

CHAPTER 33

PHYSICAL PROPERTIES OF MATERIALS

VALUES in the following tables are in consistent units to assist the engineer looking for approximate values. For data on refrigerants, see Chapter 29; for secondary coolants, see Chapter 31. Chapter 26 gives more information on the values for materials used in building construction and insulation. Many

properties vary with temperature, material density, and composition. The references document the source of the values and provide more detail or values for materials not listed here. The preparation of this chapter is assigned to TC 1.3, Heat Transfer and Fluid Flow.

Table 1 Properties of Vapor

Material	Molecular Mass	Normal Boiling Point, °F	Critical Temperature, °F	Critical Pressure, psia	Density, lb/ft ³	Specific Heat, Btu/lb·°F	Thermal Conductivity, Btu/h·ft·°F	Viscosity, lb/ft·h
Alcohol, Ethyl	46.07 ^a	173.3 ^a	469.6 ^b	927.3 ^b		0.362 ^j	0.0073 ^a	0.0343 ^j (60)
Alcohol, Methyl	32.04 ^a	148.9 ^a	464.0 ^b	1157 ^b		0.322 ^j	0.0174 ^r	0.0358 ^j (30)
Ammonia	17.03 ^a	-28 ^a	270.3 ^b	1639 ^b	0.0482 ^b	0.525 ^{aa}	0.0128 ^b	0.0225 ^{aa}
Argon	39.948 ^a	-302.5 [*]	-188.5 [*]	704.9 [*]	0.1114 ^b	0.125 ^c	0.0094 ^a	0.0507 ^a
Acetylene	26.04 ^a	-118.5 ^a	96.8 ^b	911 ^b	0.0732 ^b	0.377 ^a	0.0108 ^b	0.0226 ^a
Benzene	78.11 ^a	176.2 ^a	553.1 ^d	714.2 ^d	0.167 ^e (176)	0.31 ^e (176)	0.0041 ^e	0.017 ^a
Bromine	159.82 ^a	137.8 ^a	591.8 ^d	1499 ^d	0.38 ^f (138)	0.055 ^f (212)	0.0035 ^a	0.041 ^a
Butane	58.12 ^a	31.1 ^a	305.6 ^d	550.7 ^d	0.168 ^g	0.377 ^{aa}	0.0079 ^a	0.017 ^a
Carbon dioxide	44.01 ^a	-109.3 ^a	87.9 ^d	1071 ^d	0.123 ^g	0.20 ^g	0.0084 ^a	0.033 ^h
Carbon disulfide	76.13 ^h	115.2 ^h	534 ^h	1046 ^h		0.1431 ^p (80)		
Carbon monoxide	28.01 ^a	-312.7 ^a	-220.4 ^d	507 ^d	0.078 ^d	0.25 ^f	0.0133 ^a	0.040 ^a
Carbon tetrachloride	153.84 ^g	169.8 ^h	541.8 ^h	661 ^h		0.206 ^q (80)		0.0375 ^j
Chlorine	70.91 ^a	-30.3 ^a	291.2 ^d	1118 ^d	0.201 ^d	0.117 ^a	0.0046 ^a	0.030 ^a
Chloroform	119.39 ^h	143.1 ^h	506.1 ^h	794 ^h		0.126 ⁱ	0.0081 ^r	0.038 ⁱ
Ethyl chloride	64.52 ^h	54.2 ^h	369.0 ^h	764 ^h	0.1793 ^b	0.426 ^r	0.00504 ⁱ	0.0378 ^q
Ethylene	28.03 ^h	-154.6 ^h	49.9 ^h	742 ^h	0.0783 ^b	0.352 ^{aa}	0.0102 ^{aa}	0.0231 ^{aa}
