

Essential Reference Data for Chemistry



Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 IA H Hydrogen 1.008	2 IIA He Helium 4.003																
3 Li Lithium 6.941	4 Be Beryllium 9.012																
5 Na Sodium 22.990	6 Mg Magnesium 24.305																
7 K Potassium 39.098	8 Ca Calcium 40.078	9 Sc Scandium 44.956	10 Ti Titanium 47.88	11 V Vanadium 50.942	12 Cr Chromium 51.996	13 Mn Manganese 54.938	14 Fe Iron 55.845	15 Co Cobalt 58.933	16 Ni Nickel 58.693	17 Cu Copper 63.546	18 Zn Zinc 65.38	19 Ga Gallium 69.723	20 Ge Germanium 72.631	21 As Arsenic 74.922	22 Se Selenium 78.971	23 Br Bromine 79.904	24 Kr Krypton 84.798
25 Rb Rubidium 85.468	26 Sr Strontium 87.62	27 Y Yttrium 88.906	28 Zr Zirconium 91.224	29 Nb Niobium 92.906	30 Mo Molybdenum 95.95	31 Tc Technetium 98.907	32 Ru Ruthenium 101.07	33 Rh Rhodium 106.42	34 Pd Palladium 107.868	35 Ag Silver 107.868	36 Cd Cadmium 112.411	37 In Indium 114.818	38 Sn Tin 118.711	39 Sb Antimony 121.760	40 Te Tellurium 127.6	41 I Iodine 126.904	42 Xe Xenon 131.294
43 Cs Cesium 132.905	44 Ba Barium 137.328	45 La Lanthanum 138.905	46 Hf Hafnium 178.49	47 Ta Tantalum 180.948	48 W Tungsten 183.85	49 Re Rhenium 186.207	50 Os Osmium 190.23	51 Ir Iridium 192.22	52 Pt Platinum 195.08	53 Au Gold 196.967	54 Hg Mercury 200.59	55 Tl Thallium 204.383	56 Pb Lead 207.2	57 Bi Bismuth 208.980	58 Po Polonium 209	59 At Astatine 209	60 Rn Radon 222.018
61 Fr Francium 223.020	62 Ra Radium 226.025	63 Ac Actinium 227.028	64 Rf Rutherfordium 261	65 Db Dubnium 262	66 Sg Seaborgium 266	67 Bh Bohrium 264	68 Hs Hassium 269	69 Mt Meitnerium 278	70 Ds Darmstadtium 281	71 Rg Roentgenium 280	72 Cn Copernicium 285	73 Nh Nihonium 286	74 Fl Flerovium 289	75 Mc Moscovium 289	76 Lv Livermorium 293	77 Ts Tennessine 294	78 Og Oganesson 294
79 La Lanthanum 138.905	80 Ce Cerium 140.12	81 Pr Praseodymium 140.908	82 Nd Neodymium 144.24	83 Pm Promethium 144.913	84 Sm Samarium 150.36	85 Eu Europium 151.964	86 Gd Gadolinium 157.25	87 Tb Terbium 158.925	88 Dy Dysprosium 162.50	89 Ho Holmium 164.930	90 Er Erbium 167.259	91 Tm Thulium 168.934	92 Yb Ytterbium 173.055	93 Lu Lutetium 174.967			
95 Ac Actinium 227.028	96 Th Thorium 232.038	97 Pa Protactinium 231.036	98 U Uranium 238.029	99 Np Neptunium 237.048	100 Pu Plutonium 244.064	101 Am Americium 243.061	102 Cm Curium 247.070	103 Bk Berkelium 247.070	104 Cf Californium 251.080	105 Es Einsteinium 254	106 Fm Fermium 257.095	107 Md Mendelevium 258.1	108 No Nobelium 259.101	109 Lr Lawrencium 262			

Solubility Guidelines for Ionic Compounds

Use the chart below to see if an ionic compound dissolves in water or forms a precipitate. Match the cation and anion from the compound's formula.

