7.41 Lösung

Die Leistung ändert quadratisch zur Spannung; d.h. die Leistung wird 4-mal kleiner. (Kurzrechnung: $0.5^2 = 0.25$)

7.42 Lösung

☐ $P = 10^2 \cdot 1$ ☒ $P = \frac{10^2}{10} = \frac{U^2}{R}$ ☒ $P = 1^2 \cdot 10 = I^2 \cdot R$ ☐ $P = 1 \cdot 2^2$

7.43 Lösung

☐ Amperemeter und Voltmeter

☒ Wattmeter

☐ kWh-Zähler

☐ Voltmeter und Ohmmeter

8 Serieschaltung von Widerständen

8.1 Lösung

$R = R_1 + R_2 + R_3 = 22\,\Omega + 120\,\Omega + 470\,\Omega = \underline{\underline{612\,\Omega}}$

8.2 Lösung

$R_3 = R - R_1 - R_2 = 1800\,\Omega - 650\,\Omega - 286\,\Omega = \underline{\underline{864\,\Omega}}$

8.3 Lösung

a) $R = R_1 + R_2 = 40\,\Omega + 20\,\Omega = \underline{\underline{60\,\Omega}}$

b) $U_1 = R_1 \cdot I = 40\,\Omega \cdot 0.4\,\mathrm{A} = \underline{\underline{16\,\mathrm{V}}}$ $\quad U_2 = R_2 \cdot I = 20\,\Omega \cdot 0.4\,\mathrm{A} = \underline{\underline{8\,\mathrm{V}}}$

8.4 Lösung

$I = \dfrac{U}{R} = \dfrac{U}{R_1 + R_2} = \dfrac{230\,\mathrm{V}}{8\,\Omega + 15\,\Omega} = \underline{\underline{10\,\mathrm{A}}}$

$U_1 = R_1 \cdot I = 8\,\Omega \cdot 10\,\mathrm{A} = \underline{\underline{80\,\mathrm{V}}}$ $\quad U_2 = R_2 \cdot I = 15\,\Omega \cdot 10\,\mathrm{A} = \underline{\underline{150\,\mathrm{V}}}$

8.5 Lösung

$U_2 = U - U_1 = 230\,\mathrm{V} - 124\,\mathrm{V} = \underline{106\,\mathrm{V}}$

$I = \dfrac{U_2}{R_2} = \dfrac{106\,\mathrm{V}}{70\,\Omega} = \underline{\underline{1.51\,\mathrm{A}}}$ $\quad R_1 = \dfrac{U_1}{I} = \dfrac{124\,\mathrm{V}}{1.51\,\mathrm{A}} = \underline{\underline{82.1\,\Omega}}$

8.6 Lösung

a) $R = R_1 + R_2 + R_3 = 20\,\Omega + 30\,\Omega + 50\,\Omega = \underline{\underline{100\,\Omega}}$

b) $I = \dfrac{U}{R} = \dfrac{60\,\mathrm{V}}{100\,\Omega} = \underline{\underline{0.6\,\mathrm{A}}}$

c) $U_1 = R_1 \cdot I = 20\,\Omega \cdot 0.4\,\mathrm{A} = \underline{\underline{12\,\mathrm{V}}}$ $\quad U_2 = R_2 \cdot I = 30\,\Omega \cdot 0.6\,\mathrm{A} = \underline{\underline{18\,\mathrm{V}}}$

$U_3 = R_3 \cdot I = 50\,\Omega \cdot 0.6\,\mathrm{A} = \underline{\underline{30\,\mathrm{V}}}$

8.7 Lösung

$R = \dfrac{U}{I} = \dfrac{100\,\mathrm{V}}{0.8\,\mathrm{A}} = \underline{\underline{125\,\Omega}}$

$R_{23} = R - R_1 = 125\,\Omega - 35\,\Omega = \underline{\underline{90\,\Omega}}$ $\quad$ (beide Widerstände R_2 und R_3 zusammen)

$R_2 = R_3 = \dfrac{R_{23}}{2} = \dfrac{90\,\Omega}{2} = \underline{\underline{45\,\Omega}}$

8.8 Lösung

a) $I = \frac{U}{R} = \frac{U}{R_1 + R_2} = \frac{160\,\text{V}}{50\,\Omega + 350\,\Omega} = \underline{\underline{400\,\text{mA}}}$

b) $U_1 = R_1 \cdot I = 50\,\Omega \cdot 0.4\,\text{A} = \underline{\underline{20\,\text{V}}}$ $U_2 = R_2 \cdot I = 350\,\Omega \cdot 0.4\,\text{A} = \underline{\underline{140\,\text{V}}}$

c) $P_1 = U_1 \cdot I = 20\,\text{V} \cdot 0.4\,\text{A} = \underline{\underline{8\,\text{W}}}$ $P_2 = U_2 \cdot I = 140\,\text{V} \cdot 0.4\,\text{A} = \underline{\underline{56\,\text{W}}}$

d) $P = P_1 + P_2 = 8\,\text{W} + 56\,\text{W} = \underline{\underline{64\,\text{W}}}$

8.9 Lösung

$U = U_1 + U_2 = 36\,\text{V} + 24\,\text{V} = \underline{60\,\text{V}}$ $I = \frac{U}{R} = \frac{60\,\text{V}}{3000\,\Omega} = \underline{20\,\text{mA}}$

