Thermal Conductivity

Material	Thermal conductivity (cal/sec)/(cm^2 C/cm)	Thermal conductivity (W/m K)*
Diamond	...	1000
Silver	1.01	406.0
Copper	0.99	385.0
Gold	...	314
Brass	...	109.0
Aluminum	0.50	205.0
Iron	0.163	79.5
Steel	...	50.2
Lead	0.083	34.7
Mercury	...	8.3
Ice	0.005	1.6
Glass,ordinary	0.0025	0.8
Concrete	0.002	0.8
Water at 20° C	0.0014	0.6
Asbestos	0.0004	0.08
Snow (dry)	0.00026	...
Fiberglass	0.00015	0.04
Brick,insulating	...	0.15
Brick, red	...	0.6
Cork board	0.00011	0.04
Wool felt	0.0001	0.04
Rock wool	...	0.04
Polystyrene (styrofoam)	...	0.033
Polyurethane	...	0.02
Wood	0.0001	0.12-0.04
Air at 0° C	0.000057	0.024
Helium (20°C)	...	0.138
Hydrogen(20°C)	...	0.172
Nitrogen(20°C)	...	0.0234
Oxygen(20°C)	...	0.0238
Silica aerogel	...	0.003

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Reference
Young
Ch 15.

*Most from Young, Hugh D., University Physics, 7th Ed. Table 15-5. Values for diamond and silica aerogel from CRC Handbook of Chemistry and Physics.

Note that 1 (cal/sec)/(cm^2 C/cm) = 419 W/m K. With this in mind, the two columns above are not always consistent. All values are from published tables, but can't be taken as authoritative.

The value of 0.02 W/mK for polyurethane can be taken as a nominal figure which establishes polyurethane foam as one of the best insulators. NIST published a numerical approximation routine for calculating the thermal conductivity of polyurethane at http://cryogenics.nist.gov/NewFiles/Polyurethane.html . Their calculation for freon filled polyurethane of density 1.99 lb/ft^3 at 20°C gives a thermal conductivity of 0.022 W/mK. The calculation for CO_2 filled polyurethane of density 2.00 lb/ft^3 gives 0.035 W/mK .

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Wiedemann-Franz Ratio

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The ratio between thermal and electrical conductivities of metals can be expressed in terms of the ratio:

$$L = \frac{\kappa}{\sigma T} = \frac{\pi^2 k^2}{3e^2} = 2.45\ x\ 10^{-8} W\Omega/K^2$$

which may be called the Wiedemann-Franz Ratio or the Lorenz constant.

Metal	$\kappa/\sigma T$ ($10^{-8} W\Omega/K^2$)
Cu	2.23
Ag	2.31
Au	2.35
Zn	2.31
Cd	2.42

Mo	2.61
Pb	2.47
Pt	2.51

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Wiedemann-Franz Law

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