



# Las Propiedades Periódicas

Viewing: Atomic weight

1	H 1.00794																	He 4.00260	
2	Li 6.941	Be 9.0122											B 10.811	C 12.011	N 14.007	O 15.999	F 18.998	Ne 20.18	
3	Na 22.99	Mg 24.305										Al 26.982	Si 28.086	P 30.974	S 32.06	Cl 35.453	Ar 39.948		
4	K 39.098	Ca 40.078	Sc 44.956	Ti 47.88	V 50.942	Cr 51.996	Mn 54.938	Fe 55.847	Co 58.933	Ni 58.693	Cu 63.546	Zn 65.39	Ga 69.723	Ge 72.61	As 74.922	Se 78.96	Br 79.904	Kr 83.8	
5	Rb 85.468	Sr 87.62	Y 88.906	Zr 91.224	Nb 92.906	Mo 95.94	Tc 97.91	Ru 101.07	Rh 102.91	Pd 106.42	Ag 107.87	Cd 112.41	In 114.82	Sn 118.71	Sb 121.76	Te 127.6	I 126.9	Xe 131.29	
6	Cs 132.91	Ba 137.33	La 138.91	Hf 178.49	Ta 180.95	W 183.84	Re 186.21	Os 190.23	Ir 192.22	Pt 195.08	Au 196.97	Hg 200.59	Tl 204.38	Pb 207.2	Bi 208.98	Po (209)	At (210)	Rn (222)	
7	Fr 223	Ra 226	Ac (227)	Rf (261)	Db (262)	Sg (263)	Bh (264)	Hs (265)	Mt (266)	Uun (267)	Uuu (268)	Uub (269)							
Lanthanide Series		Ce 140.12	Pr 140.91	Nd 144.24	Pm 144.91	Sm 150.36	Eu 151.97	Gd 157.25	Tb 158.93	Dy 162.5	Ho 164.93	Er 167.26	Tm 168.93	Yb 173.04	Lu 174.97				
Actinide Series		Th 232.04	Pa 231.04	U 238.03	Np (237)	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (260)				

# Química Inorgánica I



# Créditos y referencias

El material que sigue está conformado por trabajo original y material tomado de las varias fuentes, entre ellas:

- “Inorganic Chemistry”, 4th ed. J.E. Huheey, E.A. Keiter, R.L. Keiter, Harper-Collins, NY, 1993.
- “Principles of Descriptive Inorganic Chemistry”, G. Wulfsberg, University Science Books, Mill Valley, 1991.
- También se presenta material tomado de varios sitios accesibles por Internet. En la medida de lo posible se menciona la dirección URL donde se puede consultar el material.



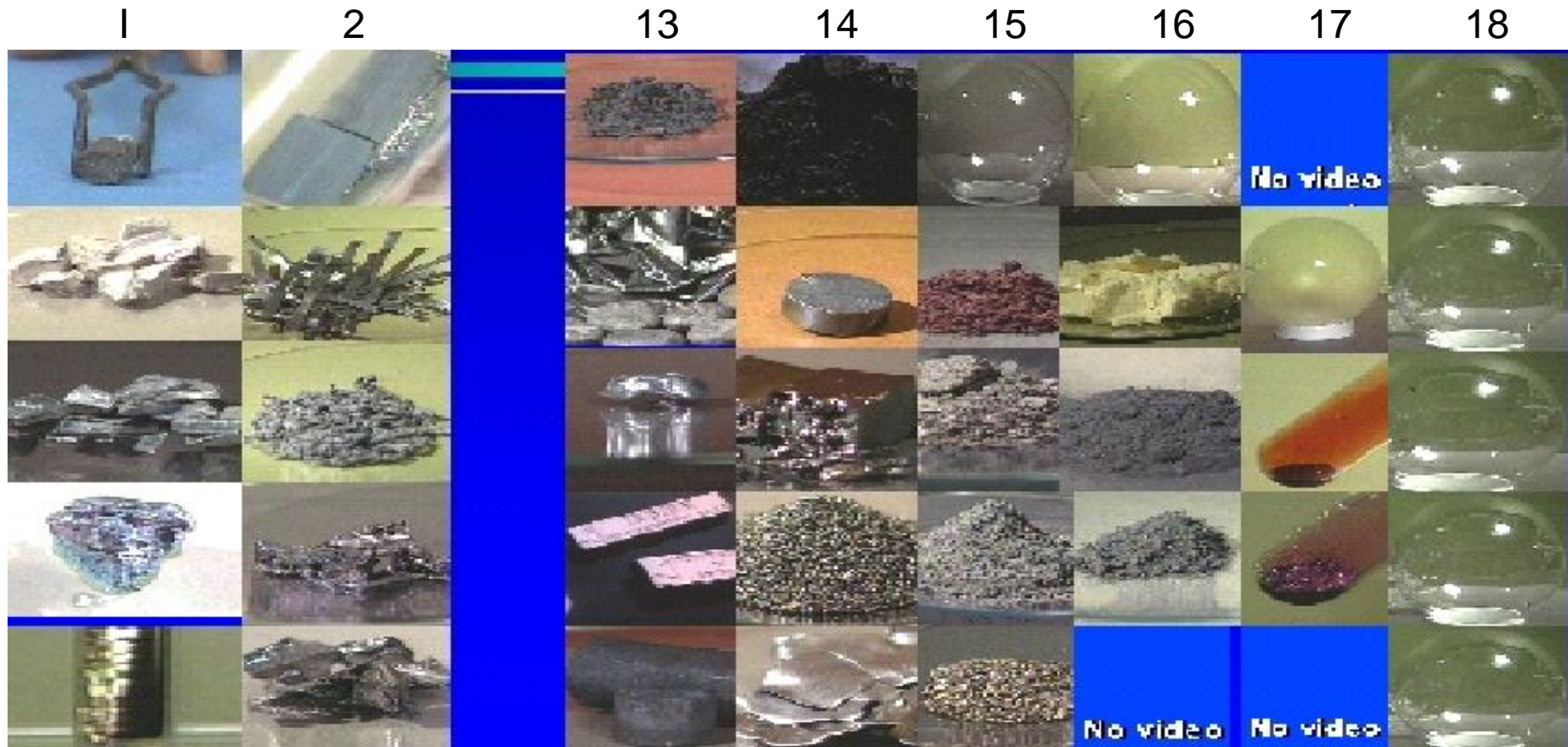
# Los compuestos sintéticos

- Al 24 de noviembre de 2010 a las 19:15 horas habían sido reportados al acervo del Chemical Abstracts Service 56 198 700 compuestos químicos sintéticos.
- Esta cifra aumenta, en promedio, a razón de 12 nuevos compuestos por minuto.

<http://www.cas.org/cas-home>



# Los elementos y su aspecto





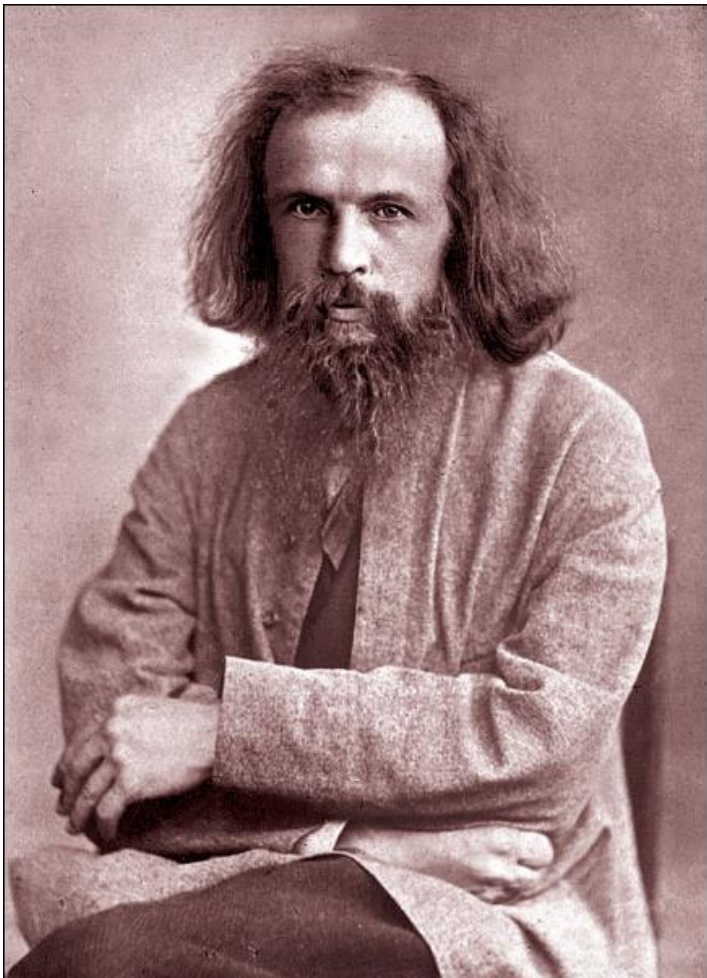


# La historia y los elementos

Fecha de descubrimiento																	
Antes de 1800			1800-1849				1850-1899				1900-1949			1950-2004			
1																18	
1 H 1.0079	2											13	14	15	16	17	2
3 Li 6.941	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.409	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.798
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57-71	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89-103	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Uuu (272)	112 Uuu (272)	113 Uuu (272)	114 Uuu (272)	115 Uuu (272)	116 Uuu (272)	117 Uuu (272)	118 Uuu (272)
			57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
			89 Ac (227)	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)



# Dimitrij Ivanovič Mendělejev



En 1869, a los 35 años, presentó la ley periódica y su 1ª versión de la Tabla Periódica



# La ley periódica

“Si ordenamos a los elementos en orden ascendente de su número atómico, sus propiedades se repiten o varían periódicamente”

¿Cuáles son las propiedades periódicas?





# La tabla original de Dimitrij Ivanovič Mendělejev

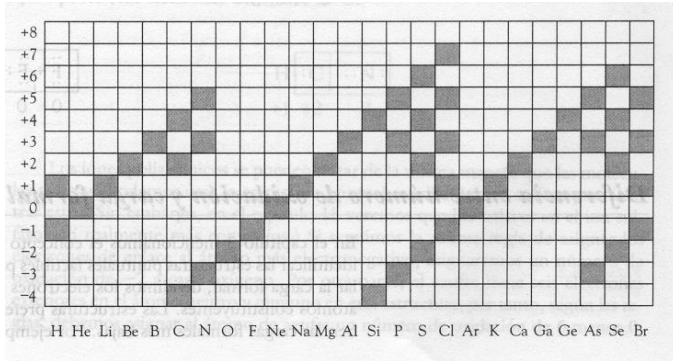
## ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ.

ОСНОВАННОЙ НА ИХЪ АТОМНОМЪ ВѢСѢ И ХИМИЧЕСКОМЪ СХОДСТВѢ.

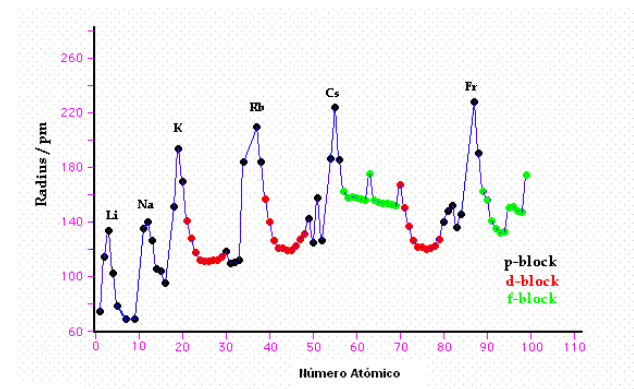
			Ti = 50	Zr = 90	? = 180.
			V = 51	Nb = 94	Ta = 182.
			Cr = 52	Mo = 96	W = 186.
			Mn = 55	Rh = 104,4	Pt = 197,1.
			Fe = 56	Ru = 104,4	Ir = 198.
			Ni = 59	Pd = 106,8	Os = 199.
H = 1			Cu = 63,4	Ag = 108	Hg = 200.
	Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112	
	B = 11	Al = 27,1	? = 68	U = 116	Au = 197?
	C = 12	Si = 28	? = 70	Sn = 118	
	N = 14	P = 31	As = 75	Sb = 122	Bi = 210?
	O = 16	S = 32	Se = 79,4	Te = 128?	
	F = 19	Cl = 35,5	Br = 80	I = 127	
Li = 7	Na = 23	K = 39	Rb = 85,4	Cs = 133	Tl = 204.
		Ca = 40	Sr = 87,6	Ba = 137	Pb = 207.
		? = 45	Ce = 92		
		?Er = 56	La = 94		
		?Yt = 60	Di = 95		
		?In = 75,6	Th = 118?		

