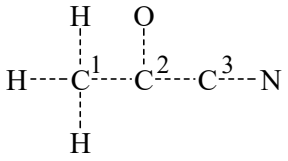
Chem 10113, Quiz 6

November 20, 2019

Name: _____
(Please Print)

	IA (1)																	VIIIA (18)
1	1 **H** 1.0080	IIA (2)											IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	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	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	. . . . . (8)	VIIIB (9)	. . . . . (10)	IB (11)	IIB (12)	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. A simple organic compound, C_3H_3NO, commonly known as acetyl cyanide, has a skeletal framework indicated by dotted lines in the figure below. The numbers on the structure are used to distinguish the carbon atoms in the following questions.



(a) (2 point) In the space above, complete the Lewis electron dot formula for C_3H_3NO.

(b) (1 point) The C^1— C^2—O bond angle is *about* _____ degrees.

(c) (1 point) The N— C^3—C^2 bond angle is _____ degrees.

(d) (6 points) **Describe the bonding** in C_3H_3NO using **Valence Bond concepts** (i.e., hybrid atomic orbitals, etc.). ***Draw and clearly label one or more pictures*** to show the ***types of orbitals*** that you are using to form the various σ and/or π bonds. Also, clearly draw the 3-D structure of the molecule, including the geometries around all of the C, O, and N centers.

2. (5 points) The nitrate anion reacts with the nitronium cation (NO_2^+) to produce dinitrogen pentoxide N_2O_5 as shown below. Write ***complete Lewis electron dot formulas*** for all three species in this reaction. (***Hint***: The skeletal structure of N_2O_5 is chemically consistent with the correct dot formulas of the reactants.)

$$NO_3^- \quad + \quad NO_2^+ \quad \longrightarrow \quad N_2O_5$$

3. (3 points) The phosphorus-centered molecule F_2PBr_3 is known from experiment to be ***non-polar***. Write a complete Lewis electron dot formula for F_2PBr_3 and clearly draw its 3-D structure as predicted by VSEPR Theory (and consistent with its polarity).

4. (7 points) Refer to the same molecules and ions in questions 2 and 3 above.
   (a) The hybridization at N is _____ in NO_2^+ and _____ in NO_3^-.
   (b) The 3-D shape of F_2PBr_3 is best described as _____.
   (c) The hybridization at P in F_2PBr_3 is _____.
   (d) The N-O bond order in NO_3^- is _____.
   (e) Circle any of the following molecules or ions that are both isoelectronic and isostructural with the nitronium cation NO_2^+.

CF_2 N_3^- SO_2 O_3 HCN CO_2 OCN^- HNO_2