Ethyl ether	74.12 ^h	94.4 ^h	378.8 ^h	523 ^h		0.589 ^h (95)		0.0273 ^q
Fluorine	38.00 ^h	-304.5 ^h	-200.5 ^h	808 ^h	0.1022 ^b	0.194 ^j	0.0147 ^j	0.089 ^j
Helium	4.0026 ^a	-452.1 ⁱ	-450.2 ^h	33.21 ⁱ	0.0111 ⁱ	1.241 ^{aa}	0.0823 ^{aa}	0.0452 ^{aa}
Hydrogen	2.0159 ^a	-423.0 ⁱ	-399.9 ⁱ	190.8 ⁱ	0.00562 ⁱ	3.40 ^j	0.0972 ^{aa}	0.0203 ^{aa}
Hydrogen chloride	36.461 ^a	-120.8 ^a	124.5 ^d	1198 ^d	0.1024 ^b	0.191 ^j	0.00757 ^j	0.0321 ^j
Hydrogen sulfide	34.080 ^a	-77.3 ^a	212.7 ^d	1307 ^d	0.0961 ^b	0.238 ^j	0.00751 ^j	0.0281 ^j
Heptane (m)	100.21 ^a	209.2 ^a	512.2 ^b	394 ^b	0.21 ^k	0.476 ^j	0.0107 ^j	0.0168 ^j
Hexane (m)	86.18 ^a	154 ^a	454.5 ^d	440 ^d	0.21 ^k	0.449 ^j	0.00971 ^j	0.0182 ^j
Isobutane	58.12 ^f	-11.1 [*]	275.0 ^j	529.1 ^j	0.154 ^s (70)	0.376 ^{aa}	0.0081 ^{aa}	0.0168 ^{aa}
Methane	16.04 ^a	-263.2 ^a	-115.18 ^j	673.1 ^b	0.0448 ^b	0.520 ^{aa}	0.0178 ^{aa}	0.0250 ^{aa}
Methyl chloride	50.49 ^a	-11.6 ^a	289.6 ^j	968.5 ^b	0.1440 ^b	0.184 ^{aa}	0.0054 ^{aa}	0.0244 ^{aa}
Naphthalene	128.19 ^a	424.4 [*]	876.2 ^j	576.1 ^j		0.313 ^q (77)		
Neon	20.183 ^a	-412.6 ^a	-379.7 ^j	391.3 ^j		0.246 ^{aa}	0.0268 ^{aa}	0.0718 ^{aa}
Nitric oxide	30.01 ^a	-241.6 ^a	-135.2 ^j	949.4 ^j		0.238 ^j		0.0712 ^j
Nitrogen	28.01 ^a	-320.4 ^a	-232.4 ^j	492.3 ^b		0.248 ^j	0.0138 ^{aa}	0.0402 ^{aa}
Nitrous oxide	44.01 ^a	-127.3 ^a	97.5 ^j	1049.3 ^j		0.203 ^j	0.01001 ^j (80.3)	0.0543 ^j
Nitrogen tetroxide	92.02 ^a		316.8 ^j	1469.6 ^j		0.201 ^p (80)	0.0232 ^r (131)	
Oxygen	31.9977 [*]	-297.3 [*]	-181.5 [*]	731.4 [*]		0.218 ^j	0.0141 ^{aa}	0.0462 ^{aa}
n-Pentane	72.53 ^a	97.0 [*]	385.9 ^j	489.5 ^j		0.400 ^a (80)	0.00877 ^j (80.3)	0.0282 ^j
Phenol	74.11 ^b	358.5 ^b	786 ^b	889 ^b	0.16 ^k	0.34 ^k	0.0099 ^k	0.029 ^k
Propane	44.09 ^g	-43.76 [*]	206.1 [*]	616.1 [*]	0.126 ^g	0.3753 ^j (40)	0.0087 ^j	0.0179 ^j
Propylene	42.08 ^b	-53.86 ^l	197.2 ^l	670.3 ^l	0.120 ^l	0.349 ^{aa}	0.0081 ^{aa}	0.0195 ^{aa}
Sulfur dioxide	64.06 ^b	14.0 ^b	315 ^b	1142 ^b	0.183 ^b	0.145 ^l	0.0049 ^j	0.0281 ^j
Water vapor	18.02 ^b	212.0 ^m	705.18 [*]	3200.0 [*]	0.0373 ^m	0.489 ^{aa}	0.0143 ^m	0.0293 ^{aa}

*Data source unknown.

Notes: 1. Properties at 14.696 psia and 32°F, or the saturation temperature if higher than 32°F, unless otherwise noted in parentheses.