Д. Менделѣевъ

# Propiedades que tienen variaciones periódicas

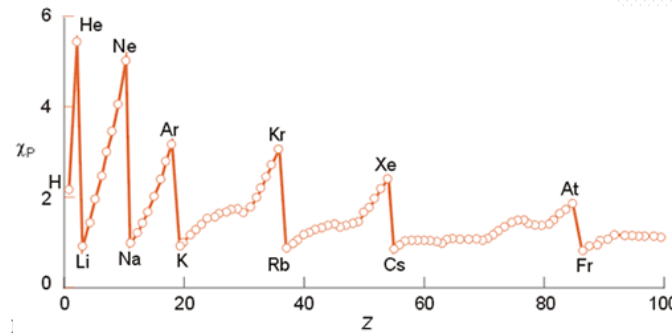


Electronegatividad



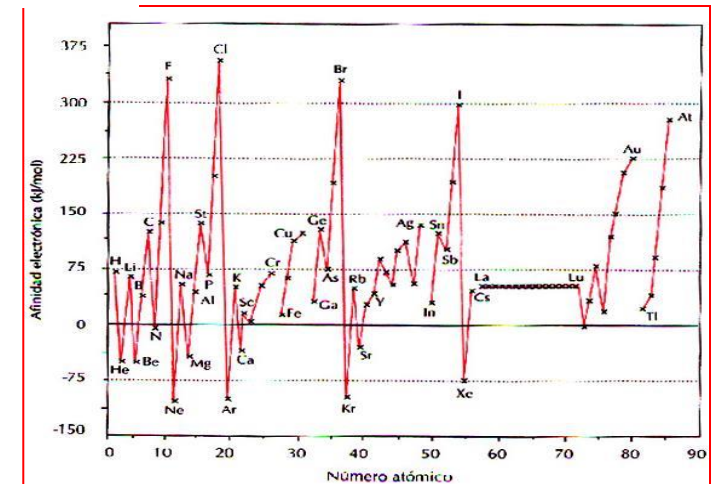
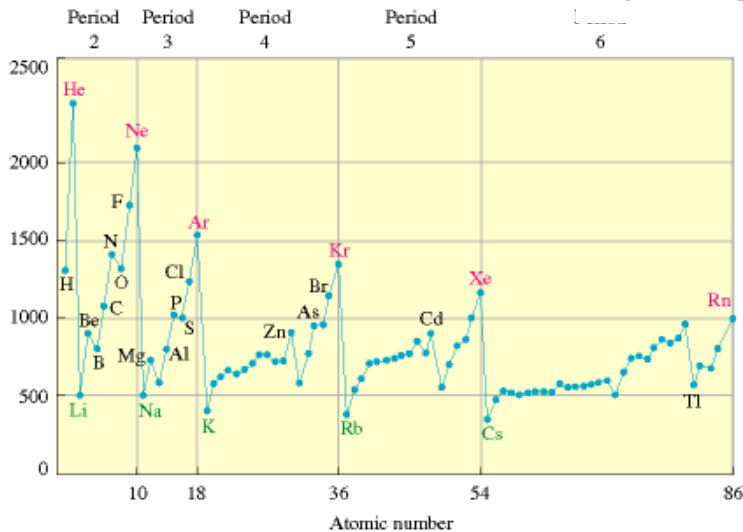
Tamaño

Estado de oxidación



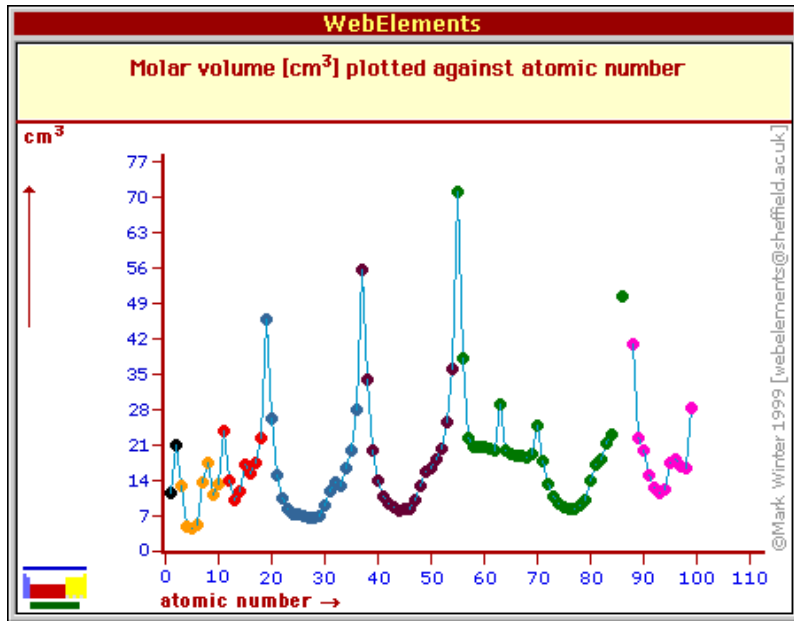
Afinidad electrónica

Energía de ionización



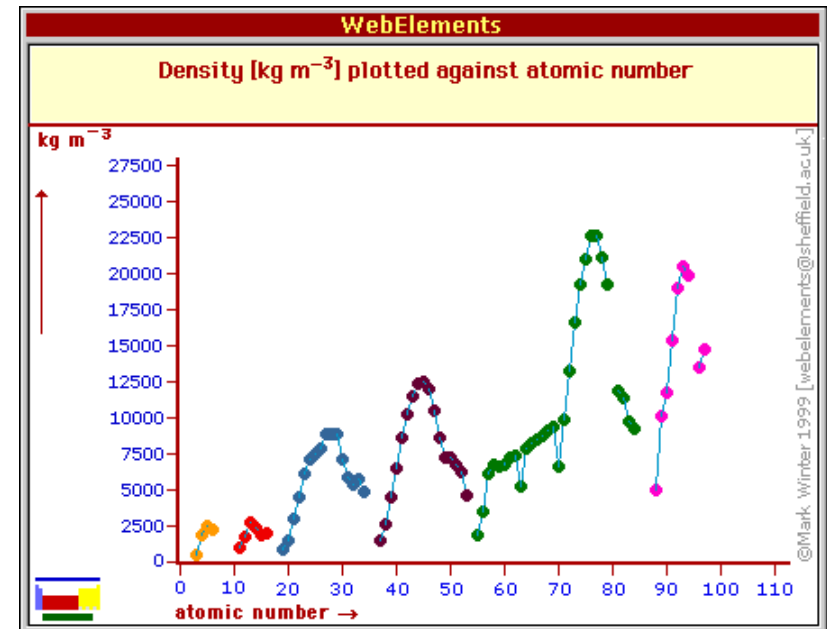


# Propiedades que tienen variaciones periódicas



Volumen molar

Densidad



# La tabla de Mendeleiev

TABELLE II

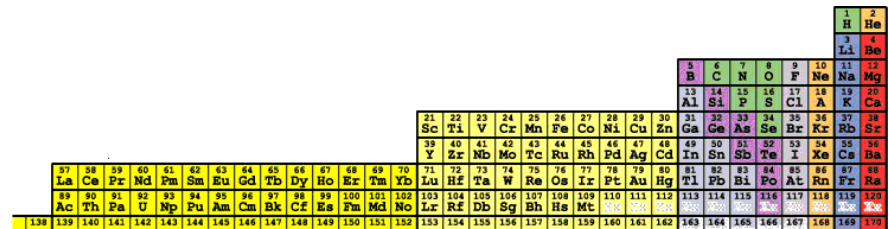
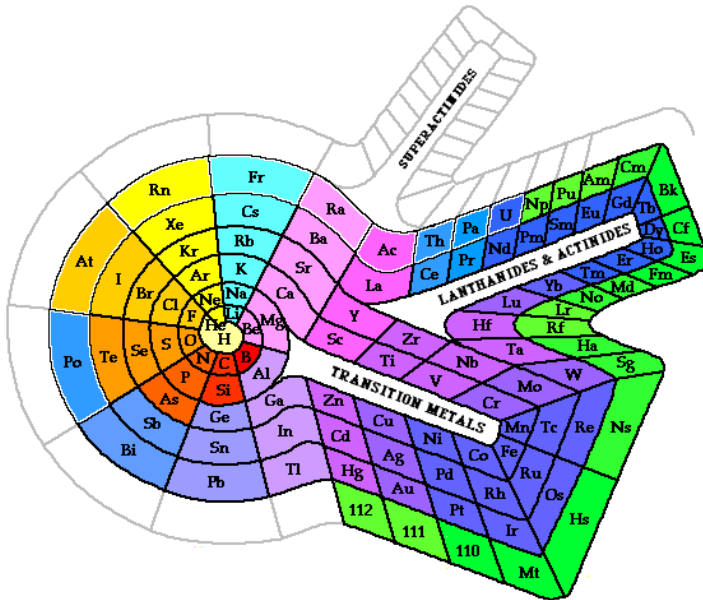
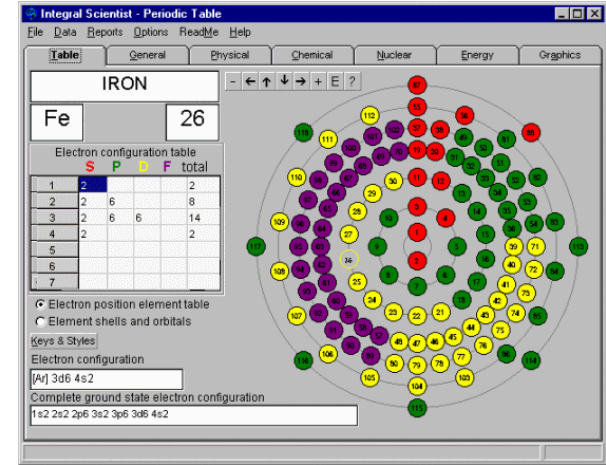
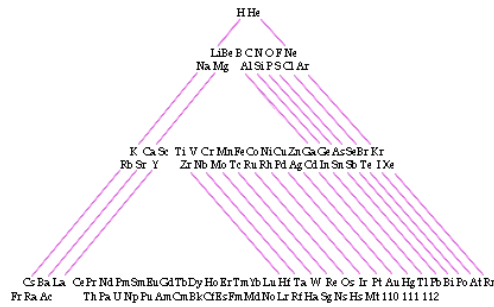
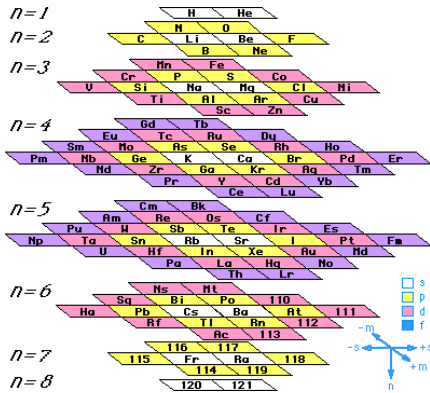
REIHEN	GRUPPE I. — R <sup>2</sup> O	GRUPPE II. — RO	GRUPPE III. — R <sup>2</sup> O <sup>3</sup>	GRUPPE IV. RH <sup>4</sup> RO <sup>2</sup>	GRUPPE V. RH <sup>3</sup> R <sup>2</sup> O <sup>5</sup>	GRUPPE VI. RH <sup>2</sup> RO <sup>3</sup>	GRUPPE VII. RH R <sup>2</sup> O <sup>7</sup>	GRUPPE VIII. — RO <sup>4</sup>
1	H = 1							
2	Li = 7	Be = 9,4	B = 11	C = 12	N = 14	O = 16	F = 19	
3	Na = 23	Mg = 24	Al = 27,3	Si = 28	P = 31	S = 32	Cl = 35,5	
4	K = 39	Cd = 40	— = 44	Ti = 48	V = 51	Cr = 52	Mn = 55	Fe = 56, Co = 59, Ni = 59, Cu = 63.
5	(Cu = 63)	Zn = 65	— = 68	— = 72	As = 75	Se = 78	Br = 80	
6	Rb = 85	Sr = 87	?Yt = 88	Zr = 90	Nb = 94	Mo = 96	— = 100	Ru = 104, Rh = 104, Pd = 106, Ag = 108.
7	(Ag = 108)	Cd = 112	In = 113	Sn = 118	Sb = 122	Te = 125	J = 127	
8	Cs = 133	Ba = 137	?Di = 138	?Ce = 140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er = 178	?La = 180	Ta = 182	W = 184	—	Os = 195, Ir = 197, Pt = 198, Au = 199.
11	(Au = 199)	Hg = 200	Tl = 204	Pb = 207	Bi = 208	—	—	
12	—	—	—	Th = 231	—	U = 240	—	— — — —

**Figure 2.5** Dmitri Mendeleev's 1872 periodic table. The spaces marked with blank lines represent elements that Mendeleev deduced existed but were unknown at the time, so he left places for them in the table. The symbols at the top of the columns (e.g., R<sup>2</sup>O and RH<sup>4</sup>) are molecular formulas written in the style of the 19th century.



# Las diferentes tablas

## ¡ hay más de 600 !







# La tabla de Seaborg



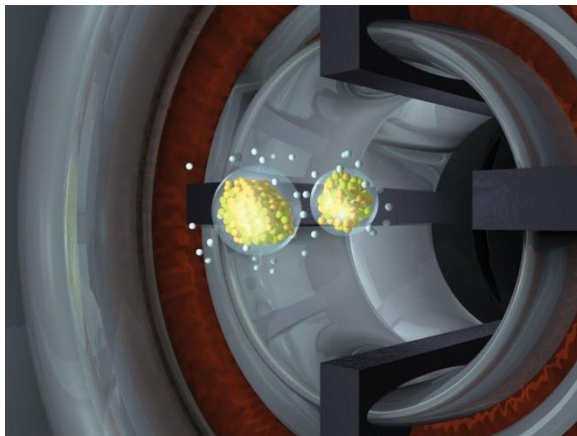
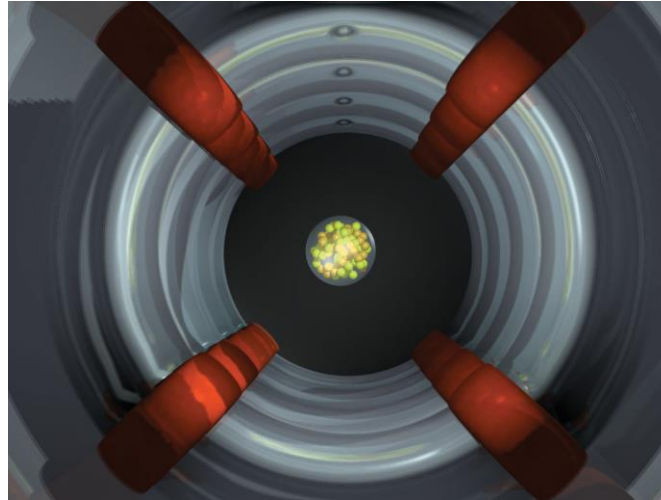
Glen Theodore Seaborg, en 1944, a sus 31 años, predijo la existencia de los elementos transuránicos y él mismo obtuvo varios de ellos. Esto provocó que la tabla periódica tuviera que ser nuevamente modificada.

Recibió el premio Nobel de química en 1951.





