In a uniform field the **E** lines are parallel and the equipotential lines form a parallel orthogonal set of lines as in Fig. 2-17*a*. Actually the equipotentials are plane surfaces perpendicular to **E** and for a fixed voltage increment ΔV (= 10 V in the figure) are spaced uniformly.

In a nonuniform field the **E** lines diverge in going from a stronger to a weaker field region, as in Fig. 2-17*b*. Furthermore, for a fixed voltage increment, such as 10 V, the equipotential surfaces become more widely spaced in the weaker field region. The uniform and nonuniform fields are shown in three dimensions in Figs. 2-17*c* and *d*.

Note that a potential *rise* is always opposite to the direction of **E**.

As another example of a nonuniform field, let us consider the field in the vicinity of a long straight wire shown in Fig. 2-18. The wire perpendicular to the page carries a uniform positive charge.

From (2-7-8) the electric field at a distance r from a long (ideally infinite) wire is

$$E_r = \frac{\rho_L}{2\pi\epsilon_0 r} \quad (\mathrm{V\,m^{-1}}) \tag{1}$$

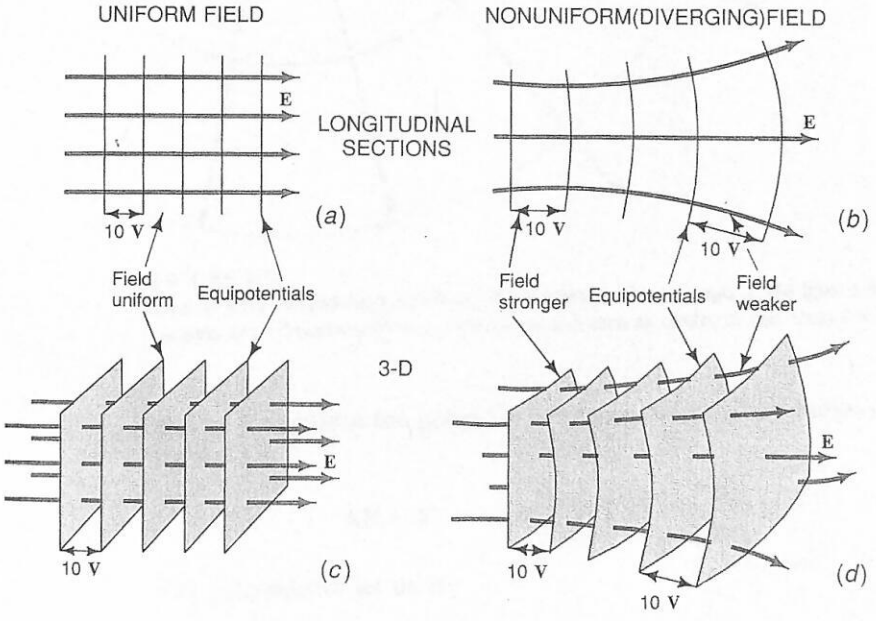

FIGURE 2-17
(*a*) Uniform electric field. (*b*) Nonuniform electric field. Equipotential surfaces are planar in (*a*) and curved in (*b*) as seen in three dimensions in (*c*) and (*d*). For a given potential difference or increment (10 V), the equipotential surfaces are equally spaced in a uniform field (*c*), but in the nonuniform field (*d*) the spacing increases as the field becomes weaker.