2. Superscript letters indicate data source from the References section.

Table 2 Properties of Liquids

Name or Description	Normal Boiling Point, °F at 14.696 psia	Enthalpy of Vaporization, Btu/lb	Specific Heat, c_p		Viscosity		Enthalpy of Fusion, Btu/lb	Density		Thermal Conductivity		Vapor Pressure		Freezing Point, °F
			Btu/lb·°F	Temp., °F	lb/h·ft	Temp., °F		lb/ft ³	Temp., °F	Btu/h·ft·°F	Temp., °F	mm of Hg	Temp., °F	
Acetic acid	245.3 ^a	174.1 ^b	0.522 ^b	79–203	2.956 ^f	68	84.0 ^b	65.49 ^a	68	0.099 ^b	68	400 ^a	210	61.9 ^a
Acetone	133.2 ^a	228.9 ^b	0.514 ^b	37–73	0.801 ^f	68	42.1 ^b	49.4 ^a	68	0.102 ^b	68	400 ^a	103	-139.6 ^a
Allyl alcohol	206.6 ^a	294.1 ^b	0.655 ^b	70–205	3.298 ^f	68		53.31 ^a	68	0.104 ^b	77–86	400 ^a	176	-200.2 ^a
<i>n</i> -Amyl alcohol	280.6 ⁱ	216.3 ^b			9.686 ^f	73.4	48.0 ^b	51.06 ^f	59	0.094 ^b	86	100 ^a	186	-110.2 ^a
Ammonia	-28 ^a	583.2 ^b	1.099 ^b	32	0.643 ^f	-28.3	142.9 ^b	43.50 ^b	-50	0.29 ^b	5–86	400 ^a	-49.7	-107.9 ^a
Alcohol, Ethyl	173.3 ^a	367.5 ^b	0.680 ^b	32–208	2.889 ^f	68	46.4 ^b	49.27 ^a	68	0.105 ^b	68	100 ^a	94.8	-179.1 ^a
Alcohol, Methyl	148.9 ^a	473.0 ^b	0.601 ^b	59–68	1.434 ^f	68	42.7 ^a	49.40 ^a	68	0.124 ^b	68	100 ^a	70.2	-144.0 ^a
Aniline	363.8 ^a	186.6 ^b	0.512 ^b	46–180	10.806 ^f	68	48.8 ^b	63.77 ^a	68	0.100 ^b	32–68	10 ^a	156.9	20.84 ^a
Benzene	176.2 ^a	169.4 ^h	0.412 ^h	68	1.58 ^a	68	54.2 ^h	54.9 ^d	68	0.085 ^h	68	75 ^d	68	42 ^a
Bromine	137.8 ^a	79.4 ^d	0.107 ^f	68	2.39 ^a	68	28.5 ^d	194.7 ^f	68	0.070 ^a	77	165 ^d	68	19 ^a
<i>n</i> -Butyl alcohol	243.5 ^a	254.3 ^h	0.563 ^f	68	7.13 ^f	68	53.9 ^b	50.6 ^a	68	0.089 ^h	68	5 ^d	68	-130 ^a
<i>n</i> -Butyric acid	326.3 ^a	217.0 ^h	0.515 ^f	68	3.73 ^a	68	54.1 ^a	60.2 ^a	68	0.094 ^h	54	0.7 ^d	68	20 ^a
Calcium chloride brine (20% by mass)			0.744 ⁱ	68	4.8 ⁱ	68		73.8 ⁱ	68	0.332 ⁱ	68			2 ⁱ
Carbon disulfide	115.3 ^a	148.8 ^h	0.240 ⁱ	68	0.88 ^a	68	24.8 ^d	78.9 ^d	68	0.093 ^b	86	295 ^d	68	-168 ^a
