

6.5: Ionization Energies

Ionization Energies

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Ionization Energy

Atom	Atomic No.	IE ₁ (kJ/mol)	IE ₂ (kJ/mol)	IE ₃ (kJ/mol)	IE ₄ (kJ/mol)	IE ₅ (kJ/mol)	IE ₆ (kJ/mol)	IE ₇ (kJ/mol)
H	1	1311.7						
He	2	2371.6	5248.8					
Li	3	520.1	7296.1	11811.7				
Be	4	899.2	1756.6	14844.3	21000.7			
B	5	800.4	2426.5	3658.7	25018.5	32817.3		
C	6	1086.8	2351.9	4618.2	6221.0	37820.9	47262.4	
N	7	1402.9	2856.4	4575.9	7472.8	9442.3	53252.7	64339.3
O	8	1313.6	3391.1	5300.3	7467.4	10987.1	13322.7	71313.7
F	9	1681.0	3375.1	6050.4	8416.4	11020.0	15159.5	17863.2
Ne	10	2080.1	3962.7	6175.1	9374.5	12195.7	15236.0	
Na	11	495.7	4562.8	6913.2	9540.5	13372.9	16630.2	20111.8
Mg	12	737.5	1450.2	7730.4	10544.9	13626.6	18029.3	21739.1
Al	13	577.4	1816.1	2744.0	11574.4	14836.6	18372.7	23342.7
Si	14	786.3	1576.6	3228.4	4354.4	16087.0	19790.1	23775.0
P	15	1011.8	1895.9	2909.6	4954.9	6272.2	21266.7	25405.6
S	16	999.3	2257.8	3377.0	4562.8	6995.2	8493.5	27111.4
Cl	17	1255.3	2296.4	3849.8	5162.0	6541.7	9330.1	11025.4
Ar	18	1520.1	2664.9	3946.3	5768.9	7236.4	8809.1	11964.2
K	19	418.6	3069.2	4438.3	5876.0	7975	9619.6	11385.3
Ca	20	589.6	1145.3	4941.0	6464.5	8142.4	10496	12350.1
Sc	21	632.9	1243.7	2388.0	7130.3	8876.7	10719.5	13314
Ti	22	659.0	1315.1	2715.1	4172.0	9629.2	11578.2	13585.1
V	23	650.3	1370.1	2865.6	4631.3	6290.8	12437.0	14569.3
Cr	24	652.5	1591.0	2986.2	4785.7	7043.4	8741.6	15543.8
Mn	25	717.1	1509.0	3250.6		7332.9		11504.9
Fe	26	762.2	1561.1	2956.3				
Co	27	758.4	1645.1	3231.3				
Ni	28	736.5	1751.2	3488.9				

Cu	29	745.3	1957.7	3553.6				
Zn	30	906.1	1732.9	3830.5				
Ga	31	578.9	1981.8	2962.1	6194.4	8299	10874	13585
Ge	32	760.3	1537.0	3300.8	4409.4	9011.7	11183	13981
As	33	946.5	1949.0	2730.5	4833.9	6040.0	12301.9	14183
Se	34	940.7	2074.4	3087.5	4139.2	7053.1	7882.9	14955.2
Br	35	1142.4	2084.1	3463.8				
Kr	36	1350.4	2369.7	3560.3				
Rb	37	402.9	2653.3	3859.4				
Sr	38	549.2	1063.9	0.0	5499.7		31261.3	
Y	39	627.2	1196.4	3762.9		7429.4		36085.5
Zr	40	670.6	1353.7	2392.8	3277.6		9552.0	
Nb	41	653.2	1350.8	2711.2	3695.4	4824.3	9938.0	12060.7
Mo	42	685.0	1558.2	2617.6	4476.9	5904.9	6561.0	12157.2
Tc	43	702.4	1472.4	0.0				
Ru	44	710.5	1617.1	2746.0				
Rh	45	719.8	1743.5	2995.9				
Pd	46	803.7	1873.7	3176.3				
Ag	47	730.8	2072.5	3359.6				
Cd	48	867.5	1631.0	3615.3				
In	49	558.2	1819.7	2704.5	5248.8			
Sn	50	708.4	1411.4	2941.8	3928.9	6975.9		
Sb	51	833.5	1592.0	2441.1	3193.7	5403.2	10420.4	
Te	52	869.3	1794.6	2991.0	3666.4	5789.1	6946.9	13218.5
I	53	1008.7	1841.9	0.0				
Xe	54	1170.1	2045.5	3097.2				
Cs	55	375.6	2421.8	0.0				
Ba	56	502.7	964.9	0.0				
La	57	538.1	1067.1	1850.3	4819.4			
Ce	58	527.4	1046.9	1948.8	3546.6			
Pr	59	523.1	1017.9	2086.4	3761.0	5550.8		
Nd	60	529.6	1035.3	2132.3	3899.0	5789.1		
Pm	61	535.9	1051.7	2151.6	3965.5	5952.2		
Sm	62	543.3	1068.1	2257.8	3994.5	6045.8		
Eu	63	546.7	1084.6	2404.4	4110.3	6100.8		

Gd	64	592.5	1166.5	1990.5	4245.4	6248.4		
Tb	65	564.6	1111.5	2114.0	3839.2	6412.4		
Dy	66	571.9	1126.0	2199.9	4001.2	5989.8		
Ho	67	580.6	1138.5	2203.7	4100.6	6168.3		
Er	68	588.7	1151.1	2194.1	4115.1	6281.2		
Tm	69	596.7	1162.6	2284.8	4119.0	6312.1		
Yb	70	603.4	1175.6	2415.0	4220.3	6327.5		
Lu	71	523.5	1341.1	2022.3	4360.2	6444.3		
Hf	72	641.6	1437.6	2248.1	3215.9	6595.4		
Ta	73	760.3				4657.6		
W	74	770.0						
Re	75	759.3						
Os	76	839.4						
Ir	77	868.4						
Pt	78	868.4	1790.8					
Au	79	889.6	1977.9					
Hg	80	1006.3	1809.2	3299.8				
Tl	81	589.1	1970.2	2875.3	4891.8			
Pb	82	715.4	1450.0	3080.8	4082.3	6638.2		
Bi	83	703.1	1609.4	2466.2	4370.8	5403.2	8519.7	
Po	84	813.4						
Rn	86	1036.8						
Fr	87	393.0						
Ra	88	509.2	978.7					
Ac	89	498.8	1167.5					
Th	90	586.6						
Pa	91	568.3						
U	92	583.7						
Np	93	597.2						
Pu	94	584.7						
Am	95	578.2						
Cm	96	580.8						
Bk	97	601.1						
Cf	98	607.9						
Es	99	619.4						

Fm	100	627.2						
Md	101	634.9						
No	102	641.6						
Lr	103	478.6						

C. E. Moore, Ionization Potentials and Limits Derived from the Analyses of Optical Spectra, NSRDS-NBS 34, National Bureau of Standards, Washington, DC, 1970.

For elements 57-72, values were obtained from Martin, W. C.; Hagan, Lucy; Reader, Joseph; Sugar, Jack J. Phys. Chem. Ref. Data, 1974, 3, 771-779.

For elements 59-73, fifth IEs came from Sugar, Jack J. Opt. Soc. Am. 1975, 65, 1366-1367.

For Lr see C&EN, Volume 93 Issue 15 | p. 8 | News of The Week, Issue Date: April 13, 2015 | Web Date: April 9, 2015
Lawrencium Ionization Energy Measured.

*Values for La, Hf, and Lr have been overwritten with more recent data

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