$R_1 = \frac{U_1}{I} = \frac{36\,\text{V}}{0.02\,\text{A}} = \underline{\underline{1800\,\Omega}}$ $R_2 = \frac{U_2}{I} = \frac{24\,\text{V}}{0.02\,\text{A}} = \underline{\underline{1200\,\Omega}}$

$P_1 = I^2 \cdot R_1 = (0.02\,\text{A})^2 \cdot 1800\,\Omega = \underline{\underline{0.72\,\text{W}}}$

8.10 Lösung

$n_1 = \frac{U}{U_1} = \frac{230\,\text{V}}{14\,\text{V}} = \underline{16.4\,\text{Stück}}$ Es müssen 17 Lampen in Reihe geschaltet werden.

$U_2 = \frac{U}{n_2} = \frac{230\,\text{V}}{17} = \underline{\underline{13.5\,\text{V}}}$

$U_3 = \frac{U}{n_3} = \frac{230\,\text{V}}{15} = \underline{\underline{15.3\,\text{V}}}$

8.11 Lösung

Bei geöffnetem Kontakt gilt:

$U_1 = U - U_i = 225\,\text{V} - 125\,\text{V} = \underline{100\,\text{V}}$

$I = \frac{U_1}{R_1} = \frac{100\,\text{V}}{50\,000\,\Omega} = \underline{0.002\,\text{A}} = \underline{2\,\text{mA}}$

$R_i = \frac{U_i}{I} = \frac{125\,\text{V}}{0.002\,\text{A}} = \underline{\underline{62.5\,\text{k}\Omega}}$

8.12 Lösung

$R = \frac{U}{I} = \frac{400\,\text{V}}{1.6\,\text{A}} = \underline{250\,\Omega}$

$R_{13} = R - R_2 = 250\,\Omega - 80\,\Omega = \underline{170\,\Omega}$ (beide Widerstände R_1 und R_3 zusammen)

$R_1 = R_3 = \frac{R_{13}}{2} = \frac{170\,\Omega}{2} = \underline{\underline{85\,\Omega}}$

8.13 Lösung

a) $R_1 = \frac{U_N^2}{P_1} = \frac{(230\,\text{V})^2}{250\,\text{W}} = \underline{211.6\,\Omega}$ $\qquad R_2 = \frac{U_N^2}{P_2} = \frac{(230\,\text{V})^2}{500\,\text{W}} = \underline{105.8\,\Omega}$

$R = R_1 + R_2 = 211.6\,\Omega + 105.8\,\Omega = \underline{\underline{317.4\,\Omega}}$

b) $I = \frac{U}{R} = \frac{230\,\text{V}}{317.4\,\Omega} = \underline{725\,\text{mA}}$

$U_1 = R_1 \cdot I = 211.6\,\Omega \cdot 0.725\,\text{A} = \underline{\underline{153.4\,\text{V}}}$ $\qquad U_2 = R_2 \cdot I = 105.8\,\Omega \cdot 0.725\,\text{A} = \underline{\underline{76.7\,\text{V}}}$

c) $P = \frac{U^2}{R} = \frac{(230\,\text{V})^2}{317.4\,\Omega} = \underline{\underline{166.7\,\text{W}}}$

8.14 Lösung

a) $I = \frac{P_2}{U_2} = \frac{7.5\,\text{W}}{30\,\text{V}} = \underline{0.25\,\text{A}}$

$U_1 = R_1 \cdot I = 60\,\Omega \cdot 0.25\,\text{A} = \underline{\underline{15\,\text{V}}}$ $\qquad U_3 = R_3 \cdot I = 180\,\Omega \cdot 0.25\,\text{A} = \underline{\underline{45\,\text{V}}}$

b) $U = U_1 + U_2 + U_3 = 15\,\text{V} + 30\,\text{V} + 45\,\text{V} = \underline{\underline{90\,\text{V}}}$

c) $P = U \cdot I = 90\,\text{V} \cdot 0.25\,\text{A} = \underline{\underline{22.5\,\text{W}}}$

8.15 Lösung

$U = R_V \cdot I = 4700\,\Omega \cdot 0.016\,\text{A} = \underline{\underline{75.2\,\text{V}}}$

8.16 Lösung

a) $U_V = U - U_L = 230\,\text{V} - 8\,\text{V} = \underline{\underline{222\,\text{V}}}$

b) $R_V = \frac{U_V}{I} = \frac{222\,\text{V}}{0.6\,\text{A}} = \underline{\underline{370\,\Omega}}$

8.17 Lösung

a) $U_V = U - U_L = 500\,\text{V} - 85\,\text{V} = \underline{\underline{415\,\text{V}}}$

b) $R_V = \frac{U_V}{I} = \frac{415\,\text{V}}{0.0004\,\text{A}} = \underline{\underline{1\,037\,500\,\Omega = 1.04\,\text{M}\Omega}}$

8.18 Lösung

$I = \frac{P_N}{U_N} = \frac{0.5\,\text{W}}{230\,\text{V}} = \underline{2.17\,\text{mA}}$ $\qquad R_V = \frac{U_V}{I} = \frac{170\,\text{V}}{2.17\,\text{mA}} = \underline{\underline{78.2\,\text{k}\Omega}}$