

PSC-4012 **Resistivity**

Answer all questions by referring to the appropriate formula/s.

1. What has greater resistance, a short fat wire, or a long skinny one?
2. If we triple the length of a wire, how will this affect the resistance of the wire?
3. If we triple the cross-sectional area of the wire, how will this affect the resistance of the wire?
4. If the radius of a wire is reduced by one half, then how is resistance affected?
5. What happens to a wire's resistance if its length is cut in half?
6. If the cross-sectional area of a wire is doubled, then how is the wire's resistance affected?

7. If the diameter of a wire is doubled, then what happens to the resistance of the wire?

8. If the length of a wire is reduced from 9m to 3m, then how is the wire's resistance affected?

9. Industrial machines require a great deal of current. To obtain this, do the industrial circuit wires need to be thicker or thinner than those in residential circuits? (hint... you will need to refer to the resistivity formula, and to Ohm's law)

10. Given that you need to use an extension cord for your lawn mower, should the cord be as long as possible, or as long as is necessary (i.e. as short as possible)?

11. A space heater is plugged in using an extension cord which is one-third the thickness ($\frac{1}{3}$ the diameter) that it should be. Is the resistance of the cord used greater or less than the resistance of the recommended cord? By how much? How will this impact on the current drawn by the heater?

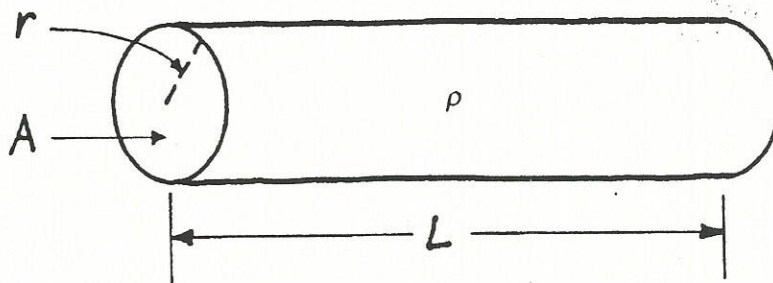
12. Why is it important to use the recommended gauge wire in a circuit?

Table representing the resistivity of various materials at 20°C

Material	Resistivity (ρ) $\Omega\cdot m$
Conductors	
Silver	1.59×10^{-8}
Copper	1.7×10^{-8}
Gold	2.44×10^{-8}
Aluminum	2.82×10^{-8}
Resistive conductors	
Tungsten	5.6×10^{-8}
Iron	10×10^{-8}
Nichrome*	150×10^{-8}
Carbon	3.5×10^{-5}
Semi-conductors	
Germanium	0.46
Silicon	640
Insulators	
Glass	10^{10} to 10^{14}
Hard rubber	10^{13} to 10^{16}
Mica	2×10^{15}
Quartz (fused)	75×10^{16}

*A nickel and chrome alloy used primarily to manufacture heating elements

Factors affecting resistance



Resistance depends on a material's resistivity and a component's dimensions.

$$R = \frac{\rho L}{A}$$