

14.1: Numerical Constants

14.1.1: Fundamental Constants

c	velocity of light	2.998×10^8 m/s
ϵ_0	permittivity of free space	8.854×10^{-12} F/m
μ_0	permeability of free space	$4\pi \times 10^{-7}$ H/m
η_0	characteristic impedance of free space	376.7Ω
e	charge of an electron, (-e.v./Joule)	-1.6008×10^{-19} C
m	mass of an electron	9.1066×10^{-31} kg
m_p	mass of a proton	1.6725×10^{-27} kg
h	Planck constant	6.624×10^{-34} J·s
k	Boltzmann constant	1.3805×10^{-23} J/K
N_0	Avogadro's constant	6.022×10^{23} mole/mole
R	Universal gas constant	8.31 J/mole·K

14.1.2: A.2 Electrical Conductivity σ , S/m

Silver	6.14×10^7	Monel	0.24×10^7
Copper	5.80×10^7	Mercury	0.1×10^7
Gold	4.10×10^7	Sea Water	3 – 5
Aluminum	3.54×10^7	Distilled Water	2×10^{-4}
Tungsten	1.81×10^7	Bakelite	$10^{-8} - 10^{-10}$
Brass	1.57×10^7	Glass	10^{-12}
Nickel	1.28×10^7	Mica	$10^{-11} - 10^{-15}$
Iron (pure)	1.0×10^7	Petroleum	10^{-14}
Steel	$0.5 - 1.0 \times 10^7$	Fused Quartz	$< 2 \times 10^{-17}$
Lead	0.48×10^7		

14.1.3: Relative Dielectric Constant ϵ/ϵ_0 at 1 MHz

Vacuum	1.00	Vycor glass	3.8
Styrofoam (25% filler)	1.03	Low-loss glass	4.1
Firwood	1.8 – 2.0	Ice	4.15
Paper	2.0 – 3.0	Pyrex glass	5.1
Petroleum	2.1	Muscovite (mica)	5.4
Paraffin	2.1	Mica	5.6 – 6.0
Teflon	2.1	Magnesium silicate	5.7 – 6.4

Vaseline	2.16	Porcelain	5.7
Rubber	2.3 – 4.0	Aluminum oxide	8.8
Polystyrene	2.55	Diamond	16.5
Sandy soil	2.6	Ethyl alcohol	24.5
Plexiglas	2.6 – 3.5	Distilled water	81.1
Fused quartz	3.78	Titanium dioxide	100

14.1.4: Relative Permeability μ/μ_0

Vacuum	1
Biological tissue	1
Cold steel	2,000
Iron (99.91%)	5,000
Purified iron (99.95%)	180,000
mu metal (FeNiCrCu)	100,000
Supermalloy (FeNiMoMn)	800,000

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