

27. Let the resistors be divided into groups of n resistors each, with all the resistors in the same group connected in series. Suppose there are m such groups that are connected in parallel with each other. Let R be the resistance of any one of the resistors. Then the equivalent resistance of any group is nR , and R_{eq} , the equivalent resistance of the whole array, satisfies

$$\frac{1}{R_{\text{eq}}} = \sum_1^m \frac{1}{nR} = \frac{m}{nR} .$$

Since the problem requires $R_{\text{eq}} = 10\,\Omega = R$, we must select $n = m$. Next we make use of Eq. 28-13. We note that the current is the same in every resistor and there are $n \cdot m = n^2$ resistors, so the maximum total power that can be dissipated is $P_{\text{total}} = n^2 P$, where $P = 1.0\,\text{W}$ is the maximum power that can be dissipated by any one of the resistors. The problem demands $P_{\text{total}} \geq 5.0P$, so n^2 must be at least as large as 5.0. Since n must be an integer, the smallest it can be is 3. The least number of resistors is $n^2 = 9$.