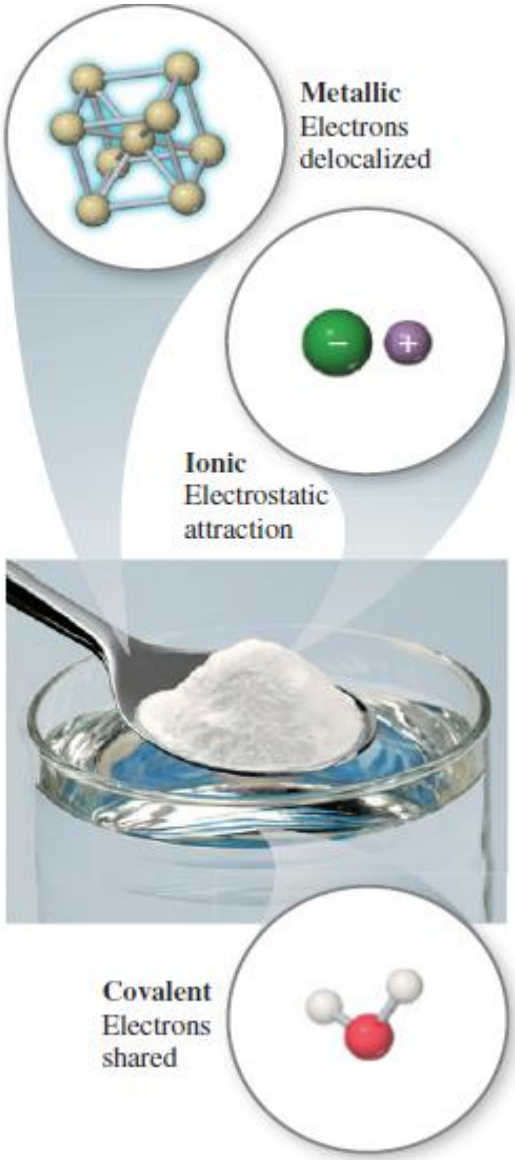
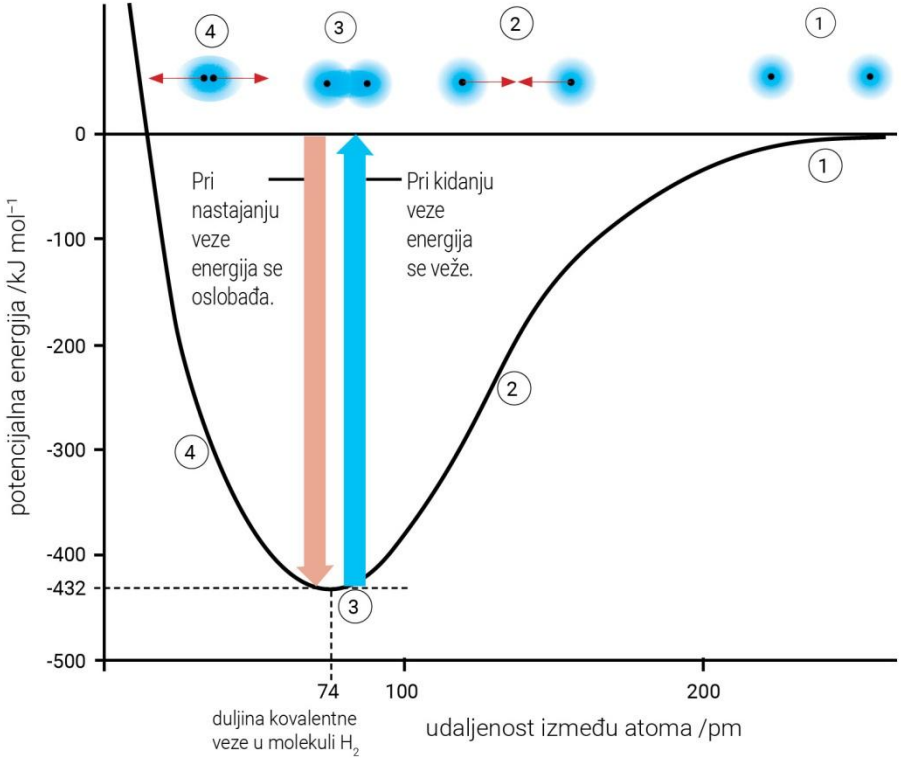
HEMIJSKE VEZE



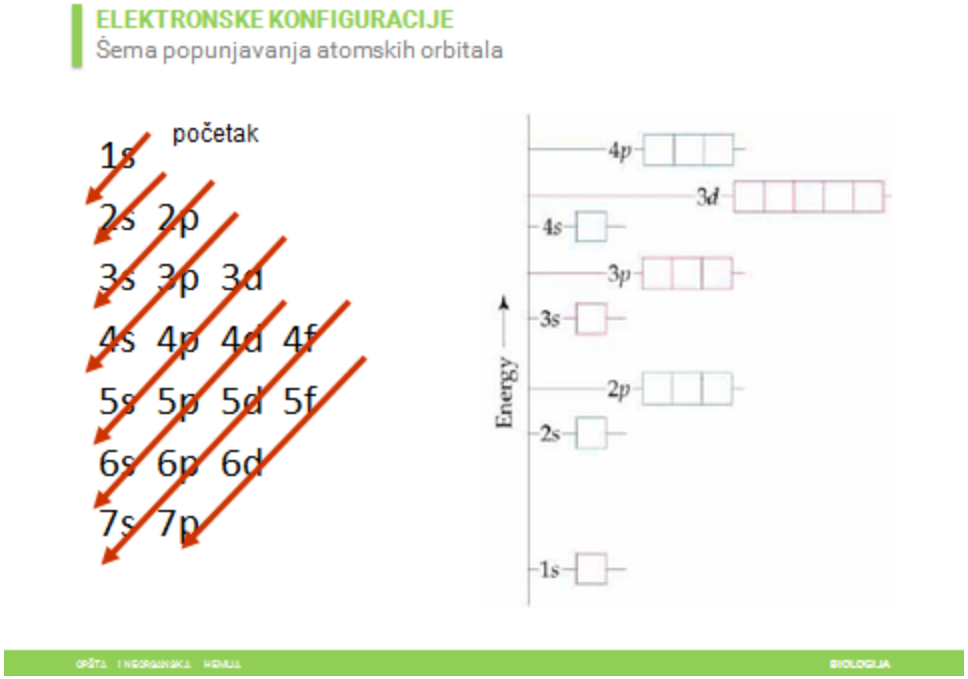
HEMIJSKE VEZE

- TRI OSNOVNA TIPA
  - **<u>jonska</u>**
    - Elektrostatičko privlačenje između jona
  - **<u>kovalentna</u>**
    - Dijeljenje elektrona
  - **<u>metalna</u>**
    - Atomi metala vezani sa nekoliko drugih atoma

Zašto atomi teže da se udružuju u veće cjeline?

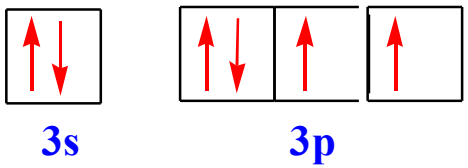


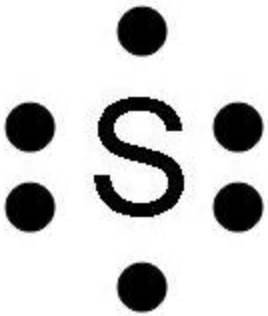
Šta određuje vrstu vezivanja u supstancama?



HEMIJSKE VEZE
Lewis-ovi simboli

$_{16}S\ 1s^2 2s^2 sp^6\ 3s^2 3p^4$

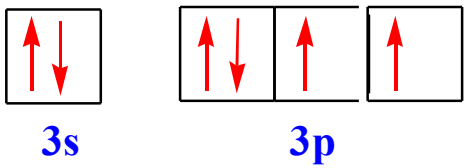


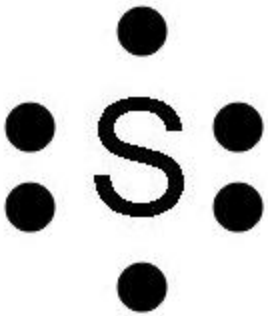


Group	Element	Electron Configuration	Lewis Symbol	Element	Electron Configuration	Lewis Symbol
1A	Li	$[He]2s^1$	Li·	Na	$[Ne]3s^1$	Na·
2A	Be	$[He]2s^2$	·Be·	Mg	$[Ne]3s^2$	·Mg·
3A	B	$[He]2s^2 2p^1$	·$\dot{B}$·	Al	$[Ne]3s^2 3p^1$	·$\dot{Al}$·
4A	C	$[He]2s^2 2p^2$	·$\dot{C}$·	Si	$[Ne]3s^2 3p^2$	·$\dot{Si}$·
5A	N	$[He]2s^2 2p^3$	·$\dot{N}$:	P	$[Ne]3s^2 3p^3$	·$\dot{P}$:
6A	O	$[He]2s^2 2p^4$	:$\dot{O}$:	S	$[Ne]3s^2 3p^4$	:$\dot{S}$:
7A	F	$[He]2s^2 2p^5$	·$\ddot{F}$:	Cl	$[Ne]3s^2 3p^5$	·$\ddot{Cl}$:
8A	Ne	$[He]2s^2 2p^6$	:$\ddot{Ne}$:	Ar	$[Ne]3s^2 3p^6$	:$\ddot{Ar}$:

HEMIJSKE VEZE
Lewis-ovi simboli

$_{16}S\ 1s^2 2s^2 sp^6\ 3s^2 3p^4$





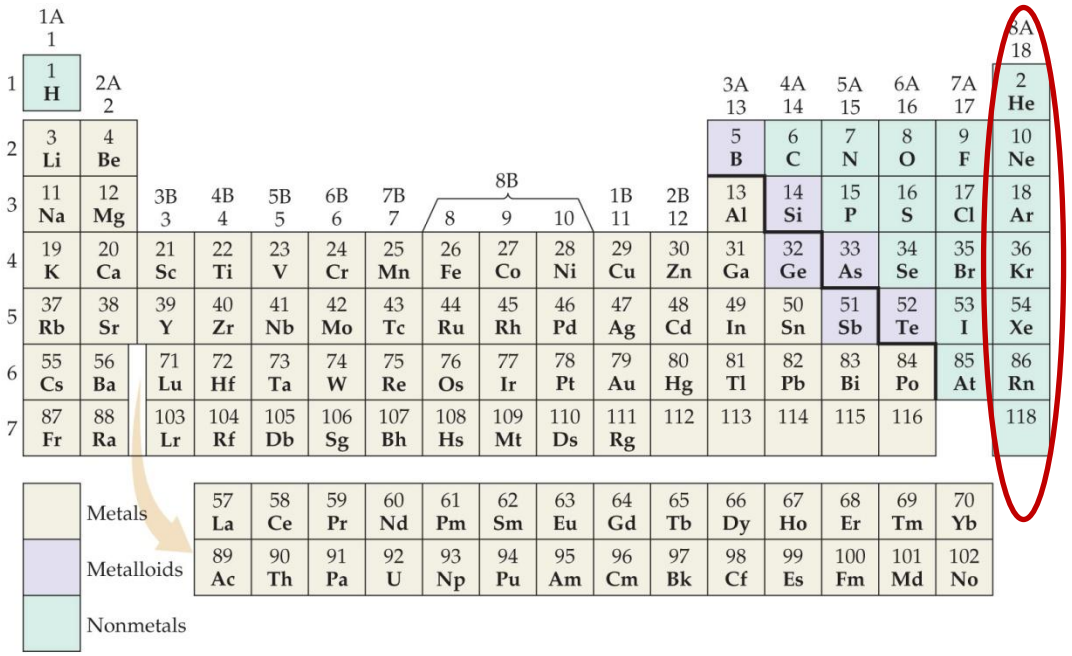
Group	Element	Electron Configuration	Lewis Symbol	Element	Electron Configuration	Lewis Symbol
1A	Li	$[He]2s^1$	Li·	Na	$[Ne]3s^1$	Na·
2A	Be	$[He]2s^2$	·Be·	Mg	$[Ne]3s^2$	·Mg·
3A	B	$[He]2s^2 2p^1$	·$\dot{B}$·	Al	$[Ne]3s^2 3p^1$	·$\dot{Al}$·
4A	C	$[He]2s^2 2p^2$	·$\dot{C}$·	Si	$[Ne]3s^2 3p^2$	·$\dot{Si}$·
5A	N	$[He]2s^2 2p^3$	·$\dot{N}$:	P	$[Ne]3s^2 3p^3$	·$\dot{P}$:
6A	O	$[He]2s^2 2p^4$	:$\dot{O}$:	S	$[Ne]3s^2 3p^4$	:$\dot{S}$:
7A	F	$[He]2s^2 2p^5$	·$\ddot{F}$:	Cl	$[Ne]3s^2 3p^5$	·$\ddot{Cl}$:
8A	Ne	$[He]2s^2 2p^6$	:$\ddot{Ne}$:	Ar	$[Ne]3s^2 3p^6$	:$\ddot{Ar}$:

HEMIJSKE VEZE
Pravilo okteta

Hemijska veza – elementi teže da postignu stabilnu elektronsku konfiguraciju najbližeg plemenitog gasa - oktetno pravilo

dublet $_2$**He** $1s^2$

oktet ns^2np^6

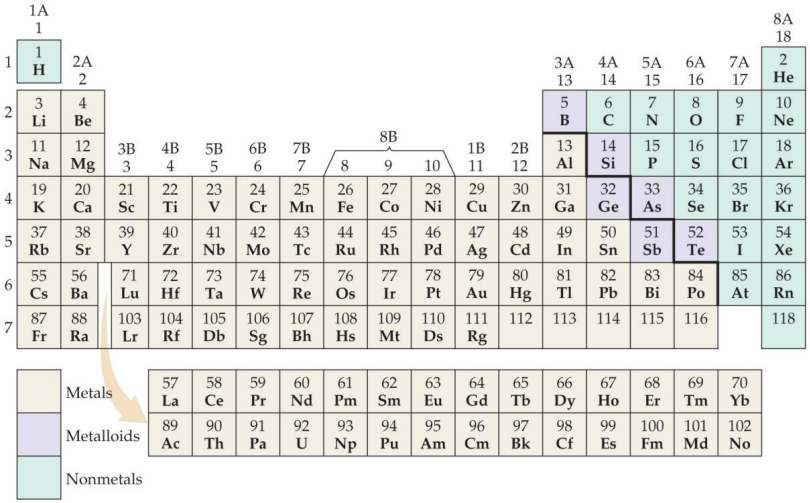


HEMIJSKE VEZE
Pravilo okteta

- Atomi imaju tendenciju da dobijaju, gube ili dele elektrone sve dok ih ne okruži osam valentnih elektrona

- Oktet elektrona sastoji se od punih s i p-podslojeva u atomu

- Postoji mnogo izuzetaka od oktetske norme, ali ovo pravilo predstavlja koristan okvir za mnoge važne koncepte vezivanja.



HEMIJSKE VEZE

-	Atomi imaju tendenciju da dobijaju, gube ili dele elektrone sve dok ih ne okruži osam valentnih elektrona

JONSKA VEZA

KOVALENTNA VEZA

HEMIJSKE VEZE
Energija jonizacije (Ei)

- Količina energije potrebne za uklanjanje elektrona iz osnovnog stanja gasovitog atoma ili jona.
- Prva energija jonizacije je energija potrebna za uklanjanje prvog elektrona.
- Druga energija jonizacije je energija potrebna da se ukloni drugi elektron, itd

El -------> $El^{+} + e^{-}$ **Ei,1 ili prva jonizaciona energija**

El^{+} -------> $El^{2+} + e^{-}$ **Ei,2 ili druga jonizaciona energija**

El -------> $El^{2+} + 2e^{-}$ **Ei,1 + Ei,2**

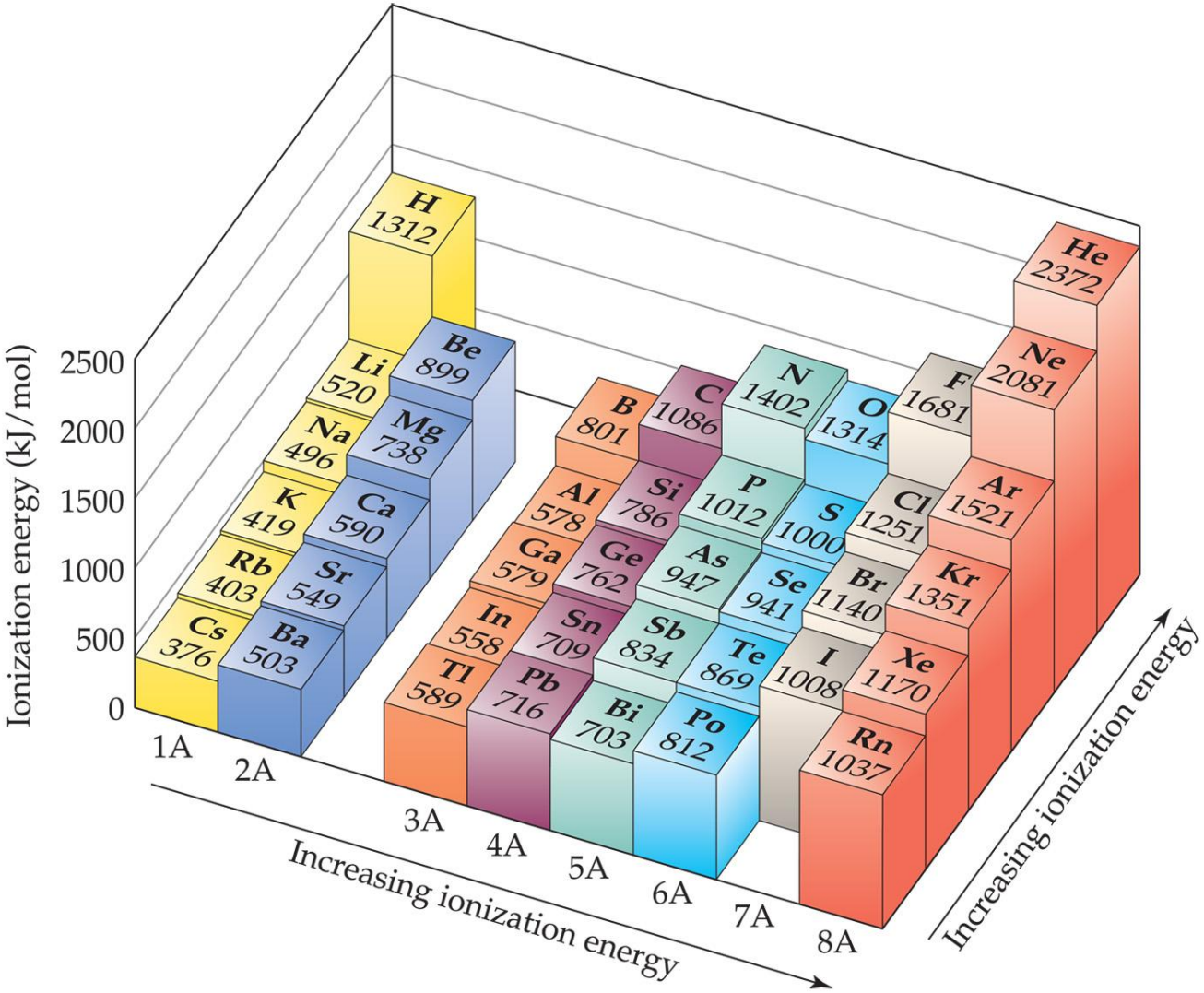
HEMIJSKE VEZE
Energija jonizacije (Ei)

- Potrebno je više energije da ukloni svaki sledeći elektron.

