



(HW3)


Direct Electric Current and Resistors

Table 27.1

Resistivities and Temperature Coefficients of Resistivity for Various Materials		
Material	Resistivity ^a ($\Omega \cdot \text{m}$)	Temperature Coefficient ^b $\alpha[(^{\circ}\text{C})^{-1}]$
Silver	1.59×10^{-8}	3.8×10^{-3}
Copper	1.7×10^{-8}	3.9×10^{-3}
Gold	2.44×10^{-8}	3.4×10^{-3}
Aluminum	2.82×10^{-8}	3.9×10^{-3}
Tungsten	5.6×10^{-8}	4.5×10^{-3}
Iron	10×10^{-8}	5.0×10^{-3}
Platinum	11×10^{-8}	3.92×10^{-3}
Lead	22×10^{-8}	3.9×10^{-3}
Nichrome ^c	1.50×10^{-6}	0.4×10^{-3}
Carbon	3.5×10^{-5}	-0.5×10^{-3}
Germanium	0.46	-48×10^{-3}
Silicon	640	-75×10^{-3}
Glass	10^{10} to 10^{14}	
Hard rubber	$\sim 10^{13}$	
Sulfur	10^{15}	
Quartz (fused)	75×10^{16}	

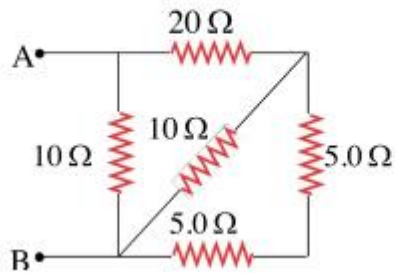
^a All values at 20°C.

1. In a particular cathode ray tube, the measured beam current is $30.0 \mu\text{A}$. How many electrons strike the tube screen every 40.0 s?

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15.  A 0.900-V potential difference is maintained across a 1.50-m length of tungsten wire that has a cross-sectional area of 0.600 mm^2 . What is the current in the wire?
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Calculate the effective resistance between the points A and B in the figure below.

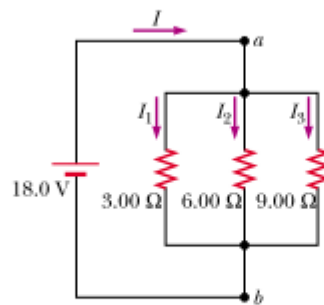


2. A copper wire has a resistance of $25 \text{ m}\Omega$ at 20°C . When the wire is carrying a current, heat produced by the current causes the temperature of the wire to increase by 27°C

(a). Calculate the change in the wire's resistance.

(b). If its original current was 10.0 mA and the potential difference across wire remains constant, what is its final current? (Given the temperature coefficient of resistivity for copper is $6.80 \times 10^{-3} \text{ }^\circ \text{C}^{-1}$).

Three resistors are connected in parallel as shown in the figure below, A potential difference of 18.0 V is maintained between points a and b .




(a). Find the current in each resistor.

(b). Calculate the power delivered to each resistor.

35. The temperature of a sample of tungsten is raised while a sample of copper is maintained at 20.0°C . At what temperature will the resistivity of the tungsten be four times that of the copper?



39.  What is the required resistance of an immersion heater that increases the temperature of 1.50 kg of water from 10.0°C to 50.0°C in 10.0 min while operating at 110 V?
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41. Suppose that a voltage surge produces 140 V for a moment. By what percentage does the power output of a 120-V, 100-W lightbulb increase? Assume that its resistance does not change.
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51. A certain toaster has a heating element made of Nichrome wire. When the toaster is first connected to a 120-V source (and the wire is at a temperature of 20.0°C), the initial current is 1.80 A. However, the current begins to decrease as the heating element warms up. When the toaster reaches its final operating temperature, the current drops to 1.53 A. (a) Find the power delivered to the toaster when it is at its operating temperature. (b) What is the final temperature of the heating element?
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