	Fluoride F ⁻	Chloride Cl ⁻	Bromide Br ⁻	Iodide I ⁻	Chlorate ClO ₃ ⁻	Perchlorate ClO ₄ ⁻	Hydroxide OH ⁻	Oxide O ²⁻	Sulfate SO ₄ ²⁻	Sulfite SO ₃ ²⁻	Sulfide S ²⁻	Nitrate NO ₃ ⁻	Nitrite NO ₂ ⁻	Phosphate PO ₄ ³⁻	Carbonate CO ₃ ²⁻	Cyanide CN ⁻	Thiocyanate SCN ⁻	Acetate C ₂ H ₃ O ₂ ⁻	Oxalate C ₂ O ₄ ²⁻
Alkali Metals (Grp 1)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ammonium NH ₄ ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Hydrogen H ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Lithium Li ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sodium Na ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Potassium K ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Rubidium Rb ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Cesium Cs ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Beryllium Be ²⁺	S	S	S	S	S	S	I	S	R	S	S	S	S	S	S	S	S	S	S
Magnesium Mg ²⁺	S	S	S	S	S	S	I	R	S	R	S	S	S	S	S	S	S	S	S
Calcium Ca ²⁺	S	S	S	S	S	S	S	R	S	R	S	S	S	S	S	S	S	S	S
Strontium Sr ²⁺	S	S	S	S	S	S	S	R	S	R	S	S	S	S	S	S	S	S	S
Barium Ba ²⁺	S	S	S	S	S	S	S	R	S	R	S	S	S	S	S	S	S	S	S
Vanadium (III) V ³⁺	I	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Chromium (III) Cr ³⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Manganese (II) Mn ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Iron (II) Fe ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Iron (III) Fe ³⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Cobalt (II) Co ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Nickel (II) Ni ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Copper (II) Cu ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Zinc Zn ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Silver Ag ⁺	S	I	I	I	I	I	S	I	S	I	S	S	S	S	S	S	S	S	S
Cadmium Cd ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Gold (III) Au ³⁺	R	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Mercury (II) Hg ²⁺	R	S	S	S	S	S	I	I	R	I	S	S	S	S	S	S	S	S	S
Mercury (I) Hg ₂ ²⁺	R	I	I	I	I	I	S	I	S	I	S	S	S	S	S	S	S	S	S
Aluminum Al ³⁺	S	S	S	S	S	S	I	I	S	R	S	S	S	S	S	S	S	S	S
Gallium Ga ³⁺	I	S	S	S	S	S	I	I	S	R	S	S	S	S	S	S	S	S	S
Tin (II) Sn ²⁺	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S	S
Lead (II) Pb ²⁺	S	S	S	S	S	S	S	I	I	S	I	S	S	S	S	S	S	S	S
Ammonium NH ₄ ⁺	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Legend: Soluble Slightly soluble Almost insoluble Unstable, reacts with water No available data

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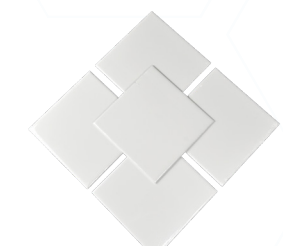
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NMR Chemical Impurity Shifts Table