# El acelerador de partículas





# El sincrotrón de gradiente alterno de Brookhaven





# El acelerador del CERN en Ginebra, Suiza.

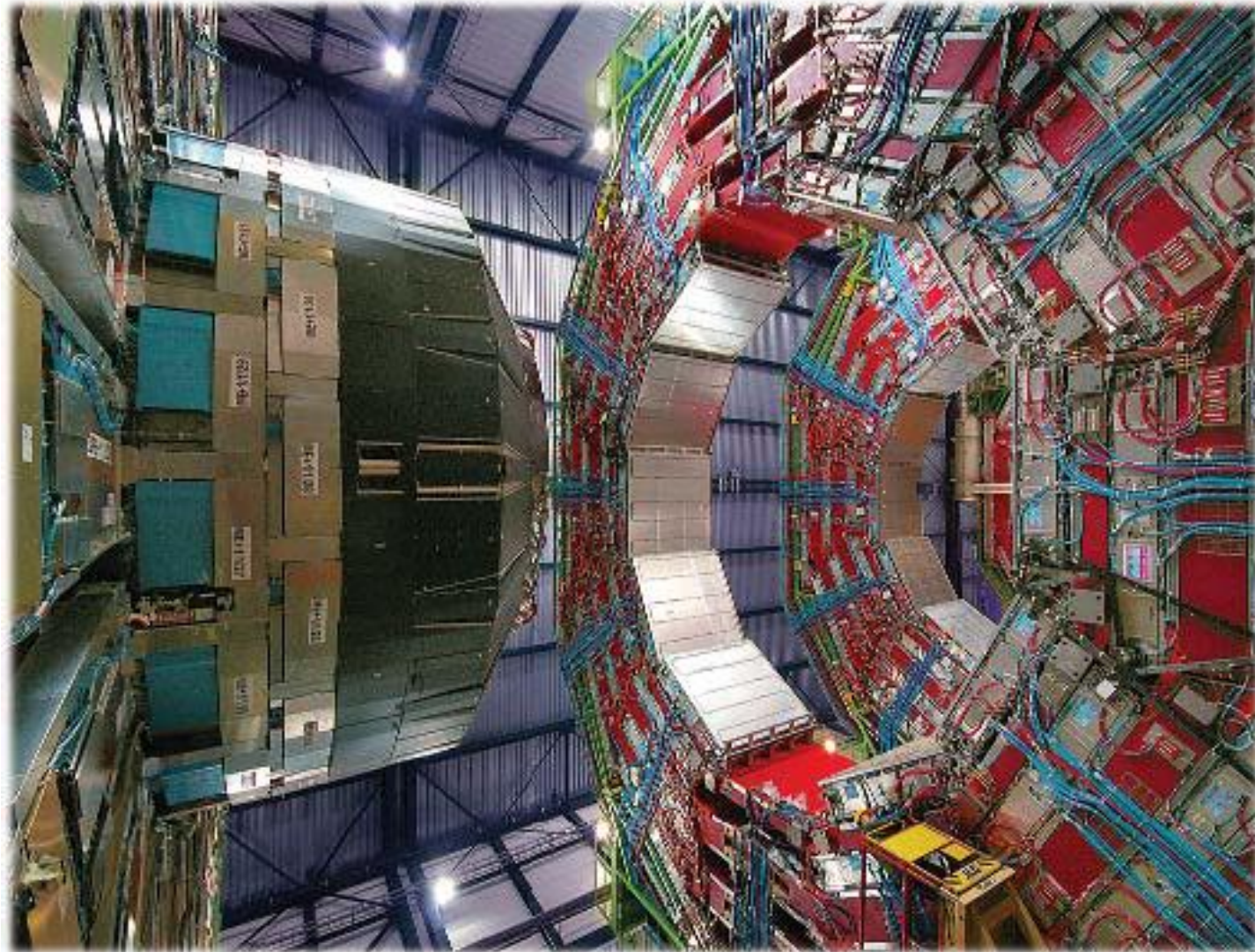


<http://press.web.cern.ch/press/>





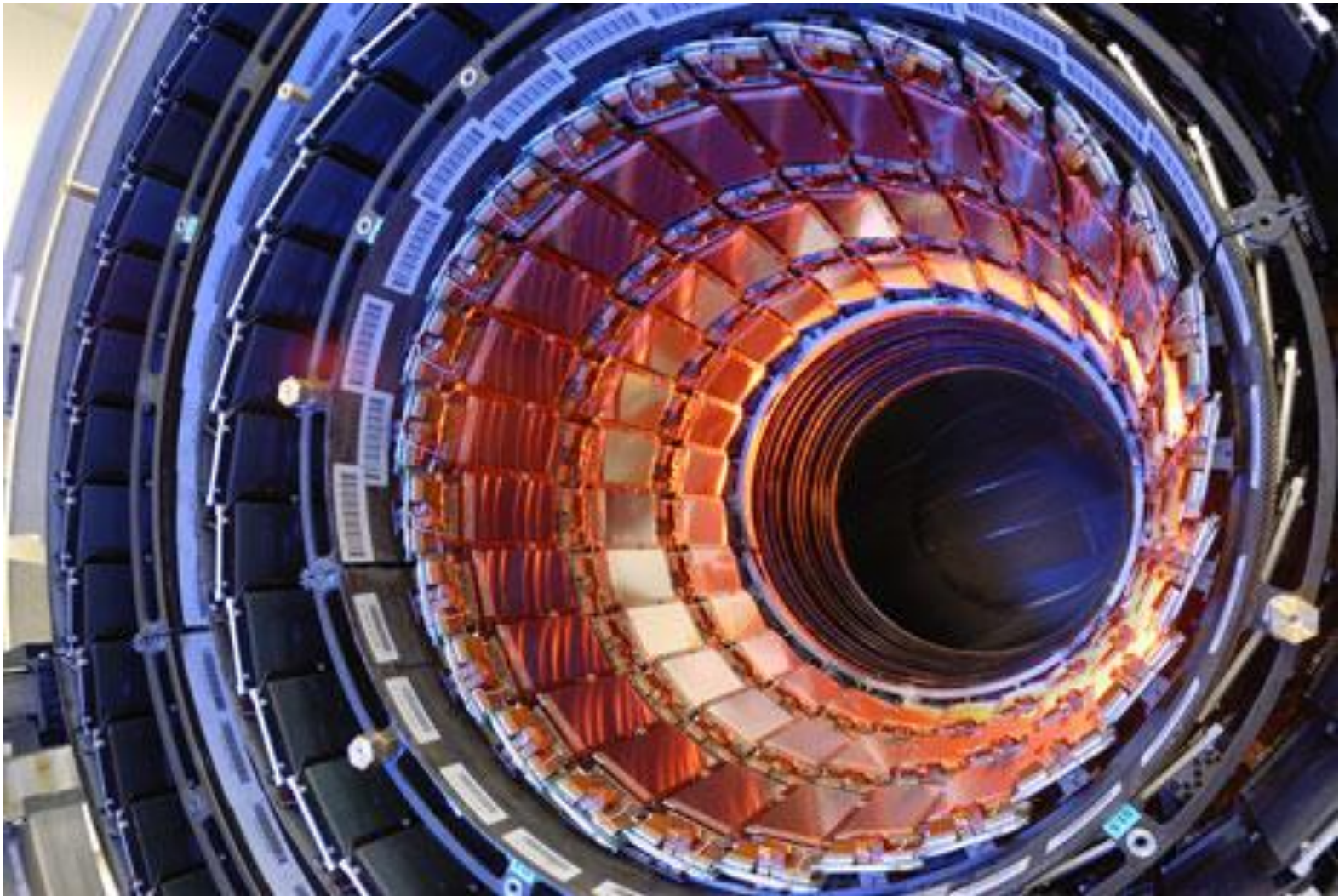
# acelerador de hadrones ... cont







# interior del colisionador de hadrones del CERN





## Metales, no metales y semi-metales

	1											18						
1	<b>H</b> 1.0079											<b>He</b> 4.0026						
2	<b>Li</b> 6.941	<b>Be</b> 9.0122											<b>B</b> 10.811	<b>C</b> 12.011	<b>N</b> 14.007	<b>O</b> 15.999	<b>F</b> 18.998	<b>Ne</b> 20.18
3	<b>Na</b> 22.99	<b>Mg</b> 24.305											<b>Al</b> 26.982	<b>Si</b> 28.086	<b>P</b> 30.974	<b>S</b> 32.066	<b>Cl</b> 35.453	<b>Ar</b> 39.948
4	<b>K</b> 39.098	<b>Ca</b> 40.078	<b>Sc</b> 44.956	<b>Ti</b> 47.88	<b>V</b> 50.941	<b>Cr</b> 51.996	<b>Mn</b> 54.938	<b>Fe</b> 55.847	<b>Co</b> 58.933	<b>Ni</b> 58.693	<b>Cu</b> 63.546	<b>Zn</b> 65.39	<b>Ga</b> 69.723	<b>Ge</b> 72.61	<b>As</b> 74.922	<b>Se</b> 78.96	<b>Br</b> 79.904	<b>Kr</b> 83.8
5	<b>Rb</b> 85.468	<b>Sr</b> 87.62	<b>Y</b> 88.906	<b>Zr</b> 91.224	<b>Nb</b> 92.906	<b>Mo</b> 95.94	<b>Tc</b> (97.91)	<b>Ru</b> 101.07	<b>Rh</b> 102.91	<b>Pd</b> 106.42	<b>Ag</b> 107.87	<b>Cd</b> 112.41	<b>In</b> 114.82	<b>Sn</b> 118.71	<b>Sb</b> 121.76	<b>Te</b> 127.6	<b>I</b> 126.9	<b>Xe</b> 131.29
6	<b>Cs</b> 132.91	<b>Ba</b> 137.33	<b>La</b> 138.91	<b>Hf</b> 178.49	<b>Ta</b> 180.95	<b>W</b> 183.84	<b>Re</b> 186.21	<b>Os</b> 190.23	<b>Ir</b> 192.22	<b>Pt</b> 195.08	<b>Au</b> 196.97	<b>Hg</b> 200.59	<b>Tl</b> 204.38	<b>Pb</b> 207.2	<b>Bi</b> 208.98	<b>Po</b> (209)	<b>At</b> (210)	<b>Rn</b> (222)
7	<b>Fr</b> (223)	<b>Ra</b> (226)	<b>Ac</b> (227)	<b>Rf</b> (261.1)	<b>Db</b> (262.1)	<b>Sg</b> (263.1)	<b>Bh</b> (262.1)	<b>Hs</b> (265.1)	<b>Mt</b> (266.1)	<b>Uun</b> (269)	<b>Uuu</b> (272)	<b>Uub</b> (277)						

Lanthanide Series	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	<b>Ce</b>	<b>Pr</b>	<b>Nd</b>	<b>Pm</b>	<b>Sm</b>	<b>Eu</b>	<b>Gd</b>	<b>Tb</b>	<b>Dy</b>	<b>Ho</b>	<b>Er</b>	<b>Tm</b>	<b>Yb</b>	<b>Lu</b>
	140.12	140.91	144.24	(144.9)	150.36	151.97	157.25	158.93	162.5	164.93	167.26	168.93	173.04	174.97
Actinide Series	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	<b>Th</b>	<b>Pa</b>	<b>U</b>	<b>Np</b>	<b>Pu</b>	<b>Am</b>	<b>Cm</b>	<b>Bk</b>	<b>Cf</b>	<b>Es</b>	<b>Fm</b>	<b>Md</b>	<b>No</b>	<b>Lr</b>
	232.04	231.04	238.03	(237)	(244.1)	(243.1)	(247.1)	(247.1)	(251.1)	(252.1)	(257.1)	(258.1)	(259.1)	(262.1)



# Los grupos

1	1											18						
1	<b>H</b> 1.0079																	2
2	<b>Li</b> 6.941	<b>Be</b> 9.0122											<b>B</b> 10.811	<b>C</b> 12.011	<b>N</b> 14.007	<b>O</b> 15.999	<b>F</b> 18.998	<b>Ne</b> 20.18
3	<b>Na</b> 22.99	<b>Mg</b> 24.305											<b>Al</b> 26.982	<b>Si</b> 28.086	<b>P</b> 30.974	<b>S</b> 32.066	<b>Cl</b> 35.453	<b>Ar</b> 39.948
4	<b>K</b> 39.098	<b>Ca</b> 40.078	<b>Sc</b> 44.956	<b>Ti</b> 47.88	<b>V</b> 50.941	<b>Cr</b> 51.996	<b>Mn</b> 54.938	<b>Fe</b> 55.847	<b>Co</b> 58.933	<b>Ni</b> 58.693	<b>Cu</b> 63.546	<b>Zn</b> 65.39	<b>Ga</b> 69.723	<b>Ge</b> 72.61	<b>As</b> 74.922	<b>Se</b> 78.96	<b>Br</b> 79.904	<b>Kr</b> 83.8
5	<b>Rb</b> 85.468	<b>Sr</b> 87.62	<b>Y</b> 88.906	<b>Zr</b> 91.224	<b>Nb</b> 92.906	<b>Mo</b> 95.94	<b>Tc</b> (97.91)	<b>Ru</b> 101.07	<b>Rh</b> 102.91	<b>Pd</b> 106.42	<b>Ag</b> 107.87	<b>Cd</b> 112.41	<b>In</b> 114.82	<b>Sn</b> 118.71	<b>Sb</b> 121.76	<b>Te</b> 127.6	<b>I</b> 126.9	<b>Xe</b> 131.29
6	<b>Cs</b> 132.91	<b>Ba</b> 137.33	<b>La</b> 138.91	<b>Hf</b> 178.49	<b>Ta</b> 180.95	<b>W</b> 183.84	<b>Re</b> 186.21	<b>Os</b> 190.23	<b>Ir</b> 192.22	<b>Pt</b> 195.08	<b>Au</b> 196.97	<b>Hg</b> 200.59	<b>Tl</b> 204.38	<b>Pb</b> 207.2	<b>Bi</b> 208.98	<b>Po</b> (209)	<b>At</b> (210)	<b>Rn</b> (222)
7	<b>Fr</b> (223)	<b>Ra</b> (226)	<b>Ac</b> (227)	<b>Rf</b> (261.1)	<b>Db</b> (262.1)	<b>Sg</b> (263.1)	<b>Bh</b> (262.1)	<b>Hs</b> (265.1)	<b>Mt</b> (266.1)	<b>Uun</b> (269)	<b>Uuu</b> (272)	<b>Uub</b> (277)						

Lanthanide Series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
<b>Ce</b>	<b>Pr</b>	<b>Nd</b>	<b>Pm</b>	<b>Sm</b>	<b>Eu</b>	<b>Gd</b>	<b>Tb</b>	<b>Dy</b>	<b>Ho</b>	<b>Er</b>	<b>Tm</b>	<b>Yb</b>	<b>Lu</b>
140.12	140.91	144.24	(144.9)	150.36	151.97	157.25	158.93	162.5	164.93	167.26	168.93	173.04	174.97

Actinide Series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
<b>Th</b>	<b>Pa</b>	<b>U</b>	<b>Np</b>	<b>Pu</b>	<b>Am</b>	<b>Cm</b>	<b>Bk</b>	<b>Cf</b>	<b>Es</b>	<b>Fm</b>	<b>Md</b>	<b>No</b>	<b>Lr</b>
232.04	231.04	238.03	(237)	(244.1)	(243.1)	(247.1)	(247.1)	(251.1)	(252.1)	(257.1)	(258.1)	(259.1)	(262.1)






# Metales Alcalinos

1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



# Metales alcalinotérreos



1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



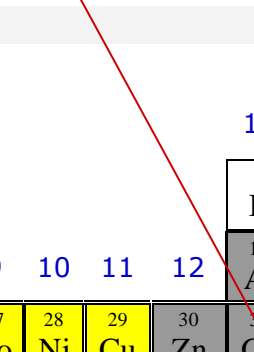
# Metales de transición

1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



# Metales post-transicionales

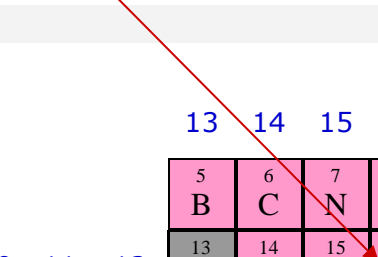


1																	18			
1 H	2														13 B	14 C	15 N	16 O	17 F	18 Ne
3 Li	4 Be											11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr			
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe			
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn			
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu			