Element	I_1	I_2	I_3	I_4	I_5	I_6	I_7
Na	495	4562			(inner-shell electrons)		
Mg	738	1451	7733				
Al	578	1817	2745	11,577			
Si	786	1577	3232	4356	16,091		
P	1012	1907	2914	4964	6274	21,267	
S	1000	2252	3357	4556	7004	8496	27,107
Cl	1251	2298	3822	5159	6542	9362	11,018
Ar	1521	2666	3931	5771	7238	8781	11,995

HEMIJSKE VEZE

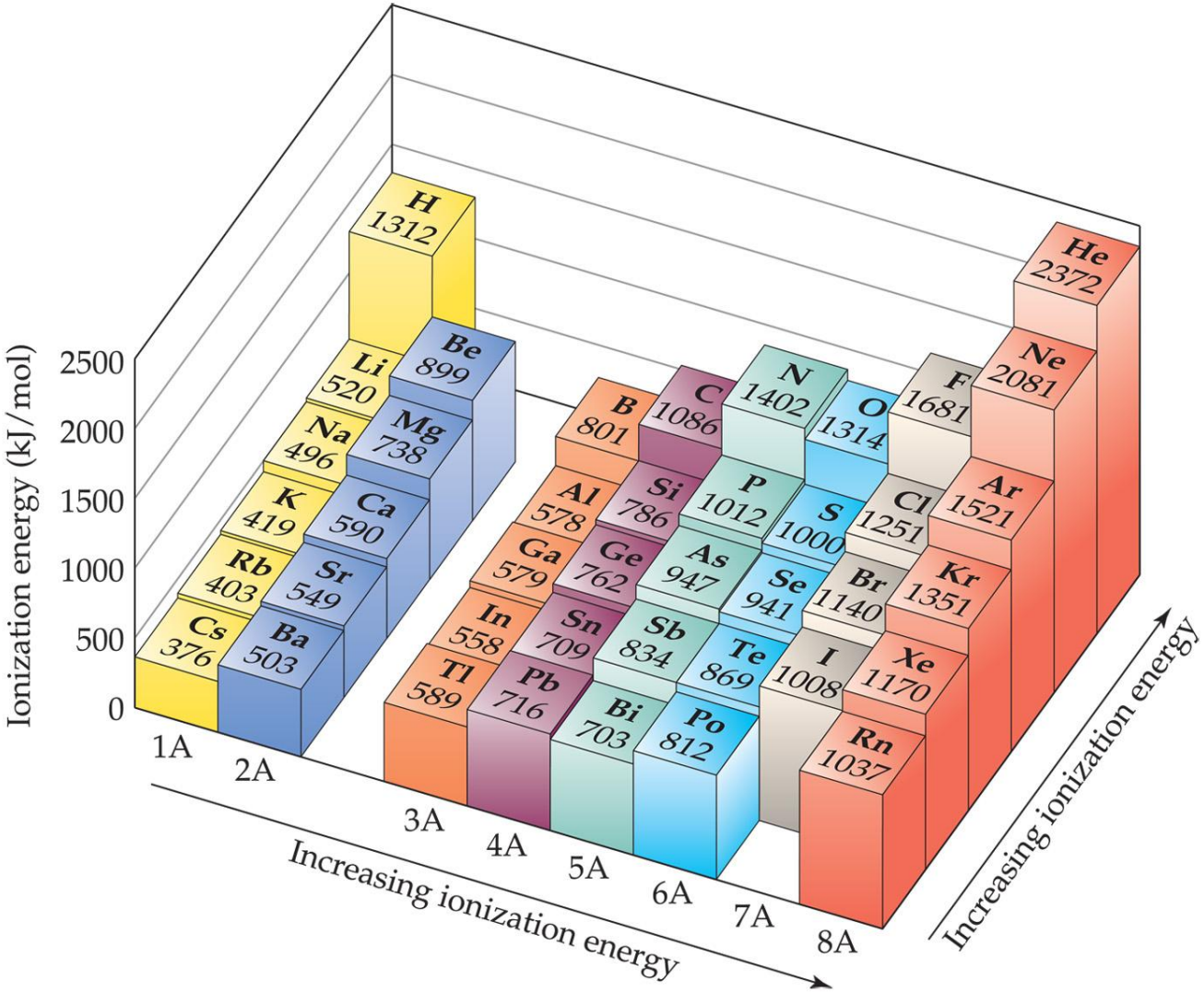
Energija jonizacije (Ei)



- Idući niz grupu, manje energije je potrebno za uklanjanje prvog elektrona.
- Za atome u istoj grupi, Z_{eff} je u suštini isto, ali valentni elektroni su dalje od jezgra.

HEMIJSKE VEZE

Energija jonizacije (Ei)



- U periodi, idući sa lijeva nadesno raste energija jonizacije.
- U okviru jedne periode sa porastom atomskog broja raste naelektrisanje jezgra.

- Energija koja se oslobodi ili utroši, kada atom (ili jon) u gasovitom stanju primi jedan elektron

$$Cl + e^- \longrightarrow Cl^-$$

HEMIJSKE VEZE
Elektronski afinitet (Ea)

Afinitet prema elektronu ***raste***

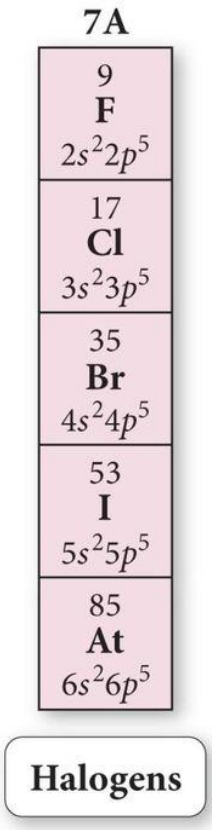
Afinitet prema elektronu ***opada***

1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 H 1.00794																	2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050											13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9381	26 Fe 55.847	27 Co 58.9332	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 *La 138.906	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	89 †Ac 227.028	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (272)		114 (287)		116 (289)		118 (293)

*Lanthanide series	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
†Actinide series	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	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)

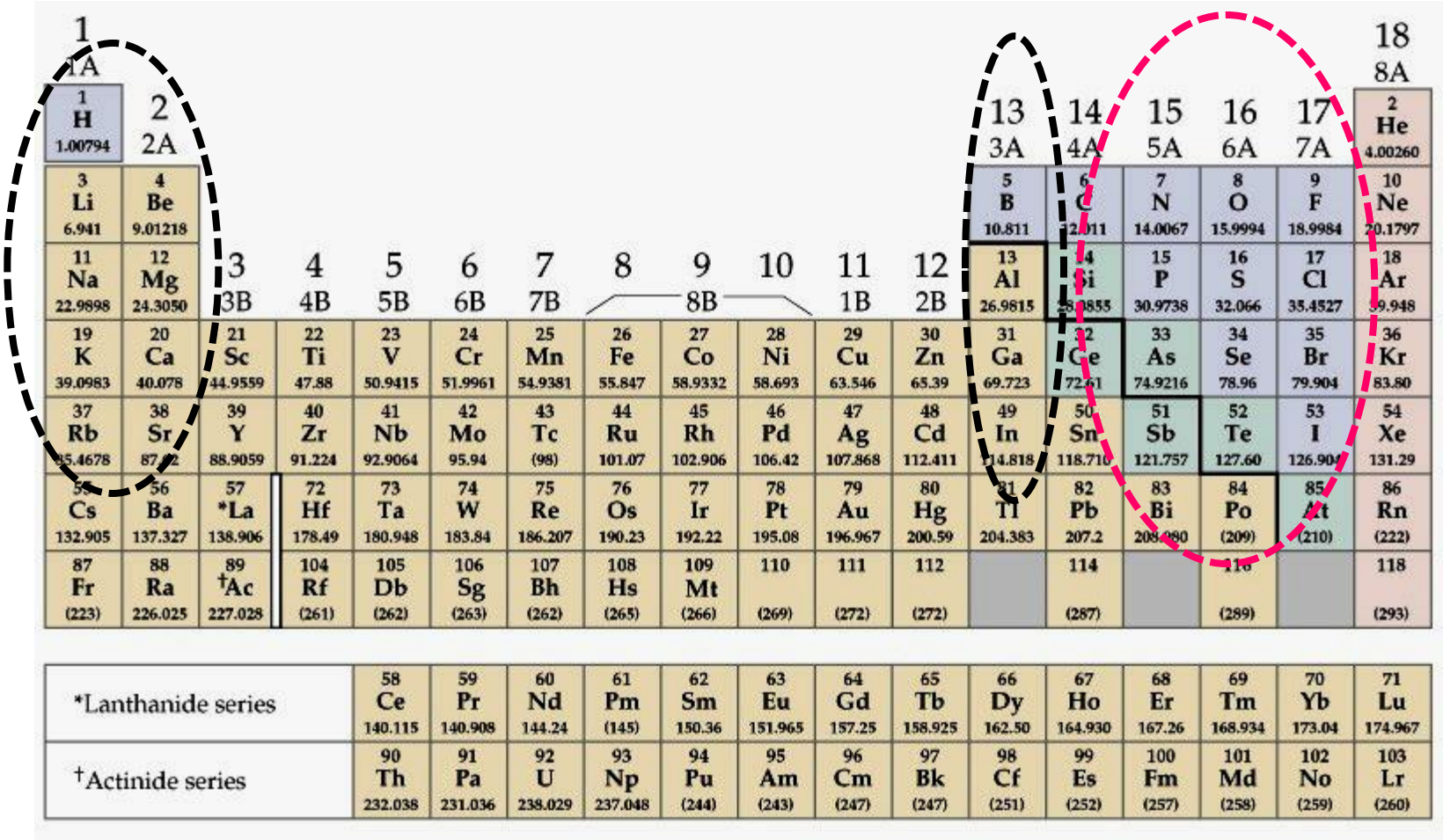
Elementi 17 g- PSE imaju najveće vrijednosti Ea!!!!

Atom	Electron Affinity (kJ/mol)
F	−327.8
Cl	−348.7
Br	−324.5
I	−295.2

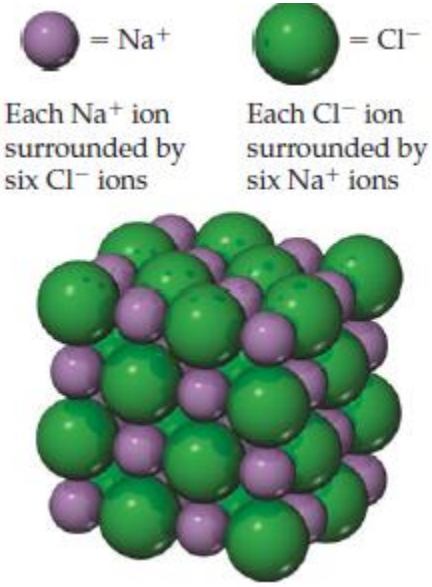


HEMIJSKE VEZE

Jonska veza



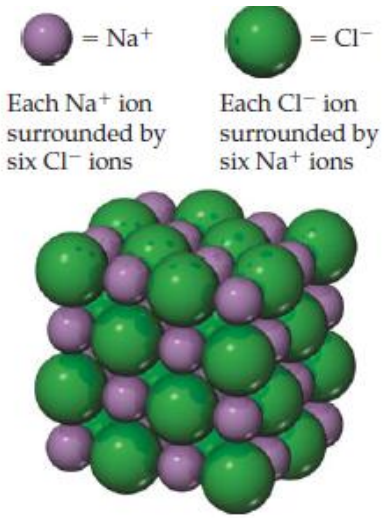
HEMIJSKE VEZE
Jonska veza



$$Na(s) + \frac{1}{2}Cl_2(g) \longrightarrow NaCl(s) \qquad \Delta H_f^\circ = -410.9\ kJ$$

HEMIJSKE VEZE

Jonska veza



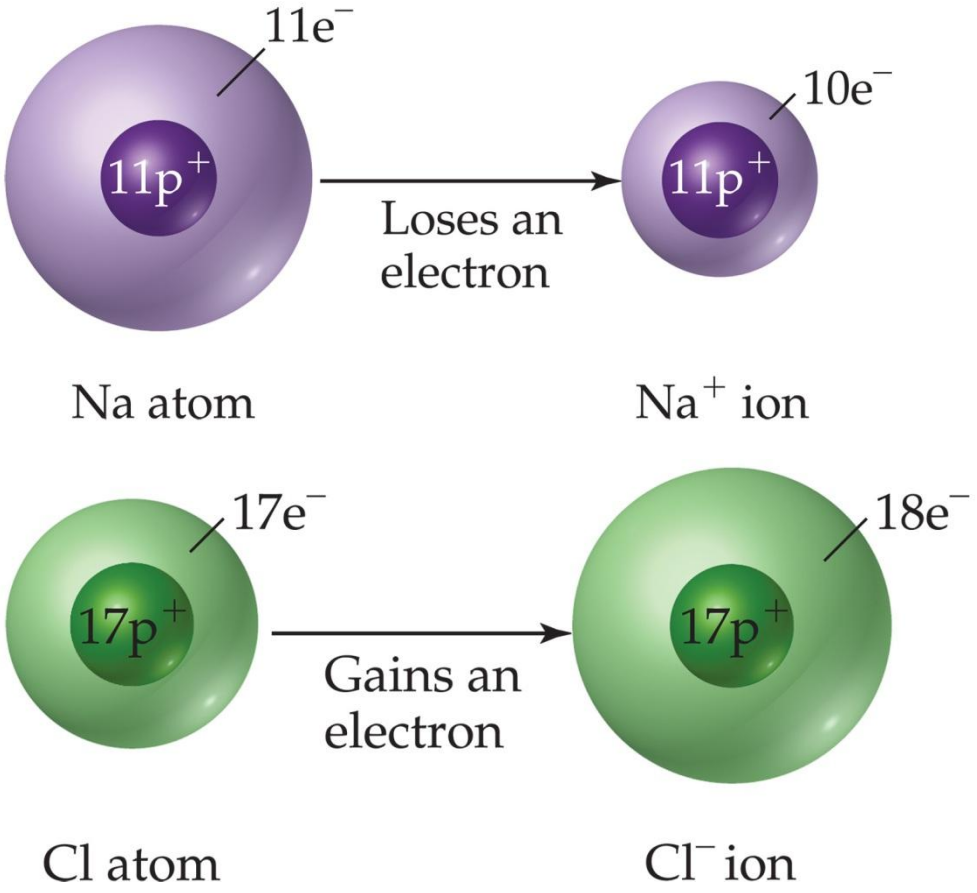
valentni elektroni

$$_{11}Na\ \underbrace{1s^2\ 2s^2\ 2p^6}_{\text{unutrašnji elektroni}}\ 3s^1 \longrightarrow Na^+\ \underbrace{1s^2\ 2s^2\ 2p^6}_{_{10}Ne}\ + e^-$$

$$_{17}Cl\ 1s^2\ 2s^2\ 2p^6\ 3s^2 3p^5\ + e^- \longrightarrow Cl^-\ \underbrace{1s^2\ 2s^2\ 2p^6\ 3s^2 3p^6}_{_{18}Ar}$$

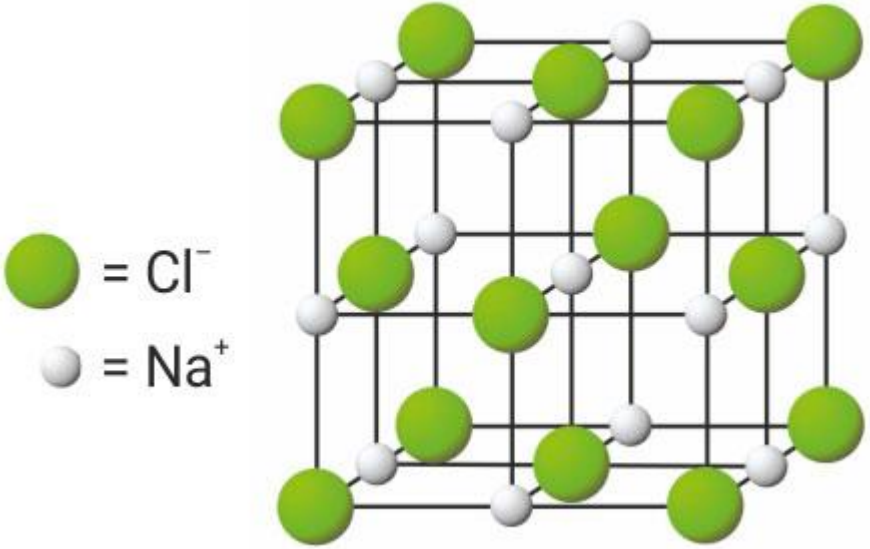
Na^+ Cl^-

elektrostatičke sile



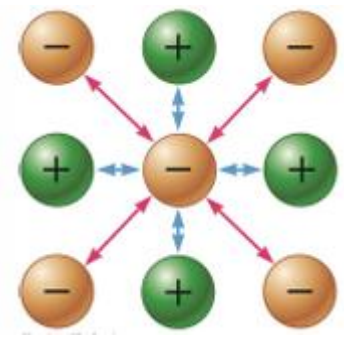
Na^+ Cl^-

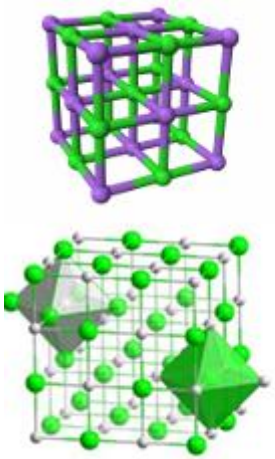
elektrostatičke sile

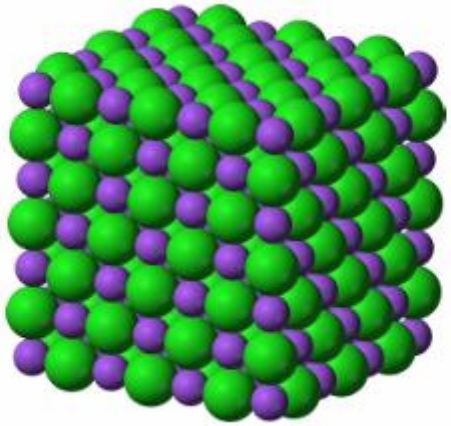


HEMIJSKE VEZE
Jonska veza

- Polje između jona je sferno.
- Veza je prostorno neusmjerena.
- Naelektrisanje jona ravnomjerno raspoređeno po površini. Anjoni se raspoređuju oko katjona i obrnuto.

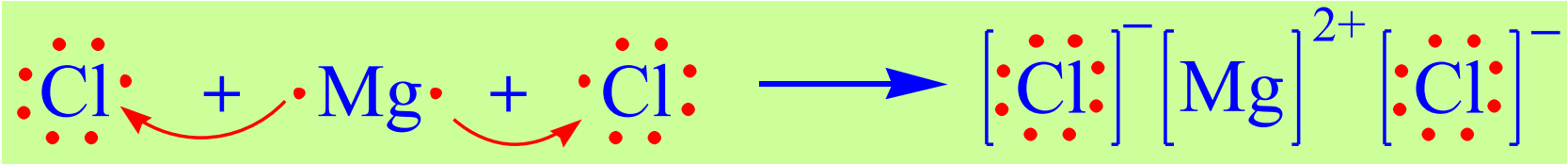






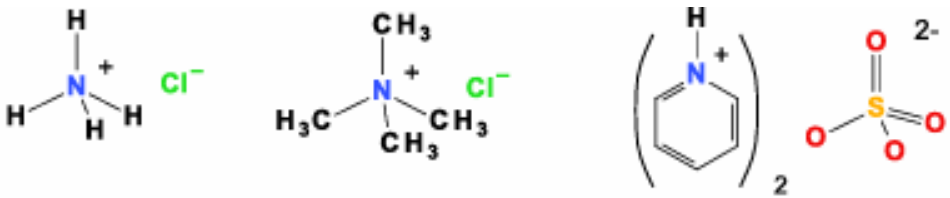
$_{12}Mg\ \ 1s^2\ \ 2s^2\ 2p^6\ 3s^2 \longrightarrow Mg^{2+}\ (\underbrace{1s^2\ \ 2s^2\ 2p^6}_{_{10}Ne})\ + 2e^-$

$_{17}Cl\ \ 1s^2\ \ 2s^2\ 2p^6\ 3s^2 3p^5\ \ + e^- \longrightarrow Cl^-\ \underbrace{1s^2\ \ 2s^2\ 2p^6\ 3s^2 3p^6}_{_{18}Ar}$



HEMIJSKE VEZE
Jonska veza

- Primjeri jonskih jedinjenja u kojima nema metala



Funkcija(e) ovog sastojka u kozmetičkim proizvodima

ANTIMIKROBNO

Pomaže u kontroli rasta mikroorganizama (npr. bakterija i gljivica)

ANTISTATIK

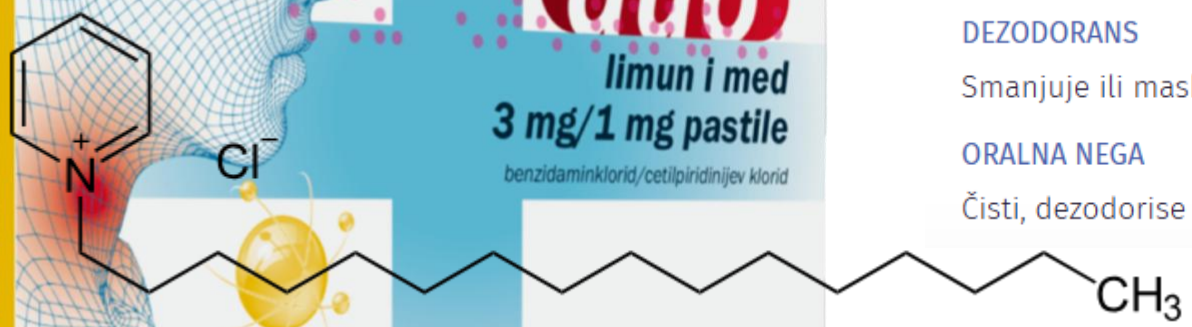
Smanjuje elektrostatičko naelektrisanje (npr. kose)

DEZODORANS

Smanjuje ili maskira neprijatne mirise tela

ORALNA NEGA

Čisti, dezodorise i/ili štiti usnu šupljinu ili zube



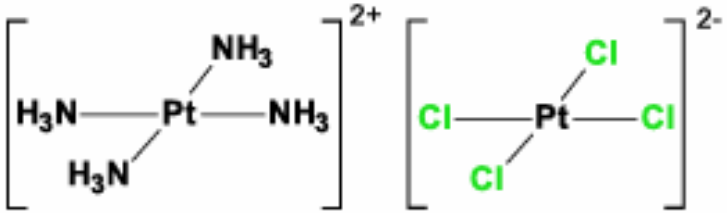
Cetilpiridinijum-hlorid

- Primjeri jonskih jedinjenja u kojima je metal sastavni dio i katjona i anjona

$KMnO_4$
K^+ MnO_4^-

$K_2Cr_2O_7$
$Cr_2O_7^{2-}$

K_2CrO_4
CrO_4^{2-}



$[Pt(NH_3)_4]^{2+}[PtCl_4]^{2-}$

HEMIJSKE VEZE
Osobine jedinjenja

-	Kovalentna veza

Molekularna jedinjenja

- Niska tačka ključanja
- Rastvaraju se većinom u nepolarnim rastvaračima
- Vodeni rastvori ne provode električnu struju

