HW 7

25-19

given $P = 100\ W$ $\alpha = 0.0045$

$R = 12\,\Omega$ at $T = 20°C$
$R = 140\,\Omega$ $T = ?$

$$R = R_0[1 + \alpha(T - T_0)]$$

$$\frac{R}{R_0} - 1 = \alpha(T - T_0)$$

$$\frac{1}{\alpha}\left(\frac{R}{R_0} - 1\right) + T_0 = T$$

$$T = 20°C + \frac{1}{0.0045}\left(\frac{12\,\Omega}{140\,\Omega} - 1\right)$$

$$\boxed{T = 2390°C}$$

25-40

(a) $\text{Cost} = \frac{\text{Cost}}{\text{kWh}} \cdot \text{kWh}$

$$= \left(\frac{\$0.095}{\text{kWh}}\right)(\#\text{ hours})(25\,W)\left(\frac{1\,kW}{1000\,W}\right)$$

$$= \left(\frac{0.095}{\text{kWh}}\right)(365\ \text{days})\left(\frac{24h}{1\ \text{day}}\right)(25\,W)\left(\frac{1\,kW}{1000\,W}\right)$$

$\approx \$21$

26-8

series $R_{eq} = R_1 + R_2 + \dots = nR'$ $(R' = 10\,\Omega)$

$\parallel$ $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots = \frac{1}{n\left(\frac{1}{R}\right)}$ $R = 100\,\Omega = 10R'$

$$\frac{1}{\frac{1}{R} + \frac{1}{R} + \frac{1}{R} + \frac{1}{R} + \frac{1}{R}} = nR'$$

$$\frac{1}{5\left(\frac{1}{R}\right)} = nR'$$

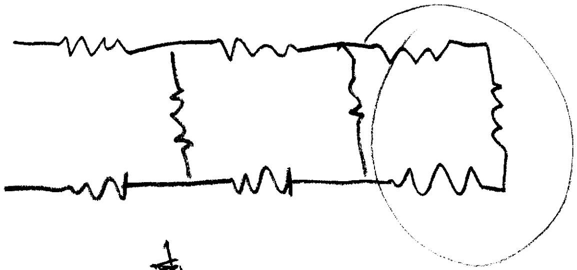
$$\frac{R}{5} = nR'$$

$$\frac{10R'}{5} = nR'$$

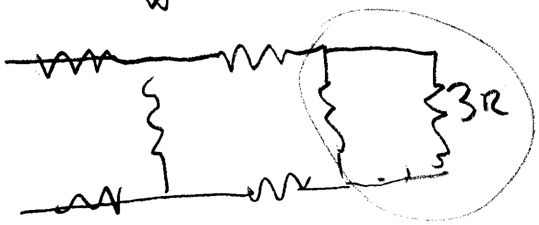
so $\boxed{n = 2}$

So 2 $10\,\Omega$ resistors are needed.

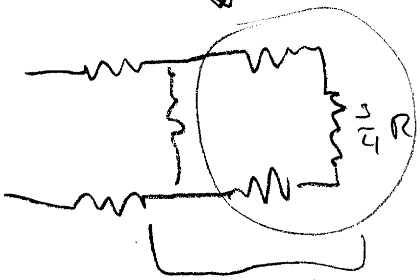
26-18 a)



$R_{eq} = 3R$



$R_{eq} = \frac{1}{\frac{1}{R} + \frac{1}{3R}} = \frac{3}{4}R$

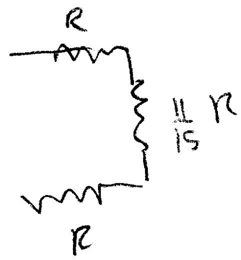


$R_{eq} = 2R + \frac{3}{4}R = \frac{11}{4}R$

$\frac{1}{R_{eq}} = \frac{1}{R} + \frac{1}{\frac{11}{4}R} = \frac{1}{R} + \frac{4}{11R}$

$R_{eq} = \frac{11}{15}R$

$R_{eq} = ?$

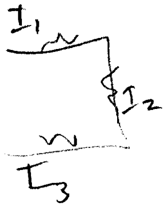


$R_{eq} = 2R + \frac{11}{15}R = \frac{41}{15}R$

$R_{eq} = \frac{41}{15}(125\,\Omega) \approx 342\,\Omega$

b) Current in first part:

$V = IR \Rightarrow I = \frac{V_{AB}}{R_{eq}} = \frac{50\,V}{342\,\Omega} = 0.146\,A = I_1, I_3$



Volatge across I_2 Branch?

Loop: $50V - I_1R - I_2R - I_3R = 0$

$\frac{50V - (0.146A)(2)(125\,\Omega)}{125\,\Omega} = I_2$

$I_2 = 0.107\,A$

23 Q10

if the potential is constant $\vec{E} = -\nabla V = 0$

the electric field must be zero.