

[Technical Data] Quantifiers, Unit Symbols, Chemical Symbols and Symbols of Elements
Calculation of Cubic Volume and Weight/Physical Properties of Materials

■ Greek Symbols

Uppercase	Lowercase	Pronunciation	Conventional Usage
A	α	alpha	Angle, Coefficient
B	β	beta	Angle, Coefficient
Γ	γ	gamma	Angle, Weight Per Unit Area, Relationship (Uppercase)
Δ	δ	delta	Small Change, Density, Displacement
E	ε	epsilon	Small Amount, Distortion
Z	ζ	zeta	Variable
H	η	theta	Angle, Temperature, Time
Θ	θ	iota	Radius of Gyration
I	κ	kappa	Wavelength, Characteristic Value
K	λ	lambda	Friction Coefficient
Λ	μ	mu	10 ⁻⁶ (Micro)
M			Frequency
N	ν	nu	Variable
Ξ	ξ	omicron	Circle Ratio π (3.14159...), Angle
O	ο	pi	Symbol of Product (Uppercase)
Π	π		Radius, Density
P	ρ	rho	Stress, Standard Deviation, Summation (Uppercase)
Σ	σ	sigma	Time constant, Time, Torque
T	τ	tau	Angle, Function, Diameter
Υ	υ	upsilon	phi, φ
Φ	φ, φ	phi	chi
X	χ	psi	psi
Ψ	ψ	psi	omega
Ω	ω	omega	Angle, Function

Remark : Unless otherwise specified, lowercase letters are the norm.

■ Characteristics of Metals

Material	Specific Gravity	Thermal Expansion Coefficient	Young's Modulus (Kg/mm ²)
		×10 ⁻⁶ /°C	
Mild steel	7.85	11.7	21000
NAK80	7.8	12.5	20500
SKD11	7.85	11.7	21000
SKD61	7.75	10.8	21000
M2 Tool Steel	8.2	10.1	22300
Carbide V30	14.1	6.0	56000
Carbide V40	13.9	6.0	54000
Cast Iron	7.3	9.2~11.8	7500~10500
304 Stainless Steel	8.0	17.3	19700
440C Stainless Steel	7.78	10.2	20400
Oxygen Free Copper C1020	8.9	17.6	11700
6/4 Brass C2801	8.4	20.8	10300
Beryllium Copper C1720	8.3	17.1	13000
Aluminum A1100	2.7	23.6	6900
Duralumin 7075 Aluminum	2.8	23.6	7200
Titanium	4.5	8.4	10600

■ How to Calculate the Volume

Solid	Volume V	Solid	Volume V	Solid	Volume V
Turncated Cylinder	$V = \frac{\pi}{4} d^2 h$ $= \frac{\pi}{4} d^2 \left(\frac{h_1 + h_2}{2} \right)$	Oval Ring	$V = \frac{\pi}{4} d^2 \sqrt{\frac{a^2 + b^2}{2}}$	Spherical Segment	$V = \frac{2}{3} \pi r^2 h$ $= 2.0944 r^2 h$
Pyramid	$V = \frac{1}{3} A \cdot h = \frac{1}{6} a r n$ A=Area of base r=Radius of inscribed circle a=Length of a side of a regular polygon n=Number of the sides of a regular polygon	Cross Cylinder	$V = \frac{\pi}{4} d^2 \left(l + e - \frac{d}{3} \right)$	Torus	$V = 2 \pi^2 R r^2$ $= 19.739 R r^2$ $= \frac{\pi}{4} D d^2$ $= 2.4674 D d^2$
Spherical Crown	$V = \frac{\pi}{3} h (3r - h)$ $= \frac{\pi}{6} h (3a^2 + h^2)$ a is the radius.	Hollow Cylinder	$V = \frac{\pi}{4} h (D^2 - d^2)$ $= \pi t h (D - t)$ $= \pi t h (d + t)$	Circular Cone	$V = \frac{\pi}{3} r^2 h$ $= 1.0472 r^2 h$
Ellipsoid	$V = \frac{4}{3} \pi a b c$ In case of a spheroid (b=c) $V = \frac{4}{3} \pi a b^2$	Turncated Pyramid	$V = \frac{h}{3} (A + a + \sqrt{Aa})$ Aa=area of both ends	Sphere	$V = \frac{4}{3} \pi r^3 = 4.1888 r^3$ $= \frac{\pi}{6} d^3 = 0.5236 d^3$

