

PERIODNI SISTEM ELEMENATA

PERIODNI ZAKON

- Fizička i hemijska svojstva elemenata, kao i njihovih jedinjenja, predstavljaju periodičnu funkciju atomskog broja.
- Elementi su poredani po atomskom broju, Z .

1 H 1.0079	2 Be 9.0122											18 He 4.0026					
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	13 Al 10.922	14 Si 12.086	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 50.948	24 Cr 51.996	25 Mn 54.928	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.499	31 Ga 69.713	32 Ge 72.64	33 As 74.923	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 91.124	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 127.69	53 I 126.90	54 Xe 131.19
55 Cs 132.91	56 Ba 137.33	57 La 138.91	58 Hf 178.49	59 Ta 180.95	60 W 183.84	61 Re 186.11	62 Os 190.23	63 Ir 192.22	64 Pt 195.08	65 Au 196.97	66 Hg 200.59	67 Ds 204.38	68 Rg 207.2	69 Bi 208.98	70 Po (209)	71 At (210)	72 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	90 Rf (261)	91 Db (262)	92 Sg (266)	93 Nh (264)	94 Pu (277)	95 Am (268)	96 Cm (281)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)	

* Lantanoidi * Aktinoidi

PERIODNI SISTEM ELEMENATA

PERIODE I GRUPE

1 H 1.0079	2 Be 9.0122											18 He 4.0026					
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										
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19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.948	24 Cr 51.996	25 Mn 54.928	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.499	31 Ga 69.713	32 Ge 72.64	33 As 74.923	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 91.124	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 131.19
55 Cs 132.91	56 Ba 137.33	57 La 138.91	58 Hf 178.49	59 Ta 180.95	60 W 183.84	61 Re 186.21	62 Os 190.23	63 Ir 192.22	64 Pt 195.08	65 Au 196.97	66 Hg 200.59	67 Ds 204.38	68 Rg 207.2	69 Bi 208.98	70 Po (209)	71 At (210)	
87 Fr (223)	88 Ra (226)	89 Ac (227)	90 Rf (261)	91 Db (262)	92 Sg (266)	93 Nh (264)	94 Pu (277)	95 Am (268)	96 Cm (281)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)	

* Lantanoidi * Aktinoidi

PERIODNI SISTEM ELEMENATA

PERIODE I GRUPE

▪ Periode:

- označavaju se brojevima 1–7 ili slovima K, L, M, N, O, P, Q (kao ljuške u elektronskom omotaču);
- broj označava najviši energetski nivo u kome se nalaze elektroni (elementi imaju isti najviši glavni kvantni broj).

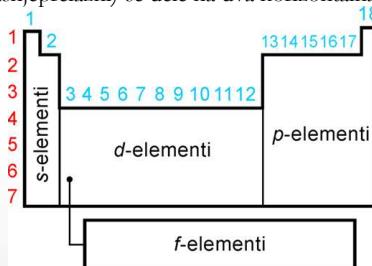
▪ Grupe:

- označavaju se brojevima 1–18 (od 1985. god.);
- elementi u istoj grupi imaju isti broj valentnih elektrona;
- neke imaju posebne nazive: alkalni metali (1.), zemnoalkalni metali (2.), halkogeni (16.), halogeni (17.) i plemeniti gasovi (18.);

PERIODNI SISTEM ELEMENATA

PERIODE I GRUPE

- **glavne grupe** → grupe sa s- i p-elementima (1, 2, 13–18);
- **sporedne grupe** → grupe sa d-elementima (3–12);
- deo d-elementata (grupe 3–11) → **prelazni elementi** (metali):
 - ❖ naziv su dobili po tome što se nalaze na prelazu između najaktivnijih metala i nemetala,
 - ❖ metali 12. grupe (Zn, Cd, Hg) ne ubrajaju se u prelazne metale;
- f-elementi (unutrašnjeprelazni) se dele na dva horizontalna niza: *lantanoide* i *aktinoide*.



