Chem 10113, Quiz 5 **Answer Key**

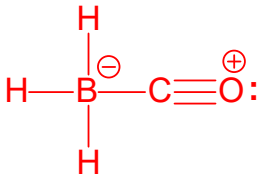
November 13, 2019

	IA (1)	IIA (2)	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	(8)	VIIIB (9)	(10)	IB (11)	IIB (12)	IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	VIIIA (18)
1	1 **H** 1.0080																	2 **He** 4.0026
2	3 **Li** 6.9410	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** 20.179
3	11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.066	17 **Cl** 35.453	18 **Ar** 39.948
4	19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.880	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.690	29 **Cu** 63.546	30 **Zn** 65.380	31 **Ga** 69.723	32 **Ge** 72.610	33 **As** 74.922	34 **Se** 78.960	35 **Br** 79.904	36 **Kr** 83.800
5	37 **Rb** 85.468	38 **Sr** 87.620	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.940	43 **Tc** 98.907	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** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
6	55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.20	77 **Ir** 192.22	78 **Pt** 195.09	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.20	83 **Bi** 208.98	84 **Po** 208.98	85 **At** 209.99	86 **Rn** 222.02
7	87 **Fr** 223.02	88 **Ra** 226.03	89 **Ac** 227.03	104 Unq 261.11	105 Unp 262.11	106 Unh 263.12	107 Uns 262.12											

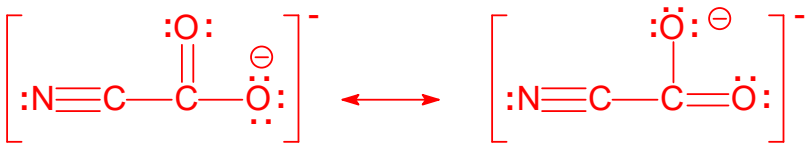
1. (9 points) For each of the following molecules or ions, write the ***complete*** Lewis electron dot formula. (***Note***: The chemical formulas, as written, reflect the skeletal structures.)

(a) OCN^-

(b) H_3BCO



(c) $NCCO_2^-$

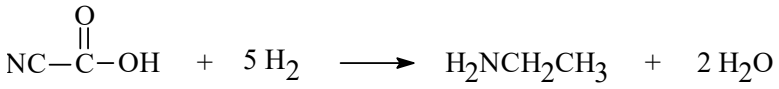


2. (2 points) (a) Referring to the question above, the C–O bond order in $NCCO_2^-$ is 1.5.

(b) Of the three species above, which has the shortest C–O bond distance? H_3BCO.

3. (4 points) **SHOW ALL WORK.** Using the bond energy data provided, estimate the enthalpy change (ΔH°) for the following chemical reaction.

Bond Energy (kJ/mole)	
H–H	436
C–H	414
N–H	389
O–H	464
C–C	347
C=C	611
C≡C	837
C–O	361
C=O	736
C≡O	1072
C–N	305
C=N	615
C≡N	891



Bonds broken = 1(C≡N) + 1(C=O) + 1(C-O) + 1(O-H) + 5(H-H)
= 891 + 736 + 361 + 464 + 5(436) = 4,632 kJ

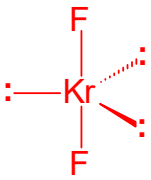
Bonds formed = 2(N-H) + 1(C-N) + 5(C-H) + 4(O-H)
= 2(389) + 305 + 5(414) + 4(464) = 5,009 kJ

ΔH° ≈ ∑ BE (bonds broken) - ∑ BE (bonds formed)

ΔH° ≈ 4,632 - 5,009 = - 377 kJ

4. (10 points) Apply **VSEPR** concepts to the following molecules. For each one, ***draw a clear 3-D structure*** and give a ***description*** of the shape (i.e., linear, trigonal planer, etc.). Also, ***state*** whether each molecule is expected to be ***polar*** or ***non-polar***.

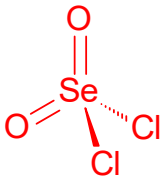
KrF_2



linear

non-polar

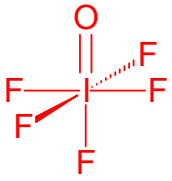
Cl_2SeO_2



tetrahedral

polar

F_5IO



octahedral

polar