

PERIODIC TABLES:

I. Directory, II. Traditional, III. Vertical, IV. Toxicity (LD₅₀ values), V. Native (elemental form)

Site developed by Steve Murov, Professor Emeritus of Chemistry, Modesto Junior College, <http://murov.info/>
Other Murov sites:

Chemistry Directory: <http://murov.info/webercises.htm>

Organic Chemistry Directory: <http://murov.info/orgchem.htm>

Organic Solvent Properties and Property Directory: <http://murov.info/orgsolvents.htm>

Reaction-Map of Organic Chemistry: <http://murov.info/rxnmaponline.pdf>

I. Directory of Periodic Tables

A. Properties, Graphing and/or Ranking Capability

WebElements - <http://www.webelements.com/>

<http://www.rsc.org/Education/Teachers/Resources/ptdata/welcome.htm>

<http://acswebcontent.acs.org/games/pt.html>

<http://www.periodictable.com/Properties/A/AbsoluteBoilingPoint.html>

<http://environmentalchemistry.com/yogi/periodic/>

B. Properties

<http://www.rsc.org/periodic-table/>

<http://www.chemicool.com/>

<http://public.wsu.edu/~wherland/>

<http://www.ch.cam.ac.uk/content/periodic-table>

<http://www.chemicalelements.com/>

<http://www.lenntech.com/periodic/periodic-chart.htm>

<http://hyperphysics.phy-astr.gsu.edu/Hbase/pertab/pertab.html>

<http://www.webqc.org/periodictable-Carbon-C.html>

<http://www.chemnetbase.com/PeriodicTable/index.jsf>

<http://www.chemglobe.org/ptoe/index.php>

<http://education.jlab.org/itselemental/>

<http://www.visualentities.com/periodictable.htm>

<http://www.americanelements.com/>

<http://pubs.acs.org/cen/80th/elements.html>

<http://www.speclab.com/elements/>

<http://www.elementsdatabase.com/>

Interactive and/or Animated Periodic Table

<http://animatedsoftware.com/elearning/Periodic%20Table/AnimatedPeriodicTable.swf>

<http://profmokeur.ca/chemistry/>

<http://www.ptable.com/>

<http://www.rsc.org/periodic-table/>

<http://www.syngentaperiodictable.co.uk/>

<http://www.humantouchofchemistry.com/sites/all/themes/zen/chem/pages/periodictable.html>

http://www.knovel.com/web/portal/periodic_table

Images of Elements

<http://periodictable.com/>

<http://chemistry.about.com/library/blperiodictable.htm>

<http://www.theodoregray.com/PeriodicTable/>

<http://www.chemtopics.com/elements.htm>

<http://www.lenntech.com/periodic/periodic-chart.htm>

<http://www.chemeddl.org/resources/pt/>

http://www.popsoci.com/files/periodic_popup.html

About the Periodic Table

<http://www.open.edu/openlearn/science-maths-technology/science/chemistry/elements-the-periodic-table>

C. Mendeleev and the History of the Periodic Table

<http://www.aip.org/history/curie/periodic.htm>
<http://web.lemoyne.edu/~giunta/EA/MENDELEEVann.HTML>
http://en.wikipedia.org/wiki/History_of_the_periodic_table
http://en.wikipedia.org/wiki/Periodic_table
<http://www.hobart.k12.in.us/ksms/PeriodicTable/index.htm>
<http://www.rsc.org/Education/Teachers/Resources/periodictable/pre16/develop/mendeleev.htm>

D. Emission Spectra of Elements and Electron Structure

<http://jersey.uoregon.edu/vlab/elements/Elements.html>
<http://www.colorado.edu/physics/2000/applets/a2.html>
http://chemlinks.beloit.edu/BlueLight/moviepages/em_el.htm
<http://chemistry.bd.psu.edu/jircitano/periodic4.html>

