1) A piece of Nichrome wire has a radius of 6.5×10^{-4} m, it was used in a lab to make a heater that uses 400 W of power when connected to a voltage source of 120V. Ignoring the effect of temp on resistance, determine the necessary length of the wire.

$P = 400W \quad V = 120V \quad P = IV \quad r = 6.5 \times 10^{-4} m = .0006.5 m$

$I = \frac{P}{V} = \frac{400W}{120V} = 3.33 A$ resistivity $\rightarrow \rho = 1.0 \times 10^{-6} m$

$A = \pi r^2 = \pi (6.5 \times 10^{-4})^2 = 1.3 \times 10^{-6} m^2$

$R = \frac{V}{I} = \frac{120V}{3.3A} = 36.36 \Omega$

$R = \frac{\rho L}{A} \Rightarrow L = \frac{AR}{\rho} = \frac{(1.3 \times 10^{-6} m^2)(36.36 \Omega)}{1.0 \times 10^{-6} m}$

$= 47.14 m$

2) 15-Ω toaster is turned on in a circuit which already has a .2 hp motor, three 100-W light bulbs and a 600 W electric iron that are on, will this trip a 15-A circuit breaker?

1 hp = 746 W

$R = 15\Omega$ $P = .2\,hp = 149.2W$

$$I_1 = \frac{V}{R} = \frac{120V}{15\Omega} = 8A$$

$$P = IV \Rightarrow I_2 = \frac{P}{V} = \frac{149.2W}{120V} = 1.24A$$

$$I_3 = \frac{P}{V} = \frac{3(100W)}{120V} = 2.5A$$

$$I_4 = \frac{P}{V} = \frac{600W}{120V} = 5A$$

$$I = 8A + 1.24A + 2.5A + 5A = 16.74A$$

This will trip the circuit since $16.74A > 15A$.