

Z	Symbol	Name	r_1/pm^a	r_2/pm^b	r_3/pm^c	r_t/pm^d	$r_{\text{vdW,calc}}/\text{pm}$	$r_{\text{vdW,cryst}}/\text{pm}^h$	$r_{\text{vdW,eq}}/\text{pm}^h$
1	H	hydrogen	32	-	-	-	110 ^f	-	-
2	He	helium	46	-	-	-	140 ^g	-	-
3	Li	lithium	133	124	-	137	181 ^g	220	263
4	Be	beryllium	102	90	85	106.1	153 ^e	190	223
5	B	boron	85	78	73	88.2	192 ^e	180	205
6	C	carbon	75	67	60	77.3	170 ^g	170	196
7	N	nitrogen	71	60	54	68.9	155 ^g	160	179
8	O	oxygen	63	57	53	67.4	152 ^g	155	171
9	F	fluorine	64	59	53	57.5	147 ^g	150	165
10	Ne	neon	67	96	-	-	154 ^g	240	-
11	Na	sodium	155	160	-	-	227 ^g	220	277
12	Mg	magnesium	139	132	127	141.2	173 ^g	210	242
13	Al	aluminium	126	113	111	128.5	184 ^e	210	240
14	Si	silicon	116	107	102	117.6	210 ^g	210	226
15	P	phosphorus	111	102	94	108.4	180 ^g	195	214
16	S	sulfur	103	94	95	104.2	180 ^g	180	206
17	Cl	chlorine	99	95	93	107.6	175 ^g	180	205
18	Ar	argon	96	107	96	-	188 ^g	-	-
19	K	potassium	196	193	-	-	275 ^g	280	302
20	Ca	calcium	171	147	133	-	231 ^e	240	278
21	Sc	scandium	148	116	114	138.6	-	230	262
22	Ti	titanium	136	117	108	-	-	215	244
23	V	vanadium	134	112	106	-	-	205	227
24	Cr	chromium	122	111	103	-	-	205	223
25	Mn	manganese	119	105	103	140.3	-	205	225
26	Fe	iron	116	109	102	120.9	-	205	227
27	Co	cobalt	111	103	96	125.6	-	200	225
28	Ni	nickel	110	101	101	-	-	200	223
29	Cu	copper	112	115	120	127.1	-	200	227
30	Zn	zinc	118	120	-	130.4	-	210	224
31	Ga	gallium	124	117	121	127.5	187 ^g	210	241
32	Ge	germanium	121	111	114	122.5	211 ^e	210	232
33	As	arsenic	121	114	106	117.4	185 ^g	205	225
34	Se	selenium	116	107	107	114.5	190 ^g	190	218
35	Br	bromine	114	109	110	119.5	183 ^g	190	210
36	Kr	krypton	117	121	108	-	202 ^g	-	-
37	Rb	rubidium	210	202	-	-	303 ^e	290	315
38	Sr	strontium	185	157	139	-	249 ^e	255	294
39	Y	yttrium	163	130	124	-	-	240	271
40	Zr	zirconium	154	127	121	-	-	230	257
41	Nb	niobium	147	125	116	-	-	215	246
42	Mo	molybdenum	138	121	113	-	-	210	239
43	Tc	technetium	128	120	110	-	-	205	237
44	Ru	ruthenium	125	114	103	-	-	205	237
45	Rh	rhodium	125	110	106	-	-	200	232
46	Pd	palladium	120	117	112	-	-	205	235
47	Ag	silver	128	139	137	147.3	-	210	237
48	Cd	cadmium	136	144	-	148.2	-	220	237
49	In	indium	142	136	146	145.5	193 ^g	220	253
50	Sn	tin	140	130	132	140.0	217 ^g	225	246
51	Sb	antimony	140	133	127	136.3	206 ^e	220	241
52	Te	tellurium	136	128	121	133.5	206 ^g	210	236
53	I	iodine	133	129	125	134.5	198 ^g	210	222
54	Xe	xenon	131	135	122	-	216 ^g	-	-
55	Cs	caesium	232	209	-	-	343 ^e	300	330
56	Ba	barium	196	161	149	-	268 ^e	270	305
57	La	lanthanum	180	139	139	-	-	250	281
58	Ce	cerium	163	137	131	-	-	-	-
59	Pr	praseodymium	176	138	128	-	-	-	-
60	Nd	neodymium	174	137	-	-	-	-	-
61	Pm	promethium	173	135	-	-	-	-	-
62	Sm	samarium	172	134	-	-	-	-	-
63	Eu	europium	168	134	-	-	-	-	-
64	Gd	gadolinium	169	135	132	-	-	-	-
65	Tb	terbium	168	135	-	-	-	-	-
66	Dy	dysprosium	167	133	-	-	-	-	-
67	Ho	holmium	166	133	-	-	-	-	-
68	Er	erbium	165	133	-	-	-	-	-
69	Tm	thulium	164	131	-	-	-	-	-
70	Yb	ytterbium	170	129	-	-	-	-	-
71	Lu	lutetium	162	131	131	-	-	-	-
72	Hf	hafnium	152	128	122	-	-	225	252
73	Ta	tantalum	146	126	119	-	-	220	242
74	W	tungsten	137	120	115	-	-	210	236

^a Ref. [1] ^b Ref. [2] ^c Ref. [3] ^d Ref. [4] ^e Ref. [5] ^f Ref. [6] ^g Ref. [7] ^h Ref. [8]