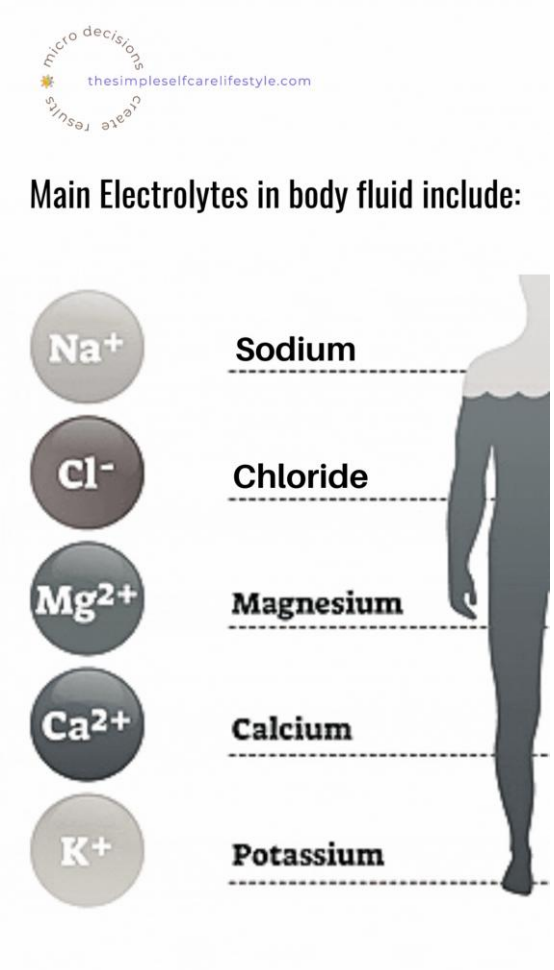
-	Jonska veza

Jonska jedinjenja

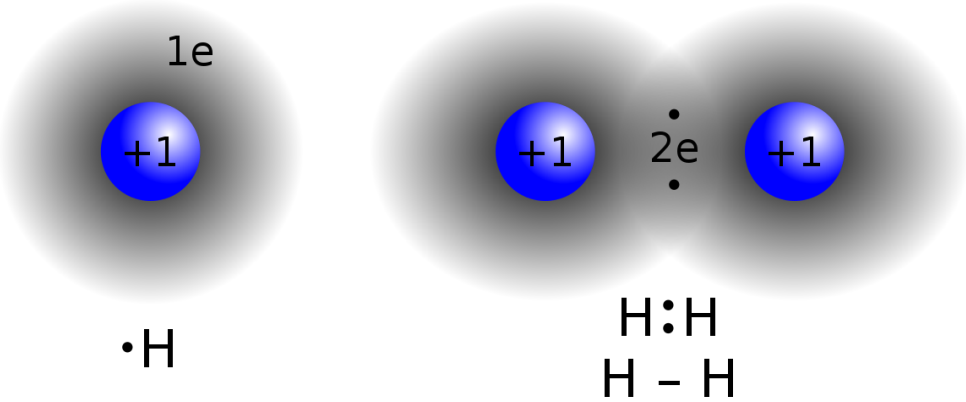
- Visoka tačka ključanja
- Rastvaraju se većinom u polarnim rastvaračima
- Vodeni rastvori provode električnu struju
- Rastopi provode električnu struju

HEMIJSKE VEZE

- Glavni izvor hlorida
- Održava koncentraciju elektrolita u organizmu
- Prema preporuci WHO dnevna doza NaCl-a za odraslu osobu iznosi 5 g
- Venska krv koja odlazi iz želuca ima manje hlorida i više hidrogenkarbonatnih jona nego arterijska krv
- Povećani unos kuhinjske soli uzrokuje povećani arterijski pritisak kao fiziološki odgovor kome je cilj održati homeostazu



HEMIJSKE VEZE
Kovalentna veza



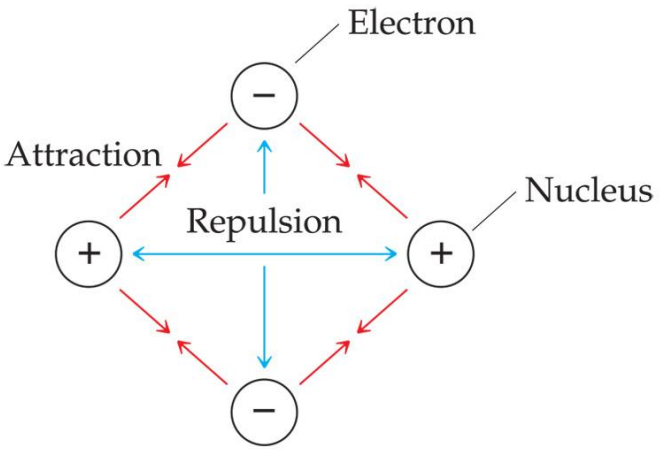
- U kovalentnim vezama atomi dijele elektrone
- Dijeljeni par elektrona djeluje kao neka vrsta “lijepka” za povezivanje atoma zajedno

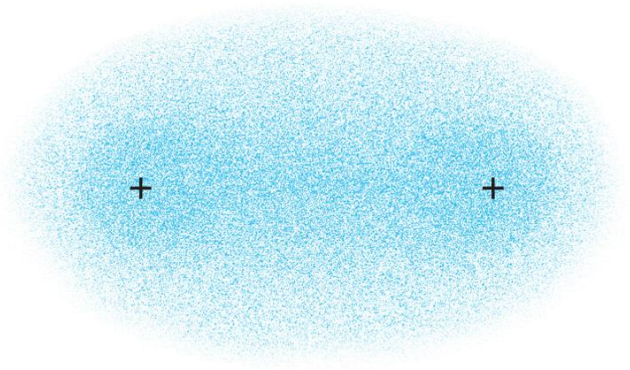
HEMIJSKE VEZE
Kovalentna veza

- Privlačenje elektrona i jezgra

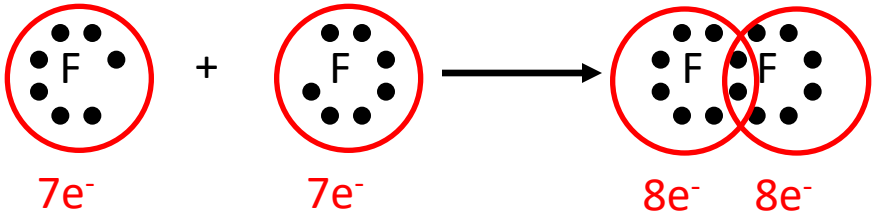
- Odbijanje između elektrona

- Odbijanje između nukleusa

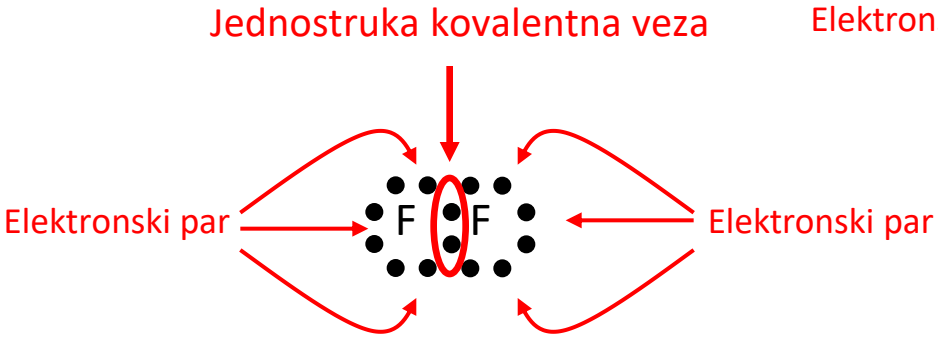


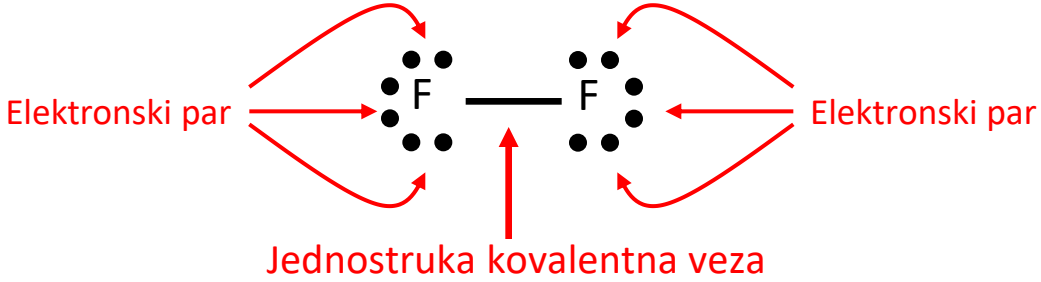


$_{9}F$ $1s^2 2s^2 2p^5$

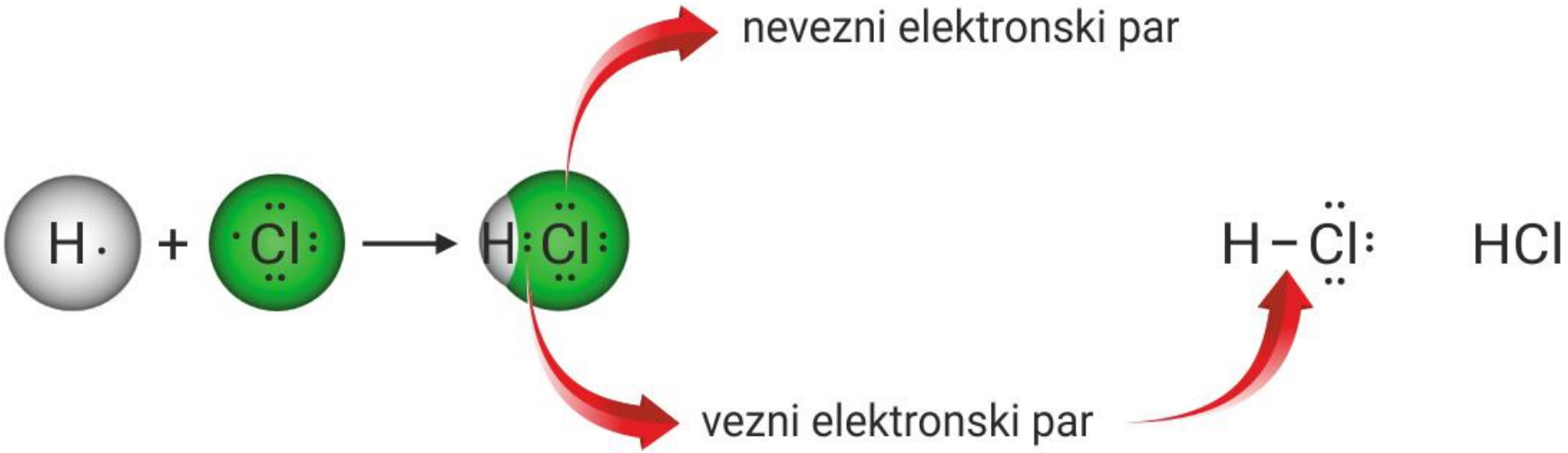


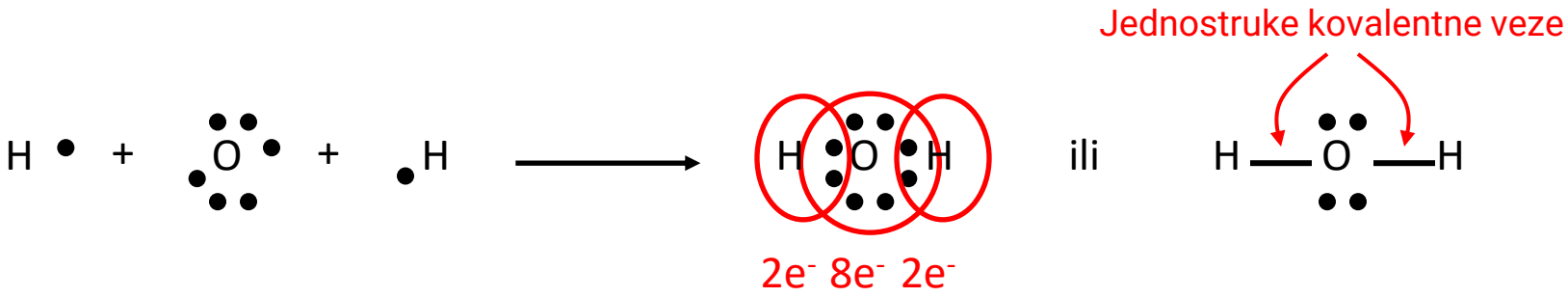
Luisove strukture F_2





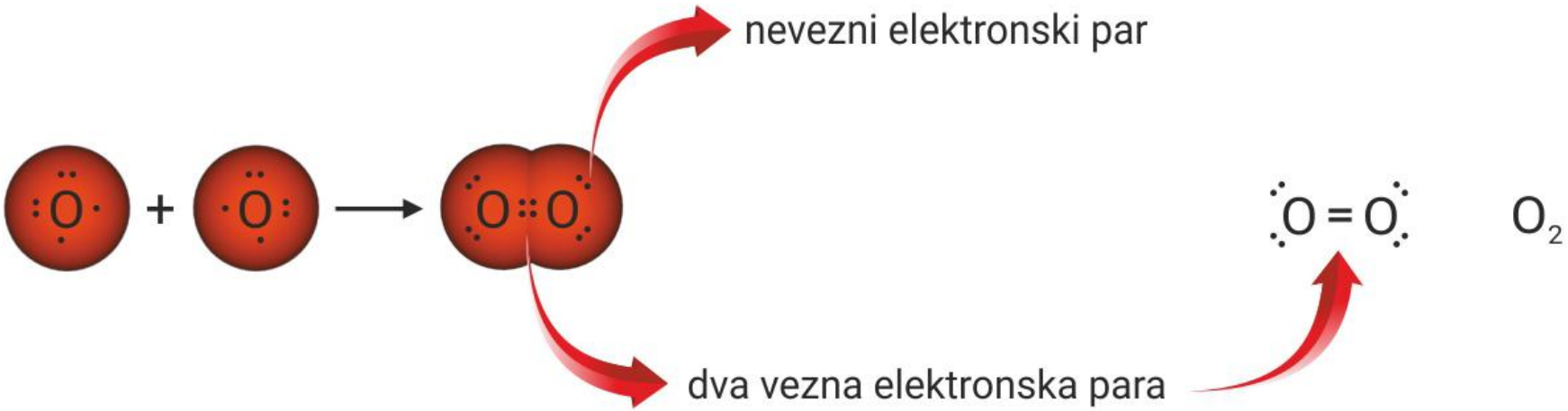
HEMIJSKE VEZE
Kovalentna veza



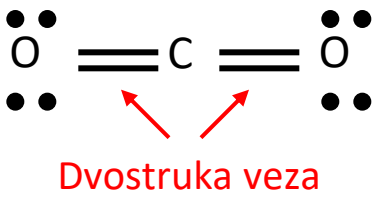


Luisove strukture vode

HEMIJSKE VEZE
Kovalentna veza



ili

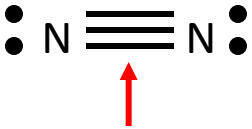


Dvostruka veza

dva atoma dijele dva elektronska para

Trostruka veza

ili

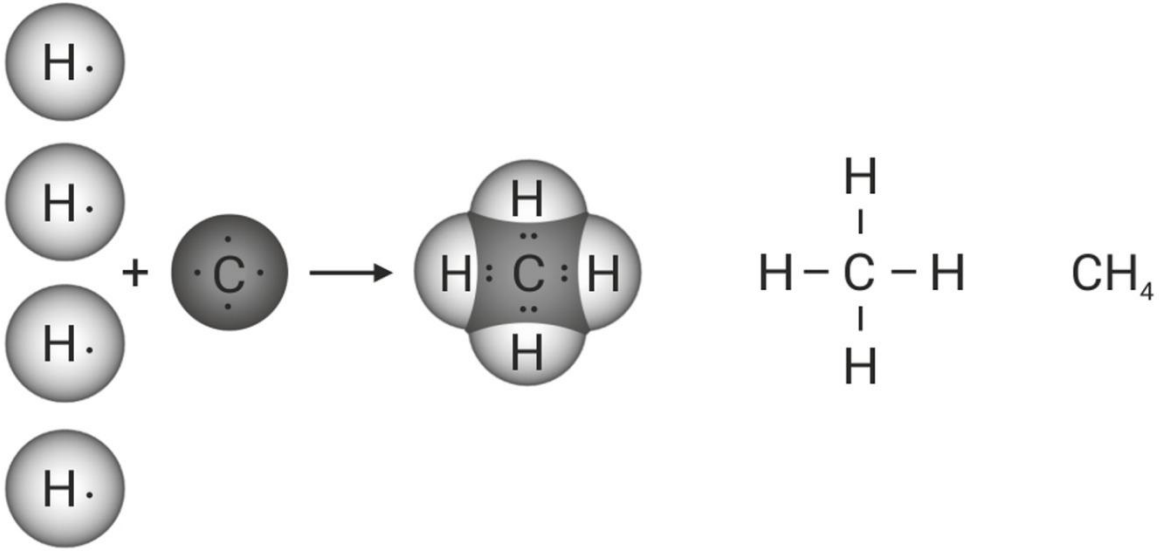


Trostruka veza

Trostruka veza

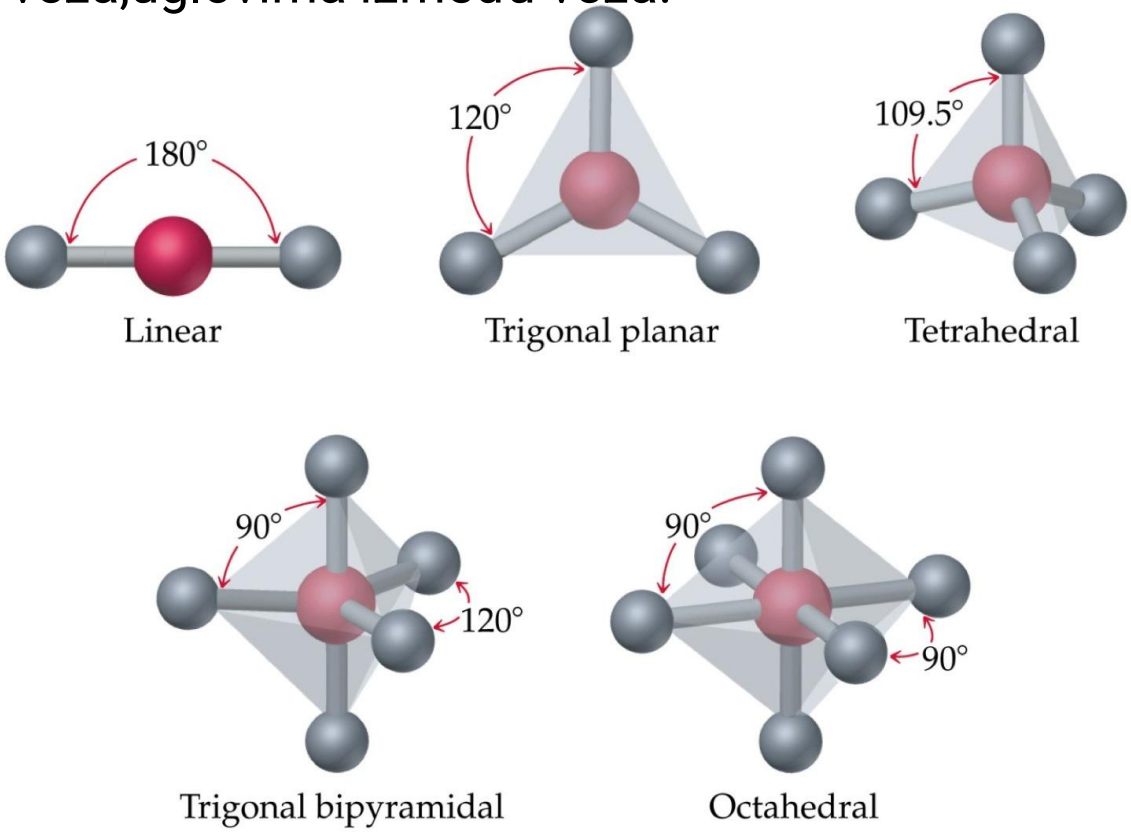
dva atoma dijele tri elektronska para

Koliko je vezivnih, a koliko nevezivnih parova u molekulu metana, CH_4



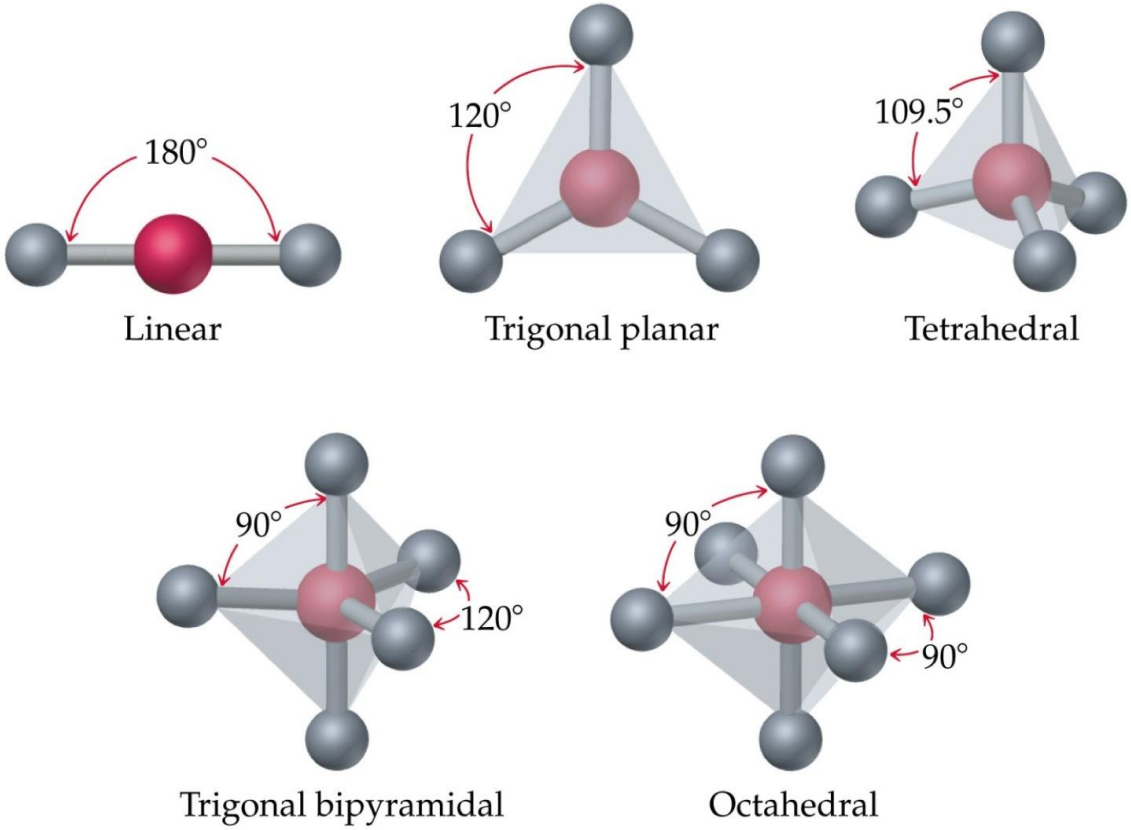
- Oblik/struktura u velikoj mjeri određuje hemijsko ponašanje (reaktivnost) i fizička svojstva: tačka ključanja, tačka topljenja, gustina, dipolni moment, rastvorljivost, molarna specifična toplota.
- tipom povezivanja atoma (vrstom veze),
- prostornim rasporedom atoma,
- dužinama veza,uglovima između veza.