PERIODNI SISTEM ELEMENATA

PERIODE I GRUPE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	1 H 1.0079	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	13 Al 26.992	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948	He 4.0026
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	13 Al 26.992	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948	He 4.0026		
3	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	13 Al 26.992	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948	He 4.0026		
4	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 Ga 65.409	31 Ge 69.723	32 Se 74.922	33 Te 78.96	34 Br 79.908	35 Kr 83.798	36 Kr 83.798	
5	37 Rb 85.468	38 Sr 87.62	39 Y 88.900	40 Zr 91.124	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	
6	55 Cs 133.91	56 Ba 137.33	57 La 138.91	72 Lu 178.49	73 Th 180.95	74 W 183.84	75 Re 186.11	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 204.39	81 Tl 204.39	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)	
7	87 Fr (223)	88 Ra (226)	89 Ac (261)	104 Rf (262)	105 Db (265)	106 Sg (264)	107 Nh (277)	108 Mt (268)	109 Ds (281)	110 Rg (272)	111								
* Lantanoidi		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 167.16	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97				
* Aktinoidi		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)				

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PERIODNI SISTEM ELEMENATA

PERIODIČNE PROMENE SVOJSTAVA ELEMENATA

- Sledeća svojstva elemenata se periodično menjaju u Periodnom sistemu:
 - atomski radijus,
 - energija ionizacije,
 - afinitet prema elektronu,
 - elektronegativnost.
 - Ova svojstva imaju ekstremne vrednosti po dijagonalni Periodnog sistema, tj. **levo dole i desno gore**.

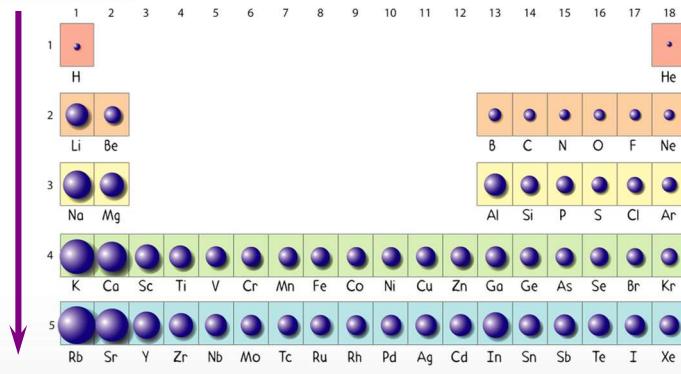
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PERIODNI SISTEM ELEMENATA

PERIODIČNE PROMENE SVOJSTAVA ELEMENATA

■ Atomski radijus



■ U periodi opada, u grupi raste.

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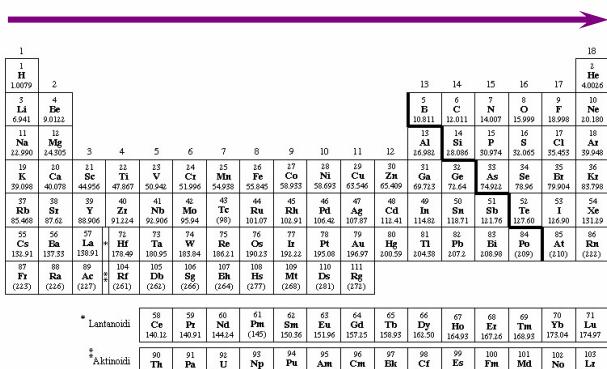
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PERIODNI SISTEM ELEMENATA

PERIODIČNE PROMENE SVOJSTAVA ELEMENATA

■ Energija (prve) ionizacije

■ energija potrebna da se ukloni elektron iz atoma nekog elementa u gasovitom stanju.



■ U periodi raste, u grupi opada.

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PERIODNI SISTEM ELEMENATA

PERIODIČNE PROMENE SVOJSTAVA ELEMENATA

- Afinitet prema elektronu

- ❖ energija koja se oslobođi ili veže kada atom u gasovitom stanju primi elektron.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H	Be	B	C	N	F	O	Ne	Mg	Si	P	S	Cl	Ar	Si	Se	Te	Br
2	Li	Be	B	C	N	F	O	Ne	Mg	Si	P	S	Cl	Ar	Si	Se	Te	Br
3	Na	Mg	Al	Si	P	S	Cl	Ar	Si	Ge	As	Se	Br	K	Ca	Sc	Ti	V
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Rb	Si	Ge	As	Se
5	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	Si	Ge	As	Se
6	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V
7	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr
8	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn
9	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe
10	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co
11	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni
12	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu
13	Ni	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
14	Cu	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As
15	Zn	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br
16	As	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar
17	Br	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K
18	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Br	Ar	K	Ca

- #### ■ U periodi raste, u grupi opada.

