20186193

1-A

1-A) What is the resistance of a 5 mile long piece of 12-gage (0.08081 inch diameter) copper wire? Show the details of your work.

$D = 0.08081\ \text{in} = 0.00205\ \text{m}$

$\rho = 0.0172\ \Omega\cdot\text{m}$, $L = 5\ \text{mile} = 8046.72\ \text{m}$

$R = \frac{\rho L}{A} = \frac{\rho L}{\frac{1}{4}\pi D^2} = 4193\ \text{M}\Omega$

$\rho = 0.0172\ \Omega\cdot\text{m}$

$1\ \text{mile} = 1609.344\ \text{m}$

$1\ \text{inch} = 0.0254\ \text{m}$

1-B) Determine the possible range of resistance values for each of the following cases. Be sure to evaluate both the nominal value and the explicit upper and lower range value. (*Note: the color bands are listed in order, starting with the first.*) Show the details of your work.

- Resistor R_1 with color bands: blue, gray, red.
- Resistor R_2 with color bands: red, violet, orange.
- The series combination of R_1 and R_2.
- The parallel combination of R_1 and R_2.

(a) $R_1 = 68 \times 10^2 \pm 20\%$ so $5.44\ \text{k}\Omega \le R_1 \le 8.16\ \text{k}\Omega$

(b) $R_2 = 27 \times 10^3 \pm 20\%$ so $21.6\ \text{k}\Omega \le R_2 \le 32.4\ \text{k}\Omega$

(c) $R_s = R_1 + R_2 = 33.8 \times 10^3 \pm 20\%$ so $27.04\ \text{k}\Omega \le R_s \le 40.56\ \text{k}\Omega$

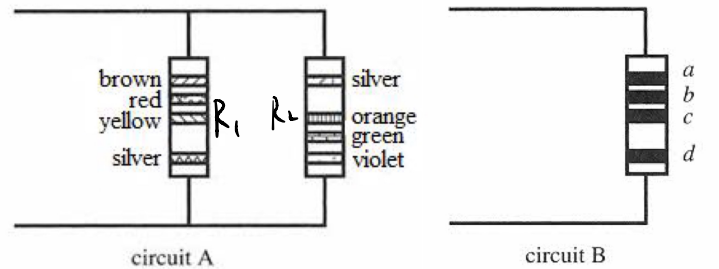
(d) $R_p = \frac{R_1 R_2}{R_1 + R_2}$

$(R_p)_{min} = \frac{(R_1)_{min}(R_2)_{min}}{(R_1)_{min} + (R_2)_{min}} = 4.35\ \text{k}\Omega$

$(R_p)_{max} = \frac{(R_1)_{max}(R_2)_{max}}{(R_1)_{max} + (R_2)_{max}} = 6.52\ \text{k}\Omega$

so $4.35\ \text{k}\Omega \le R_p \le 6.52\ \text{k}\Omega$

1-C) What colors should bands *a*, *b*, *c*, and *d* be for the following circuit B to have the equivalent resistance of circuit A? Show the details of your work.



circuit A circuit B

$R_1 = 12 \times 10^4 \pm 10\%$

$R_2 = 75 \times 10^3 \pm 10\%$

$R_p = \frac{R_1 R_2}{R_1 + R_2} = 46 \times 10^3 \pm 10\%$

Yellow, Blue, Orange, Silver