Five fundamental shapes

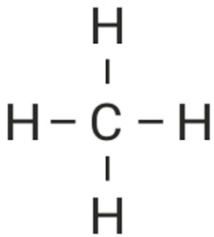


VSEPR princip: (**Valence Shell Electron Pair Repulsion teorija odbijanja elektronskih parova u valentnoj ljusci)**
raspored vezanih atoma oko centralnog atoma takav je da je razmak između njih što veći, kako bi se minimizovalo odbijanje elektronskih parova.

Five fundamental shapes



Empirijska ili strukturna formula



CH_4

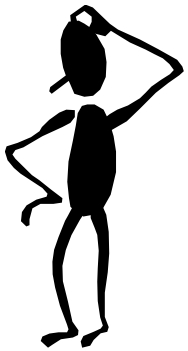
Formula natrijum-hlorida

$Na^{+}\ Cl^{-}$

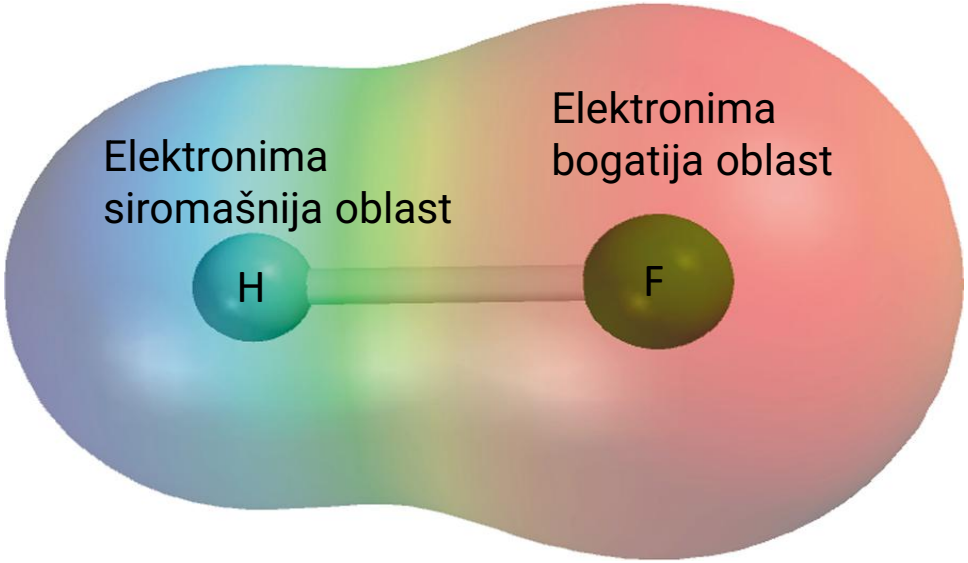
Na Cl

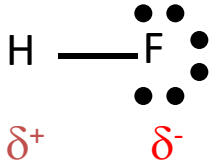
~~Na - Cl~~

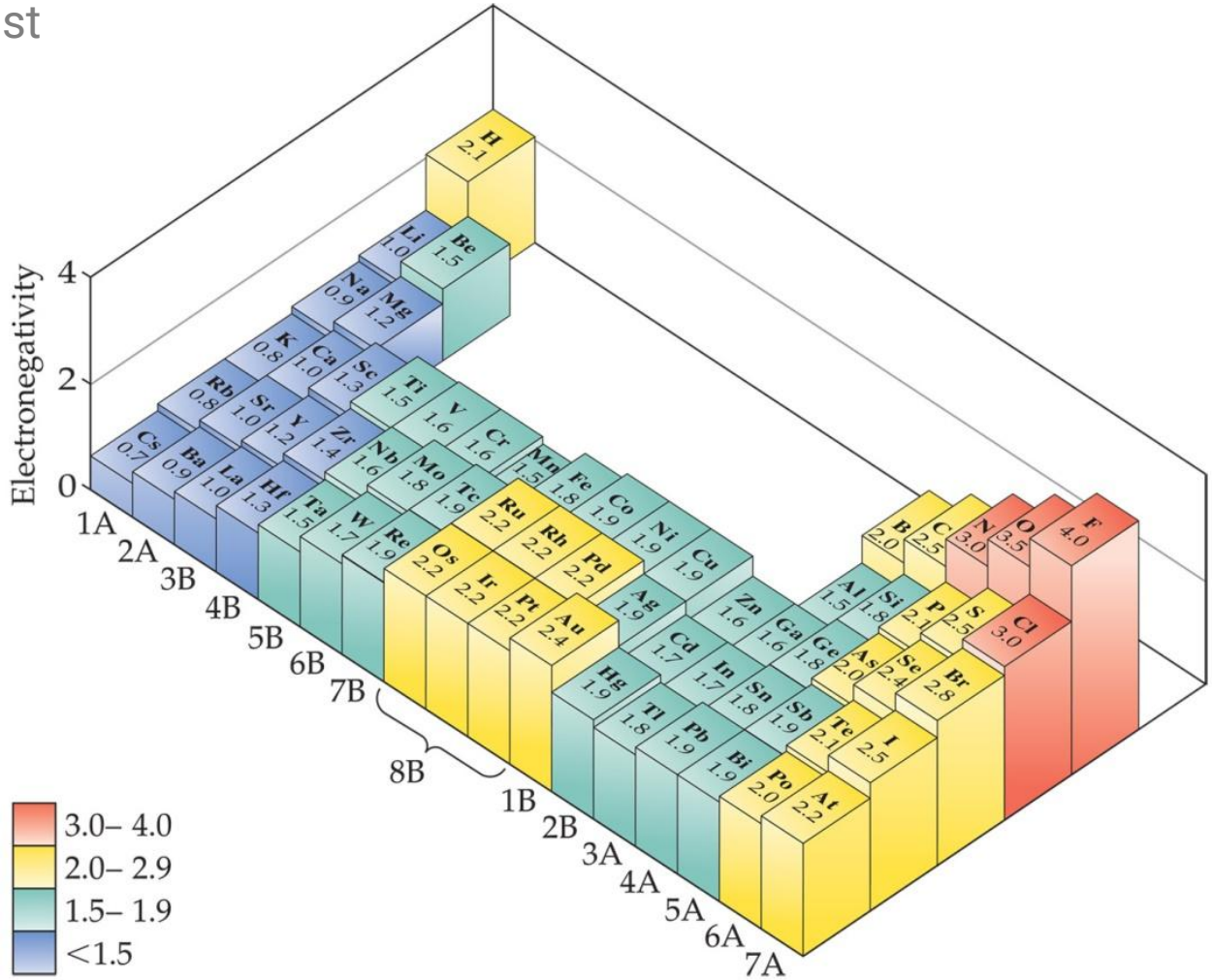
HEMIJSKE VEZE
Kovalentna veza



Da li elektroni iz zajedničkog para jednako pripadaju i jednom i drugom atomu?







Elektronegativnost χ

sposobnost atoma da privlači elektrone iz kovalentne veze

HEMIJSKE VEZE
polarnost

Elektronegativnost ***raste***

Elektronegativnost ***opada***

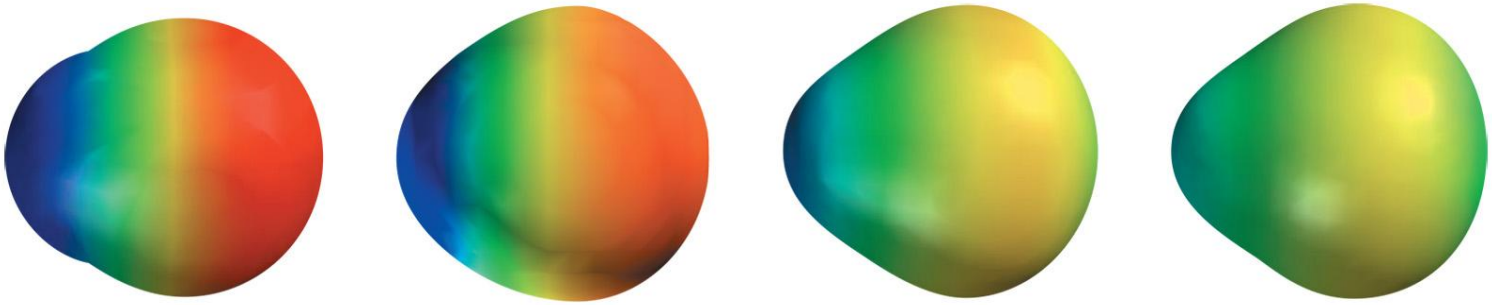
1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 H 1.00794																	2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050											13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9381	26 Fe 55.847	27 Co 58.9332	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 *La 138.906	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	89 †Ac 227.028	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (272)		114 (287)		116 (289)		118 (293)

*Lanthanide series	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
†Actinide series	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	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)

HEMIJSKE VEZE
Polarna kovalentna veza

Compound	Bond Length (Å)	Electronegativity Difference	Dipole Moment (D)
HF	0.92	1.9	1.82
HCl	1.27	0.9	1.08
HBr	1.41	0.7	0.82
HI	1.61	0.4	0.44

Što je veća razlika u elektronegativnosti, veza je polarnija



HF HCl HBr HI

HEMIJSKE VEZE
Polarna kovalentna veza

GRUPA

PERIODA	1	2	13	14	15	16	17
1	H 2,2						
2	Li 0,98	Be 1,57	B 2,04	C 2,55	N 3,04	O 3,44	F 3,98
3	Na 0,93	Mg 1,31	Al 1,61	Si 1,9	P 2,19	S 2,58	Cl 3,16
4	K 0,82	Ca 0,95	Ga 1,81	Ge 2,01	As 2,18	Se 2,55	Br 2,96
5	Rb 0,82	Sr 0,89	In 1,78	Sn 1,96	Sb 2,05	Te 2,1	I 2,66
6	Cs 0,79	Ba 0,89	Tl 1,8	Pb 1,8	Bi 1,9	Po 2	At 2,2

- **F_2**

4.0 –4.0 =0 nepolarna

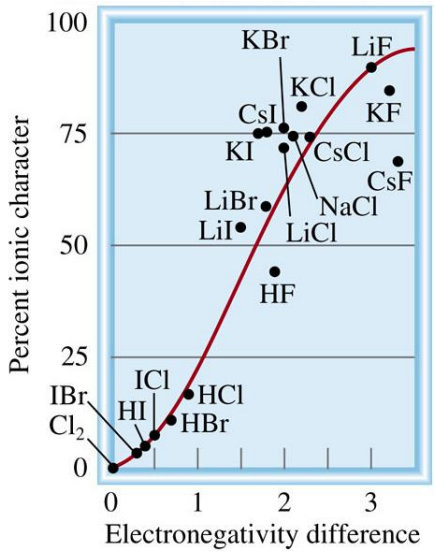
- **HF**

4.0 –2.1 = 1.9 polarna kovalentna

- **LiF**

4.0 –1.0 = 3.0 jonska

HEMIJSKE VEZE
Polarna kovalentna veza



Razlika elektronegativnosti	Tip veze
0	Nepolarna kovalentna
≥ 1,9	jonska
0 < and < 1,9	Polarna kovalentna

Povećanje razlike elektronegativnosti →

kovalentna → Polarna kovalentna → jonska

Dijeljenje e^- → Parcijalna predaja e^- → predaja e^-

Koja veza je polarnija?

B-Cl ili C-Cl

Koja veza je polarnija?

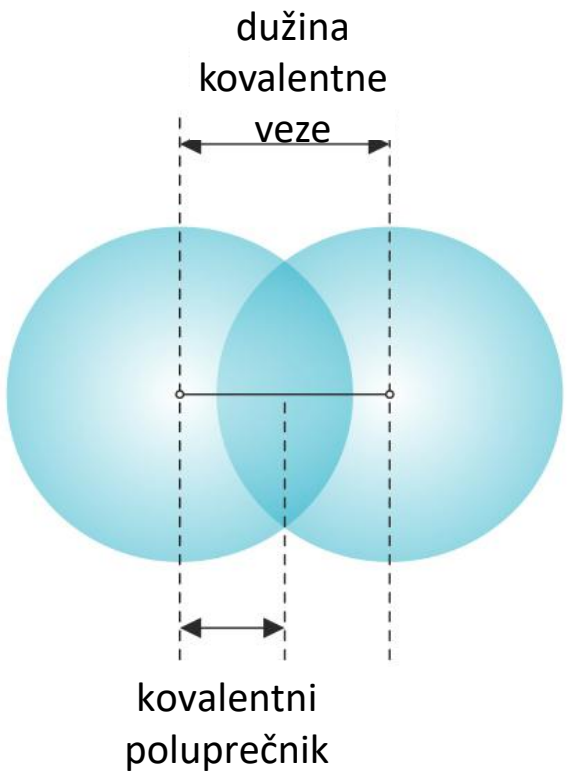
B-Cl ili C-Cl

•Razlika u elektronegativnosti između Cl i B
3.0 –2.0 = 1.0

•Razlika između hlora i ugljenika
3.0 –2.5 = 0.5

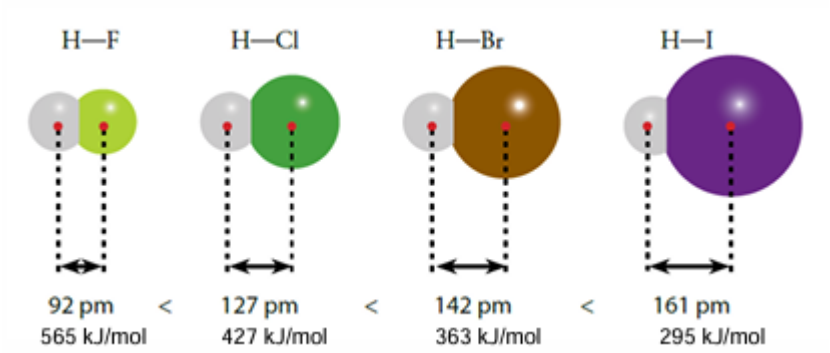
•***B-Cl je polarnija***. Atom *hlora je parcijalno negativno naelektrisan jer ima veću elektronegativnost.*

HEMIJSKE VEZE



- Svaka hemijska veza je određena dužinom veze i energijom veze.
- Veza je jača što je dužina veze manje, a energija veze veća.

HEMIJSKE VEZE



	C–C 154 pm 347 kJ/mol	N–N 145 pm 163 kJ/mol	O–O 145 pm 142 kJ/mol
	C=C 134 pm 611 kJ/mol	N=N 123 pm 418 kJ/mol	O=O 121 pm 498 kJ/mol
	C≡C 120 pm 837 kJ/mol	N≡N 110 pm 946 kJ/mol	

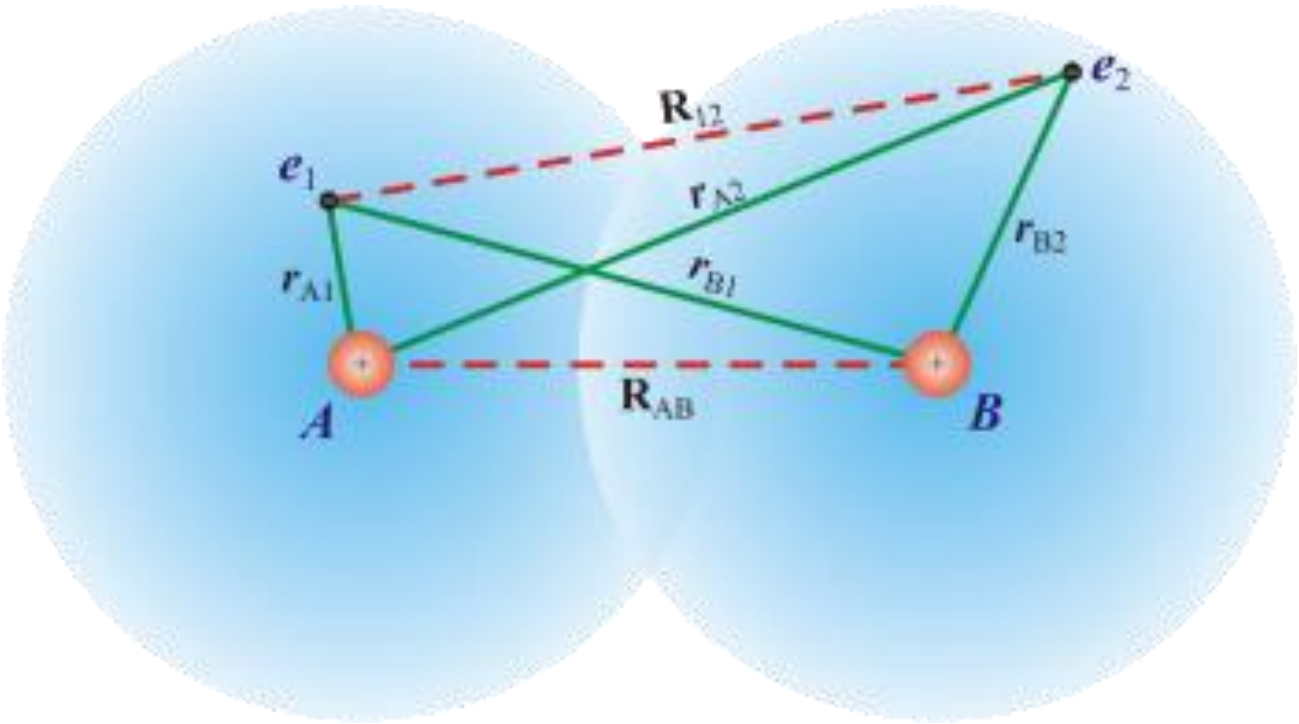
- Dužina veze zavisi i od veličine atoma
- Ali i od reda veze

- Kvantno-mehaničke teorije kovalentne veze

Teorija valentne veze

Teorija molekulskih orbitala

HEMIJSKE VEZE
Teorija valentne veze



a. međusobno privlačenje jezgra A i elektrona e_1
b. međusobno privlačenje jezgra A i elektrona e_2
c. međusobno privlačenje jezgra B i elektrona e_2
d. međusobno privlačenje jezgra B i elektrona e_1
e. međusobno odbijanje elektrona e_1 i e_2
f. međusobno odbijanje jezgara A i B

HEMIJSKE VEZE
Teorija valentne veze

Generalić, Eni. "Kemijska veza: Teorija valentne veze." *EniG. Periodni sustav elemenata*. KTF-Split, 3 Mar. 2020. Web. 8 Oct. 2020. <https://www.periodni.com/enig/kemijska_veza_teorija_valentne_veze.html>.