<i>Z</i>	Symbol	Name	r_1/pm^{a}	r_2/pm^{b}	r_3/pm^{c}	r_t/pm^{d}	$r_{\text{vdW,calc}}/\text{pm}$	$r_{\text{vdW,cryst}}/\text{pm}^{\text{h}}$	$r_{\text{vdW,eq}}/\text{pm}^{\text{h}}$
75	Re	rhenium	131	119	110	-	-	205	235
76	Os	osmium	129	116	109	-	-	200	233
77	Ir	iridium	122	115	107	-	-	200	234
78	Pt	platinum	123	112	110	-	-	205	237
79	Au	gold	124	121	123	-	-	210	241
80	Hg	mercury	133	142	-	147.8	-	205	225
81	Tl	thallium	144	142	150	138	196 ^g	220	253
82	Pb	lead	144	135	137	144.1	202 ^g	230	253
83	Bi	bismuth	151	141	135	146.0	207 ^e	230	252
84	Po	polonium	145	135	129	141.6	197 ^e	-	-
85	At	astatine	147	138	138	-	202 ^e	-	-
86	Rn	radon	142	145	133	-	220 ^e	-	-
87	Fr	francium	223	218	-	-	348 ^e	-	-
88	Ra	radium	201	173	159	-	283 ^e	-	-
89	Ac	actinium	186	153	140	-	-	-	-
90	Th	thorium	175	143	136	-	-	240	275
91	Pa	protactinium	169	138	129	-	-	-	-
92	U	uranium	170	134	118	-	-	230	265
93	Np	neptunium	171	136	116	-	-	-	-
94	Pu	plutonium	172	135	-	-	-	-	-
95	Am	americium	166	135	-	-	-	-	-
96	Cm	curium	166	136	-	-	-	-	-
97	Bk	berkelium	168	139	-	-	-	-	-
98	Cf	californium	168	140	-	-	-	-	-
99	Es	einsteinium	165	140	-	-	-	-	-
100	Fm	fermium	167	-	-	-	-	-	-
101	Md	mendelevium	173	139	-	-	-	-	-
102	No	nobelium	176	159	-	-	-	-	-
103	Lr	lawrencium	161	141	-	-	-	-	-
104	Rf	rutherfordium	157	140	131	-	-	-	-
105	Db	dubnium	149	136	126	-	-	-	-
106	Sg	seaborgium	143	128	121	-	-	-	-
107	Bh	bohrium	141	128	119	-	-	-	-
108	Hs	hassium	134	125	118	-	-	-	-
109	Mt	meitnerium	129	125	113	-	-	-	-
110	Ds	darmstadtium	128	116	112	-	-	-	-
111	Rg	roentgenium	121	116	118	-	-	-	-
112	Cn	copernicium	122	137	130	-	-	-	-
113	Nh	nihonium	136	-	-	-	-	-	-
114	Fl	flerovium	143	-	-	-	-	-	-
115	Mc	moscovium	162	-	-	-	-	-	-
116	Lv	livermorium	175	-	-	-	-	-	-
117	Ts	tennessine	165	-	-	-	-	-	-
118	Og	oganesson	157	-	-	-	-	-	-

^a Ref. [1] ^b Ref. [2] ^c Ref. [3] ^d Ref. [4] ^e Ref. [5] ^f Ref. [6] ^g Ref. [7] ^h Ref. [8]

References

- [1] Pekka Pyykkö and Michiko Atsumi. “Molecular Single-Bond Covalent Radii for Elements 1-118”. In: *Chem. Eur. J.* 15.1 (2009), pp. 186–197. DOI: 10.1002/chem.200800987.
- [2] Pekka Pyykkö and Michiko Atsumi. “Molecular Double-Bond Covalent Radii for Elements Li-E112”. In: *Chem. Eur. J.* 15.46 (2009), pp. 12770–12779. DOI: 10.1002/chem.200901472.
- [3] Pekka Pyykkö, Sebastian Riedel, and Michael Patzschke. “Triple-Bond Covalent Radii”. In: *Chem. Eur. J.* 11.12 (2005), pp. 3511–3520. DOI: 10.1002/chem.200401299.
- [4] Pekka Pyykkö. “Refitted tetrahedral covalent radii for solids”. In: *Phys. Rev. B* 85.2 (2012). DOI: 10.1103/physrevb.85.024115.
- [5] Manjeera Mantina et al. “Consistent van der Waals Radii for the Whole Main Group”. In: *J. Phys. Chem. A* 113.19 (2009), pp. 5806–5812. DOI: 10.1021/jp8111556.
- [6] R. Scott Rowland and Robin Taylor. “Intermolecular Nonbonded Contact Distances in Organic Crystal Structures: Comparison with Distances Expected from van der Waals Radii”. In: *J. Phys. Chem.* 100.18 (1996), pp. 7384–7391. DOI: 10.1021/jp953141+.
- [7] A. Bondi. “van der Waals Volumes and Radii”. In: *J. Phys. Chem.* 68.3 (1964), pp. 441–451. DOI: 10.1021/j100785a001.
- [8] Stepan S. Batsanov. “Van der Waals Radii of Elements”. In: *Inorg. Mater.* 37.9 (2001), pp. 871–885. DOI: 10.1023/a:1011625728803.