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steel wire heating equation

Deriving the wire heating equation from the resistance formula, the joule heating formula, and kelvin to fahrenheit conversion.This equation will allow you to calculate the temperature that a wire will heat up to if you know all but one of the following symbols.

symbols are as follows:

- Q = energy (joules)
- I = the current(amps)
- R = the resistance(ohms)
- A = the area(meters squared)-gage of wire
- L = the length of the wire(meters)
- P = resistivity(ohm meters)
- t = time (seconds)
- T=average temperature(c)
- c=specific heat capacity

Equations used:

- $Q = m * c * \Delta T$
- $R = \frac{P * L}{A}$
- $Q = I^2 * R * t$

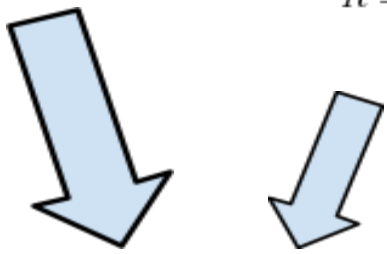
I created the equation by doing the following:

start with joule heating equation

$$Q = I^2 * R * t$$

$$R = \frac{P * L}{A}$$

Sub-in the resistance formula



$$Q = I^2(\frac{P * L}{A}) * t$$

Replace Q with the specific heating equation:

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Divide m*c from both sides:

$$\frac{m*c*\Delta T}{m*c} = \frac{I^2(\frac{P*L}{A})*t}{m*c}$$

After dividing m and c I had this equation which will allow calculate exactly what I needed.

$$\Delta T = \frac{I^2(\frac{P*L}{A})*t}{m*c}$$