Glavne postavke teorije valentne veze

- Većina elektrona u molekulu ostaje u istim atomskim orbitalama koje su zauzimali dok su bili u razdvojenim atomima

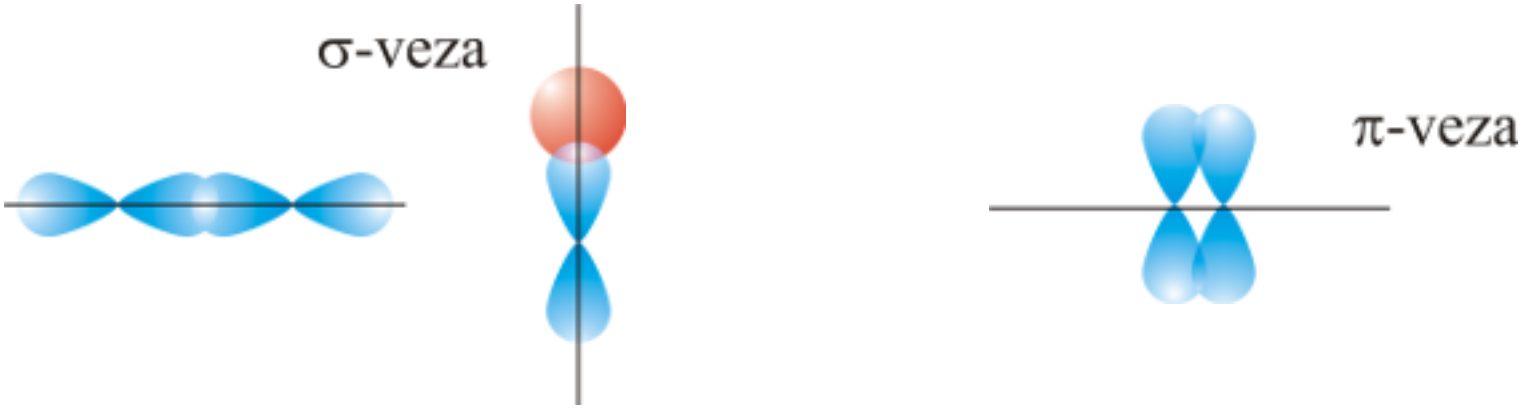
- Po jedna valentna orbitala oba atoma stupa u vezu pri čemu se djelimično preklapaju

- Dva elektrona suprotnog spina, smještaju se u preklopljen orbitale

- Elektronski par u preklopljenim orbitalama čini vezu i zove se zajednički elektronski par

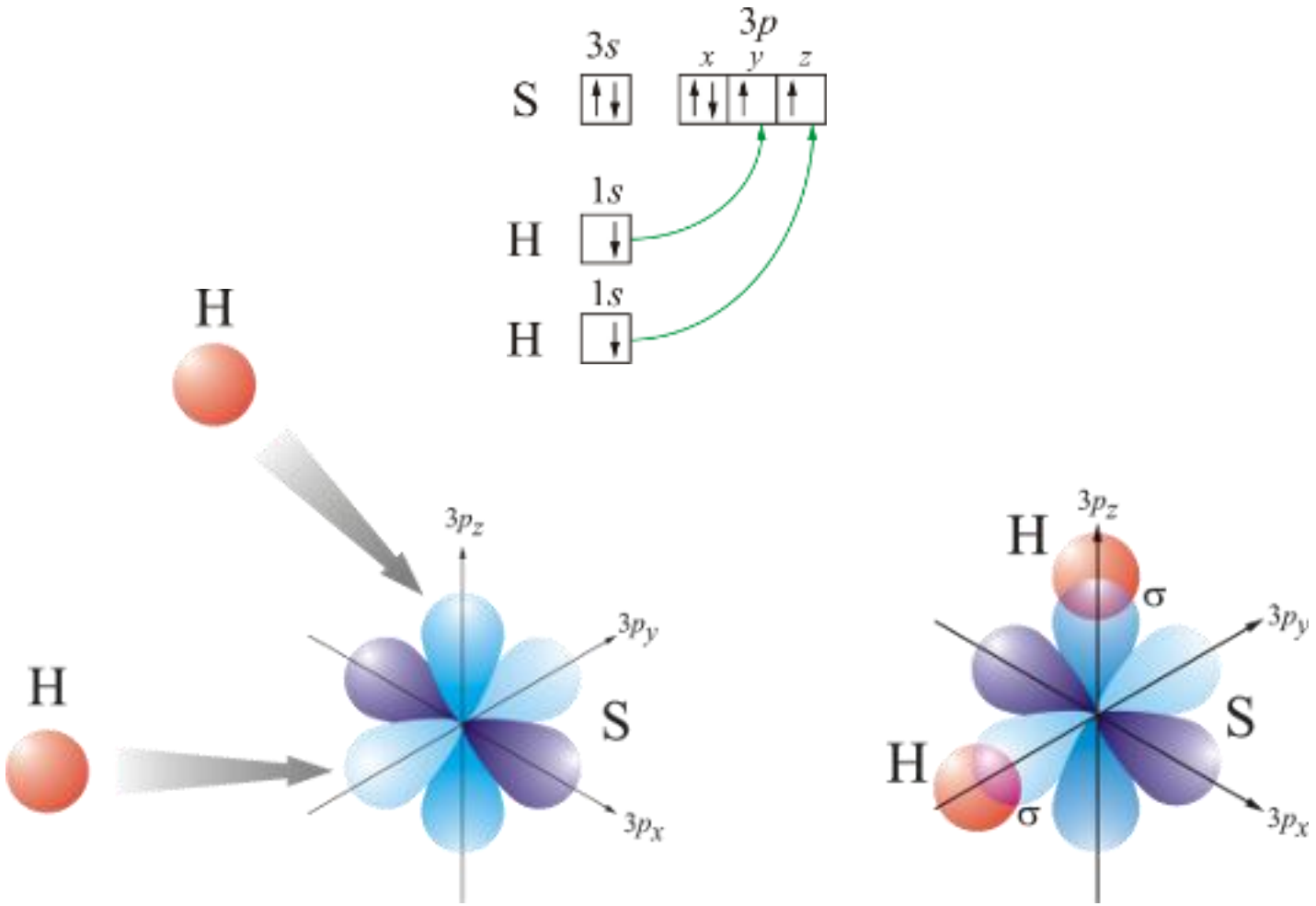
- Među atomima u molekulu nastaje lokalizovana veza

Glavne postavke teorije valentne veze



Generalić, Eni. "Kemijska veza: Teorija valentne veze." *EniG. Periodni sustav elemenata*. KTF-Split, 3 Mar. 2020. Web. 8 Oct. 2020. <https://www.periodni.com/enig/kemijska_veza_teorija_valentne_veze.html>.

Primjer: molekul sumporvodonika



Generalić, Eni. "Kemijska veza: Teorija valentne veze." *EniG. Periodni sustav elemenata*. KTF-Split, 3 Mar. 2020. Web. 8 Oct. 2020. <https://www.periodni.com/enig/kemijska_veza_teorija_valentne_veze.html>.

Primjeri objašnjenja veza hibridnim orbitalama

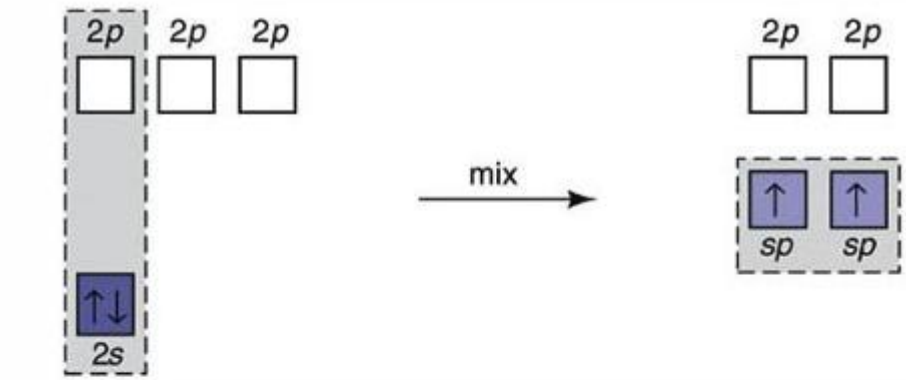
- Hibridizacija je računski postupak kojim iz datog broja AO dobijamo isti broj novih hibridnih orbitala (linearna kombinacija talasnih funkcija istog atoma).

- Hibridne orbitale su u prostoru usmjerene tako da su što više razmaknute.

- Hibridne orbitale se intenzivnije preklapaju od početnih AO → jače veze u molekulima.

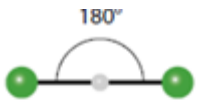
Primjeri objašnjenja veza hibridnim orbitalama

- sp hibridizacija

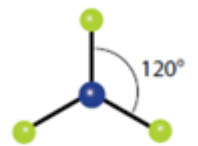


Be [He] $2s^2\ 2p_x^0\ 2p_y^0\ 2p_z^0$

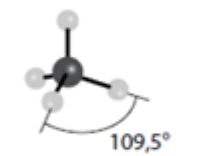
$BeCl_2$



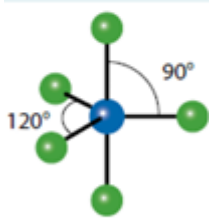
BF_3



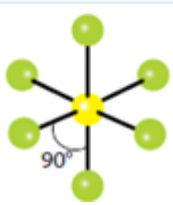
CH_4

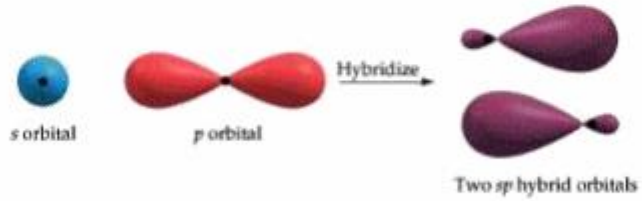


PCl_5



SF_6

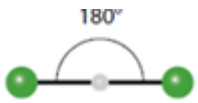




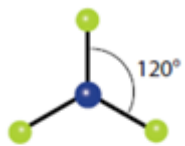
Primjeri objašnjenja veza hibridnim orbitalama

- sp^2 hibridizacija

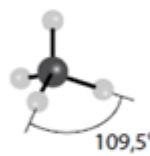
$BeCl_2$



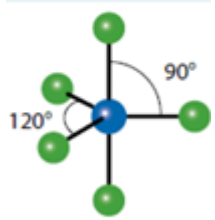
BF_3



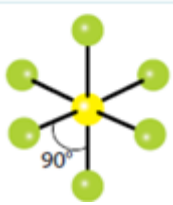
CH_4

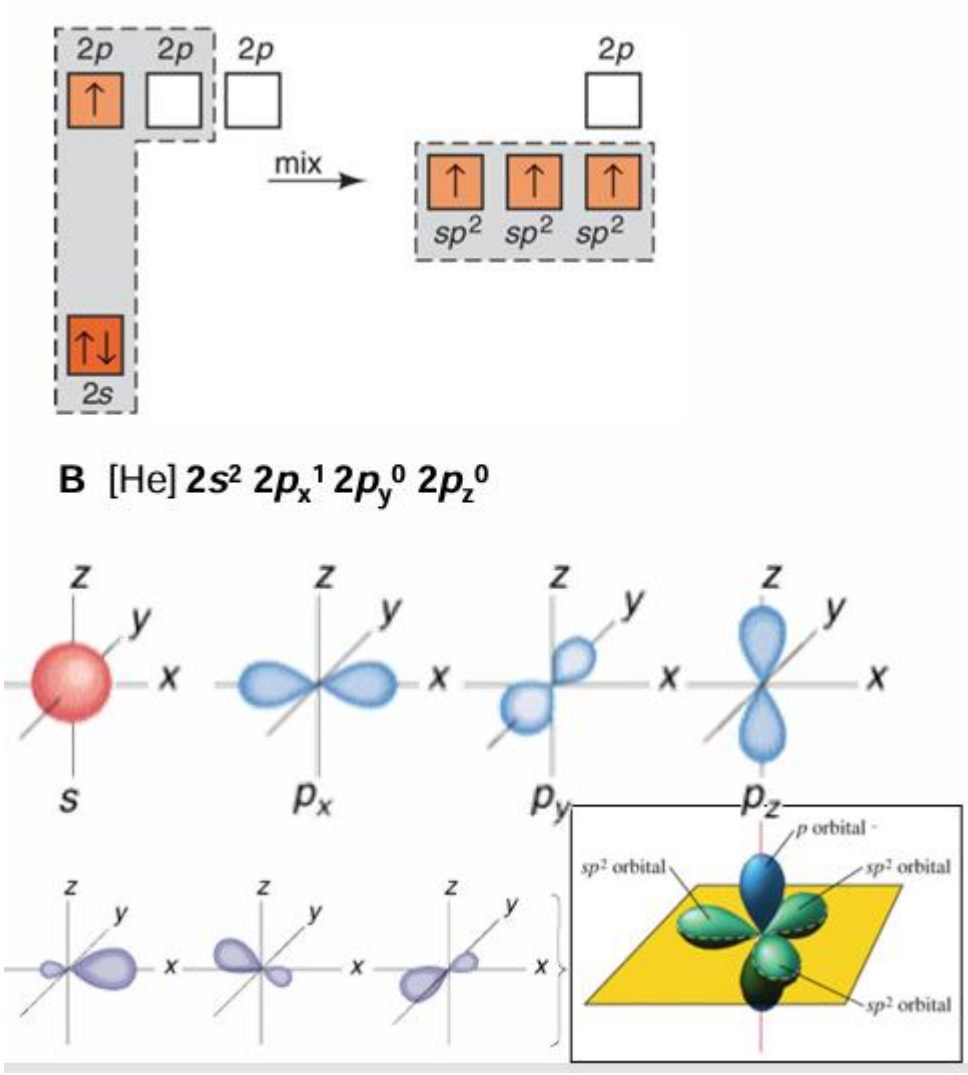


PCl_5



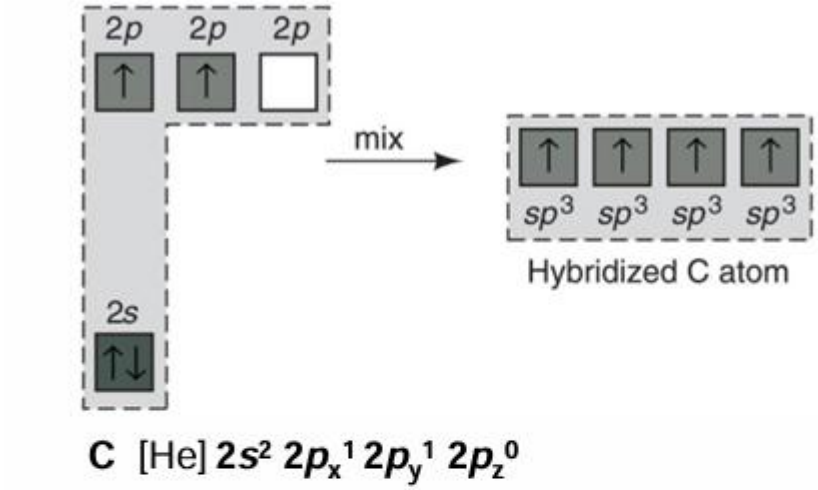
SF_6



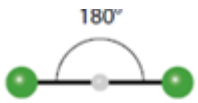


Primjeri objašnjenja veza hibridnim orbitalama

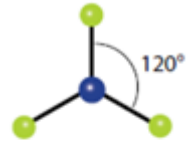
- sp^3 hibridizacija



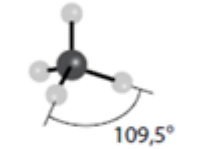
$BeCl_2$



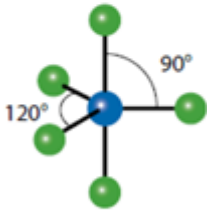
BF_3



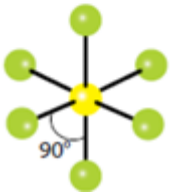
CH_4

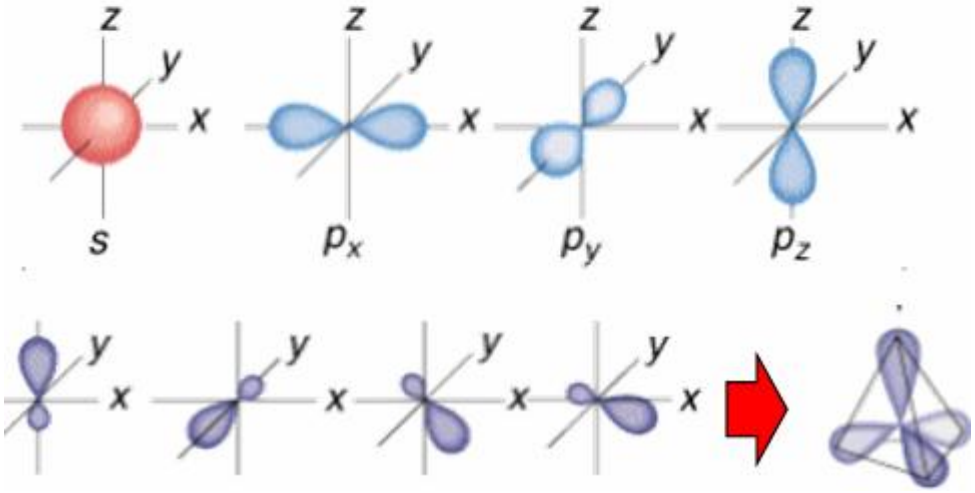


PCl_5



SF_6

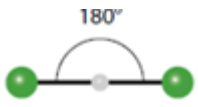




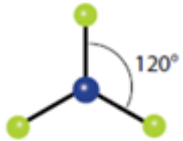
Primjeri objašnjenja veza hibridnim orbitalama

- sp^3d hibridizacija

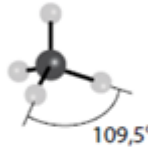
$BeCl_2$



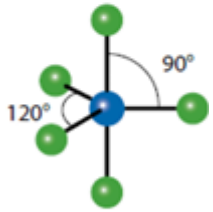
BF_3



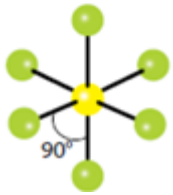
CH_4

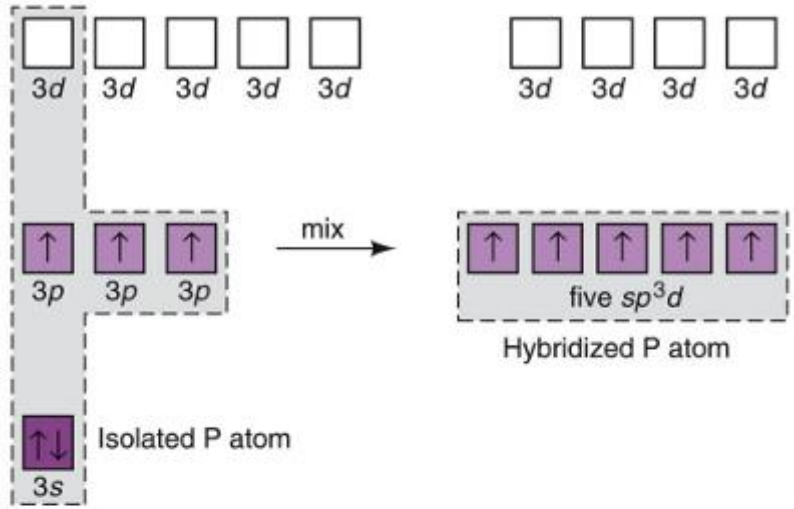


PCl_5

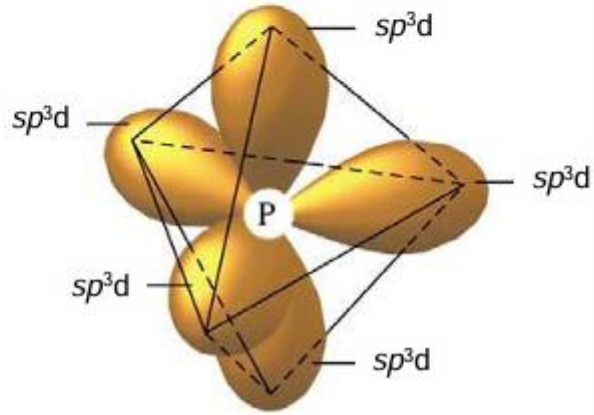


SF_6





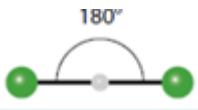
P [Ne] $3s^2\ 3p_x^1\ 3p_y^1\ 3p_z^1$



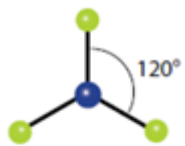
Primjeri objašnjenja veza hibridnim orbitalama

