Answer on Question #43581-Physics-Electric Circuits

You are having 6 resistors of 3ohm each using the combination of resistances how many different values are possible?

Answer

Let $R_0 = 3\text{ohm}$ be the value of the n equal resistors being used. The net resistance of all the configurations is proportional to R_0. So, we can set its value to be unity. The proportionality constant is a rational number (say $\frac{a}{b}$; with a and b being natural numbers, $\frac{a}{b}$ is in its reduced form) depending on the configuration. The value of $\frac{a}{b}$ ranges from $\frac{1}{n}$ (for all the n resistors in parallel configuration) to n (for all the n resistors in series configuration. The set of values of $\frac{a}{b}$ obtained for all conceivable configurations, for $n = 6$ are:

$$53: \left\{ \begin{array}{c} \frac{1}{6}, \frac{2}{9}, \frac{3}{11}, \frac{3}{10}, \frac{1}{3}, \frac{4}{11}, \frac{5}{13}, \frac{5}{12}, \frac{4}{9}, \frac{5}{11}, \frac{6}{13}, \frac{7}{13}, \frac{6}{11}, \\ \frac{5}{9}, \frac{7}{12}, \frac{8}{13}, \frac{7}{11}, \frac{2}{3}, \frac{7}{10}, \frac{8}{11}, \frac{3}{4}, \frac{7}{9}, \frac{4}{5}, \frac{5}{6}, \frac{9}{10}, \frac{10}{11}, 1, \\ \frac{11}{10}, \frac{10}{9}, \frac{6}{5}, \frac{5}{4}, \frac{9}{7}, \frac{4}{3}, \frac{11}{8}, \frac{10}{7}, \frac{3}{2}, \frac{11}{7}, \frac{13}{8}, \frac{12}{7}, \frac{9}{5}, \\ \frac{11}{6}, \frac{13}{7}, \frac{13}{6}, \frac{11}{5}, \frac{9}{4}, \frac{12}{5}, \frac{13}{5}, \frac{11}{4}, 3, \frac{10}{3}, \frac{11}{3}, \frac{9}{2}, 6. \end{array} \right\}$$

Answer: 53.