Carbon tetrachloride	170.2 ^a	83.7 ^h	0.201 ^f	68	2.34 ^a	68	12.8 ^d	99.5 ^d	68	0.062 ^j	68	87 ^d	68	-9 ^a
Chloroform	142.3 ^v	106 ^v	0.234 ^v	68	1.36 ^v	68		92.96 ^v	68	0.075 ^v	68	160 ^v	68	-81.8 ^v
<i>n</i> -Decane	345.2 ^b		0.50 ^b	68			86.9 ^b	45.6 ^b	68	0.086 ^b	68	1.3 ^b	68	-21.5 ^b
Ethyl ether	94.06 ^v	151 ^v	0.541 ^v	68	0.56 ^v	68	42.4 ^v	44.61 ^v	68	0.081 ^b	68	440 ^v	68	-177.3 ^v
Ethyl acetate	170.8 ^v	183.8 ^v	0.468 ^v	68	1.09 ^v	68	51.2 ^b	52.3 ^v	68	0.101 ^b	68	72 ^b	68	-116.3 ^v
Ethyl chloride	54.2 ^j	165.9 ^f (68)	0.368 ^f	32			29.68 ^a	56.05 ^a	68	0.179 ^f	33.6	400 ^v	53.1	-213.5 ^a
Ethyl iodide	162.1 ^a	82.1 ^f (160)	0.368 ^f	32	0.0239 ^f	68		120.85 ^a	68	0.214 ^f	86	100 ^v	64.4	-162.4 [*]
Ethylene bromide	268.8 ^a	99.2 ^f (210)	0.174 ^f	68	0.0694 ^f	68	24.82 ^a	136.05 ^a	68			10 ^v	65.5	49.2 ^a
Ethylene chloride	182.3 ^a	153.4 ^f (308)	0.301 ^f	68	0.0338 ^f	68	38.02 ^a	77.10 ^a	68			60 ^v	64.6	-31.64 ^a
Ethylene glycol	388.4 ^a	344.0 ^f (651)					77.86 ^a	69.22 ^a	68	0.100 ^f	68	1 ^v	128	12.7 ^a
Formic acid	213.3 ^a	215.8 ^f (420)	0.526 ^f	68	0.0719 ^f	68	118.89 ^a	76.16 ^a	68	0.104 ^a	33	40 ^v	75.2	47.1 ^a
Glycerin (glycerol)	359 [*] (20 mm)				43.1 ^f	68		78.72 ^a	68	0.113 ^a	68	1 ^a	125.5	68 ^a
Heptane	209.2 ^a	138 ^f	0.532 ^j	68	0.990 ^a	68	60.4 ^b	42.7 ^a	68	0.074 ^j	68	35.5 ^v	68	-132 ^a
Hexane	154 ^a	145 ^f	0.538 ^j	68	0.775 ^d	68	65.0 ^b	41.1 ^a	68	0.0720 ^j	68	120.0 ^v	68	-139 ^a
Hydrogen chloride	-120.8 ^a	191 ^f					23.6 ^f	74.6 ^d	b.p.					-174.6 ^a
Isobutyl alcohol	226.4 ^a	249 ^f	0.116 ^f	68	9.45 ^f	68		50.0 ^f	68	0.082 ^f	68	9.7 ^v	68	-162.4 ^a
Kerosene	400–560 ^b		0.50 ⁿ	68	6.0 ^b	68		51.2 ^a	68	0.086 ⁿ	68			
Linseed oil					104 ^b	68		58 ^d	68					-11 ^{†a}
Methyl acetate	134.6 ^a	177 ^f	0.468 ^f	68	0.940 ^f	68		60.6 ^a	68	0.093 ^f	68	169.8 ^v	68	-144.6 ^a
Methyl iodide	108.5 ^a	82.6 ^f			1.21 ^f	68		142 ^a	68			320 ^v	68	-87.7 ^a
Naphthalene	411.4 ^a	136 ^f	0.402 ^f	m.p.	2.18 ^b	m.p.	64.9 ^b	60.9 ^v	m.p.				2.18 ^b	176.4 ^a
