

AVERAGE SINGLE BOND ENERGIES (kJ/mol)

BOND	BOND ENERGY (kJ/mol)
H-H	435
H-C	414
H-Si	293
H-N	389
H-P	318
H-O	464
H-S	339
H-F	565
H-Cl	431
H-Br	368
H-I	297
C-H	435
C-C	347
C-Si	289
C-N	293
C-P	263

C-O	351
C-S	259
C-F	439
C-Cl	330
C-Br	276
C-I	238
Si-H	293
Si-C	289
Si-Si	176
Si-N	-
Si-P	213
Si-O	368
Si-S	226
Si-F	539
Si-Cl	360
Si-Br	289
Si-I	213
N-H	389
N-C	293
N-Si	-
N-N	159
N-P	209
N-O	201

N-S	-
N-F	272
N-Cl	201
N-Br	243
N-I	-
P-H	318
P-C	263
P-Si	213
P-N	209
P-P	213
P-O	351
P-S	230
P-F	489
P-Cl	330
P-Br	272
P-I	213
O-H	464
O-C	351
O-Si	368
O-N	201
O-P	351
O-O	138
O-S	-
O-F	184
O-Cl	205

O-Br	-
O-I	201
S-H	339
S-C	259
S-Si	226
S-N	-
S-P	230
S-O	-
S-S	213
S-F	284
S-Cl	251
S-Br	213
S-I	-
F-H	565
F-C	439
F-Si	539
F-N	272
F-P	489
F-O	184
F-S	284
F-F	159
F-Cl	184
F-Br	255

F-I	-
Cl-H	431
Cl-C	330
Cl-Si	360
Cl-N	201
Cl-P	330
Cl-O	205
Cl-S	251
Cl-F	184
Cl-Cl	243
Cl-Br	217
Cl-I	209
Br-H	368
Br-C	276
Br-Si	289
Br-N	243
Br-P	272
Br-O	-
Br-S	213
Br-F	255
Br-Cl	217
Br-Br	193
Br-I	180

I-H	297
I-C	238
I-Si	213
I-N	-
I-P	213
I-O	201
I-S	-
I-F	-
I-Cl	209
I-Br	180
I-I	151

AVERAGE DOUBLE AND TRIPLE BOND ENERGIES (kJ/mol)

C=C	611
C=N	615
C=O	740
N=N	418
C≡C	836
C≡N	891
C≡O	1071
N≡N	945

HYDROGEN BOND STRENGTH

Hydrogen bond strength varies from very weak 1-2 KJ/mol to very strong 161.5 KJ/mol.

F-H----:F	161.5 kJ/mol
O-H----:N	29 kJ/mol
O-H----:O	21 kJ/mol
N-H----:N	13 kJ/mol
N-H----:O	8 kJ/mol

Intramolecular hydrogen bonding makes the compound more volatile (less B.P).

BOND ORDER IN SOME IMPORTANT MOLECULES

Bond order increases means bond length decreases and bond strength increases. For homonuclear diatomic molecules we have different energy order for molecules having $z \leq 7$ than $z > 7$ because of intermixing of 2s and 2p orbitals.

Molecule/ion	Bond Order	Magnetic behaviour
H ₂	1	Diamagnetic
H ₂ ⁺	1/2	Paramagnetic
H ₂ ⁻	1/2	
He ₂	0 (does not exist)	
He ₂ ²⁺	1/2	
Li ₂	1 (may exist in gaseous state)	
Be ₂	0 (does not exist)	
B ₂	1 (the inner shells do not participate in the bonding, the effect of bonding and antibonding orbitals cancel - stabilisation occurs by π_{2p})	Paramagnetic
C ₂	(2) Diamond and graphite are in preference to C ₂	Diamagnetic
N ₂	3	Diamagnetic
O ₂	2 (two unpaired electrons in antibonding molecular orbitals π_{2p}^*)	Paramagnetic
O ₂ ⁻	1.5	Paramagnetic
O ₂ ²⁻	1	Diamagnetic
F ₂	1	Diamagnetic
MOLECULAR ORBITAL TREATMENT FOR HETERONUCLEAR DIATOMIC MOLECULES		
NO	2.5	Paramagnetic
NO ⁺	3	Diamagnetic
CO	3	Diamagnetic
CO ⁺	This is obtained by removal of 1 electron from CO so it is expected to be removed from bonding σ_{2p} orbital so bond order should be reduced to 2.5 and bond length should increase. But the fact is bond length of CO is 1.128Å and CO ⁺ is 1.115Å. This means electron must have been removed from antibonding MO, so here we assume that energy gap between σ_{2s} and σ_{2s}^* is very high and energy of σ_{2s}^* is greater than even σ_{2p}, π_{2p} (so energy order of MOs after intermixing cannot be taken same for all diatomic molecules $Z \leq 7$).	Paramagnetic

MOLECULAR ORBITAL TREATMENT INVOLVING DELOCALIZED π BONDING

CO_3^{2-}	Each C-O bond order 1.33 (1 from σ and 1/3 from π bond)	
NO_3^-	Each N-O bond order 1.33 (1 from σ and 1/3 from π bond)	
SO_3	Each S-O bond order 2 (1 from σ and 1 from π bond)	
O_3	1.5	Diamagnetic
NO_2^-	1.5	
CO_2	2	
N_3^-	2	