Appendix B: Properties of Gases, Liquids, and Solids

APPENDIX B Properties of Gases, Liquids, and Solids

Material	Density ρ, kg/m^3	Speed of sound c, m/s	Characteristic impedance Z_0, rayl
Gases at 25°C (77°F) and 1 atm.			
Air	1.184	346.1	409.8
Ammonia	0.696	434.5	302.4
Carbon dioxide	1.799	269.5	484.7
Helium	0.1636	1,016.1	166.2
Hydrogen	0.0824	1,316.4	108.5
Methane	0.666	448.1	293.7
Nitrogen	1.145	352.0	403.0
Oxygen	1.308	328.5	429.6
Steam at 100°C	0.5978	472.8	282.6
Liquids:			
Ethyl alcohol (25°C)	787	1,144	0.900×10^6
Ethylene glycol (25°C)	1,100	1,644	1.808×10^6
Gasoline (25°C)	700	1,171	0.820×10^6
Kerosene (25°C)	823	1,320	1.086×10^6
Sea water (20°C)	1,026	1,500	1.539×10^6
Water (15°C or 59°F)	999.1	1,462.7	1.461×10^6
Water (20°C or 68°F)	998.2	1,483.2	1.481×10^6
Water (25°C or 77°F)	997.0	1,494.5	1.490×10^6
Water (30°C or 86°F)	995.6	1,505.8	1.499×10^6

Appendix C: Plate Properties of Solids

APPENDIX C Plate Properties of Solids[a]

Material	c_L, m/s	ρ_w, kg/m^3	$M_S f_c$, Hz-kg/m^2	η	E, GPa	σ
Aluminum (2014)	5,420	2,800	34,090	0.001	73.1	0.33
Brass (red)	3,710	8,710	155,200	0.001	103.4	0.37
Brick	3,800	1,800	31,250	0.015	25.0	0.20
Chipboard	675	750	73,400	0.020	0.340	0.08
Concrete	2,960	2,400	50,200	0.020	20.7	0.13
Glass	5,450	2,500	30,300	0.0013	71.0	0.21
Granite	4,413	2,690	40,270	0.001	48.3	0.28
Gypsum board	6,790	650	6,320	0.018	29.5	0.13
Lead	1,206	11,300	819,000	0.015	13.8	0.40
Lexan™	1,450	1,200	54,650	0.015	2.12	0.40
Marble	4;600	2,800	40,200	0.001	55.2	0.26
Masonry block (6 in)	3,120	1,100	23,300	0.007	10.6	0.10
Plaster	4,550	1,700	24,700	0.005	32.0	0.30
Plexiglas™	2,035	1,150	37,300	0.020	4.00	0.40
Plywood	3,100	600	12,780	0.030	4.86	0.40
Polyethylene	765	935	80,700	0.010	0.48	0.35
Pyrex	5,350	2,300	28,400	0.004	62.0	0.24
Rubber (hard)	1,700	950	36,900	0.080	2.30	0.40
Steel (C1020)	5,100	7,700	99,700	0.0013	200.0	0.27
Wood (oak)	3,860	770	11,900	0.008	11.2	0.15
Wood (pine)	4,680	640	8,160	0.020	13.7	0.15

[a] c_L is the longitudinal speed of sound; ρ_w is the material density; $M_S = \rho_w h$ = surface density; f_c is the critical or wave coincidence frequency, η is the damping coefficient; E is Young's modulus; and σ is Poisson's ratio.

TABLE 4-1 Values of the Plateau Height (TL_P) and Plateau Width (Δf_P) for the Approximate Method of Calculation of the Transmission Loss for Panels.

Material	TL_P, dB	$\Delta f_P = f_2 - f_1$, octaves	f_2/f_1
Aluminum	29	3.5	11
Brick	37	2.2	4.5
Concrete	38	2.2	4.5
Glass	27	3.3	10
Lead	56	2.0	4
Masonry block			
Cinder	30	2.7	6.5
Dense	32	3.0	8
Plywood	19	2.7	6.5
Sand plaster	30	3.0	8
Steel	40	3.5	11

Source: Watters (1959).