- sp^3d^2 hibridizacija

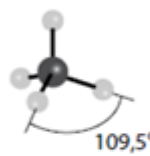
$BeCl_2$



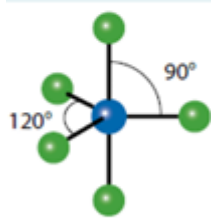
BF_3



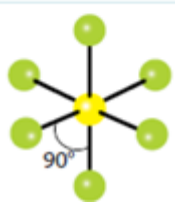
CH_4

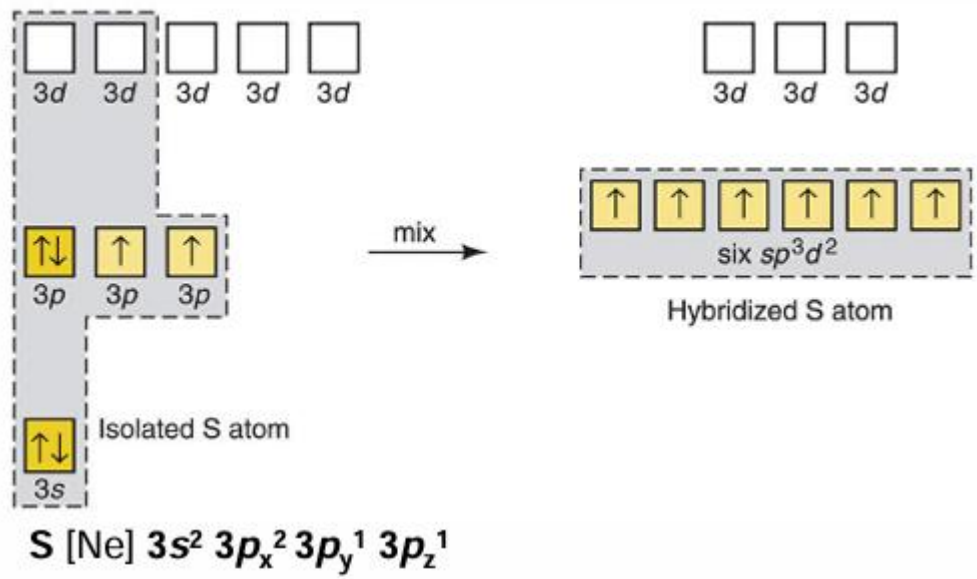


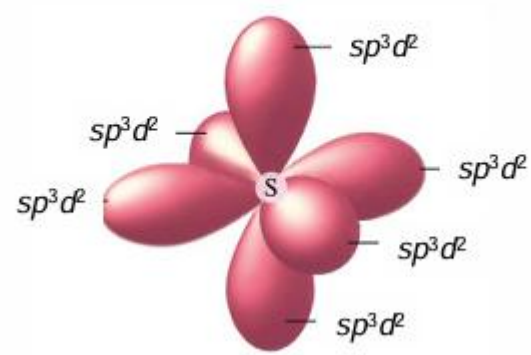
PCl_5



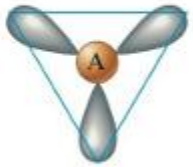
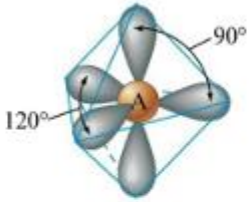
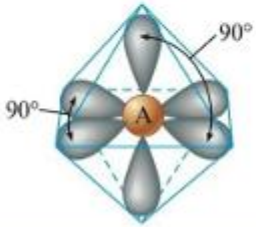
SF_6







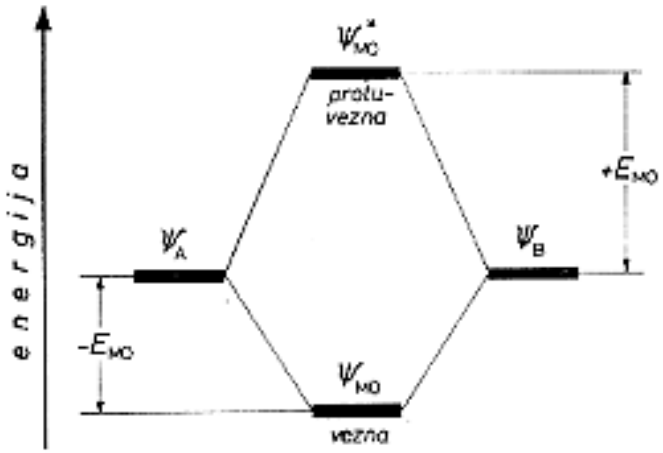
HEMIJSKE VEZE

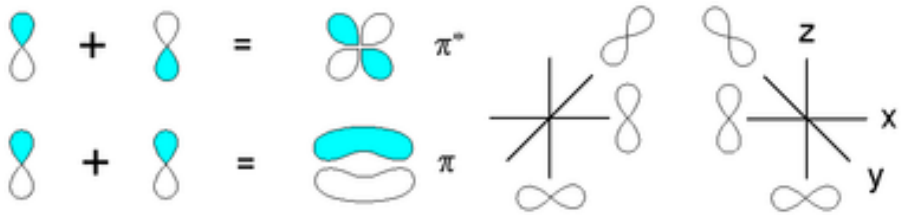
Number of Electron Pairs	Arrangement of Electron Pairs		Example
2	Linear		
3	Trigonal planar		
4	Tetrahedral		
5	Trigonal bipyramidal		
6	Octahedral		

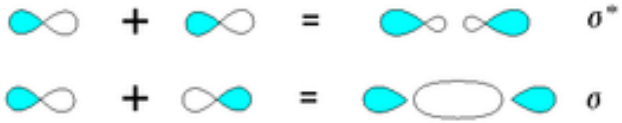
Photos: Ken O'Donoghue © Cengage Learning

© Cengage Learning. All Rights Reserved.

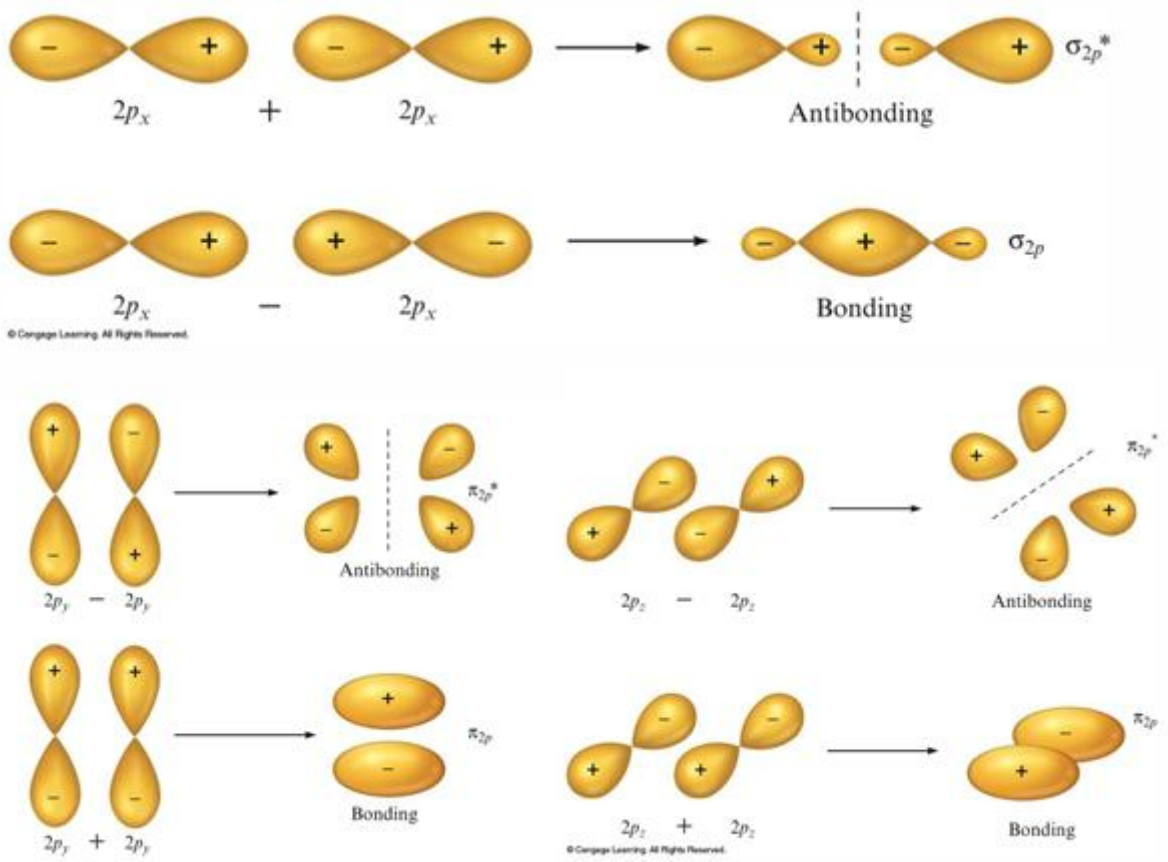
HEMIJSKE VEZE
Teorija molekulskih orbitala

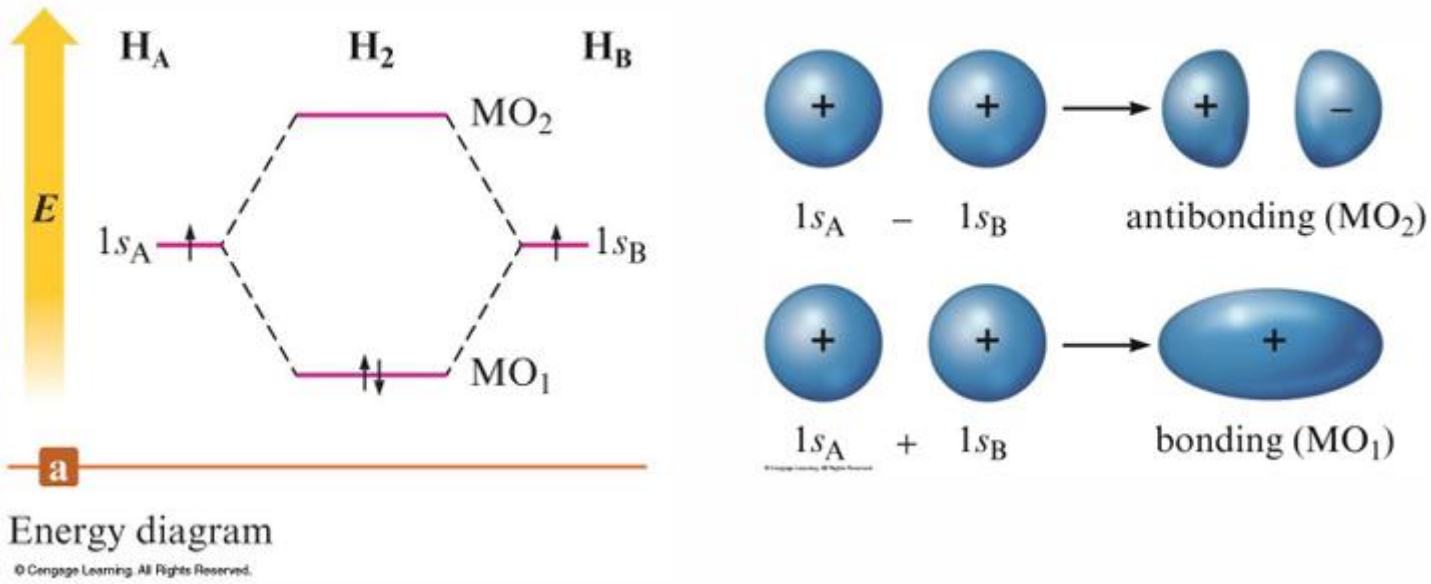






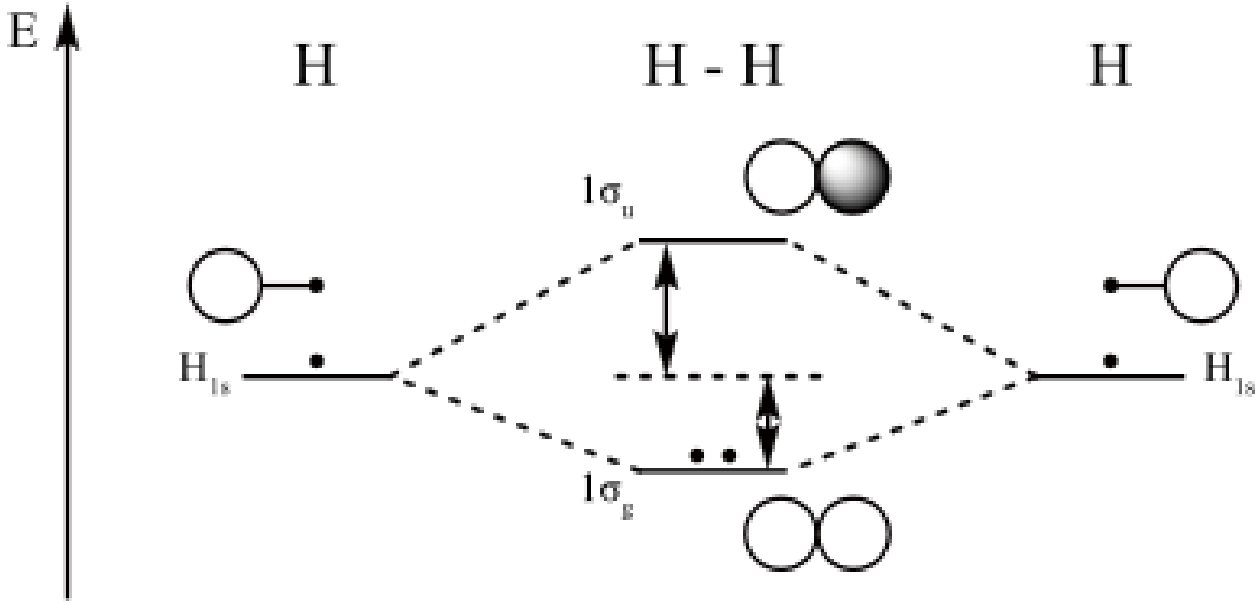
HEMIJSKE VEZE
Teorija molekulskih orbitala





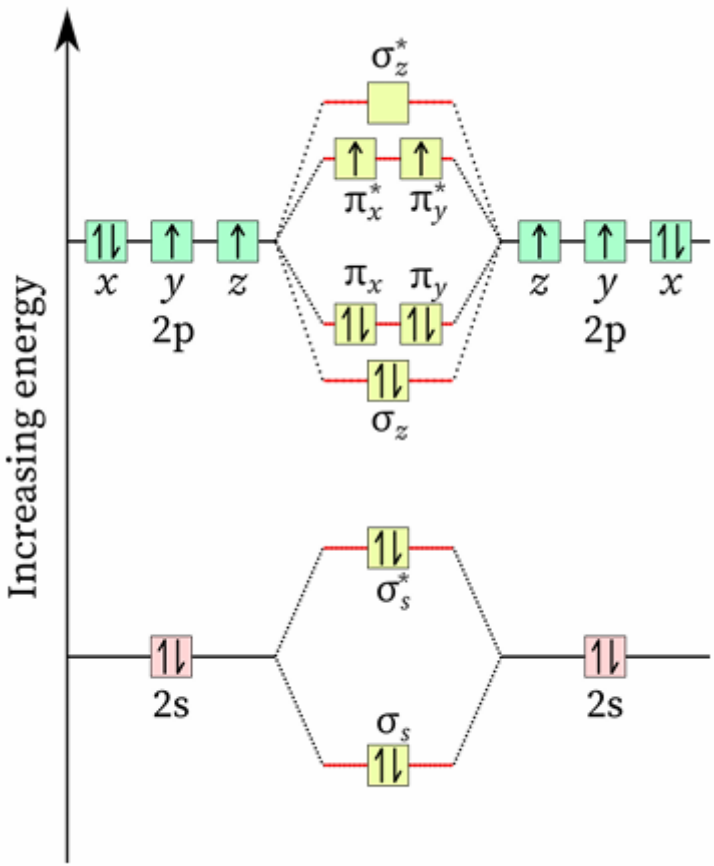
MO dijagram vodonika

$$\textbf{Red veze} = \frac{br.elektrona\ u\ vezivnim - br.elektrona\ u\ antivezivnim\ MO}{2}$$



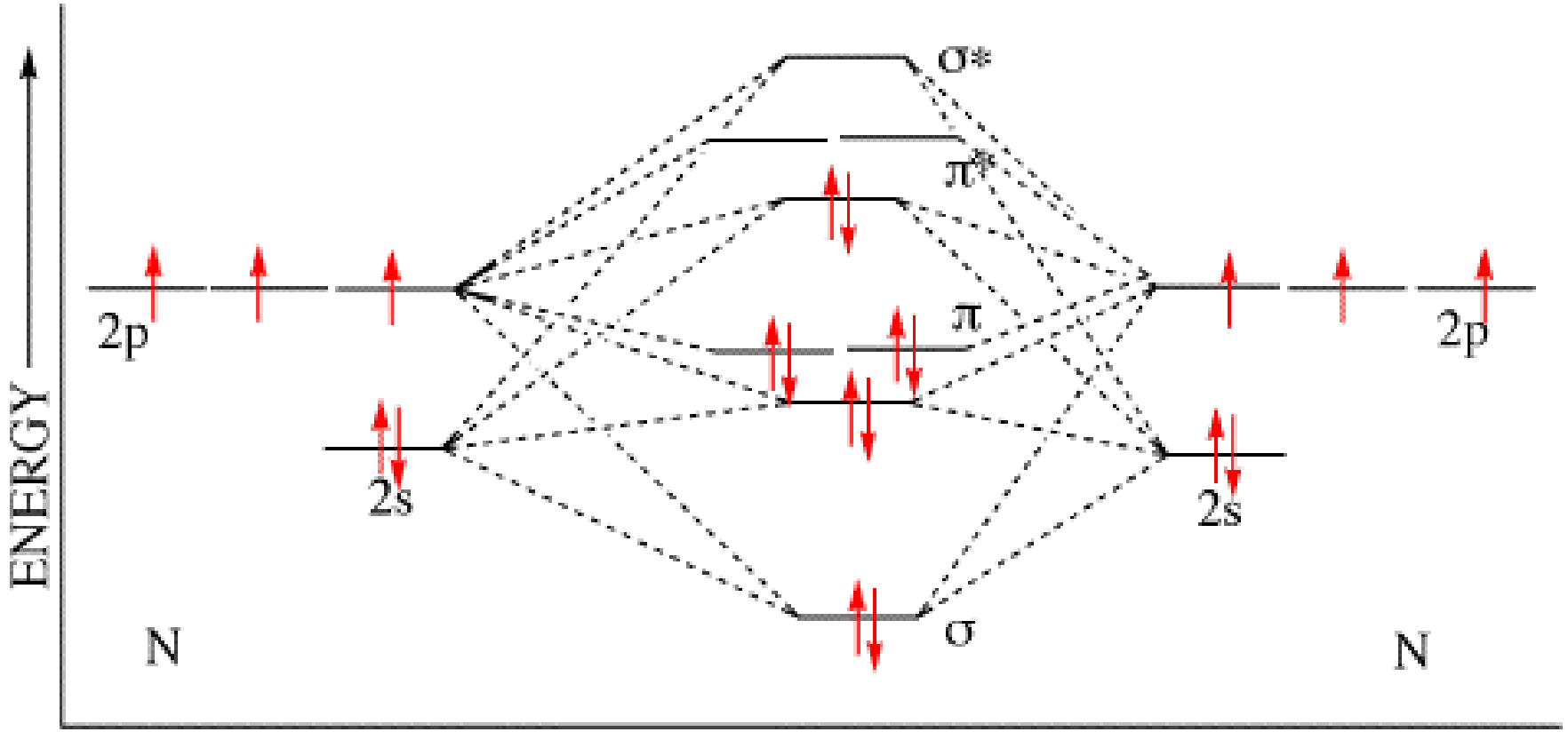
MO dijagram vodonika

$$\textbf{Red veze} = \frac{br.elektrona\ u\ vezivnim - br.elektrona\ u\ antivezivnim\ MO}{2}$$



MO dijagram kiseonika

$$R.V=\frac{8-4}{2}=2$$



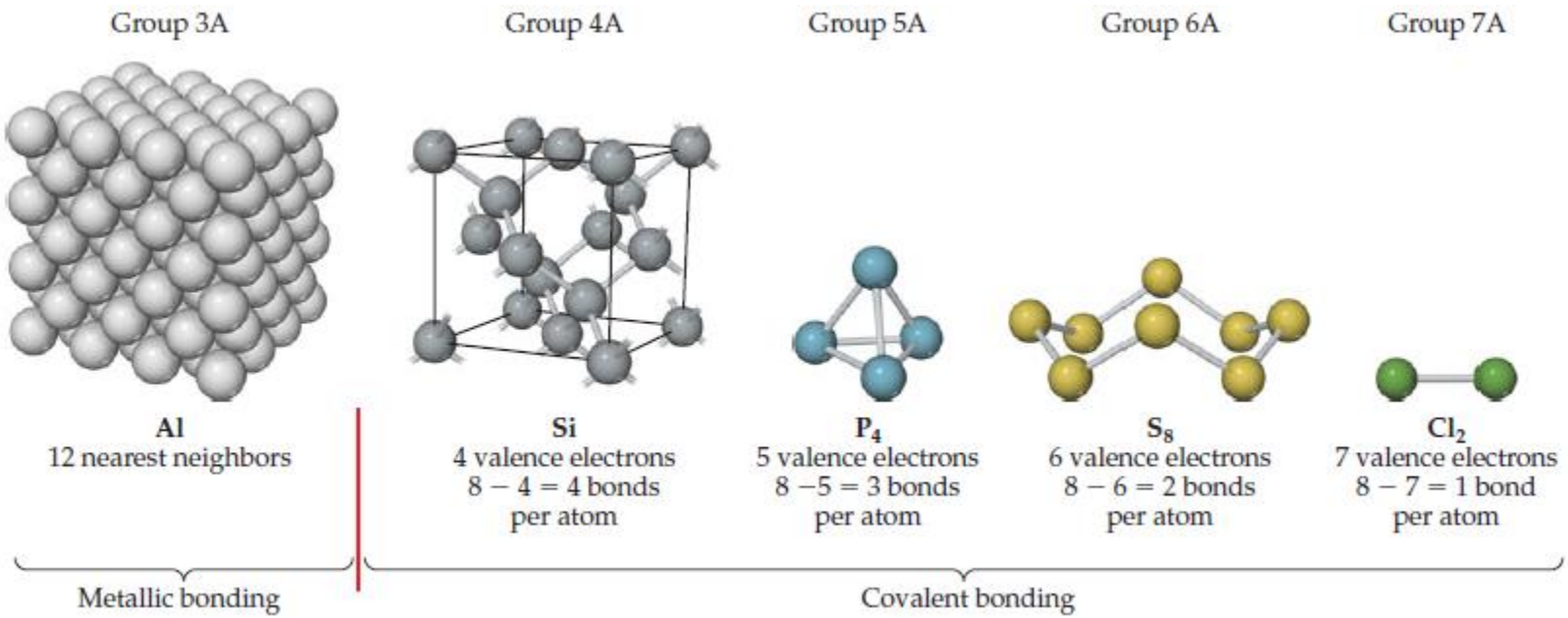
MO dijagram azota

R.V=?