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



# Calcógenos



1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



# Halógenos

1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



# Gases nobles

1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



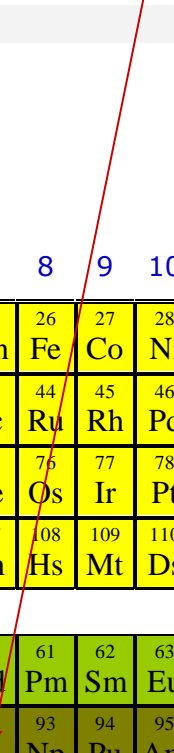


# Lantanoideos

1																	18
1 H	2											13	14	15	16	17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu			
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr			



# Actinoides

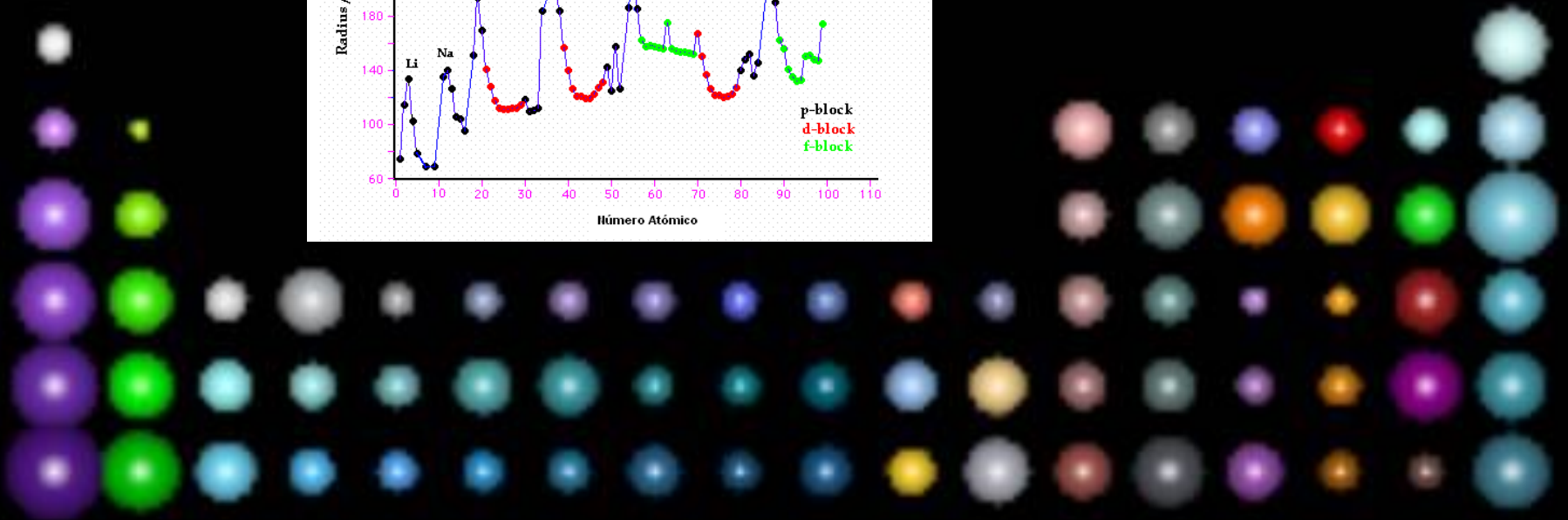
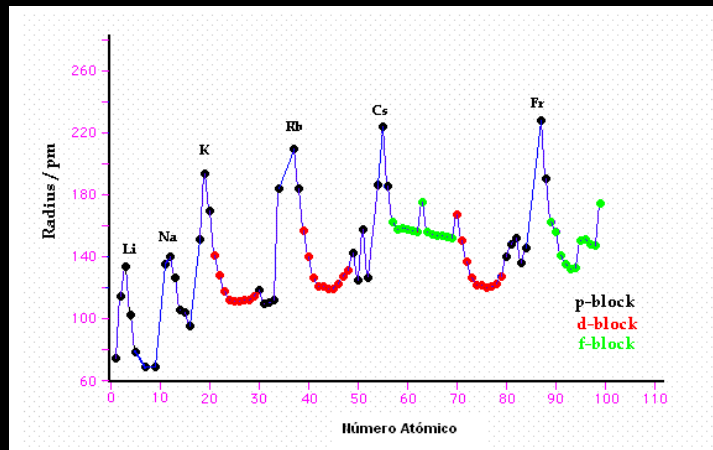


1																	18
1 H	2											13	14	15	16	17	2
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uuu	113 Uuu	114 Uuu	115 Uuu	116 Uuu	117 Uuu	118 Uuu
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu			
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr			



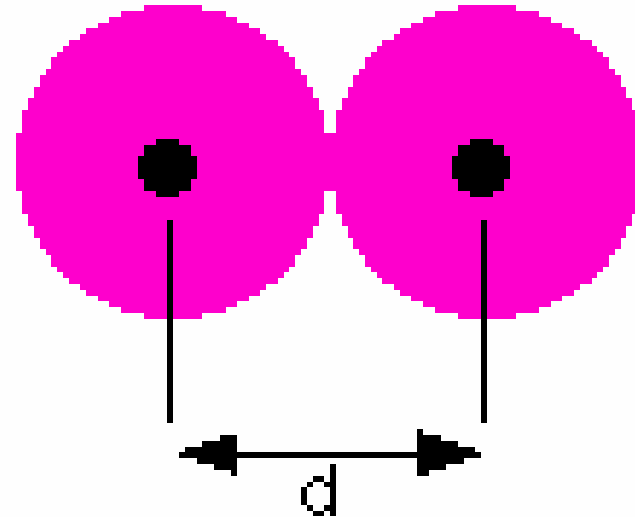
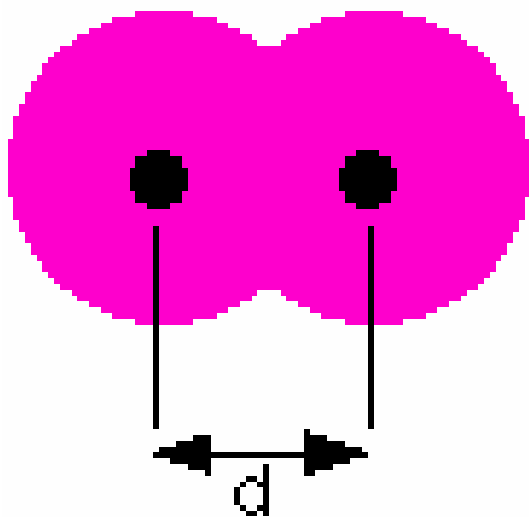


# Radios atómicos





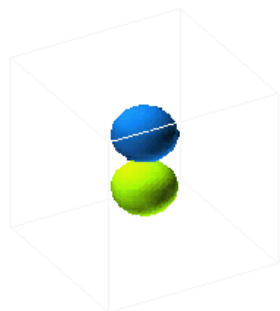
# Radio covalente vs radio de Van der Waals