Nitric acid	186.8 ^a	270 ^v	0.42 ^v	68	2.2 ^k	68	71.5 ^v	94.45 ^v	68	0.16 ^v	68	1.77 ^v	68	-42.9 ^v
Nitrobenzene	411.6 ^b	142 ^b	0.348 ^b	68	5.20 ^b	68	40.28 ^v	75.2 ^b	68	0.96 ^b	68	< 0.01 ^b	68	42.3 ^b
Octane	258.3 ^b	131.7 ^b	0.51 ^b	68	1.36 ^b	68	77.70 ^b	43.9 ^b	68	0.084 ^b	68	0.42 ^b	68	-69.7 ^b
Petroleum		98–165 ^w	0.4–0.6 ^w	68	19–2900 ^w	68		40–66 ^w	68					
<i>n</i> -Pentane	96.8 ^a	153.6 ^h	0.558 ^h	68	0.546 ^d	68	50.1 ^h	39.1 ^a	68	0.066 ^h	68	425 ^d	68	-201.5 ^a
Propionic acid	286.0 ^a	177.8 ^f	0.473 ^h	68	2.666 ^a	68		61.9 ^a	68	0.100 [*]	54	3 ^d	68	-5.4 ^a
Sodium chloride brine														
20% by mass	220.8 ^a		0.745 ^x	68	3.80 ^x	68		71.8 ^x	68	0.337 ^x	68	0.57 ^x	68	2.6 ^x
10% by mass	215.5 ^a		0.865 ^x	68	2.85 ^x	68		66.9 ^x	68	0.343 ^x	68	0.65 ^x	68	20.6 ^x
Sodium hydroxide and water														
15% by mass	215.0 ^v		0.864 ^b	68				72.4 ^b	68					-5.8 ^b
Sulfuric acid and water														
100% by mass	550.0 ^v		0.335 ^b	68	53 ^b	68		114.4 ^v	68			< 0.01 ^b	68	50.9 ^b
95% by mass	575.0 ^v		0.35 ^v	68	52 ^v	68		114.6 ^v	68			< 0.01 ^v	68	-18 ^v
90% by mass	500.0 ^v		0.39 ^v	68	60 ^v	68		113.4 ^v	68	0.22 ^b	68	< 0.01 ^v	68	15.0 ^v
Toluene (C ₆ H ₅ CH ₃)	231 ^b	156 ^b	0.404 ^v	68	1.42 ^v	68	30.9 ^b	54.1 ^b	68	0.090 ^b	68	0.88 ^b	68	-139 ^b
Turpentine	303 ^a	123 ^v	0.42 ^b	68	1.32 ^b	68		53.9 ^b	68	0.073 ^b	68			
Water	211.9 [*]	970.3 ^m	0.999 ^m	68	2.39 ^m	68	143.5 ^b	62.32 ^m	68	0.348 ^m	68	17.59 [*]	68	32.018 ^m
Xylene [C ₆ H ₄ (CH ₃) ₂]														
Ortho	291 ^b	149 ^b	0.411 ^b	68	2.01 ^b	68	55.1 ^b	55.0 ^b	68	0.90 ^b	68	0.196 ^b	68	-13 ^b
Meta	283 ^b	147 ^b	0.400 ^b	68	1.52 ^b	68	46.9 ^b	54.1 ^b	68	0.90 ^b	68	0.218 ^b	68	-53 ^b
Para	281 ^b	146 ^b	0.393 ^b	68	1.62 ^b	68	69.3 ^b	53.8 ^b	68			0.227 ^b	68	56 ^b
Zinc sulfate and water														
10% by mass			0.90 ^b	68	3.80 ^a	68		69.2 ^f	68	0.337 ^a	68			29.7 ^a
1% by mass			0.80 ^b	68	2.54 ^a	68		63.0 ^f	68	0.346 ^a	68			31.7 ^a

