

Average Single Bond Lengths (Picometers)

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	74	110	98	94	92	145	138	132	127	142	161
C		154	147	143	141	194	187	181	176	191	210
N			140	136	134	187	180	174	169	184	203
O				132	130	183	176	170	165	180	199
F					128	181	174	168	163	178	197
Si						234	227	221	216	231	250
P							220	214	209	224	243
S								208	203	218	237
Cl									200	213	232
Br										228	247
I											266

Average Multiple Bond Lengths (Picometers)

C = C	134	C ≡ C	121
C = N	127	C ≡ N	115
C = O	122	C ≡ O	113
N = O	115	N ≡ O	108

$$1 \text{ pm} = 1 \times 10^{-12} \text{ m}$$

Average Single Bond Energies (kJ per mole)

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	436	414	389	464	569	293	318	339	431	368	297
C		347	293	351	439	289	264	259	330	276	238
N			159	201	272		209		201	243	
O				138	184	368	351		205		201
F					159	540	490	285	255	197	
Si						176	213	226	360	289	
P							213	230	331	272	213
S								213	251	213	
Cl									243	218	209
Br										192	180
I											151

Average Multiple Bond Energies (kJ per mole)

N = N	418	C = C	611	
N ≡ N	946	C ≡ C	837	
N = O	590	C = O	803	<i>In CO₂ Only</i>
C ≡ N	891	C = O	745	
O = O	498	C ≡ O	1075	

<p>Question 6 12 Points</p>	<p>Draw the best Lewis Dot structure for the following</p> <p>N_2:</p>	<p>$HFCO$:</p>
	<p>ClO_2^-: (Cl = Chlorine)</p>	<p>I_3^-</p>
<p>Question 7 6 Points</p>	<p>Draw the best Lewis Dot structure for the following organic molecules</p> <p>CH_3CH_2COOH:</p>	<p>C_2H_4:</p>
<p>Question 8 4 Points</p>	<p>Draw the best Lewis Dot structure for the following molecules on the rough work paper provided and then classify each as either a free radical (yes) or not (no)</p> <p>a) O_2^-: _____ b) OCl_2: (Cl = Chlorine) _____</p>	
<p>Question 9 8 Points (6 Points)</p>	<p>Draw all reasonable resonance structure for NO_2F:</p>	
<p>(2 Points)</p>	<p>Circle the best answer: <i>Average bond length table is on the front page of this exam.</i> The N to O bond length in pm is expected to be:</p> <p>a) = 136 b) > 136 c) = 115 d) > 115</p>	