■ Name of Elements and Atomic Symbols

Atomic Number	Name	Symbol	Atomic Number	Name	Symbol
1	Hydrogen	H	53	Iodine	I
2	Helium	He	54	Xenon	Xe
3	Lithium	Li	55	Cesium	Cs
4	Beryllium	Be	56	Barium	Ba
5	Boron	B	57	Lanthanum	La
6	Carbon	C	58	Cerium	Ce
7	Nitrogen	N	59	Praseodymium	Pr
8	Oxygen	O	60	Neodymium	Nd
9	Fluorine	F	61	Promethium	Pm
10	Neon	Ne	62	Samarium	Sm
11	Sodium	Na	63	Europium	Eu
12	Magnesium	Mg	64	Gadolinium	Gd
13	Aluminum	Al	65	Terbium	Tb
14	Silicon	Si	66	Dysproium	Dy
15	Phosphorous	P	67	Holmium	Ho
16	Sulfur	S	68	Erbium	Er
17	Chlorine	Cl	69	Thulium	Tm
18	Argon	Ar	70	Ytterbium	Yb
19	Potassium	K	71	Lutetium	Lu
20	Calcium	Ca	72	Hafnium	Hf
21	Scandium	Sc	73	Tantalum	Ta
22	Titanium	Ti	74	Tungsten	W
23	Vanadium	V	75	Rhenium	Re
24	Chromium	Cr	76	Osmium	Os
25	Manganese	Mn	77	Iridium	Ir
26	Iron	Fe	78	Platinum	Pt
27	Cobalt	Co	79	Gold	Au
28	Nickel	Ni	80	Mercury	Hg
29	Brass	Cu	81	Thallium	Tl
30	Zinc	Zn	82	Lead	Pb
31	Gallium	Ga	83	Bismuth	Bi
32	Germanium	Ge	84	Polonium	Po
33	Arsenic	As	85	Astatine	At
34	Selenium	Se	86	Radon	Rn
35	Bromine	Br	87	Francium	Fr
36	Krypton	Kr	88	Radium	Ra
37	Rubidium	Rb	89	Actinium	Ac
38	Strontium	Sr	90	Thorium	Th
39	Yttrium	Y	91	Protactinium	Pa
40	Zirconium	Zr	92	Uranium	U
41	Niobium	Nb	93	Neptunium	Np
42	Molybdenum	Mo	94	Plutonium	Pu
43	Technetium	Tc	95	Americium	Am
44	Ruthenium	R	96	Curium	Cm
45	Rhodium	Rh	97	Berkellum	Bk
46	Palladium	Pd	98	Californium	Cf
47	Silver	Ag	99	Einsteinium	Es
48	Cadmium	Cd	100	Fermium	Fm
49	Indium	In	101	Mendelevium	Md
50	Tin	Sn	102	Nobelium	No
51	Antimony	Sb	103	Lawrencium	Lr
52	Tellurium	T			

Remark: This table is based on Appendix A (Names and Symbols of Elements) of ISO 31/8-1980 (Amounts and Units of Physical Chemistry and Molecular Physics) and Appendix C (Names and Symbols of Radionuclides) of ISO 31/9-1980 (Amounts and Units of Atomic Physics and Nuclear Physics).

■ How to Calculate the Weight

Weight W[g]=Volume[cm³]×Specific Gravity

Ex. : Mild Steel

φ D=16 and L=50mm, the weight is:

$W = \frac{\pi}{4} D^2 \times L \times \text{Specific Gravity}$

$= \frac{\pi}{4} \times 1.6^2 \times 5 \times 7.85$

$\approx 79[g]$

[Technical Data] Calculation of Area, Center of Gravity and Geometrical Moment of Inertia

Cross Section	A	e	I	Z=I/e
	bh	$\frac{h}{2}$	$\frac{bh^3}{12}$	$\frac{bh^2}{6}$
	h ²	$\frac{h}{2}$	$\frac{h^4}{12}$	$\frac{h^3}{6}$
	h ²	$\frac{h}{2} \sqrt{2}$	$\frac{h^4}{12}$	$0.1179 \frac{h^3}{\sqrt{2}}$
	$\frac{bh}{2}$	$\frac{2}{3} h$	$\frac{bh^3}{36}$	$\frac{bh^2}{24}$
	$(2b+b_1) \frac{h}{2}$	$\frac{1}{3} \times \frac{3b+2b_1}{2b+b_1} h$	$\frac{6b^3+6bb_1+b_1^2}{36(2b+b_1)} h^3$	$\frac{6b^2+6bb_1+b_1^2}{12(3b+b_1)} h^2$
	$\frac{3\sqrt{3}}{2} r^2$	$\sqrt{\frac{3}{4}} r = 0.866 r$	$\frac{5\sqrt{3}}{16} r^4 = 0.5413 r^4$	$\frac{5}{8} r^3$
	$\frac{3\sqrt{3}}{2} r^2$	r	$\frac{5\sqrt{3}}{16} r^4 = 0.5413 r^4$	$\frac{5\sqrt{3}}{16} r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$ $= 0.1 d^3$ $= 0.7854 r^3$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491 d^4$ $= 0.05 d^4$ $= 0.7854 r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982 d^3$