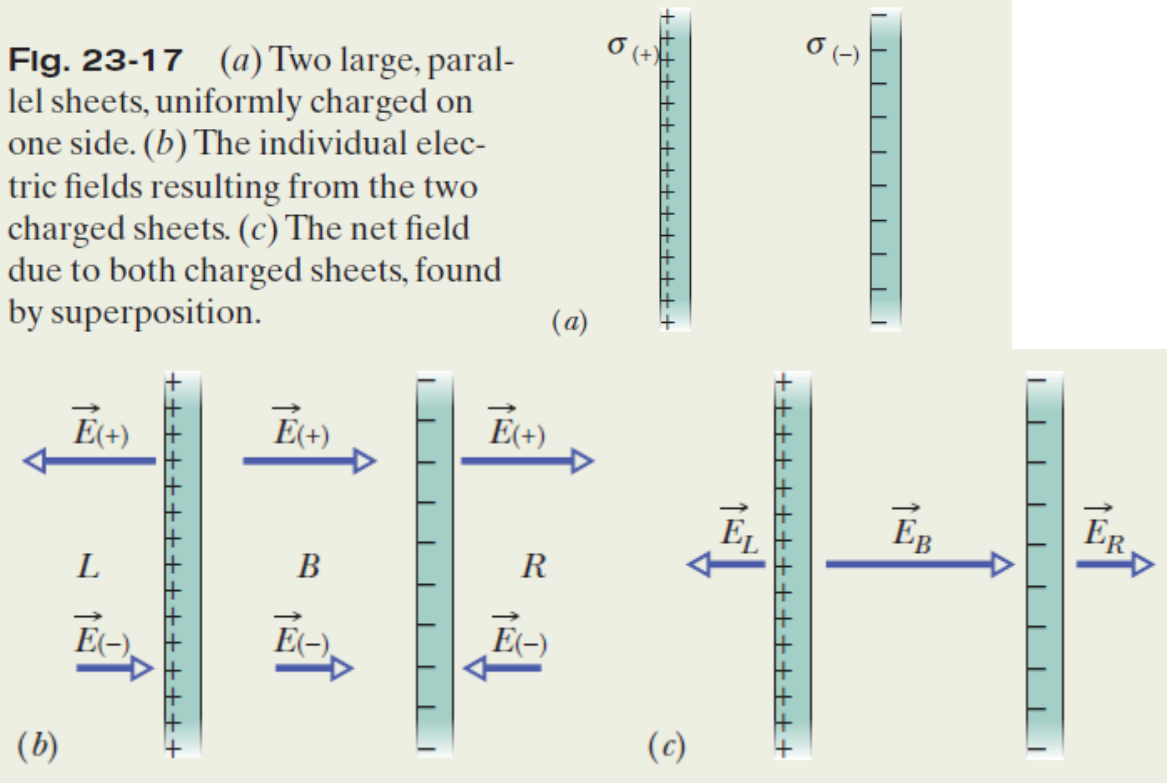


Figure 23-17a shows portions of two large, parallel, nonconducting sheets, each with a fixed uniform charge on one side. The magnitudes of the surface charge densities are  $\sigma_{(+)} = 6.8 \mu\text{C}/\text{m}^2$  for the positively charged sheet and  $\sigma_{(-)} = 4.3 \mu\text{C}/\text{m}^2$  for the negatively charged sheet. Find the electric field (a) to the left of the sheets, (b) between the sheets, and (c) to the right of the sheets.

**Calculations:** At any point, the electric field  $\vec{E}_{(+)}$  due to the positive sheet is directed *away* from the sheet and, from Eq. 23-13, has the magnitude

$$E_{(+)} = \frac{\sigma_{(+)}}{2\epsilon_0} = \frac{6.8 \times 10^{-6} \text{ C/m}^2}{(2)(8.85 \times 10^{-12} \text{ C}^2/\text{N} \cdot \text{m}^2)} = 3.84 \times 10^5 \text{ N/C}.$$

**Fig. 23-17** (a) Two large, parallel sheets, uniformly charged on one side. (b) The individual electric fields resulting from the two charged sheets. (c) The net field due to both charged sheets, found by superposition.



Similarly, at any point, the electric field  $\vec{E}_{(-)}$  due to the negative sheet is directed *toward* that sheet and has the magnitude

$$E_{(-)} = \frac{\sigma_{(-)}}{2\epsilon_0} = \frac{4.3 \times 10^{-6} \text{ C/m}^2}{(2)(8.85 \times 10^{-12} \text{ C}^2/\text{N} \cdot \text{m}^2)} = 2.43 \times 10^5 \text{ N/C}.$$

Figure 23-17*b* shows the fields set up by the sheets to the left of the sheets (*L*), between them (*B*), and to their right (*R*).

The resultant fields in these three regions follow from the superposition principle. To the left, the field magnitude is

$$\begin{aligned} E_L &= E_{(+)} - E_{(-)} \\ &= 3.84 \times 10^5 \text{ N/C} - 2.43 \times 10^5 \text{ N/C} \\ &= 1.4 \times 10^5 \text{ N/C.} \end{aligned} \quad (\text{Answer})$$

Because  $E_{(+)}$  is larger than  $E_{(-)}$ , the net electric field  $\vec{E}_L$  in this region is directed to the left, as Fig. 23-17*c* shows. To the right of the sheets, the electric field has the same magnitude but is directed to the right, as Fig. 23-17*c* shows.

Between the sheets, the two fields add and we have

$$\begin{aligned} E_B &= E_{(+)} + E_{(-)} \\ &= 3.84 \times 10^5 \text{ N/C} + 2.43 \times 10^5 \text{ N/C} \\ &= 6.3 \times 10^5 \text{ N/C.} \end{aligned} \quad (\text{Answer})$$

The electric field  $\vec{E}_B$  is directed to the right.