E. Isotopes

<http://ie.lbl.gov/education/isotopes.htm>
[http://encyclopedia.thefreedictionary.com/Isotope%20table%20\(complete\)](http://encyclopedia.thefreedictionary.com/Isotope%20table%20(complete))
[http://encyclopedia.thefreedictionary.com/Isotope%20table%20\(divided\)](http://encyclopedia.thefreedictionary.com/Isotope%20table%20(divided))
http://www.meta-synthesis.com/webbook/33_segre/segre.html
<http://atom.kaeri.re.kr/>
http://www.ciaaw.org/pubs/Periodic_Table_Isotopes.pdf
<http://www.sisweb.com/mstools.htm>
<http://www.ptable.com/>

F. Chemogenesis (chemical reactivity from the periodic table)

<http://www.meta-synthesis.com/webbook.html>

G. Tabular Compilation of Elemental Properties and Abundances

http://www.kayelaby.npl.co.uk/chemistry/3_1/3_1_2.html
http://www.kayelaby.npl.co.uk/chemistry/3_1/3_1_3.html

H. Elemental Toxicities

<http://www.danasview.net/metals.htm>
<http://corrosion-doctors.org/Elements-Toxic/Elements.htm>
<http://www.vitaletherapeutics.org/vtlmntox.htm>

I. Sources, Uses, Functions and Mineralogy of Elements

<http://www.corrosionsource.com/FreeContent/1/Periodic%20Table>
<http://www.speclab.com/elements/>
<http://www.mii.org/periodic/miiperiodicchart.htm>

Native Elements

<http://www.britannica.com/EBchecked/topic/405982/native-element>
<http://www.galleries.com/Elements>
<http://ruby.colorado.edu/~smyth/G3010/14Natives.pdf>

J. Periodic Table Videos

<http://periodicvideos.com/>

K. Extended Periodic Table

<http://jeries.rihani.com/>
http://en.wikipedia.org/wiki/Extension_of_the_periodic_table_beyond_the_seventh_period

L. Vertical Periodic Table

extended - [http://en.wikipedia.org/wiki/Periodic_table_\(vertical\)](http://en.wikipedia.org/wiki/Periodic_table_(vertical))
[http://english.turkcebilgi.com/Periodic+table+\(vertical\)](http://english.turkcebilgi.com/Periodic+table+(vertical))

M. Periodic Table Printmaking Projects

<http://periodictableprints.com/table/>
<http://uwaterloo.ca/chemistry/international-year-chemistry/periodic-table-project>

N. Periodic Table of Comic Books - <http://www.uky.edu/Projects/Chemcomics/>

O. The Element Song by Tom Lehrer

<http://www.youtube.com/watch?v=SmwlzwGMMwc&feature=related>

<http://www.privatehand.com/flash/elements.html>

<http://www.youtube.com/watch?v=GFIvXVMbII0>

<http://www.youtube.com/watch?v=zGM-wSKFBpo>

<http://www.youtube.com/watch?v=DYW50F42ss8>

<http://www.edu-cyberpg.com/iec/elementsong.html>

P. Periodic Table Templates

<http://www.vertex42.com/ExcelTemplates/periodic-table-of-elements.html>

<http://science.widener.edu/~svanbram/ptable.html>

Q. Directories of Periodic Tables

http://www.meta-synthesis.com/webbook/35_pt/pt_database.php

http://www.martindalecenter.com/Reference_3_PerTables.html

<http://www.thecatalyst.org/m03ptabl.html>

<http://www.liv.ac.uk/Chemistry/Links/refperiodic.html>

<http://www.anachem.umu.se/cgi-bin/pointer.exe?PeriodicTables>

http://chemistry.about.com/od/periodictableelements/Periodic_Table_The_Elements.htm

<http://www.chemtopics.com/elements.htm>

Questions about the periodic Tables

1. Suggest reasons for the predominance of the horizontal periodic table model over the vertical model but also suggest some advantages of the vertical model.
2. Which elements are sometimes referred to as the noble metals and why are they called noble metals? Is there any relationship of this terminology to the use of these metals in jewelry?
3. Of the elements with LD₅₀ values for rodents reported, list the five most toxic. Does there appear to be any periodicity to toxicity? Explain your answer. (Note: a possibly relevant reference is: <http://www.vitaletherapeutics.org/vtlmntox.htm>)
4. Which of the native elements occur in nature in uncombined form (not as diatomics or bonded to themselves)? Is there a difference between the definition of an element and an elementary substance? (Note: a possibly relevant reference is Myers, R.J. *J. Chem. Educ.*, **2012**, 89, pp. 832-833.)