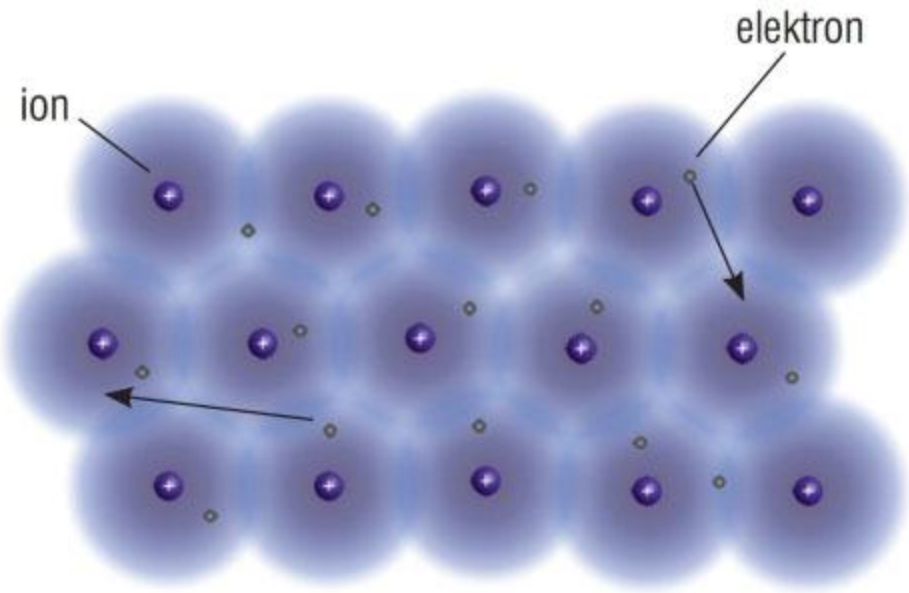
HEMIJSKE VEZE

- TRI OSNOVNA TIPA
  - **<u>jonska</u>**
    - Elektrostatičko privlačenje između jona
  - **<u>kovalentna</u>**
    - Dijeljenje elektrona
  - **<u>metalna</u>**
    - Atomi metala vezani sa nekoliko drugih atoma

HEMIJSKE VEZE
Metalna veza



HEMIJSKE VEZE
Metalna veza

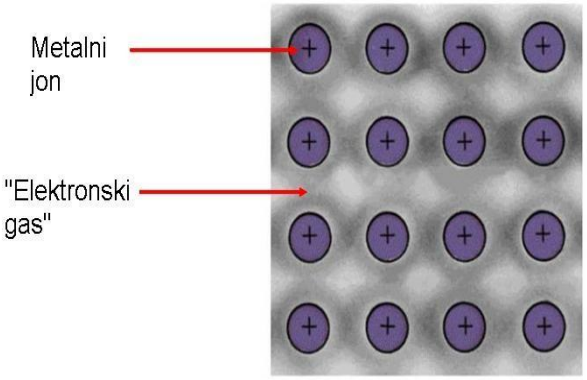


HEMIJSKE VEZE
Metalna veza

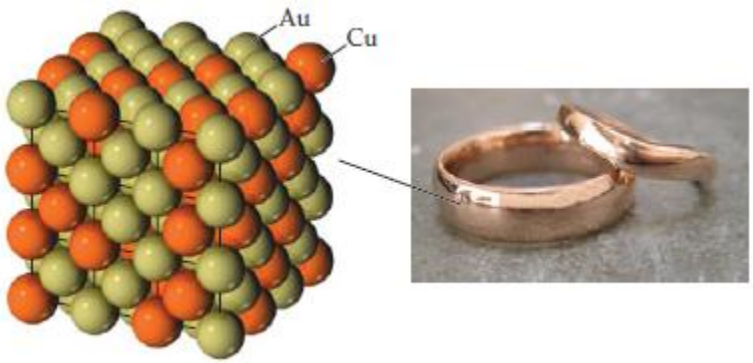
- Metalnu vezu čine delokalizovani elektroni

- Kristalna rešetka metala se sastoji od jona metala i delokalizovanih elektrona (elektronski gas)

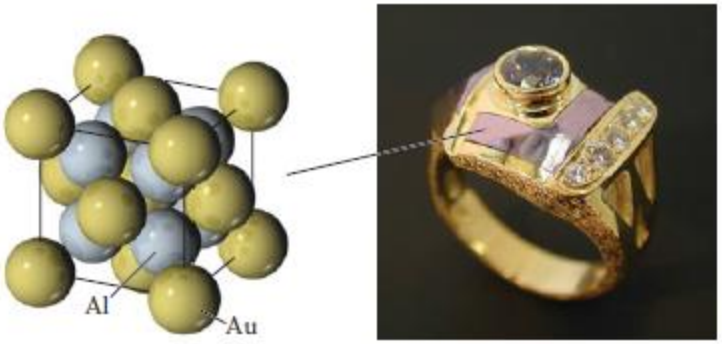
- Metalna veza objašnjava osobine metala: električna i toplotna provodljivost, kovnost, sposobnost izvlačenja u žice i folije



HEMIJSKE VEZE
Metalna veza

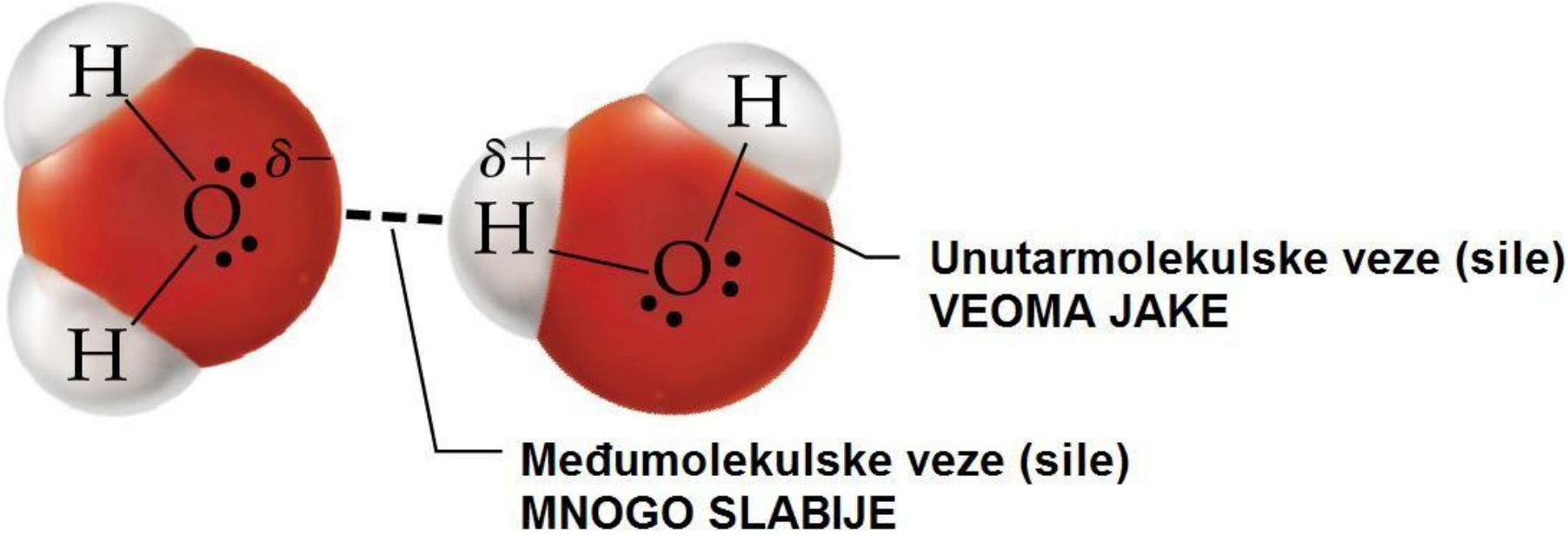


14-karatno crveno zlato



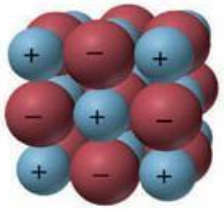
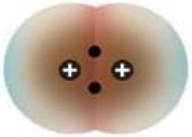
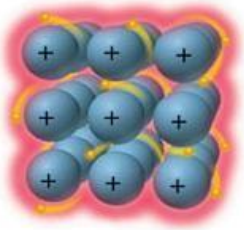
Ljubičasto zlato,
intermetalno jedinjenje $AuAl_2$

MEĐUMOLEKULSKE INTERAKCIJE

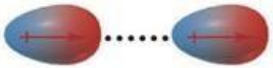


MEĐUMOLEKULSKE INTERAKCIJE

Unutarmolekulske veze

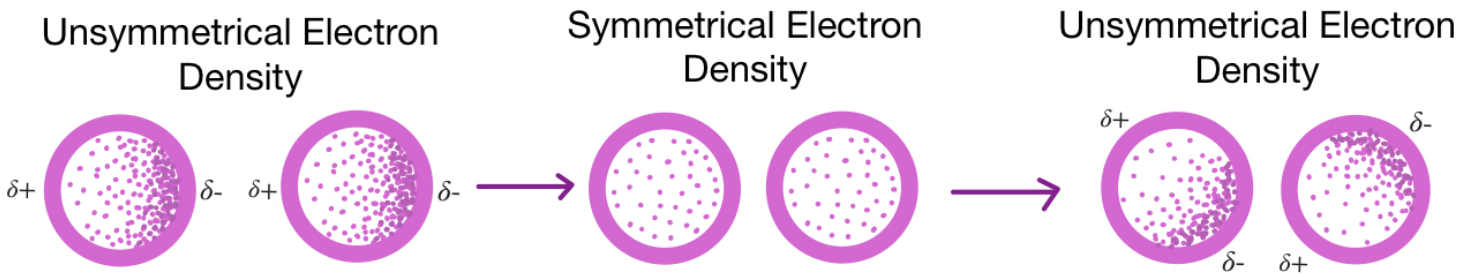
Veza	Model	Jačina veze (kJ/mol)	Primer
Jonska		400–4000	NaCl
Kovalentna		150–1100	H—H
Metalna		75–1000	Fe

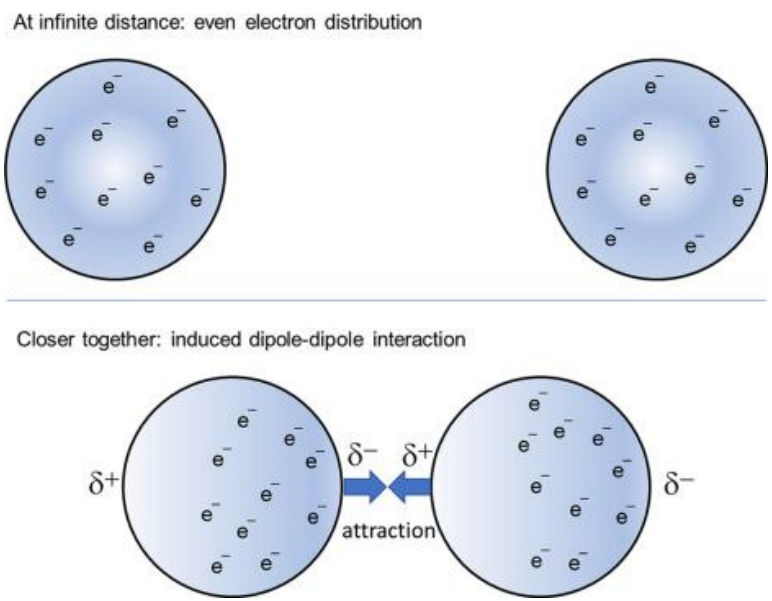
Međumolekulske veze

Veza (interakcija)	Model	Jačina veze (kJ/mol)	Primer
Jon-dipol		40–600	$Na^+ \cdots O(H)_2$
Vodonična veza		10–40	$:\ddot{O}(H)—H \cdots :\ddot{O}(H)—H$
Dipol-dipol		5–25	I—Cl····I—Cl
Jon-indukovani dipol		3–15	$Fe^{2+} \cdots O_2$
Dipol-indukovani dipol		2–10	H—Cl····Cl—Cl
Disperzione (Londonove sile) Indukovani dipol - indukovani dipol		0.05–40	F—F····F—F

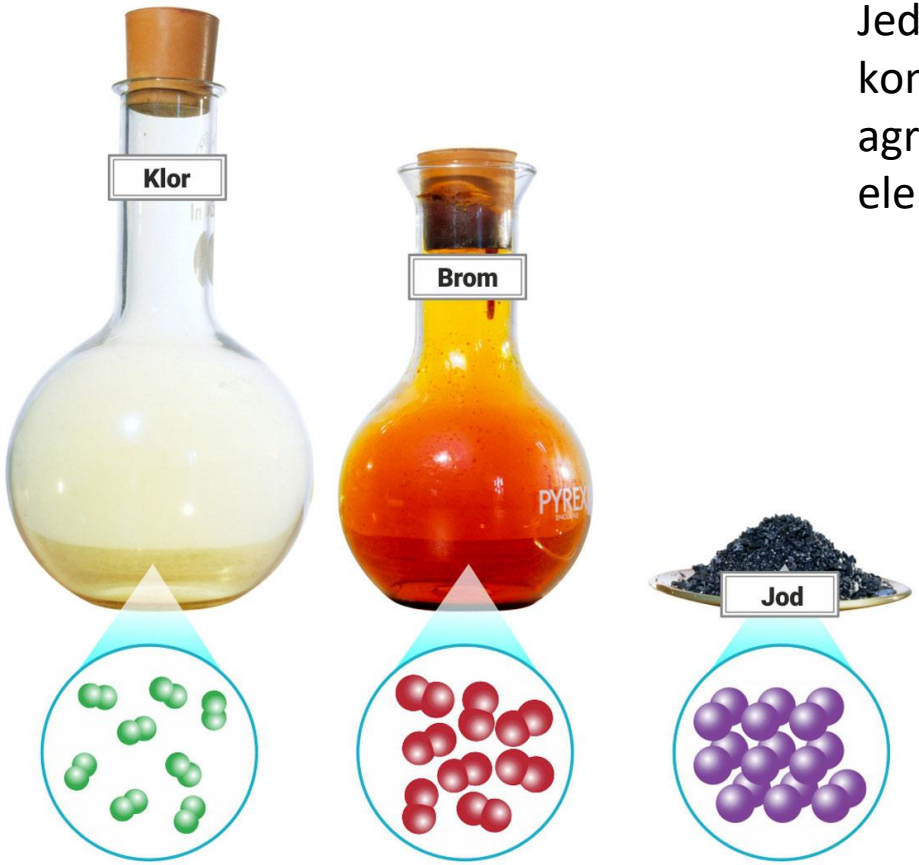
LONDONOVE DISPERZIONE SILE

Privlačne sile između nepolarnih molekula molekula





MEĐUMOLEKULSKE INTERAKCIJE



Jedina grupa elemenata u PSE u kome su elementi u sva tri agregatna stanja: halogeni elementi?

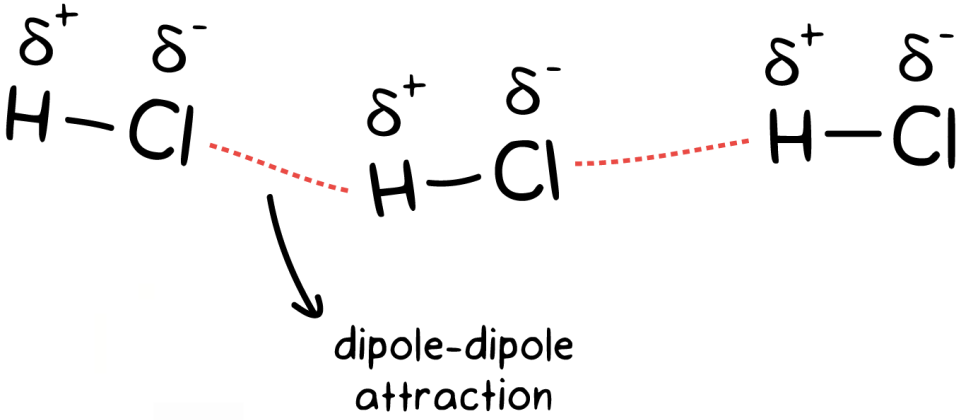
Zašto?

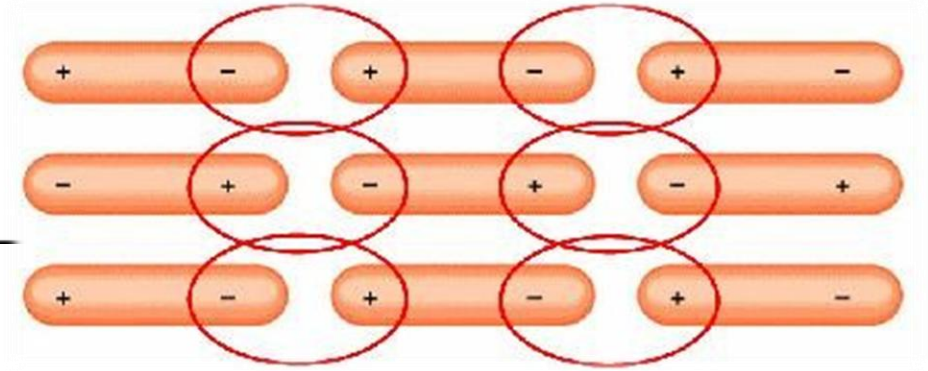
MEĐUMOLEKULSKE INTERAKCIJE

- Raste zapremina atoma, raste veličina molekula, jačaju Londonove sile
- Najslabije su privlačne sile među molekulima fluora, a najjače među molekulima joda

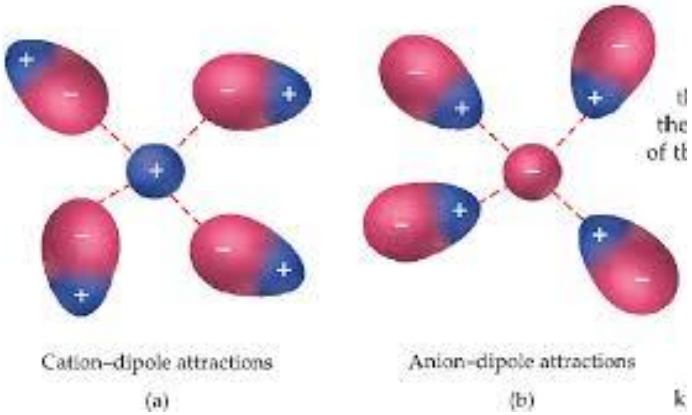
DIPOL-DIPOL INTERAKCIJA

Privlačne sile između polarnih molekula





JON-DIPOL INTERAKCIJA

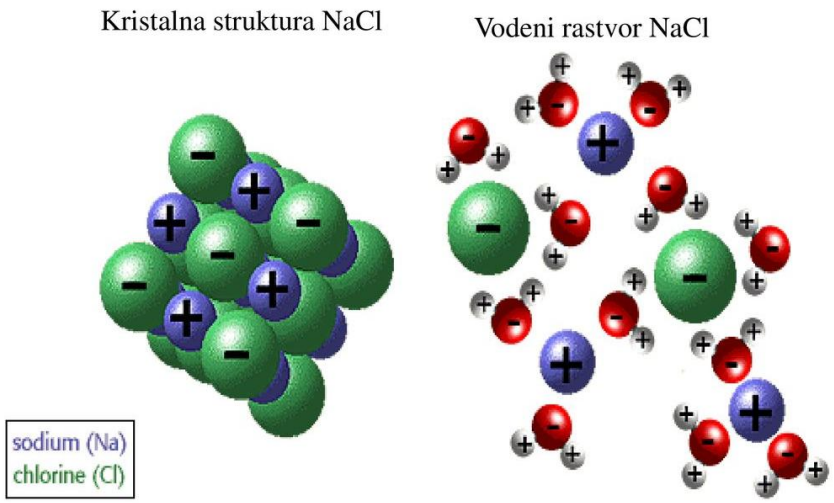


Najznačajniji oblik interakcija u rastvorima jonskih soli, jakih kiselina i jakih baza u polarnim rastvaračima kao što je voda.

