x axis. With V = 0 at infinity, find the electric potential at point P_1 on the axis, at distance d = 2.50 cm from one end of the rod. (HRW24-30)

3-2 The thin plastic rod shown in Fig. 24-43 has length L = 12.0 cm and a nonuniform linear charge density $\lambda = cx$, where c = 28.9 pC/m2. With V = 0 at infinity, find the electric potential at point P1 on the axis, at distance d = 3.00 cm from one end. (HRW24-33)

3-3 Figure 24-43 shows a thin plastic rod of length L =13.5 cm and uniform charge 43.6 fC. (a) In terms of distance d, find an expression for the electric potential at point P_1. (b) Next, substitute variable x for d and find an expression for the magnitude of the component E_x of the electric field at P_1. (c) What is the direction of E_x relative to the positive direction of the x axis? (d) What is the value of E_x at P_1 for x = d = 6.20 cm? (e) From the symmetry in Fig. 24-43, determine E_y at P_1. (HRW24-38)

3-4 The thin plastic rod of length L = 10.0 cm in Fig. 24-43 has a nonuniform linear charge density $\lambda = cx$, where c = 49.9 pC/m2. (a) With V = 0 at infinity, find the electric potential at point P_2 on the y axis at y = D = 3.56 cm. (b) Find the electric field component E_y at P_2. (c) Why cannot the field component E_x at P_2 be found using the result of (a)? (HRW24-40)

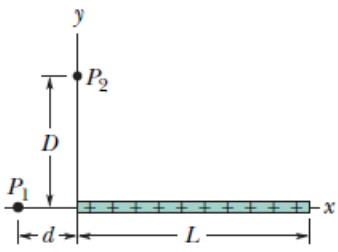

FIG. 24-43 Problems 30, 33, 38, and 40.

23.57 •• **CALC** A vacuum tube diode consists of concentric cylindrical electrodes, the negative cathode and the positive anode. Because of the accumulation of charge near the cathode, the electric potential between the electrodes is not a linear function of the position, even with planar geometry, but is given by

$$V(x) = Cx^{4/3}$$

where x is the distance from the cathode and C is a constant, characteristic of a particular diode and operating conditions. Assume that the distance between the cathode and anode is 13.0 mm and the potential difference between electrodes is 240 V. (a) Determine the value of C. (b) Obtain a formula for the electric field between the electrodes as a function of x. (c) Determine the force on an electron when the electron is halfway between the electrodes.