II. Traditional PERIODIC TABLE OF THE ELEMENTS

s		d										p					18
1																	8A
1A																	8A
1 H 1.008	2 He 4.0026											13 B 10.82	14 C 12.011	15 N 14.007	16 O 15.999	17 F 18.998	18 Ne 20.180
3 Li 6.97	4 Be 9.012											5 B 10.82	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 B 10.82	4 C 12.011	5 N 14.007	6 O 15.999	7 F 18.998	8 Ne 20.180	9 Na 22.990	10 Mg 24.305	11 Al 26.982	12 Si 28.085	13 P 30.974	14 S 32.07	15 Cl 35.45	16 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 55.847	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.63	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 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	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 226.03	89 Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Cn (277)	113 Uu 2003 (284)	114 Uu Fr (289)	115 Uu 2003 (288)	116 Lv (292)	117 Uu 2010 (294)	118 Uu 2006 (294)
f																	
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				
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	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 (260)				

key: bold or normal italics - gas, shadow - liquid, bold or normal - solid, normal print - all known isotopes are radioactive

III. Vertical PERIODIC TABLE OF THE ELEMENTS

	1	3	11	19	37	55	87		
1 <i>IA</i>	<i>H</i> 1.008	Li 6.97	Na 22.990	K 39.098	Rb 85.468	Cs 132.91	Fr (223)		
s	2 <i>2A</i>	4	12	20	38	56	88		
		Be 9.012	Mg 25.305	Ca 40.078	Sr 87.62	Ba 137.33	Ra 226.03		
			3 <i>3B</i>	21	39	57	89		
				Sc 44.956	Y 88.906	La 138.91	Ac 227.03		
			4 <i>4B</i>	22	40	72	104	58	90
				Ti 47.867	Zr 91.224	Hf 178.49	Rf (261)	Ce 140.12	Th 232.04
			5 <i>5B</i>	23	41	73	105	59	91
				V 50.942	Nb 92.906	Ta 180.95	Db (262)	Pr 140.91	Pa 231.04
			6 <i>6B</i>	24	42	74	106	60	92
				Cr 51.996	Mo 95.94	W 183.85	Sg (263)	Nd 144.24	U 232.04
			7 <i>7B</i>	25	43	75	107	61	93
d				Mn 54.938	Tc (98)	Re 186.21	Bh (262)	Pm (145)	Np 237.05
			8 <i>8B</i>	26	44	76	108	62	94
				Fe 55.847	Ru 101.07	Os 190.23	Hs (265)	Sm 150.36	Pu (244)
			9 <i>8B</i>	27	45	77	109	63	95
				Co 58.933	Rh 102.93	Ir 180.95	Mt (266)	Eu 151.96	Am (243)
			10 <i>8B</i>	28	46	78	110	64	96
				Ni 58.693	Pd 106.42	Pt 195.08	Ds (269)	Gd 157.25	Cm (257)
			11 <i>1B</i>	29	47	79	111	65	97
				Cu 63.546	Ag 107.87	Au 196.97	Rg (272)	Tb 158.93	Bk (247)
			12 <i>2B</i>	30	48	80	112	66	98
				Zn 65.39	Cd 112.41	Hg 200.59	Cn (277)	Dy 162.50	Cf (257)
		13 <i>3A</i>	5	13	31	49	81	67	99
			B 10.82	Al 26.982	Ga 69.723	In 114.82	Tl 204.38	Ho 164.93	Es (252)
		14 <i>4A</i>	6	14	32	50	82	68	100
			C 12.011	Si 28.085	Ge 72.63	Sn 118.71	Pb 207.2	Er 167.26	Fm (257)
		15 <i>5A</i>	7	15	33	51	83	69	101
			N 14.007	P 30.974	As 74.922	Sb 121.76	Bi 208.98	Tm 168.93	Md (258)
p		16 <i>6A</i>	8	16	34	52	84	70	102
			O 15.999	S 32.07	Se 78.96	Te 127.60	Po (209)	Lv (292)	No (259)
		17 <i>7A</i>	9	17	35	53	85	71	103
			F 18.998	Cl 35.45	Br 79.904	I 126.90	At (210)	Lu 174.97	Lr (260)
18 <i>8A</i>	2	10	18	36	54	86	118		
	He 4.0026	Ne 20.180	Ar 39.948	Kr 83.798	Xe 131.29	Rn (222)	Og (294)		