HIDRATACIJA

SOLVATACIJA

MEĐUMOLEKULSKE INTERAKCIJE

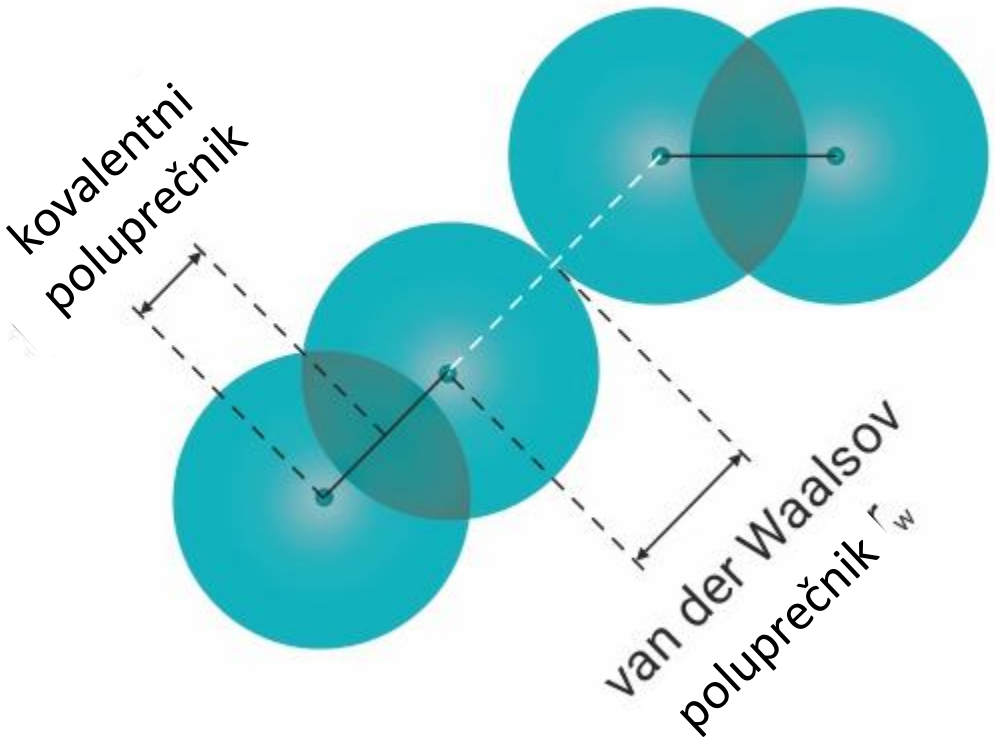


Najznačajniji oblik interakcija u rastvorima jonskih soli, jakih kiselina i jakih baza u polarnim rastvaračima kao što je voda.

HIDRATACIJA

SOLVATACIJA

MEĐUMOLEKULSKE INTERAKCIJE



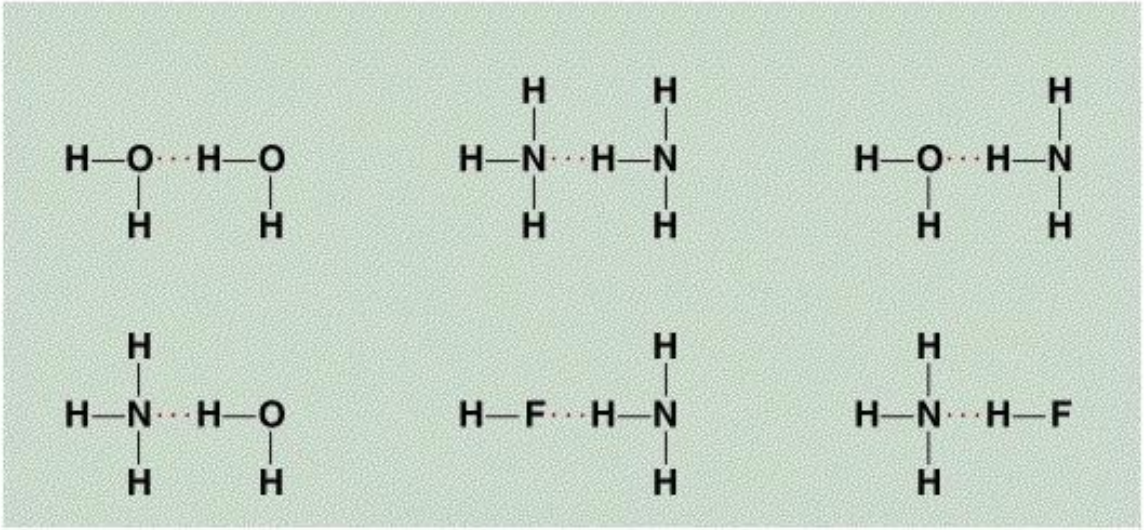
Van der Waalsov poluprečnik, polovina udaljenosti jezgara dva ista atoma koji se dodiruju, a nisu međusobno povezani hemijskom vezom.

Vodonična veza

posebna vrsta dipol – dipol interakcije između vodonikovih atoma u polarnim N-H, O-H ili F-H vezama i elektronegativnih atoma O, N ili F.

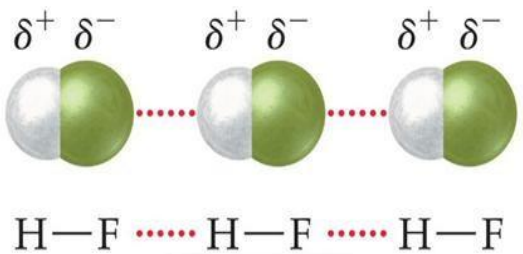
A — H··· B **ili** A — H··· A

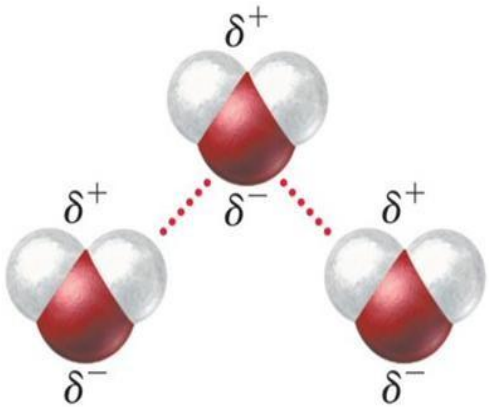
A **i** B **su** N, O **ili** F

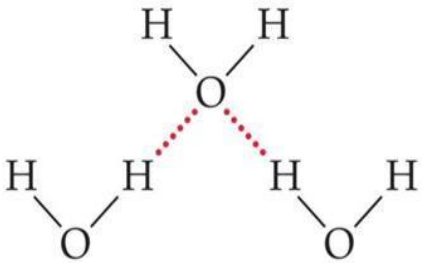


Vodonična veza

posebna vrsta dipol – dipol interakcije između vodonikovih atoma u polarnim N-H, O-H ili F-H vezama i elektronegativnih atoma O, N ili F.

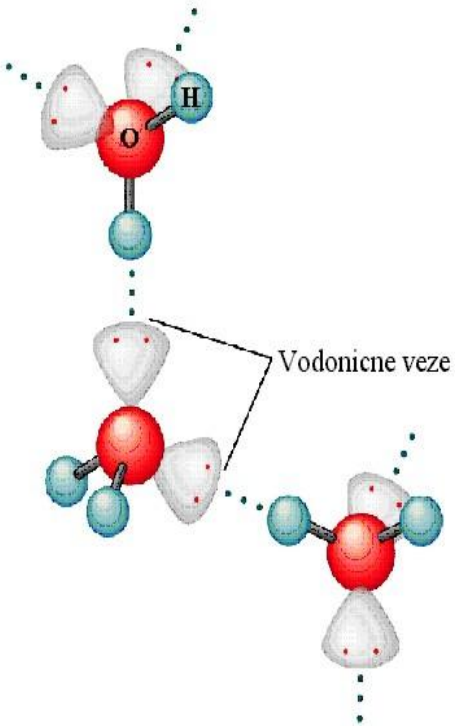


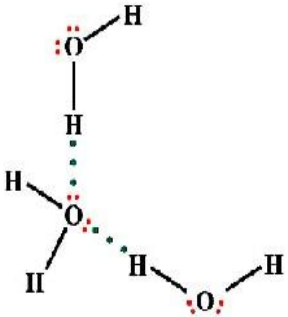




Vodonična veza

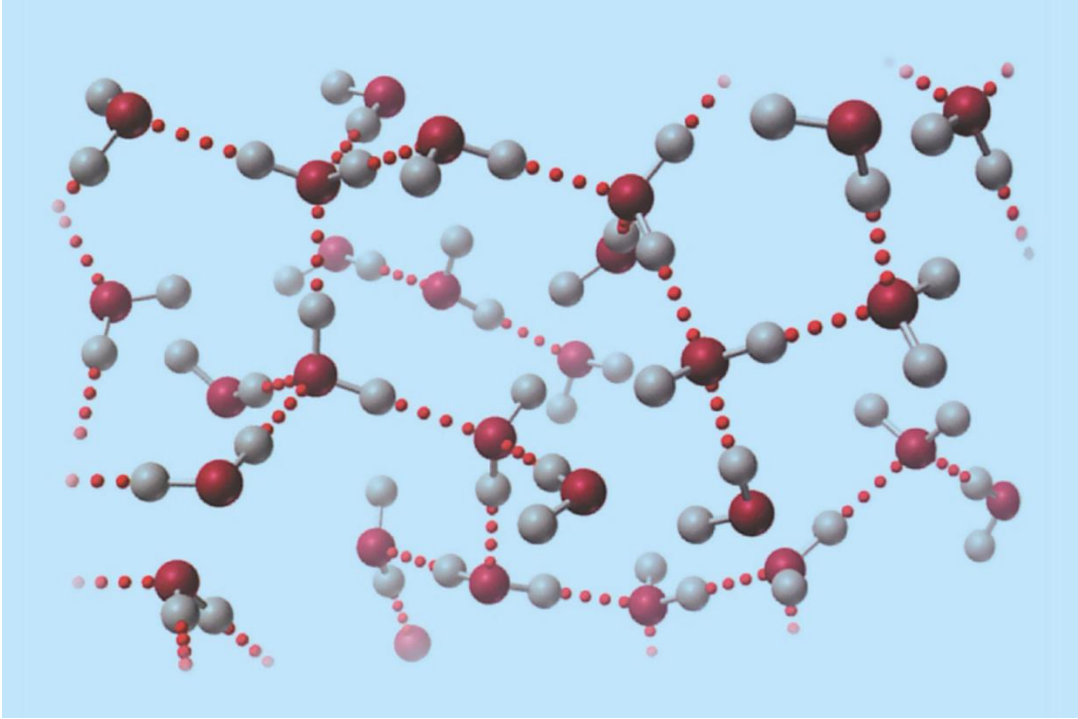
posebna vrsta dipol – dipol interakcije između vodonikovih atoma u polarnim N-H, O-H ili F-H vezama i elektronegativnih atoma O, N ili F.





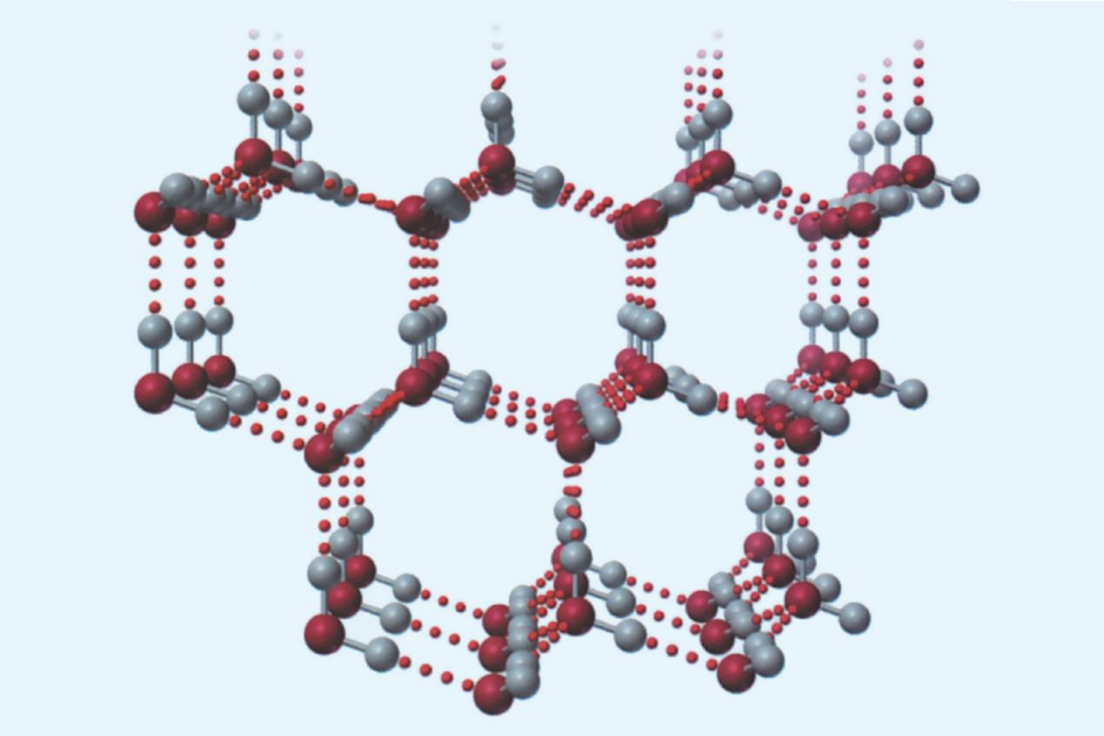
MEĐUMOLEKULSKE INTERAKCIJE

Kad ne bi bilo vodoničnih veza između molekula vode, voda bi bila u gasovitom agregatnom stanju



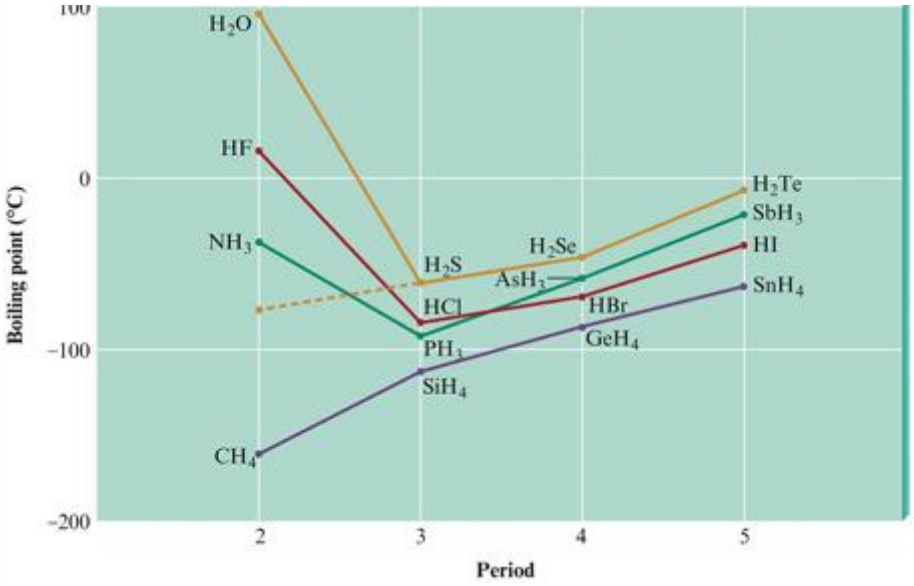
MEĐUMOLEKULSKE INTERAKCIJE

Da li je tečna voda gušća od leda?



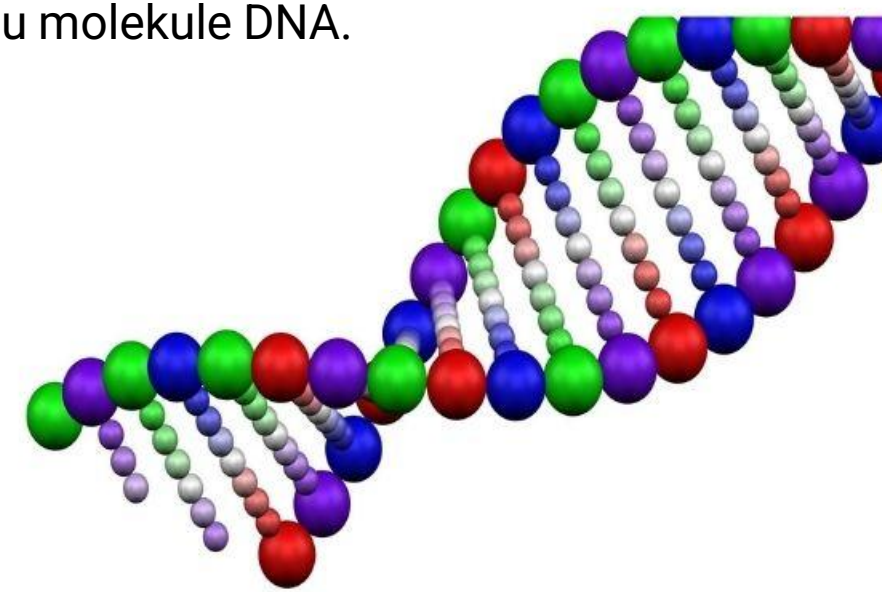
MEĐUMOLEKULSKE INTERAKCIJE

Vodonične veze su uzrok visoke TK vode, fluorovodonika, amonijaka, sirćetne kiseline.

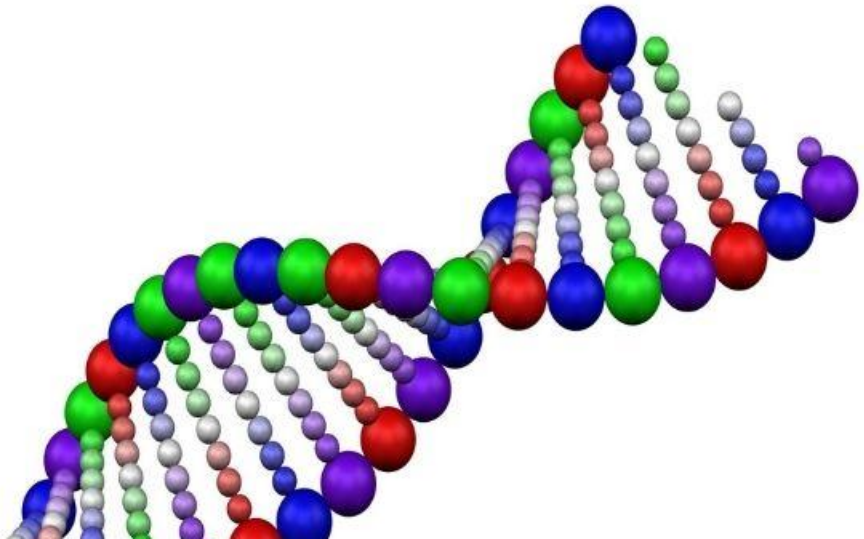


MEĐUMOLEKULSKE INTERAKCIJE

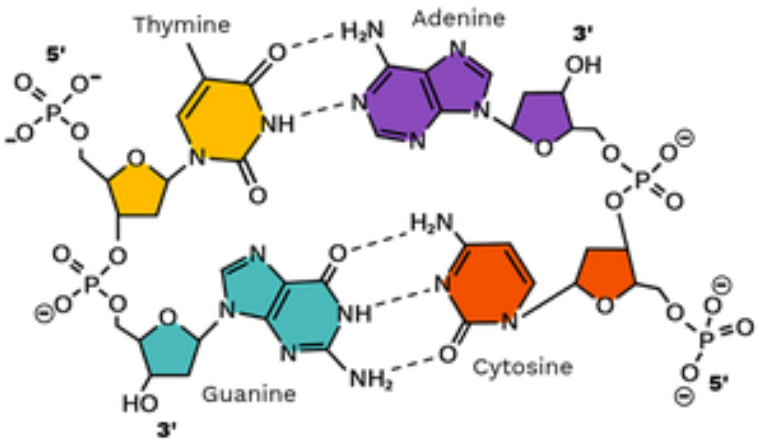
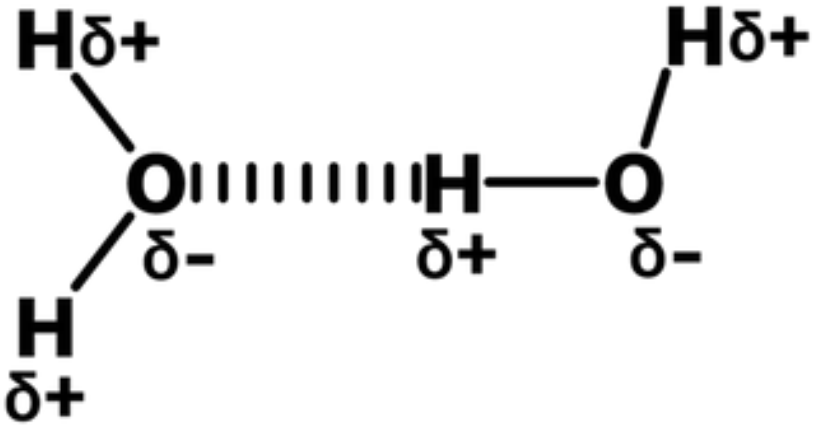
Vodonične veze povezuju molekule DNA.



Obezbjeđuju sekundarnu i tercijernu strukturu DNK i RNK.
Obrazuju se izmedju komplementarnih azotnih baza naspramnih lanaca DNK,odnosno,naspramno postavljenih djelova jednog lanca RNK.



MEĐUMOLEKULSKE INTERAKCIJE

Vodonične veze povezuju molekule DNA.

Obezbjeđuju sekundarnu i tercijernu strukturu DNK i RNK.
Obrazuju se izmedju komplementarnih azotnih baza naspramnih lanaca DNK,odnosno,naspramno postavljenih djelova jednog lanca RNK.