¹ H NMR	proton	mult	CDCl ₃	(CD ₃) ₂ CO	(CD ₃) ₂ SO	C ₆ D ₆	CD ₃ CN	CD ₃ OD	D ₂ O
Solvent residual peak			7.26	2.05	2.50	7.16	1.94	3.31	4.79
H ₂ O		s	1.56	2.84	3.33	0.40	2.13	4.87	
Acetic acid	CH ₃	s	2.10	1.96	1.91	1.55	1.96	1.99	2.08
Acetone	CH ₃	s	2.17	2.09	2.09	1.55	2.08	2.15	2.22
Acetonitrile	CH ₃	s	2.10	2.05	2.07	1.55	1.96	2.03	2.06
Benzene	CH	s	7.36	7.36	7.37	7.15	7.37	7.33	
tert-butyl alcohol	CH ₃	s	1.28	1.18	1.11	1.05	1.16	1.40	1.24
	OH	s			4.19	1.55	2.18		
tert-butyl methyl ether	CCl ₃	s	1.19	1.13	1.11	1.07	1.14	1.15	1.21
	OCH ₃	s	3.22	3.13	3.08	3.04	3.13	3.20	3.22
BHT	ArH	s	6.98	6.96	6.87	7.05	6.97	6.92	
(2,6-dimethyl-4-tert-butylphenol)	OH	s	5.01		6.65	4.79	5.20		
	ArCH ₃	s	2.27	2.22	2.18	2.24	2.22	2.21	
	ArC(CH ₃) ₂	s	1.43	1.41	1.36	1.38	1.39	1.40	
Chloroform	CH	s	7.26	8.02	8.32	6.15	7.58	7.90	
Cyclohexane	CH ₂	s	1.43	1.43	1.40	1.40	1.44	1.45	
1,2-dichloroethane	CH ₂	s	3.73	3.87	3.90	2.90	3.81	3.78	
Dichloromethane	CH ₂	s	5.30	5.63	5.76	4.27	5.44	5.49	
Diethyl ether	CH ₃	t, 7	1.21	1.11	1.09	1.11	1.12	1.18	1.17
	CH ₂	q, 7	3.48	3.41	3.38	3.26	3.42	3.49	3.56
Diglyme	CH ₂	m	3.65	3.56	3.51	3.46	3.53	3.61	3.67
	CH ₃	m	3.57	3.47	3.38	3.34	3.45	3.58	3.61
	OCH ₃	s	3.39	3.28	3.24	3.11	3.29	3.35	3.37
1,2-dimethoxyethane	CH ₃	s	3.40	3.28	3.24	3.12	3.28	3.35	3.37
	CH ₂	s	3.55	3.46	3.43	3.33	3.45	3.52	3.60
Dimethylacetamide	CH ₃ CO	s	2.09	1.97	1.96	1.60	1.97	2.07	2.08
	NCH ₃	s	3.02	3.00	2.94	2.57	2.96	3.31	3.06
	NCH ₃	s	2.94	2.83	2.78	2.05	2.83	2.92	2.90
Dimethylformamide	CH	s	8.02	7.96	7.95	7.63	7.92	7.97	7.92
	CH ₃	s	2.96	2.94	2.89	2.36	2.89	2.99	3.01
	CH ₃	s	2.88	2.78	2.73	1.86	2.77	2.86	2.85
Dimethyl sulfoxide	CH ₃	s	2.62	2.52	2.54	1.68	2.50	2.65	2.71
Dioxane	CH ₂	s	3.71	3.59	3.57	3.35	3.60	3.66	3.75
	CH ₃	t, 7	1.25	1.12	1.06	0.96	1.12	1.19	1.17
Ethanol	CH ₃	q, 7	3.72	3.57	3.44	3.34	3.54	3.60	3.65
	OH	s	1.32	3.39	4.63	2.47			
Ethyl acetate	CH ₃ CO	s	2.05	1.97	1.99	1.65	1.97	2.01	2.07
	CH ₂ CH ₃	t, 7	1.12	1.05	1.03	0.89	1.06	1.09	1.14
	CH ₂ CH ₃	t, 7	1.26	1.20	1.17	0.92	1.20	1.24	1.24
Ethyl methyl ketone	CH ₃ CO	s	2.14	2.07	2.07	1.58	2.06	2.12	2.19
	CH ₂ CH ₃	q, 7	2.46	2.45	2.43	1.81	2.43	2.50	3.18
	CH ₂ CH ₃	t, 7	1.06	0.96	0.91	0.85	0.96	1.01	1.26
Ethylene glycol	CH ₂	s	3.63	3.28	3.34	3.41	3.51	3.59	3.65
	CH ₃	m	0.86	0.87		0.92	0.86	0.88	
"Grease"	CH ₂	br s	1.26	1.29		1.36	1.27	1.29	
n-hexane	CH ₃	t	0.88	0.88	0.86	0.89	0.89	0.90	
	CH ₂	m	1.26	1.28	1.25	1.24	1.28	1.29	
HMPA	CH ₃	d, 9.5	2.65	2.59	2.53	2.40	2.57	2.64	2.61
	CH ₃	s	3.49	3.31	3.16	3.07	3.28	3.34	3.34
Methanol	OH	s	1.09	3.12	4.01	2.16			
Nitromethane	CH ₃	s	4.33	4.43	4.42	2.94	4.31	4.34	4.40
n-pentane	CH ₃	t, 7	0.88	0.88	0.86	0.87	0.89	0.90	
	CH ₂	m	1.27	1.27	1.27	1.23	1.29	1.29	
2-propanol	CH ₃	d, 6	1.22	1.10	1.04	0.95	1.09	1.50	1.17
	CH	sep, 6	4.04	3.90	3.78	3.67	3.87	3.92	4.02
	CH(2)	m	8.62	8.58	8.58	8.53	8.57	8.53	8.52
	CH(3)	m	7.29	7.35	7.39	6.66	7.73	7.44	7.45
	CH(4)	m	7.76	7.76	7.79	6.98	7.73	7.85	7.87
Silicone grease	CH ₃	s	0.07	0.13		0.29	0.08	0.10	
Tetrahydrofuran	CH ₂	m	1.85	1.79	1.76	1.40	1.80	1.87	1.88
	CH ₂ O	m	3.76	3.63	3.60	3.57	3.64	3.71	3.74
	CH ₂	s	2.36	2.32	2.30	2.11	2.31	2.32	
Toluene	CH(o/p)	m	7.17	7.1-7.2	7.18	7.02	7.1-7.3	7.16	
	CH(m)	m	7.25	7.1-7.2	7.25	7.13	7.1-7.3	7.16	
Triethylamine	CH ₃	t, 7	1.03	0.96	0.93	0.96	0.96	1.05	0.99
	CH ₂	q, 7	2.53	2.45	2.43	2.40	2.45	2.58	2.57