key: bold or normal italics - gas, shadow - liquid, bold or normal - solid, normal print - all known isotopes are radioactive

IV. PERIODIC TABLE OF TOXICITIES OF ELEMENTS

LD₅₀ (mg/kg) values for rats¹ of the chlorides¹ of the elements (oxidation state indicated)

1 H 900 ² 1																		2 He					
3 Li 526 1		4 Be 86 2												5 B 2350 4		6 C 2350 4	7 N	8 O	9 F	10 Ne			
11 Na 3000 1		12 Mg 2800 2												13 Al 3450 3		14 Si	15 P 18 3	16 S	17 Cl	18 Ar			
19 K 2600 1	20 Ca 1000 2	21 Sc 3980 ³ 3	22 Ti <464 4 >10000 ⁴ 4	23 V 350 3 160 4	24 Cr 1870 2 1870 3	25 Mn 250 2	26 Fe 450 2 450 3	27 Co 80 2	28 Ni 681 2	29 Cu 140 1 584 2	30 Zn 360 3	31 Ga	32 Ge	33 As 48 3	34 Se	35 Br	36 Kr						
37 Rb 4440 1	38 Sr 2250 2	39 Y	40 Zr 1688 4	41 Nb	42 Mo 1400 5	43 Tc	44 Ru	45 Rh	46 Pd 1302 3	47 Ag 2704 2	48 Cd 1173 ⁵ 1	49 In 88 2	50 Sn	51 Sb 700 2 1115 5	52 Te 525 3	53 I	54 Xe						
55 Cs 2600 1	56 Ba 118 2	57 La 4184 3	72 Hf 2362 4	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt 3423 2	79 Au	80 Hg 6 ³ 2 26 ⁵ 2	81 Tl 24 ³ 1	82 Pb 1947 2	83 Bi 3334 3	84 Po	85 At	86 Rn						
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 2003	114 Fl	115 2003	116 Lv	117 2010	118 2006						
58 Ce 2111 3	59 Pr 2987 ³ 3	60 Nd 3692 ³ 3	61 Pm	62 Sm 3073 3	63 Eu 3527 ³ 3	64 Gd	65 Tb 3631 ³ 3	66 Dy 5443 ³ 3	67 Ho 5165 ³ 3	68 Er 4417 ³ 3	69 Tm 4294 ³ 3	70 Yb 4836 ³ 3	71 Lu 7074 ³ 3										
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										

¹ values taken from <http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp> for rats and chlorides unless noted otherwise ² rabbit ³ mouse ⁴ oxide ⁵ nitrate

V. PERIODIC TABLE OF ELEMENTS FOUND IN ELEMENTAL FORM

1 H																	2 He 😊
3 Li	4 Be											5 B	6 C 😊	7 N 😊	8 O 😊	9 F	10 Ne 😊
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 La	72 Hf	73 Ta	74 W	75 Re	76 Os 😊	77 Ir 😊	78 Pt 😊	79 Au 😊	80 Hg rarely 😊	81 Tl	82 Pb 😊	83 Bi ? 😊	84 Po	85 At	86 Rn 😊 ☠️
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 2003	114 Fl	115 2003	116 Lv	117 2010	118 2006
			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	
			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	