PERIODNI SISTEM ELEMENATA

PERIODIČNE PROMENE SVOJSTAVA ELEMENATA

- #### ■ Elektronegativnost

- ❖ mera sposobnosti atoma vezanog kovalentnom vezom u molekulu da privuče elektronski par iz veze.

1												18												
1	H																							
2	Li	B											13	14	15	16	17	18						
	6.941	(9.112)											5	6	7	8	9	10	P	S	C	Cl	Br	I
3	Na	Mg											13	14	15	16	17	18						
	23.950	14.305											12	Al	Si	P	S	C	Cl	Br	I	Br	I	Te
4	K	Ca											13	14	15	16	17	18						
	39.098	40.078	44.956	47.897	50.948	51.996	54.998	55.845	58.933	58.693	61.654	65.409	69.712	71.64	74.912	78.956	79.904	83.798						
5	Rb	Sr											13	14	15	16	17	18						
	87.986	88.005	93.371	94.162	95.924	96.913	98.910	99.811	100.811	100.841	101.841	102.841	103.841	104.841	105.841	106.841	107.841	108.841	109.841	110.841	111.841	112.841	113.841	
6	Cs	La	H	Tl	Ts	Ta	W	Re	Os	Ir	Au	Pt	Ag	Ca	Pd	Pt	Pd	Pt	Pd	Pt	Pd	Pt	Pd	Pt
	138.91	137.33	135.91	137.189	138.195	138.84	138.21	139.23	139.22	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	139.23	
7	Fr	Ra	Ac	Sc	Rf	Db	Sg	Eh	Hs	Mh	Th	Rg	Pa	Th	Pa	Th								
	(223)	(226)	(227)	(228)	(229)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)
* Lanthanoids												13	14	15	16	17	18							
* Actinoids												13	14	15	16	17	18							

- #### ■ U periodi raste, u grupi opada.

PERIODNI SISTEM ELEMENATA

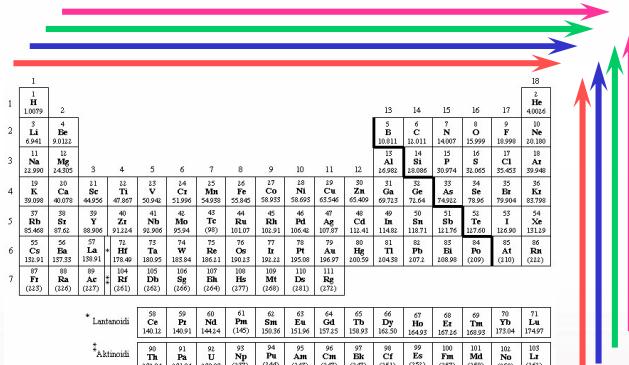
PERIODIČNE PROMENE SVOJSTAVA ELEMENATA

2. Energija (prve) ionizacije

3. Afinitet prema elektronu

4. Elektronegativnost

5. E°



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PERIODNI SISTEM ELEMENATA

OKSIDACIONI BROJEVI

- Maksimalan oksidacioni broj elementa jednak je:
 - broju grupe (za s- i deo d-elemenata),
 - broju grupe umanjenom za deset (za p- i deo d-elemenata).
- Sa porastom oksidacionog broja raste:
 - oksidaciona moć jedinjenja (ako element gradi više jedinjenja),
 - kiseli karakter oksida,
 - kovalentni karakter veze.

0	II	IV	VI	VII
Mn	Mn	Mn	Mn	Mn
najjače redukciono sredstvo				najjače oksidaciono sredstvo
-II	-I	0	IV	VI
S	S	S	S	S

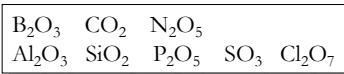
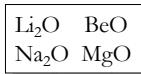
Oksidaciona moć jedinjenja

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PERIODNI SISTEM ELEMENATA

OKSIDACIONI BROJEVI



1	¹ H 10079	2											18			
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921	78,96	79,904
39,098	40,078	44,956	47,867	50,942	51,996	54,938	55,845	56,933	58,693	63,546	65,409	69,713	72,64	74,921		