*Data source unknown.

†Approximate solidification temperature.

Notes: Superscript letters indicate data source from the section on References.

m.p. = melting point

b.p. = boiling point

Table 3 Properties of Solids

Material Description	Specific Heat, Btu/lb·°F	Density, lb/ft ³	Thermal Conductivity, Btu/h·ft·°F	Emissivity	
				Ratio	Surface Condition
Aluminum (alloy 1100)	0.214 ^b	171 ^u	128 ^u	0.09 ⁿ 0.20 ⁿ	Commercial sheet Heavily oxidized
Aluminum bronze (76% Cu, 22% Zn, 2% Al)	0.09 ^u	517 ^u	58 ^u		
Asbestos: Fiber Insulation	0.25 ^b 0.20 ^t	150 ^u 36 ^b	0.097 ^u 0.092 ^b	0.93 ^b	“Paper”
Ashes, wood	0.20 ^t	40 ^b	0.041 ^b (122)		
Asphalt	0.22 ^b	132 ^b	0.43 ^b		
Bakelite	0.35 ^b	81 ^u	9.7 ^u		
Bell metal	0.086 ^t (122)				
Bismuth tin	0.040 [*]		37.6 [*]		
Brick, building	0.2 ^b	123 ^u	0.4 ^b	0.93 [*]	
Brass: Red (85% Cu, 15% Zn)	0.09 ^u	548 ^u	87 ^u	0.030 ^b	Highly polished
Yellow (65% Cu, 35% Zn)	0.09 ^u	519 ^u	69 ^u	0.033 ^b	Highly polished
Bronze	0.104 ^t	530 ^t	17 ^d (32)		
Cadmium	0.055 ^a	540 ^f	53.7 ^b	0.02 ^d	
Carbon (gas retort)	0.17 ^a		0.20 ^b (2)	0.81 ^a	
Cardboard			0.04 ^b		
Cellulose	0.32 ^b	3.4 ^t	0.033 ^t		
Cement (portland clinker)	0.16 ^b	120 ⁱ	0.017 ⁱ		
Chalk	0.215 ^t	143 ^t	0.48 [*]	0.34 [*]	About 250°F
Charcoal (wood)	0.20 ^t	15 ^a	0.03 ^a (392)		
Chrome brick	0.17 ^b	200 ^b	0.67 ^b		
Clay	0.22 ^b	63 ^t			
Coal	0.3 ^b	90 ^t	0.098 ^f (32)		
Coal tars	0.35 ^b (104)	75 ^b	0.07 ^b		
Coke (petroleum, powdered)	0.36 ^b (752)	62 ^b	0.55 ^b (752)		
Concrete (stone)	0.156 ^b (392)	144 ^b	0.54 ^b		
Copper (electrolytic)	0.092 ^u	556 ^u	227 ^u	0.072 ⁿ	Commercial, shiny
Cork (granulated)	0.485 ^t	5.4 ^t	0.028 ^t (23)		
Cotton (fiber)	0.319 ^u	95 ^u	0.024 ^u		
Cryolite (AlF ₃ ·3NaF)	0.253 ^b	181 ^b			
Diamond	0.147 ^b	151 ^t	27 ^t		
Earth (dry and packed)		95 ^t	0.037 [*]	0.41 [*]	
Felt		20.6 ^b	0.03 ^b		
Fireclay brick	0.198 ^b (212)	112 ^t	0.58 ^b (392)	0.75 ⁿ	At 1832°F
Fluorspar (CaF ₂)	0.21 ^b	199 ^v	0.63 ^v		
German silver (nickel silver)	0.09 ^u	545 ^u	19 ^u	0.135 ⁿ	Polished
Glass: Crown (soda-lime)	0.18 ^b	154 ^u	0.59 ^t (200)	0.94 ⁿ	Smooth
Flint (lead)	0.117 ^b	267 ^u	0.79 ^t		
Heat-resistant “Wool”	0.20 ^b 0.157 ^b	139 ^t 3.25 ^t	0.59 ^t (200) 0.022 ^t		
Gold	0.0312 ^u	1208 ^u	172 ^t	0.02 ⁿ	Highly polished
Graphite: Powder	0.165 [*]		0.106 [*]		
Impervious	0.16 ^u	117 ^u	75 ^u	0.75 ⁿ	
Gypsum	0.259 ^b	78 ^b	0.25 ^b	0.903 ^b	On a smooth plate
Hemp (fiber)	0.323 ^u	93 ^u			
Ice: 32°F	0.487 ^t	57.5 ^b	1.3 ^b	0.95 [*]	
-4°F	0.465 ^t		1.41 [*]		
Iron: Cast	0.12 ^v (212)	450 ^b	27.6 ^b (129)	0.435 ^b	Freshly turned
Wrought		485 ^b	34.9 ^b	0.94 ^b	Dull, oxidized
Lead	0.0309 ^u	707 ^u	20.1 ^u	0.28 ⁿ	Gray, oxidized
Leather (sole)		62.4 ^b	0.092 ^b		
Limestone	0.217 ^b	103 ^b	0.54 ^b	0.36 [*] to 0.90	At 145 to 380°F
Linen			0.05 ^b		
Litharge (lead monoxide)	0.055 ^b	490 ^b			
Magnesia: Powdered	0.234 ^b (212)	49.7 ^b	0.35 ^b (117)		
Light carbonate		13 ^b	0.034 ^b		
Magnesite brick	0.222 ^b (212)	158 ^b	2.2 ^b (400)		
Magnesium	0.241 ^b	108 ^u	91 ^u	0.55 ⁿ	Oxidized
Marble	0.21 ^b	162 ^b	1.5 ^b	0.931 ^b	Light gray, polished
Nickel, polished	0.105 ^u	555 ^u	34.4 ^u	0.045 ⁿ	Electroplated
Paints: White lacquer				0.80 ⁿ	
White enamel				0.91 ⁿ	On rough plate
Black lacquer				0.80 ⁿ	
Black shellac		63 ^u	0.15 ^u	0.91 ⁿ	“Matte” finish
Flat black lacquer				0.96 ⁿ	
Aluminum lacquer				0.39 ⁿ	On rough plate