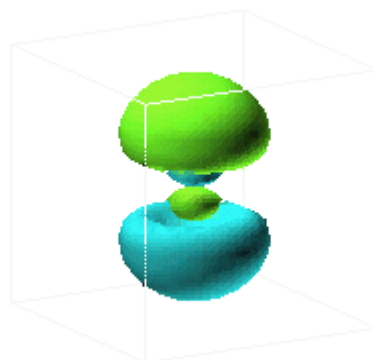
**radio =  $d/2$**



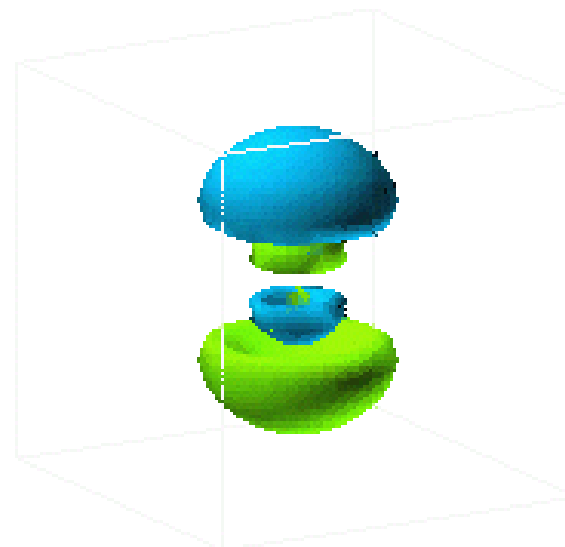
# Tamaño orbital



$2p$



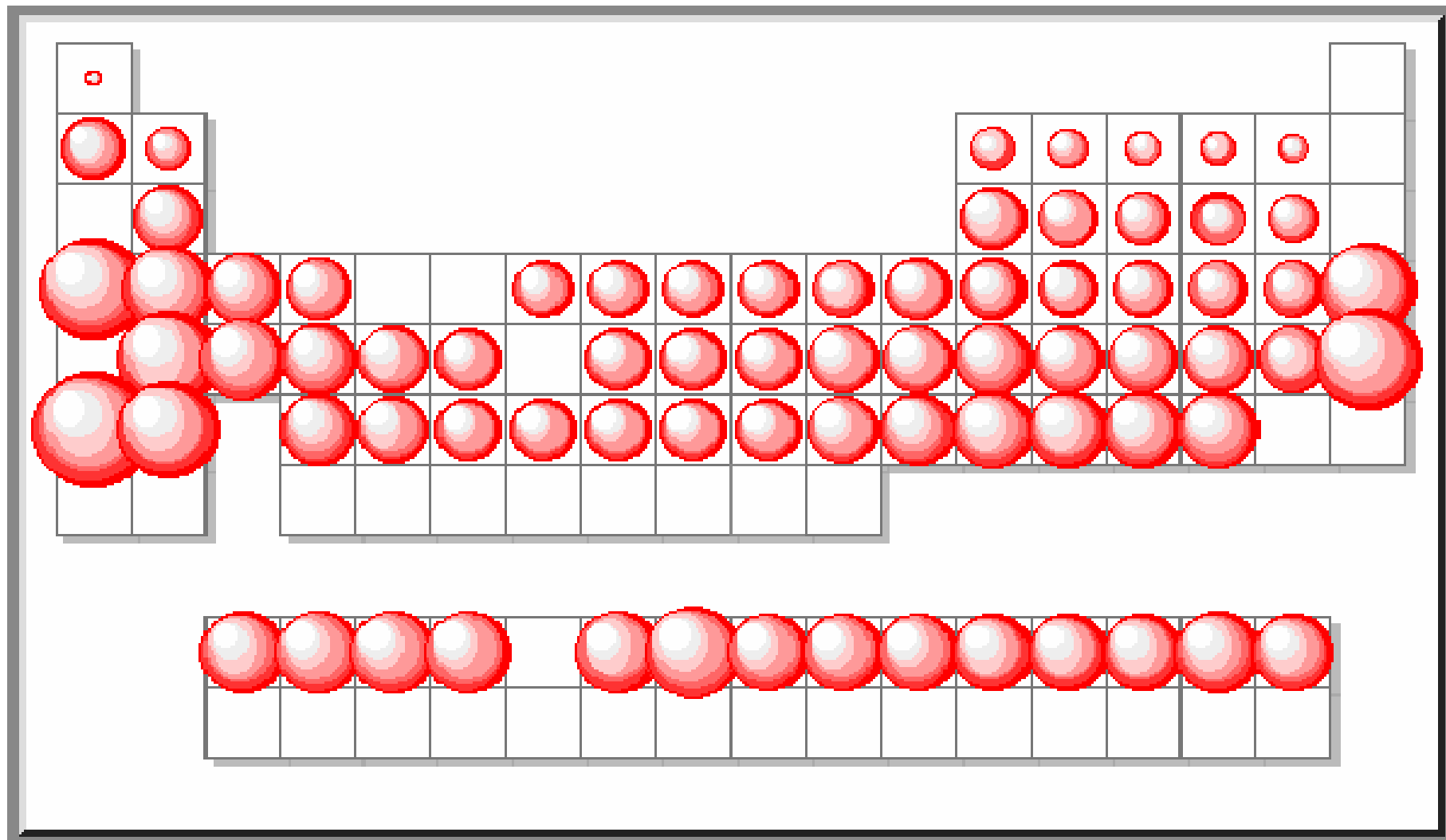
$3p$

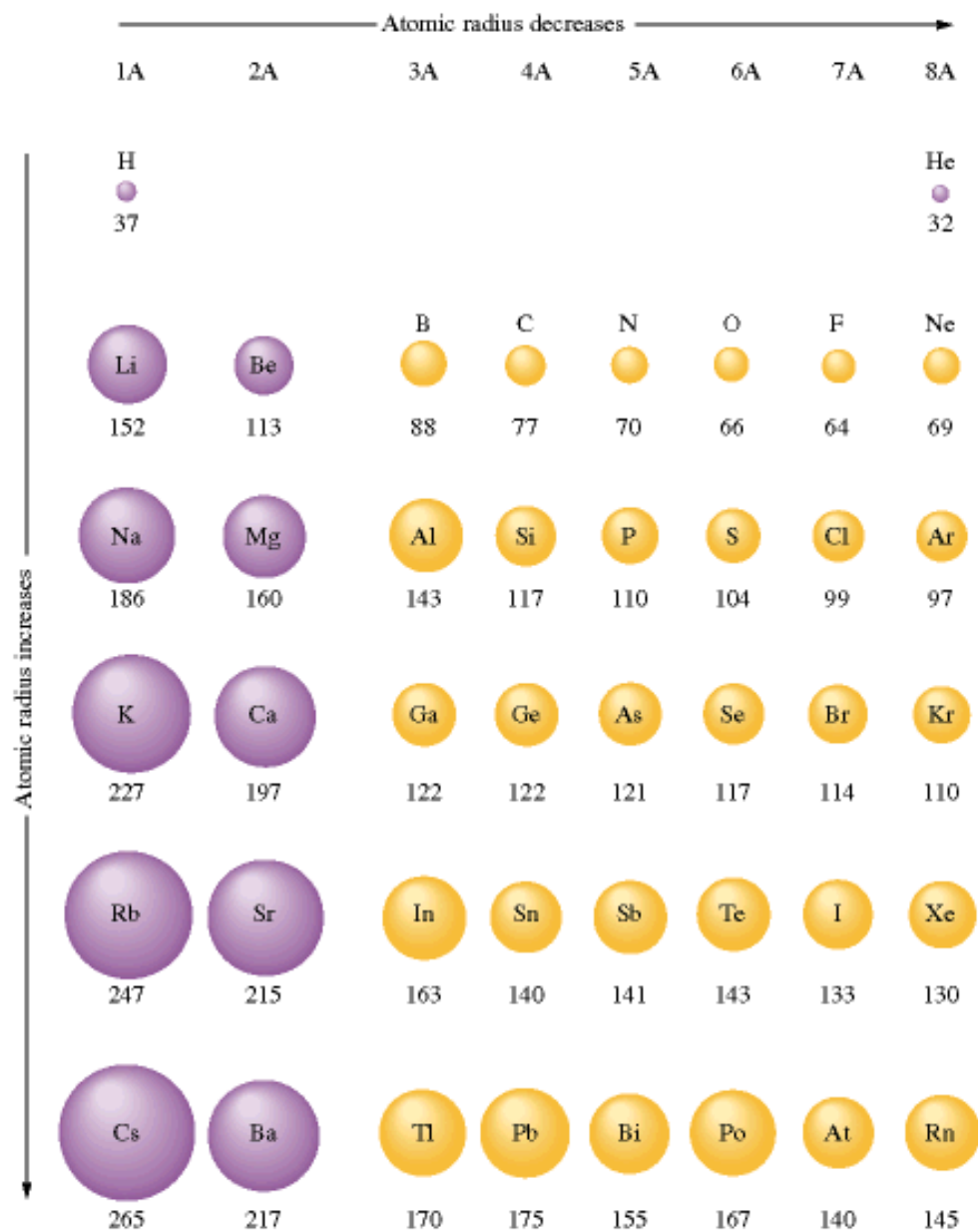


$4p$



# Radios covalentes





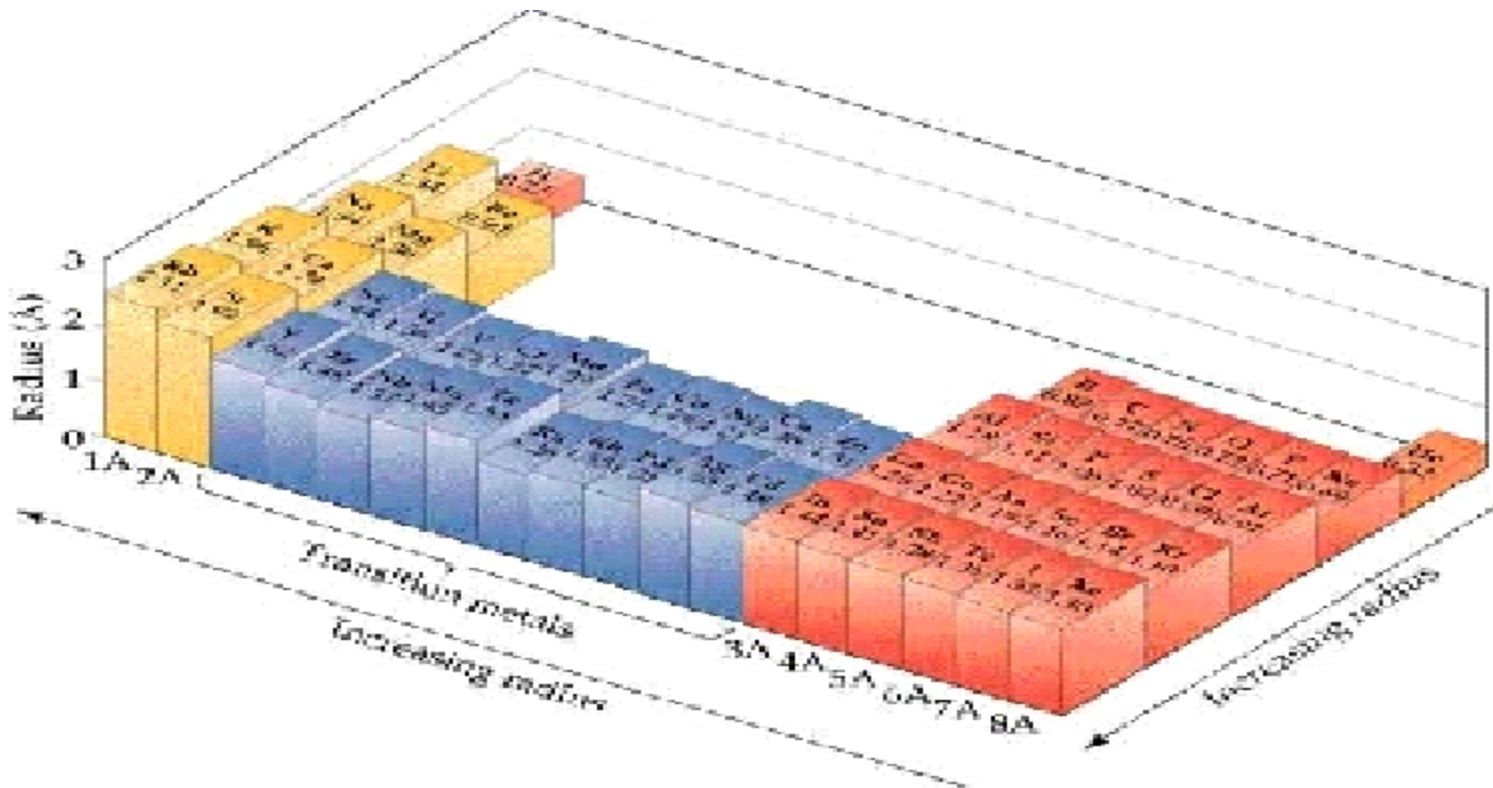
## Tamaño atómico



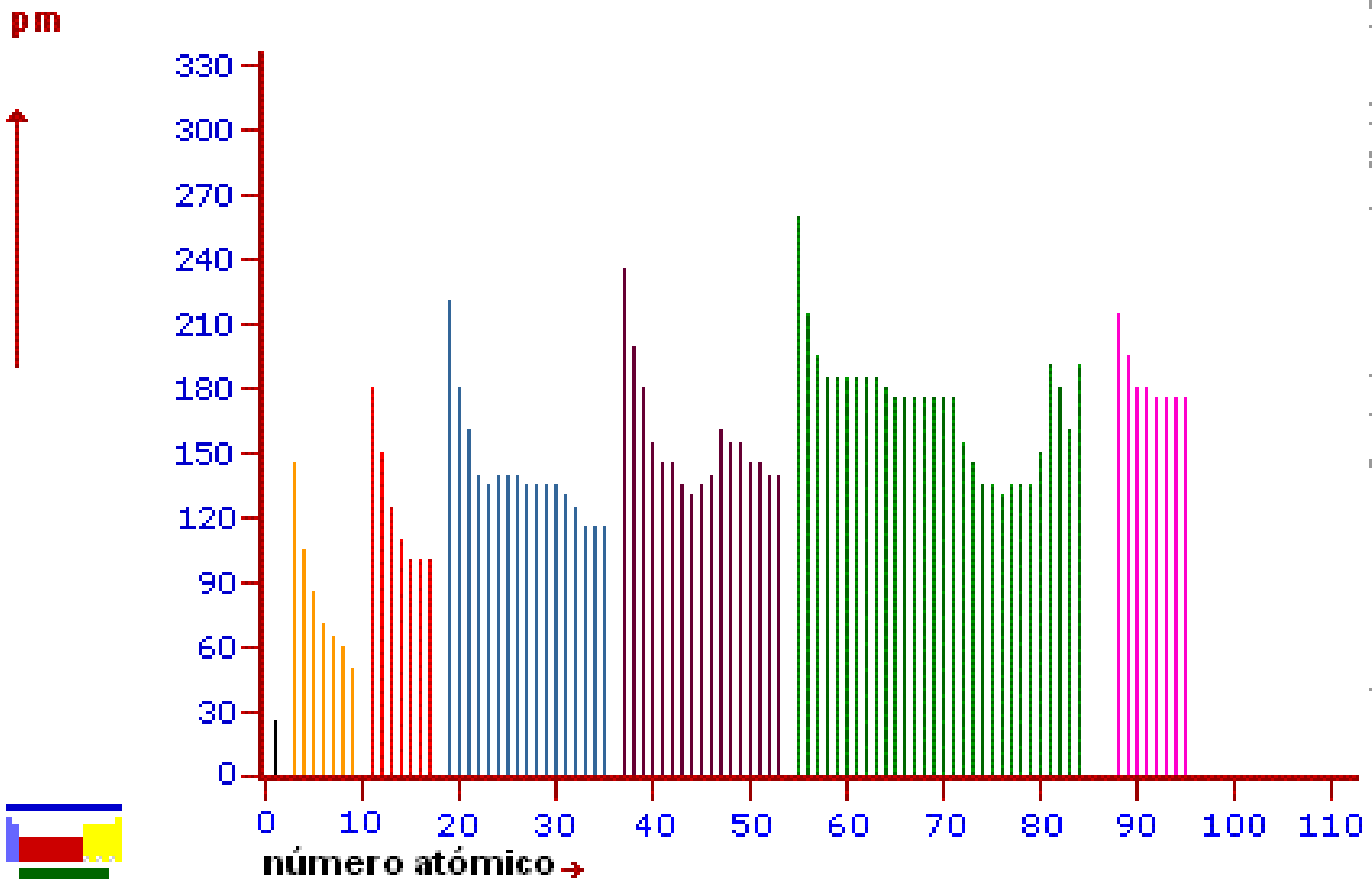




# Radios atómicos...cont.

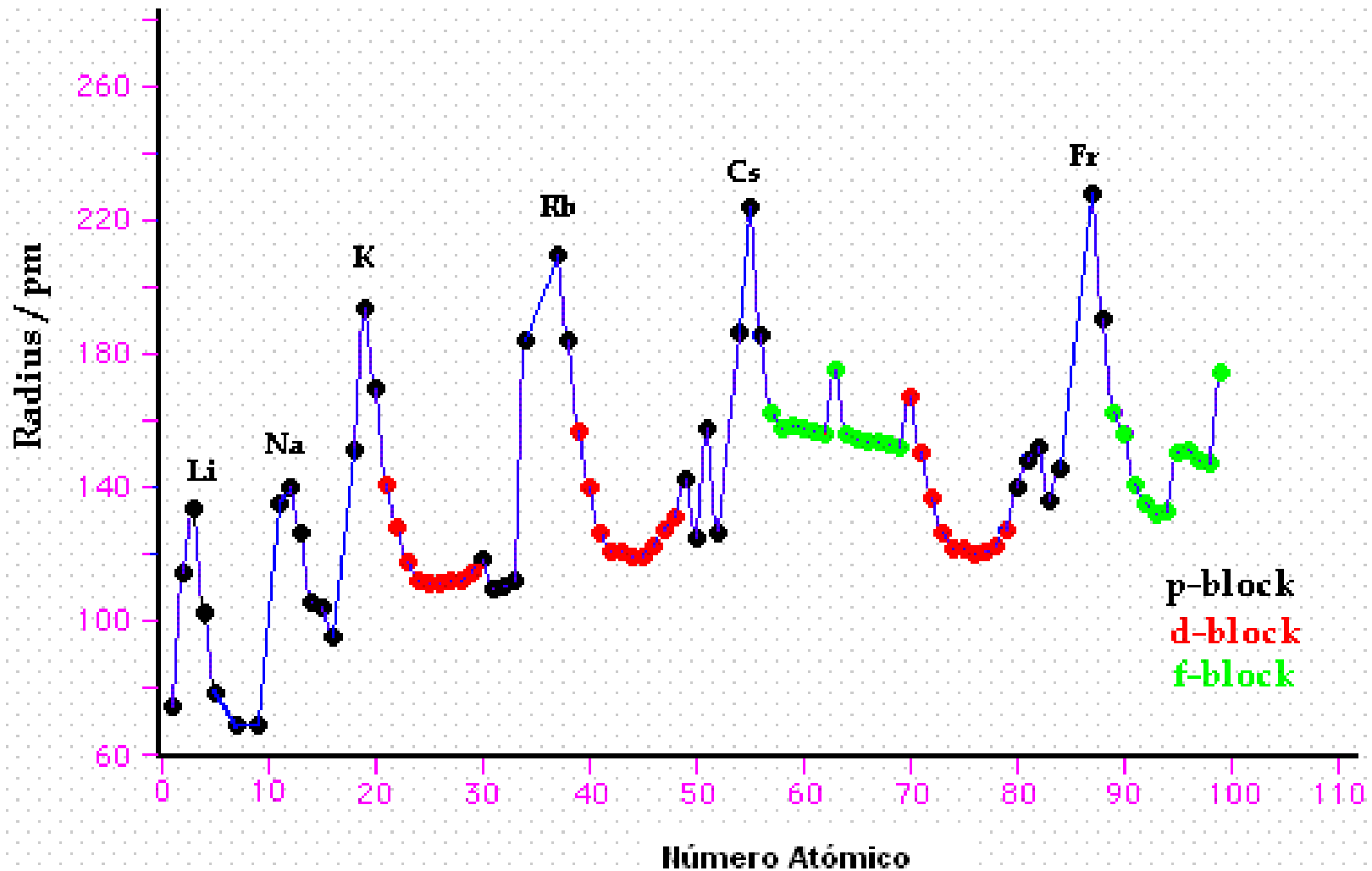


## Radio atómico experimental (pm) en función del número atómico.



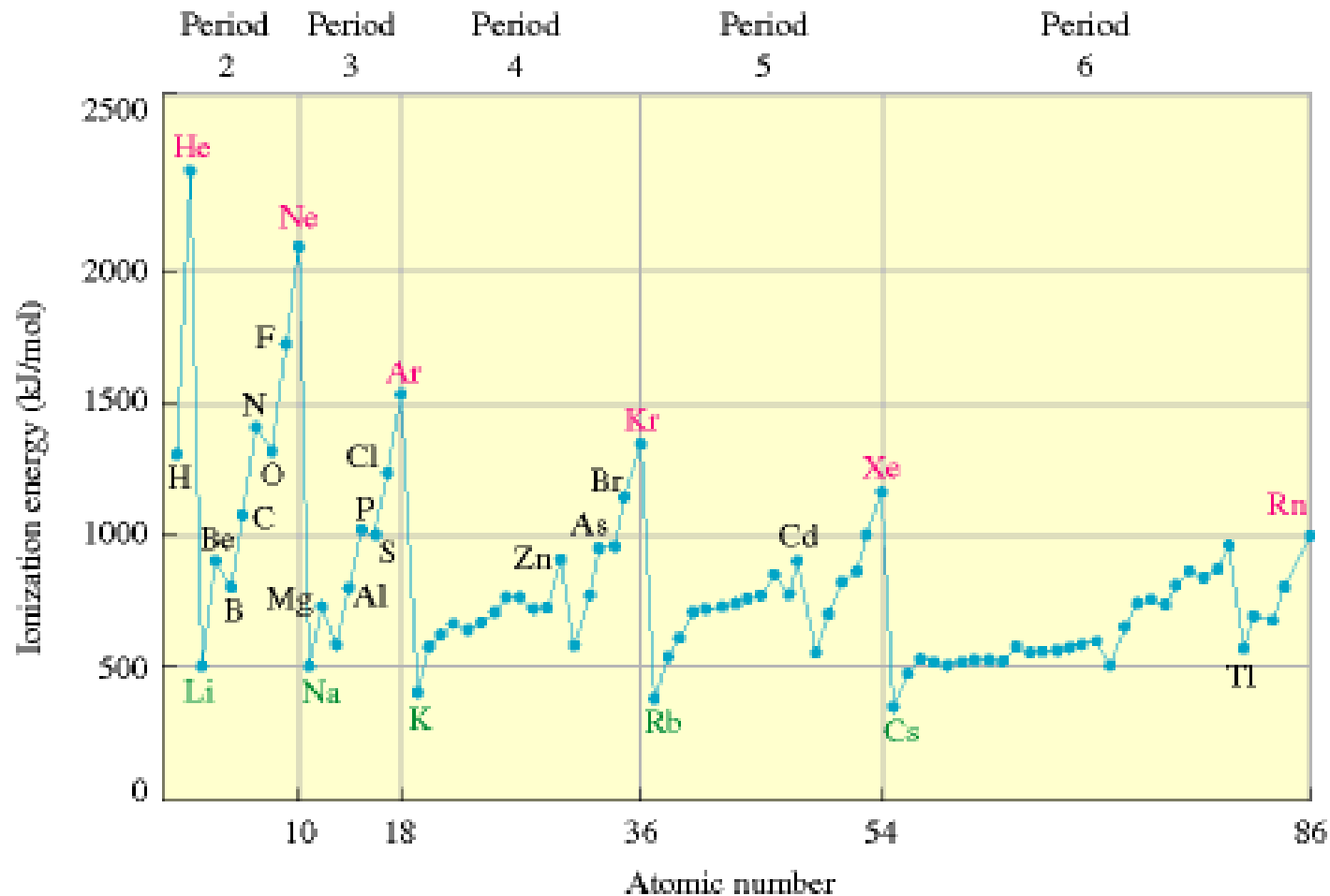
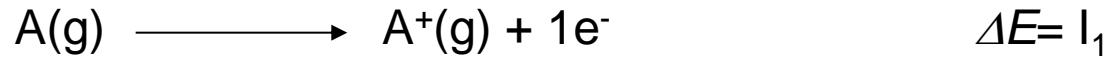


