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

Skill 39-Resistance in a wire

"Low R is Short, Fat, Cold, Gold"

92. A manufacturer recommends that the longer the extension cord used with an electric drill, the thicker (heavier gauge) the extension cord should be. This recommendation is made because the resistance of a wire varies

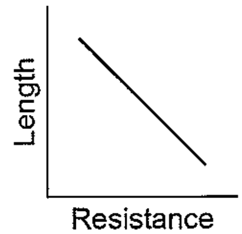
A) directly with length and inversely with cross-sectional area
B) inversely with length and directly with cross-sectional area
C) directly with both length and cross-sectional area
D) inversely with both length and cross-sectional area

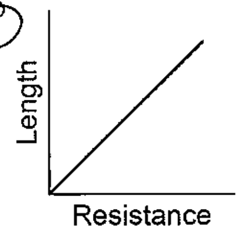
R = resistance
ρ = Resistivity
L = Length
A = Cross-sectional area

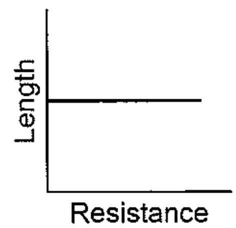
$R = \frac{\rho L}{A}$

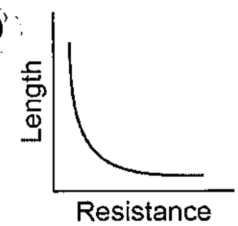
$R \propto L$
$R \propto \frac{1}{A}$

93. A copper wire is part of a complete circuit through which current flows. Which graph best represents the relationship between the wire's length and its resistance?

A)


B)


C)


D)


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

$L = \frac{RA}{\rho}$

94. If the length of a copper wire is reduced by half, then the resistance of the wire will be

A) halved
B) doubled
C) quartered
D) quadrupled

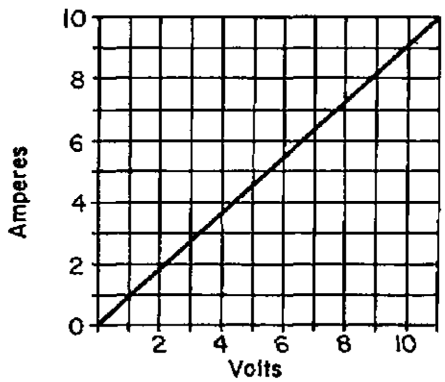
$R = \frac{\rho L}{A}$

Low "R" is Short, fat, Cold, Gold

Skill 39-Resistance in a wire

95. Base your answer to the following question on the accompanying graph which shows the data collected for a copper wire at a constant temperature.

Graph is not really related



If the length of the copper wire being tested is decreased, its total resistance will

(A) decrease B) increase
C) remain the same

96. Which change decreases the resistance of a piece of copper wire?

A) increasing the wire's length ↑
B) increasing the wire's resistivity ↑
(C) decreasing the wire's temperature ↓
D) decreasing the wire's diameter ↑

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

Short, Fat, Cold, Gold

97. The resistance of a copper wire is measured to be 4 ohms at 20°C. If the wire is heated to 30°C, the resistance of the wire will be

A) zero ohms
B) less than 4 ohms
(C) more than 4 ohms
D) 4 ohms

as temp goes up R goes up

98. To reduce the resistance of a metal conductor one should

(A) cool the conductor to a low temperature ↓
B) heat the conductor to a high temperature ↑
C) coat the conductor with an insulator
D) wire the conductor in series with another resistor

99. The electrical resistance of a metallic conductor is inversely proportional to its

A) temperature direct
B) length direct
(C) cross-sectional area inverse
D) resistivity direct

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

100. If the diameter of a wire were decreased, its electrical resistance would

related to radius

A) decrease
(B) increase
C) remain the same

$R = \frac{\rho L}{\pi r^2}$

wire thinner

101. If a wire of cross-sectional area equal to *A* has a resistance of *R*, then another wire of the same material with a cross-sectional area equal to 2A will have a resistance of

A) R B) 2R C) *R/2* D) *R/4*

R	ρ	L	A
R/2	ρ	L	2A

thickness ↑ R decreases

÷2 $R = \frac{\rho L}{A}$ ×2

Skill 39-Resistance in a wire

102. A copper wire has a resistance of 200 ohms. A second copper wire with twice the cross-sectional area and the same length would have a resistance of

A) 50Ω   B) 100Ω
C) 200Ω   D) 400Ω

R	A
200Ω	A
100Ω	2A

÷2 ×2

103. At 20°C, four conducting wires made of different materials have the same length and the same diameter. Which wire has the *least* resistance?

A) aluminum $2.82\times10^{-8}\,\Omega m$ B) gold $2.44\times10^{-8}\,\Omega m$
C) nichrome $150\times10^{-8}\,\Omega m$ D) tungsten $5.6\times10^{-8}\,\Omega m$

lowest ρ

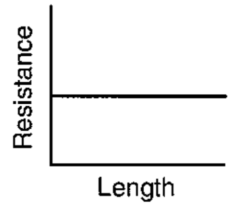
104. What is the resistance at 20.°C of a 2.0-meter length of tungsten wire with a cross-sectional area of 7.9×10^{-7} meter^2?

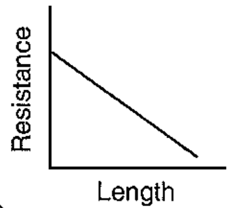
A) $5.7 \times 10^{-1}\,\Omega$ B) $1.4 \times 10^{-1}\,\Omega$
C) $7.1 \times 10^{-2}\,\Omega$ D) $4.0 \times 10^{-2}\,\Omega$

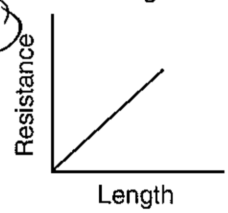
$$R = \frac{\rho L}{A} = \frac{(5.6\times10^{-8}\,\Omega m)(2m)}{(7.9\times10^{-7}m^2)}$$

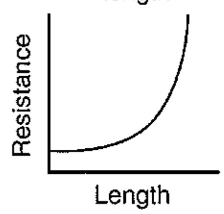
$1.4\times10^{-1}\,\Omega$

105. Which graph best represents the relationship between resistance and length of a copper wire of uniform cross-sectional area at constant temperature?

A)


B)


C)


D)


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

106. A 12.0-meter length of copper wire has a resistance of 1.50 ohms. How long must an aluminum wire with the same cross-sectional area be to have the same resistance?

A) 7.32 m   B) 8.00 m
C) 12.0 m   D) 19.7 m

	R	L	ρ	A
copper	1.5Ω	12m	$1.72\times10^{-8}\,\Omega m$	A
aluminum	1.5Ω	?	$2.82\times10^{-8}\,\Omega m$	A

$R_c = R_A$ $\rho_c L = \rho_A L$

$\frac{\rho L}{A} = \frac{\rho L}{A}$ $(1.72\times10^{-8}\,\Omega m)(12m) = (2.82\times10^{-8}\,\Omega m)L$

$L = 7.32m$