*Data source unknown.

Notes: 1. Values are for room temperature unless otherwise noted in parentheses.

2. Superscript letters indicate data source from the section on References.

Table 3 Properties of Solids (Continued)

Material Description	Specific Heat, Btu/lb·°F	Density, lb/ft ³	Thermal Conductivity, Btu/h·ft·°F	Emissivity	
				Ratio	Surface Condition
Paper	0.32*	58 ^b	0.075 ^b	0.92 ^b	Pasted on tinned plate
Paraffin	0.4 ^{bb}	47 ^{bb}	0.14 ^b (32)		
Plaster		132 ^b	0.43 ^b (167)	0.91 ^b	Rough
Platinum	0.032 ^u	1340 ^u	39.9 ^u	0.054 ^b	Polished
Porcelain	0.18*	162 ^u	1.3 ^u	0.92 ^b	Glazed
Pyrites (copper)	0.131 ^b	262 ^b			
Pyrites (iron)	0.136 ^b (156)	310 ^v			
Rock salt	0.219 ^u	136 ^u			
Rubber, vulcanized: Soft	0.48*	68.6 ^t	0.08 ^t	0.86 ^b	Rough
Hard		74.3 ^t	0.092 ^t	0.95 ^b	Glossy
Sand	0.191 ^b	94.6 ^b	0.19 ^b		
Sawdust		12 ^b	0.03 ^b		
Silica	0.316 ^b	140 ^v	0.83 ^t (200)		
Silver	0.0560 ^u	654 ^u	245 ^u	0.02 ⁿ	Polished and at 440°F
Snow: Freshly fallen		7 ^y	0.34 ^t		
At 32°F		31 ^t	1.3 ^t		
Steel (mild)	0.12 ^b	489 ^b	26.2 ^b	0.12 ⁿ	Cleaned
Stone (quarried)	0.2 ^b	95 ^t			
Tar: Pitch	0.59 ^v	67 ^u	0.51 ^v		
Bituminous		75 ^t	0.41 ^u		
Tin	0.0556 ^u	455 ^u	37.5 ^u	0.06 ^h	Bright and at 122°F
Tungsten	0.032 ^u	1210 ^u	116 ^u	0.032 ⁿ	Filament at 80°F
Wood: Hardwoods—	0.45/0.65 ^b	23/70 ^z	0.065/0.148 ^z		
Ash, white		43 ^z	0.0992 ^z		
Elm, American		36 ^z	0.0884 ^z		
Hickory		50 ^z			
Mahogany		34 ^u	0.075 ^u		
Maple, sugar		45 ^z	0.108 ^z		
Oak, white	0.570 ^b	47 ^z	0.102 ^z	0.90 ⁿ	Planed
Walnut, black		39 ^z			
Softwoods—	See Table 4,	22/46 ^z	0.061/0.093 ^z		
Fir, white	Chapter 25	27 ^z	0.068 ^z		
Pine, white		27 ^z	0.063 ^z		
Spruce		26 ^z	0.065 ^z		
Wool: Fiber	0.325 ^u	82 ^u			
Fabric		6.9/20.6 ^u	0.021/0.037 ^u		
Zinc: Cast	0.092 ^u	445 ^u	65 ^u	0.05 ⁿ	Polished
Hot-rolled	0.094 ^b	445 ^b	62 ^b		
Galvanizing				0.23 ⁿ	Fairly bright

*Data source unknown.

Notes: 1. Values are for room temperature unless otherwise noted in parentheses.

2. Superscript letters indicate data source from References.

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