# Radios atómicos...cont.



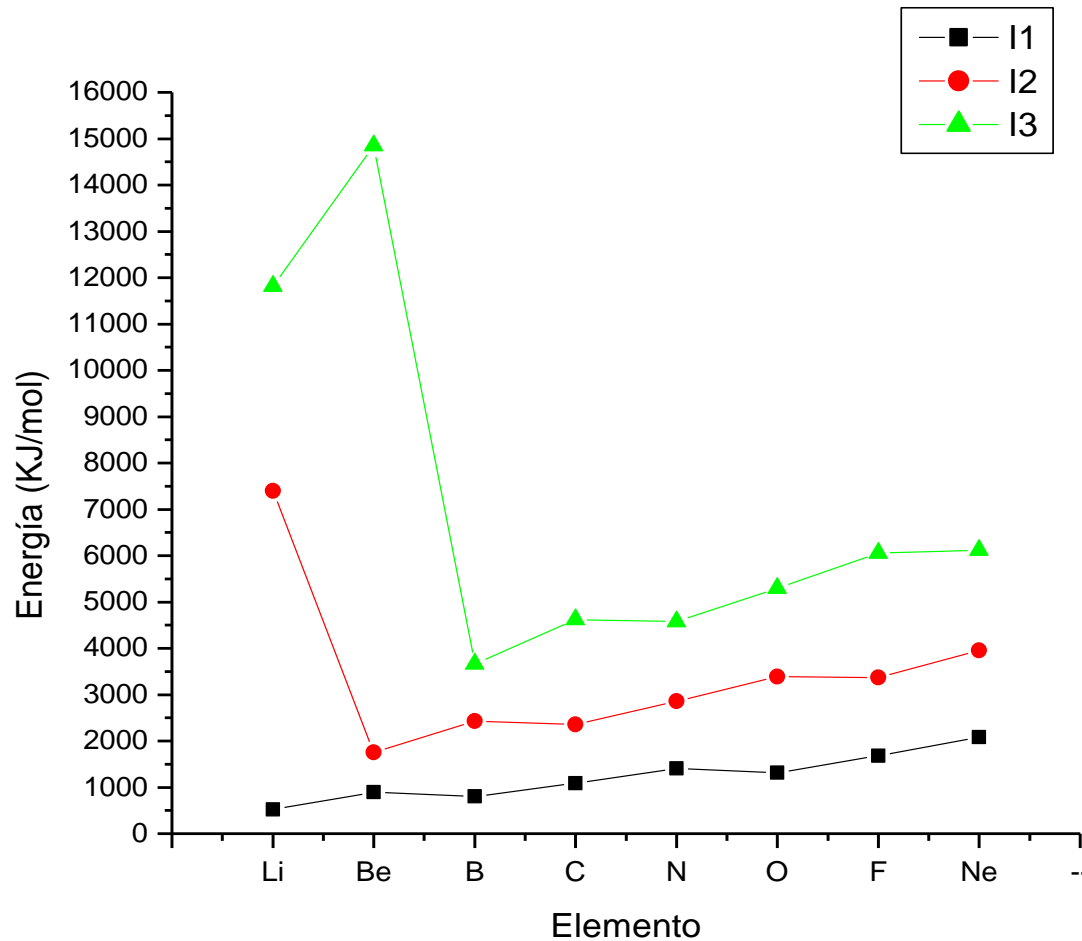


# Energía de ionización





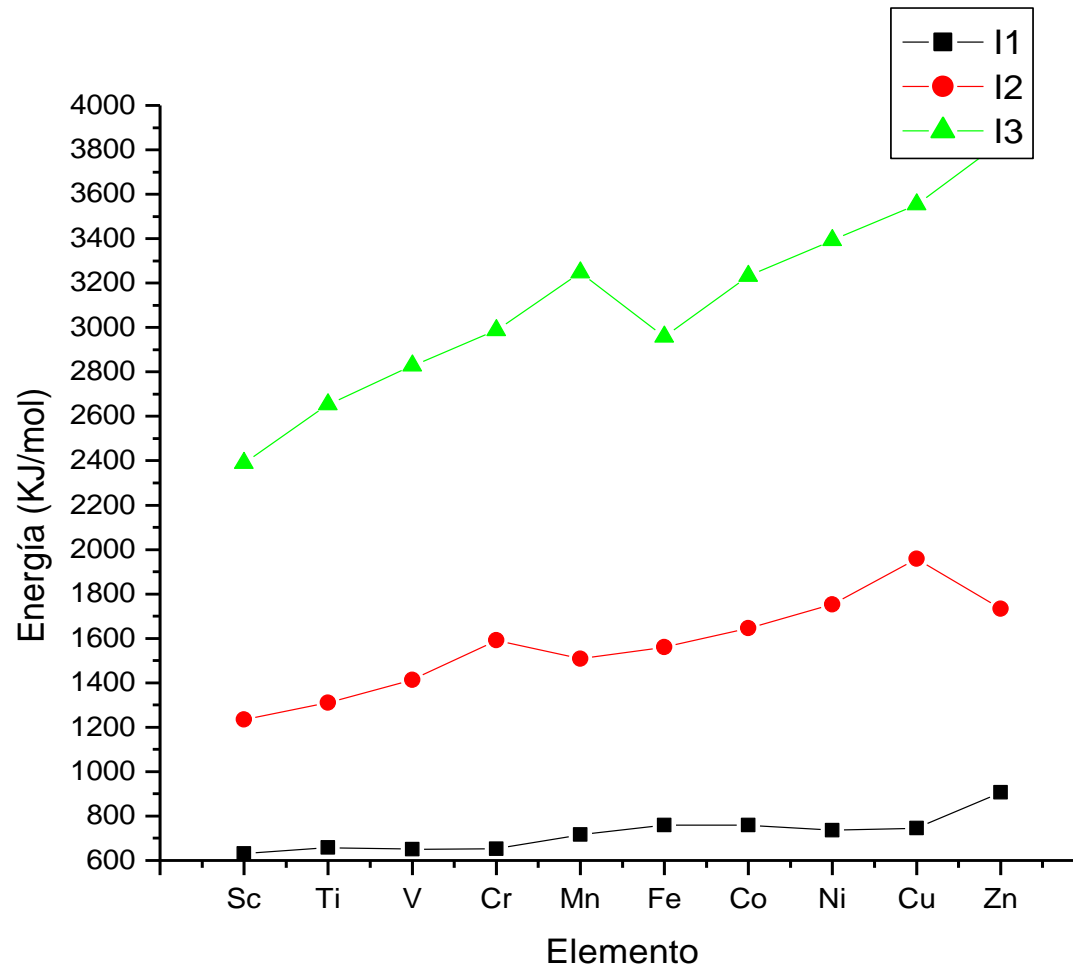
# 2o período: $I_1$ , $I_2$ e $I_3$





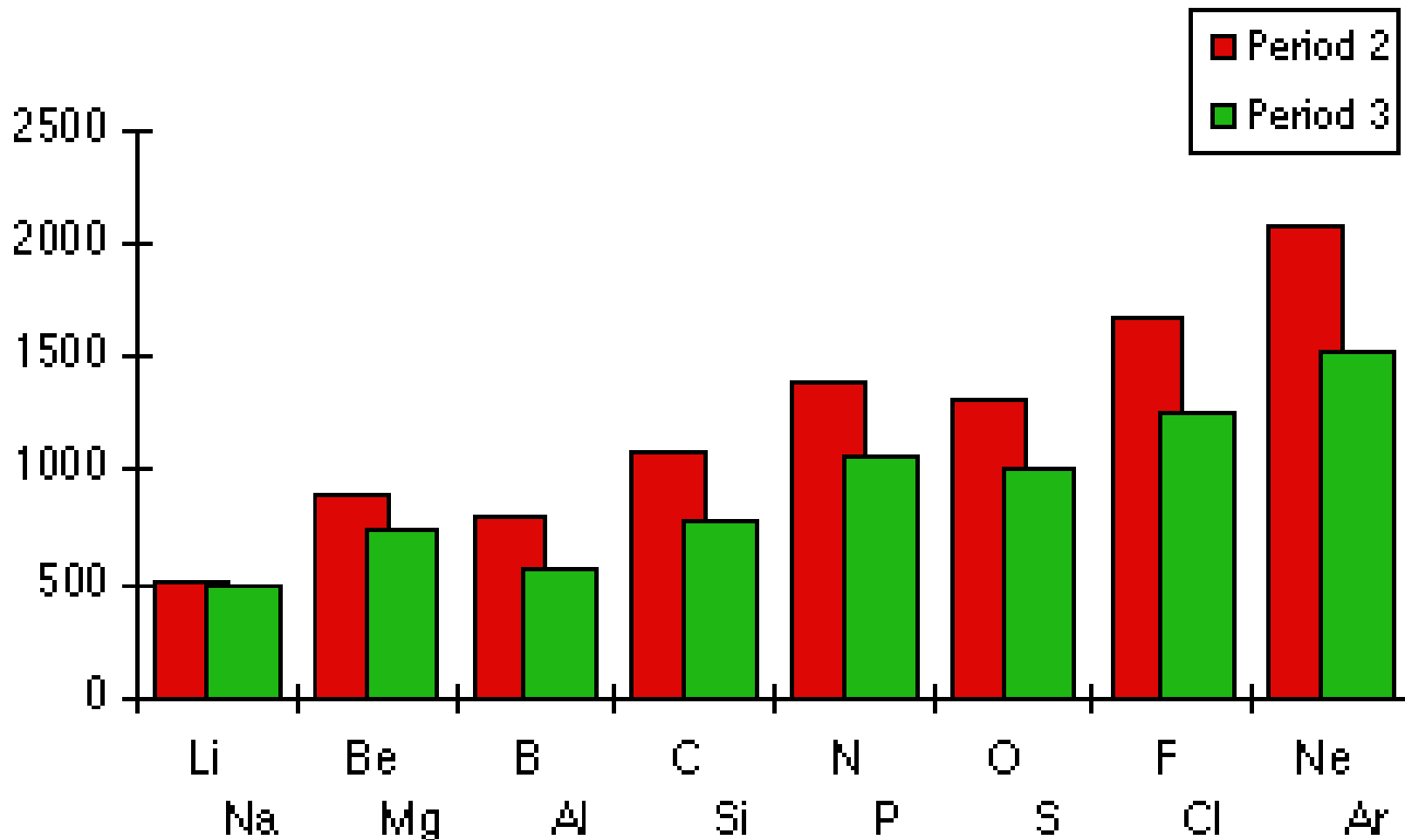


# 1a serie de transición: $I_1$ , $I_2$ e $I_3$





## First ionisation energies (kJ per mole)



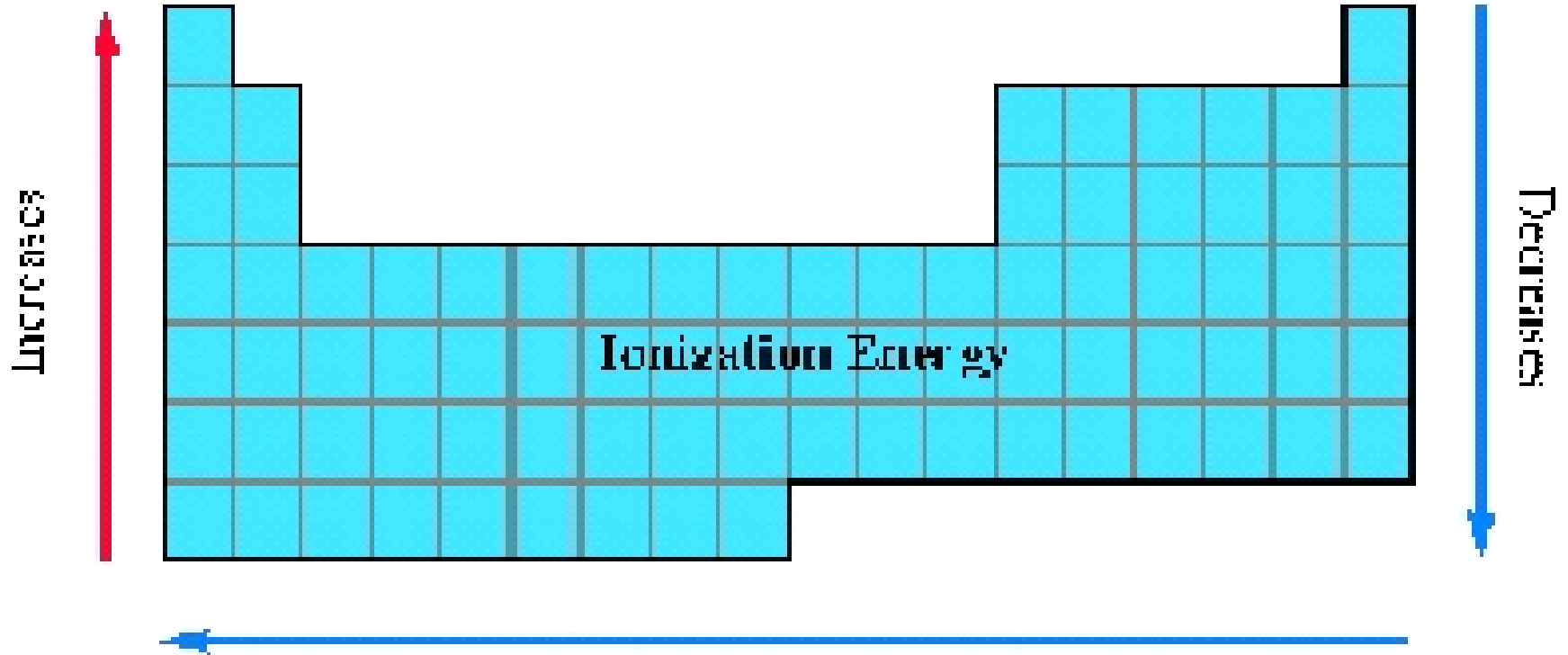






# Tendencias en $I_1$

Increases



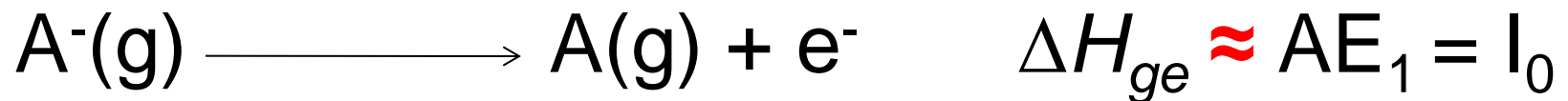
Decreases



# También la afinidad electrónica presenta variaciones periódicas

Para empezar, ¿Qué es la afinidad electrónica?

Es la energía involucrada en el siguiente proceso:







# Afinidad electrónica

**Table 6.9** Electron Affinities of the Elements (kJ/mol) (Zeroth Ionization Energies of the  $-1$  Ions of the Elements)

$s^1$	$s^2$	$s^2p^1$											$s^2p^2$	$s^2p^3$	$s^2p^4$	$s^2p^5$	$s^2p^6$	
1	H 73																	
2	He 0	Li 60	Be 0											B 27	C 122	N -7	O 141	F 328
3	Ne 0	Na 53	Mg 0											Al 44	Si 134	P 72	S 200	Cl 349
4	Ar 0	K 48	Ca 0	Sc 0	Ti 20	V 50	Cr 64	Mn 0	Fe 24	Co 70	Ni 111	Cu 118	Zn 0	Ga 29	Ge 120	As 77	Se 195	Br 325
5	Kr 0	Rb 47	Sr 0	Y 0	Zr 50	Nb 100	Mo 100	Tc 70	Ru 110	Rh 120	Pd 60	Ag 126	Cd 0	In 29	Sn 121	Sb 101	Te 190	I 295
6	Xe 0	Cs 46	Ba 0	Lu 50	Hf 0	Ta 60	W 60	Re 15	Os 110	Ir 160	Pt 205	Au 223	Hg 0	Tl 30	Pb 110	Bi 110	Po 180	At 270

$$AE_2(O) = I_{-1}(O) = -744 \text{ kJ mol}^{-1}$$

$$AE_2(S) = I_{-1}(S) = -456 \text{ kJ mol}^{-1}$$

Tabla tomada de tu libro de texto  
de G. Wulfsberg



# no todos están de acuerdo

Li -60	Be 0	B -26	C -154	N -7	O -141	F -328	Ne 0
Na -53							
K -48							
Rb -47							
Cs -46							

**Figura 2.14** Afinidades electrónicas ( $\text{kJ}\cdot\text{mol}^{-1}$ ) de un grupo y un periodo representativos.

Tabla tomada de tu libro de texto  
