

The Periodic Table

<i>IA</i> H 1 1.01																	<i>VIIA</i> He 2 4.00																				
<i>IIA</i> Li 3 6.94	Be 4 9.01											<i>IIIA</i> B 5 10.81	<i>IVA</i> C 6 12.01	<i>VA</i> N 7 14.01	<i>VIA</i> O 8 16.00	<i>VIIA</i> F 9 19.00	Ne 10 20.18																				
Na 11 22.99	Mg 12 24.31			<i>IIIB</i> Sc 21 44.96	<i>IVB</i> Ti 22 47.88	<i>VB</i> V 23 50.94	<i>VIB</i> Cr 24 52.00	<i>VIB</i> Mn 25 54.94	<i>VIB</i> Fe 26 55.85	<i>VIB</i> Co 27 58.93	<i>VIB</i> Ni 28 58.69	<i>IB</i> Cu 29 63.55	<i>IB</i> Zn 30 65.39	<i>IIIA</i> Ga 31 69.72	<i>IVA</i> Ge 32 72.61	<i>VA</i> As 33 74.92	<i>VIA</i> Se 34 78.96	<i>VIIA</i> Br 35 79.90	Kr 36 83.80																		
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29																				
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)																				
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 (263)	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)																													
																			Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97					
																			Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11					

Some Useful And Not So Useful Information:

$$\lambda\nu = c$$

$$E = h\nu$$

$$E = mc^2$$

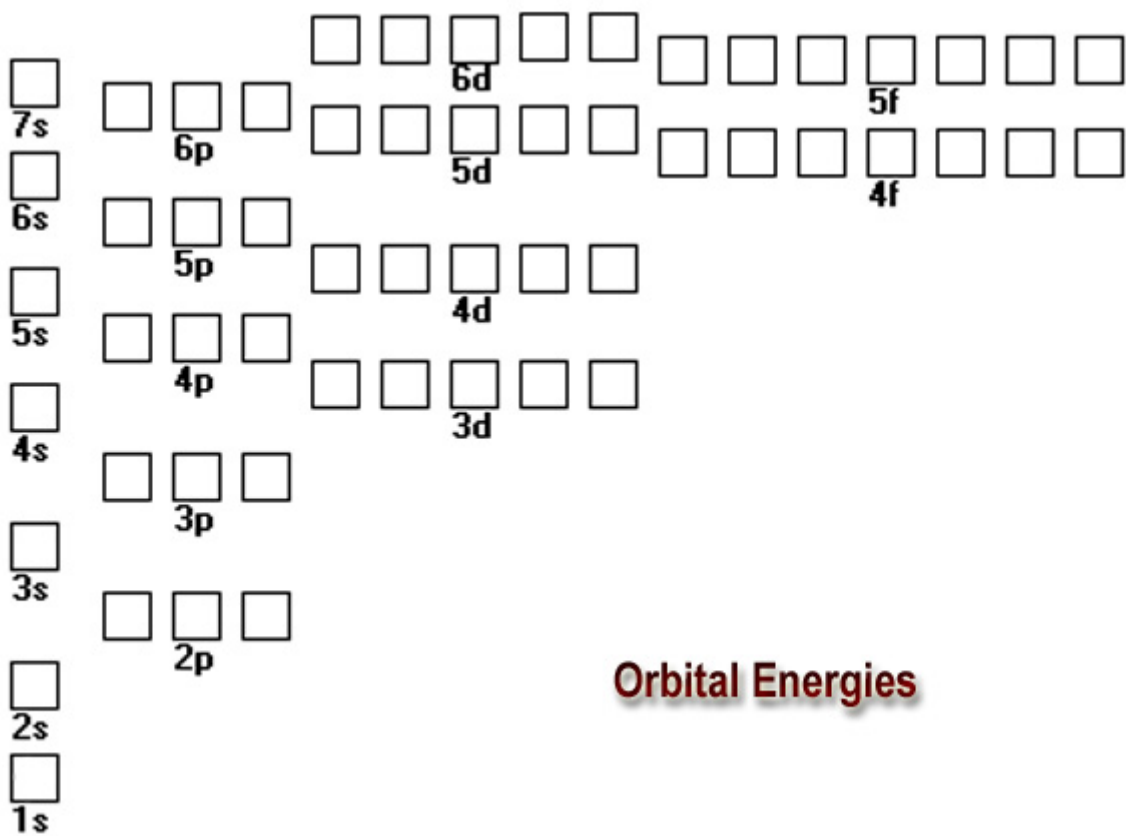
$$1 \text{ kJ} = 1000 \text{ J}$$

$$N = 6.023 \times 10^{23} \text{ mol}^{-1}$$

$$c = 2.998 \times 10^8 \text{ m}\cdot\text{s}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

Energy



Orbital Energies

Some Approximate Single and Multiple Bond Lengths*

Single Bond Lengths											
	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
Multiple Bond Lengths											
		C=C	134			C≡C	121				
		C=N	127			C≡N	115				
		C=O	122			C≡O	113				
		N=O	115			N≡O	108				

*In picometers (pm); 1 pm = 10^{-12} m.