**G. Rayner-Canham**



# Electronegatividad de Pauling $\chi_p$



$$E_{AB} = \frac{1}{2}(E_{AA} + E_{BB}) + \Delta$$

$$E_{AB} = (E_{AA} \cdot E_{BB})^{1/2} + \Delta'$$

$$(\Delta)^{1/2} = K(\chi_A - \chi_B)$$

Existen muchas otras escalas de electronegatividad: Mulliken, Sanderson, Allred-Rochow, etc.



# Variaciones en $\chi_p$

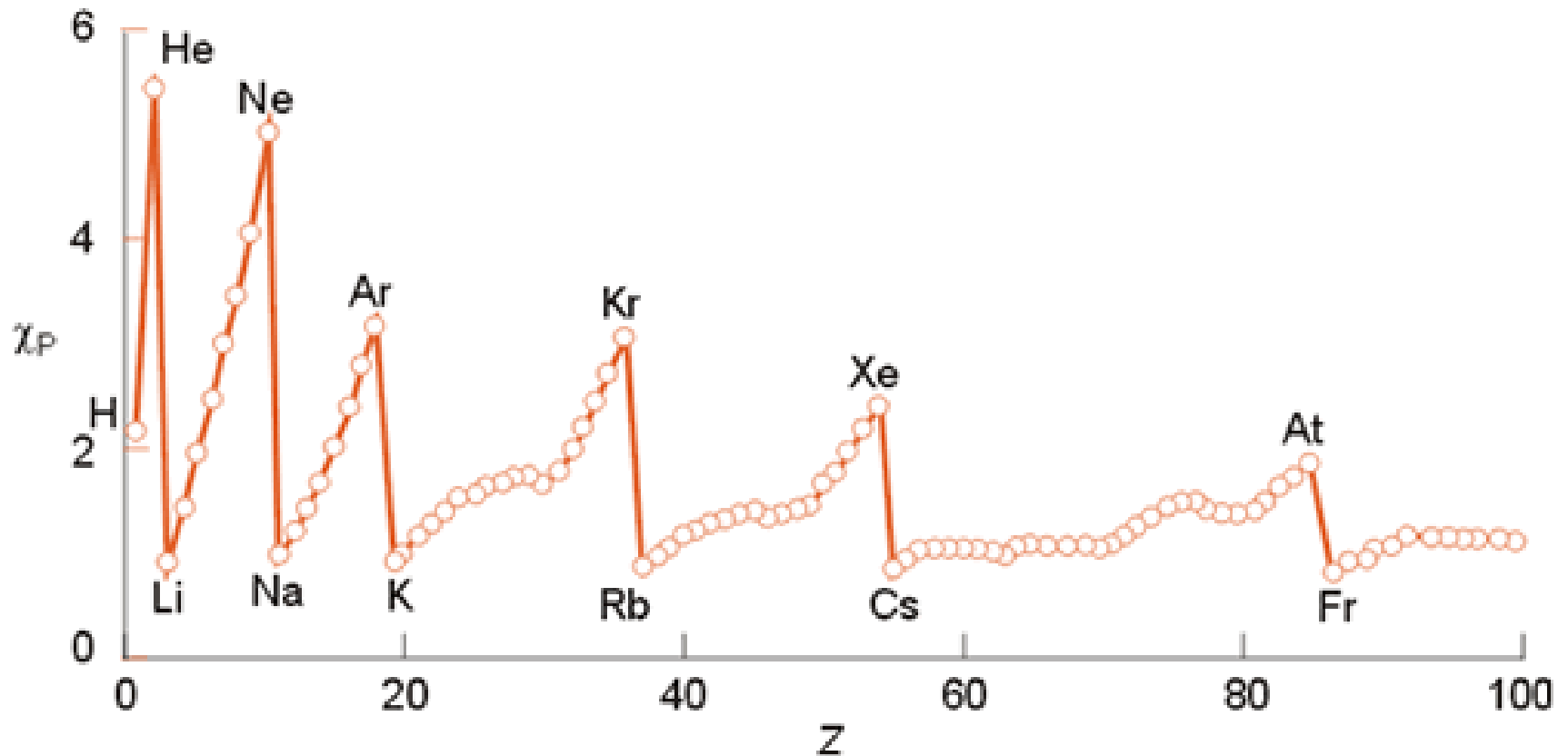
H 2.2															He						
Li 0.98	Be 1.57	Hard acids						Hard acids						B 2.04	Borderline bases C 2.55		N 3.04	Hard bases O 3.44   F 3.98		Ne	
Na 0.93	Mg 1.31															Al 1.61	Si 1.90	P 2.19	S 2.58	Cl 3.16	Ar
K 0.82	Ca 1.00	Sc 1.36	Ti 1.54	V 1.63	Cr 1.66	Mn 1.55	Fe(+3) 1.83(+2)	Co(+3) 1.88(+2)	Ni 1.91	Cu(+1) 2.0	Zn 1.65	Ga 1.81	Ge 2.01	As 2.18	Se 2.55	Br 2.96	Kr 3.0				
Rb 0.82	Sr 0.95	Y 1.22	Zr 1.33	Nb 1.6	Mo 2.16?	Tc 1.9?	Ru 2.2	Rh (+3) 2.28	Pd (+1) 2.20	Ag 1.93	Cd 1.69	In(+3) 1.78(+1)	Sn(+4) 1.96(+2)	Sb 2.05	Te 2.1	I 2.66	Xe 2.6				
Cs 0.79	Ba 0.89	Lu 1.27	Hf 1.3	Ta 1.5	W 2.36?	Re 1.9?	Os 2.2	Ir (+3) 2.2	Pt (+1) 2.28	Au 2.54	Hg 2.0	Tl (+1)1.60 (+3)2.04	Pb (+2)1.87 (+4)2.33	Bi 2.02							
Fr 0.7	Ra 0.9															Soft acids					
																Borderline acids					
		La 1.10	Ce 1.12	Pr 1.13	Nd 1.14	Pm	Sm 1.17	Eu	Gd 1.20	Tb	Dy 1.22	Ho 1.25	Er 1.24	Tm 1.25	Yb						
		Ac 1.1	Th 1.3	Pa 1.5	U 1.38	Np 1.36	Pu 1.28	Am 1.3	Cm 1.3	Bk 1.3	Cf 1.3	Es 1.3	Fm 1.3	Md 1.3	No 1.3						
																Hard acids					

Most often seen as Lewis bases

NOTES: Numbers in parentheses are oxidation numbers. The number below each atomic symbol is the Pauling electronegativity of that element.



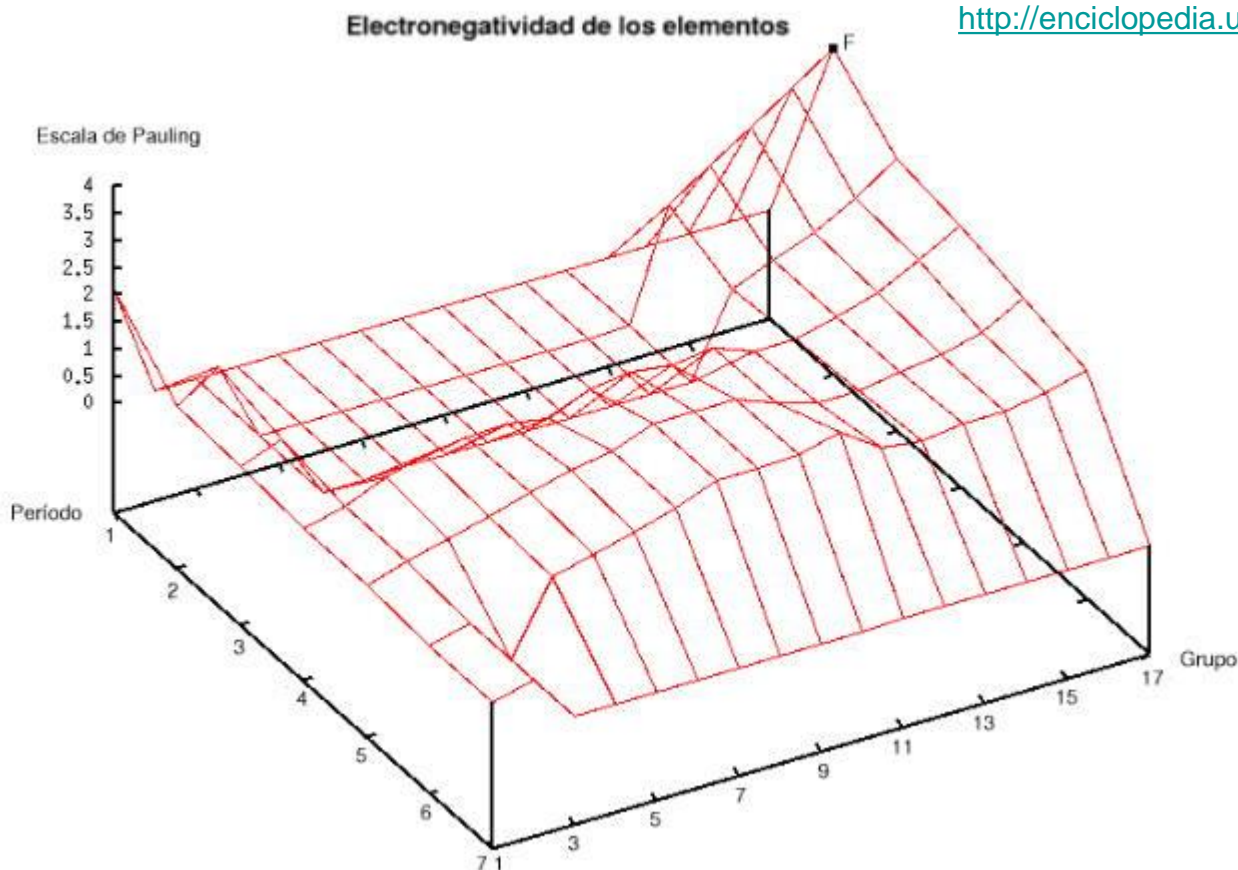
# Electronegatividad...cont.



<http://www.textoscientificos.com/quimica/inorganica/electronegatividad>



# La electronegatividad en la tabla periódica



Una amplia discusión sobre electronegatividad y las diferentes escalas propuestas pueden encontrarla en el capítulo 5 del libro “Inorganic Chemistry”, 4th ed. de James E. Huheey, páginas 182 a 199.



# Propiedades termodinámicas

- Energía y entropía
- Energía libre y espontaneidad
- Algunas entalpías importantes:

$\Delta H_f$  entalpía de formación

$\Delta H_r$  entalpía de reacción

$E_{AB}$  energía de enlace y  $\Delta H_{dis}$  entalpía de disociación

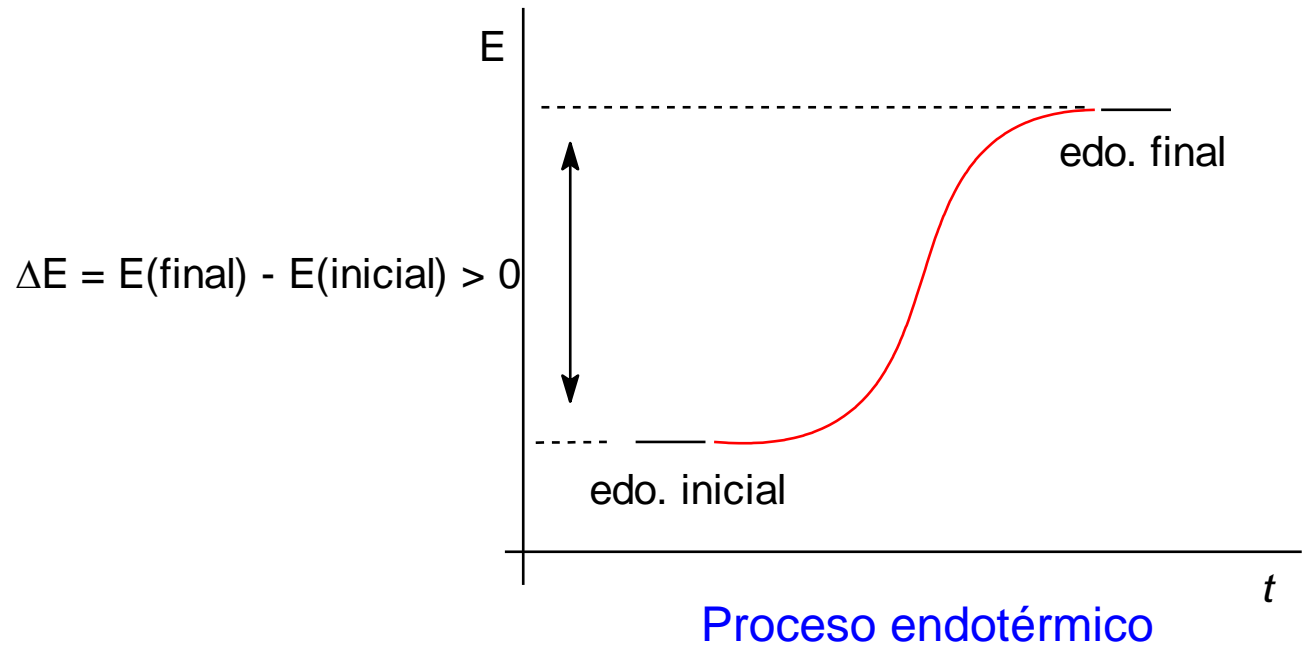
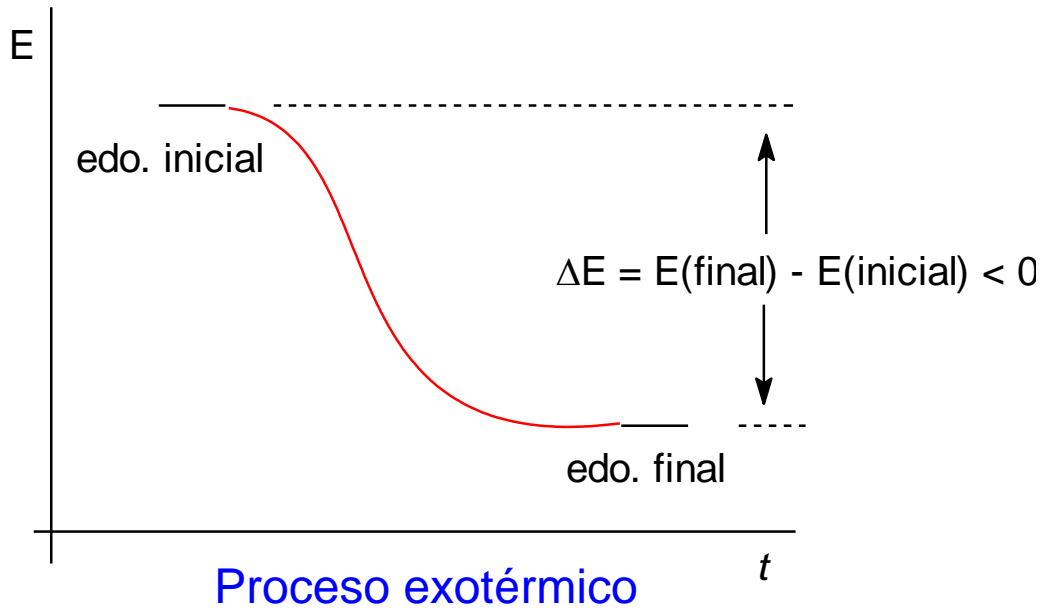
$\Delta H_{at}$  entalpía de atomización

$\Delta H_{hid}$  entalpía de hidratación

$U_0$  energía de red cristalina

$$H = U + pV = q_p$$







# Energía libre de Gibbs

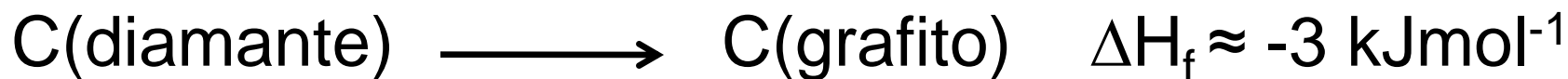
$$\Delta G = \Delta H - T\Delta S$$

$\Delta H$	$\Delta S$	$\Delta G$	Obs.
$< 0$	$> 0$	$< 0$	Proceso espontáneo
$> 0$	$< 0$	$> 0$	Proceso no espontáneo
$> 0$	$> 0$	$< 0$ (si T es alta)	Espontáneo a Ts altas
$< 0$	$< 0$	$< 0$ (si T es baja)	Espontáneo a Ts bajas



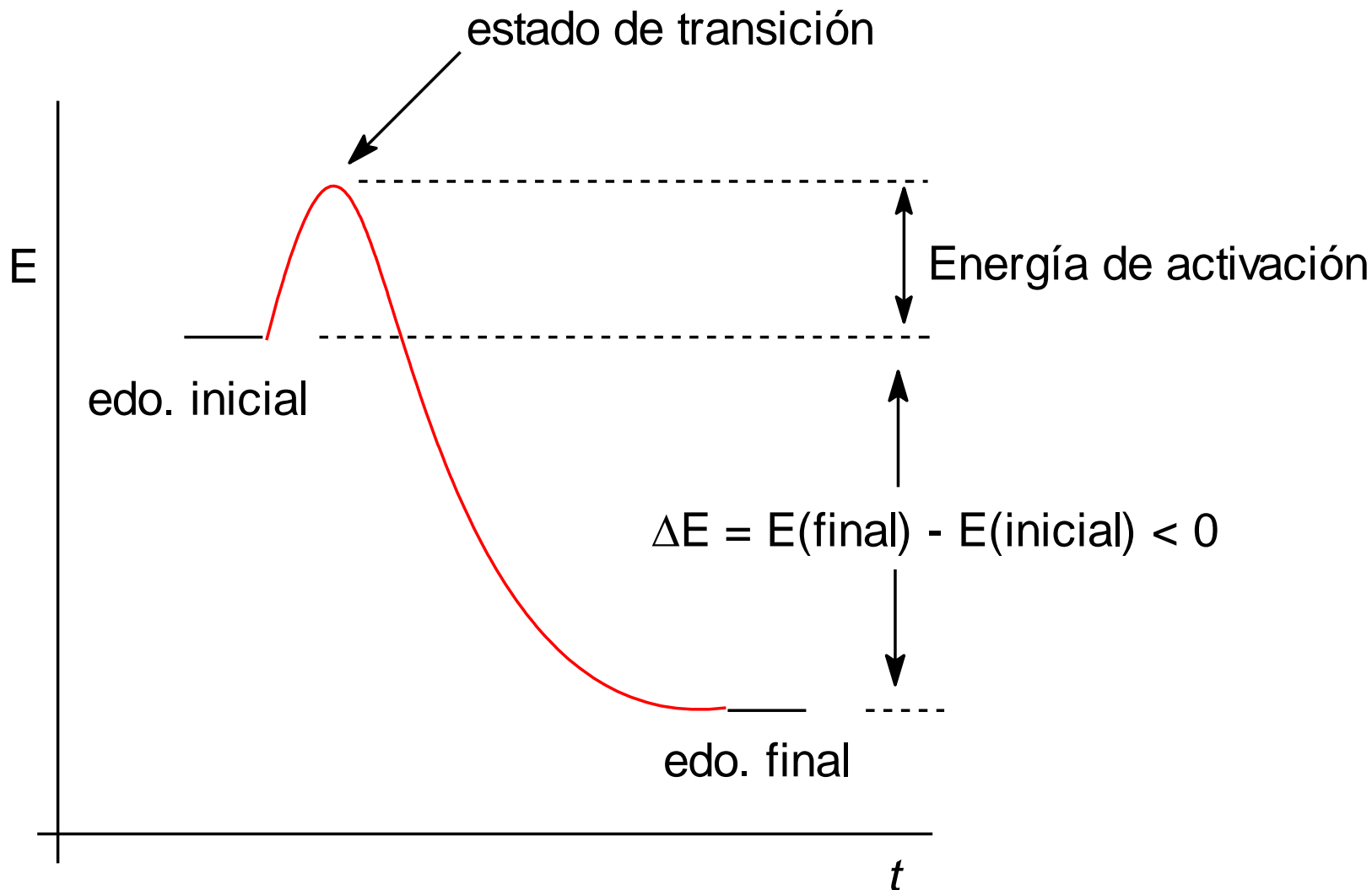
# Termodinámica vs Cinética

**En ocasiones un proceso termodinámicamente favorecido no se lleva a cabo porque cinéticamente no lo está.**



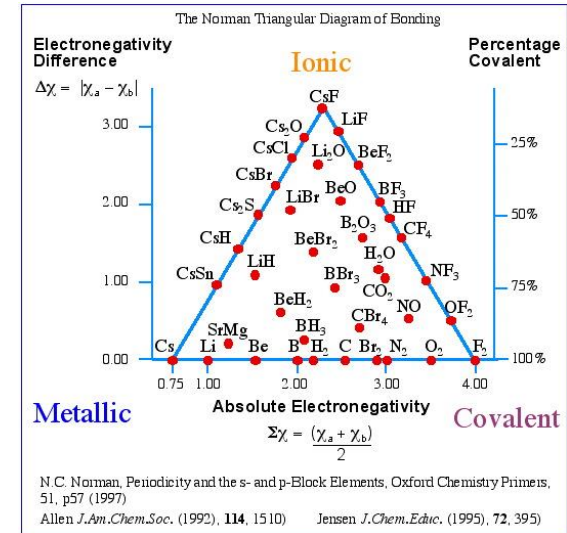
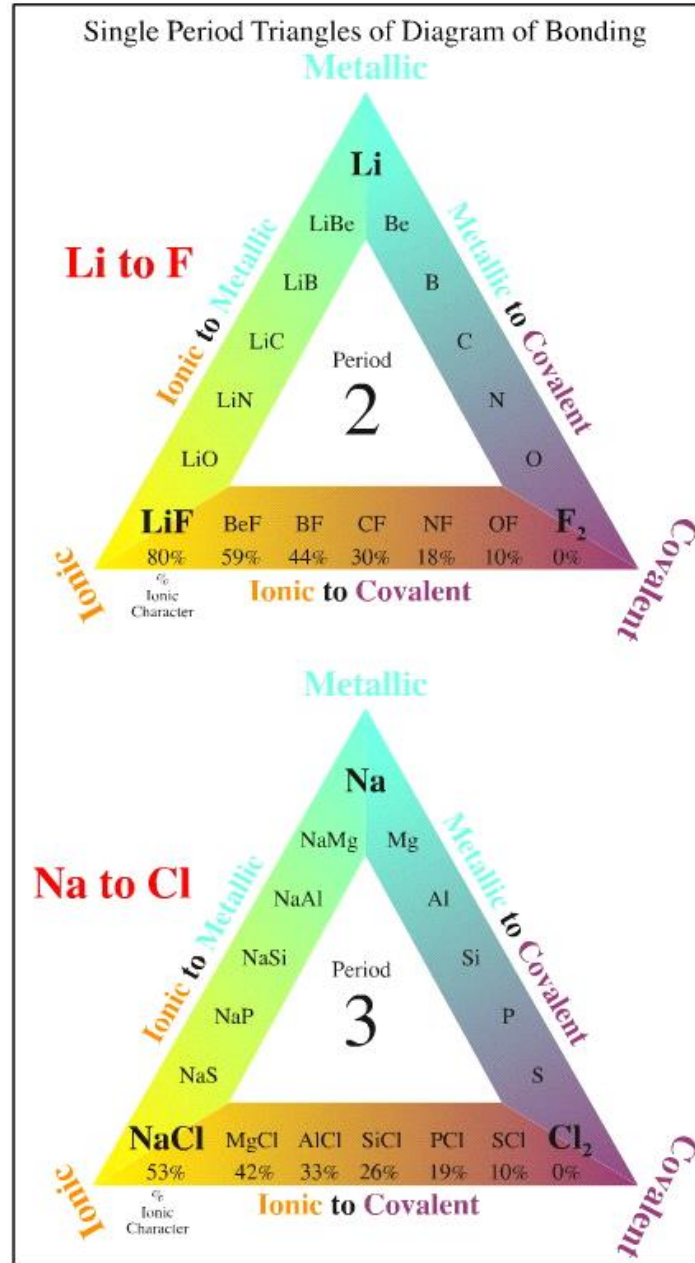


# Cinética y termodinámica





# Los diferentes tipos de compuestos



## Triángulos de Van Arkel-Ketelaar

**Lee poco y serás como  
muchos,**

**Lee mucho y serás como  
pocos.**