Some Average Single- and Multiple-Bond Energies*

Single Bonds											
	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

Multiple Bonds			
N=N	418	C=C	611
N≡N	946	C≡C	837
N=O	590	C=O (in O=C=O)	803
C≡N	891	C=O (as in H ₂ C=O)	745
O=O (in O ₂)	498	C≡O	1075

*In kilojoules per mole.

Question 1 Give the noble gas electronic configuration for the following:

8 Points

1. P^{3-} _____
2. Co _____
3. Cr _____
4. Fe^{2+} _____

Question 2 Consider the two elements lithium and beryllium:

10 Points

1. Greatest metallic character? _____
2. Highest ionization energy? _____
3. Least electronegative? _____

Consider the two elements fluorine and chlorine

4. Greatest electron affinity? _____
5. Smallest atomic size? _____

Question 3 Draw the **best** Lewis Dot structures for the following:

16 Points

NO_2^+	SF_4
BCl_3	I_3^-

Question 4 Which of the following molecules is expected to have a nitrogen to oxygen bond length closest to 136pm? [Circle your choice]

5 Points



4 Points

Briefly justify your choice?

Question 5 The molecule N_2O , connectivity N-N-O, has three resonance structures. Draw all three.

9 Points

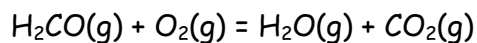
1.	2.	3.
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6 Points

Using formal charges can you eliminate one of these structures? If so which one? Briefly justify your answer.

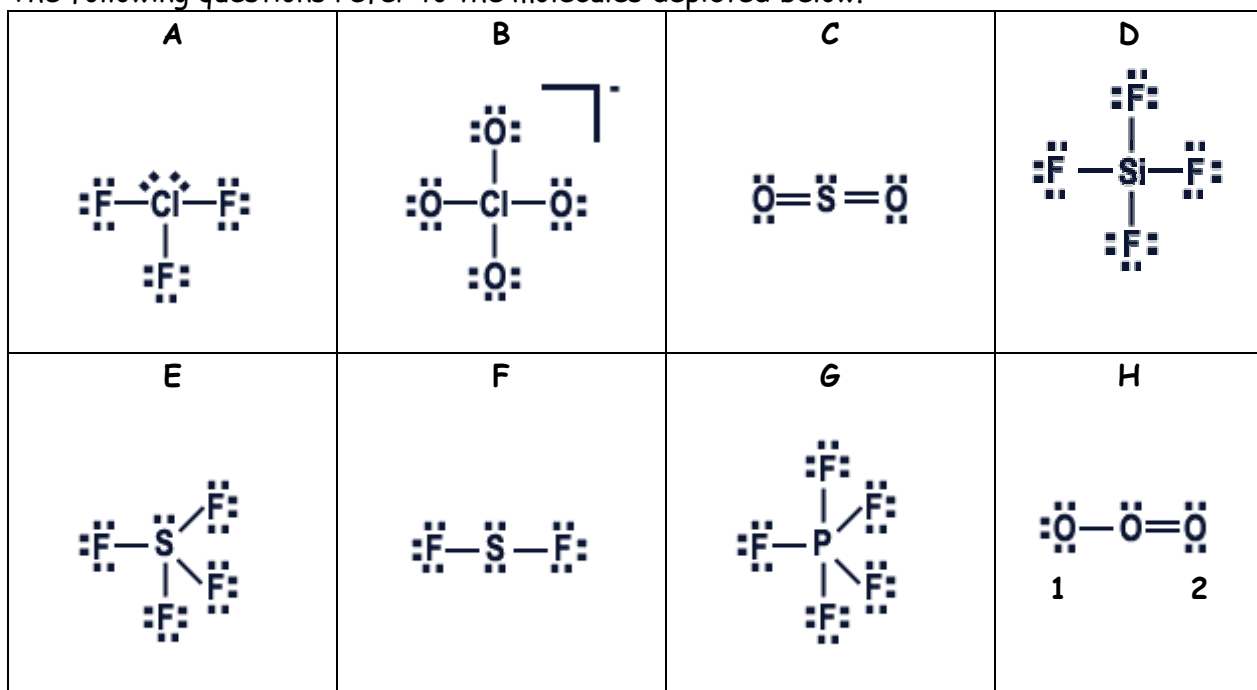
Question 6 Using the average bond estimate the amount of energy that would be produced by the combustion of 1 mole of H_2CO ?

6 Points



Question 7 The following questions refer to the molecules depicted below.

36 Points



1. What is the **electron pair geometry** of:

A _____

C _____

B _____

F _____

2. What is the **molecular geometry** of:

D _____

G _____

E _____

H _____

3. What is the **formal charge** on the oxygen atoms in H

O1: ____

O2: ____

4. What is the **oxidation number** on the oxygen atoms in H

O1: ____

O2: ____

5. What is the **bond angle** about the central atom in:

C: _____

F: _____

H: _____

6. Which, if any, of the above are **non-polar**? _____

