

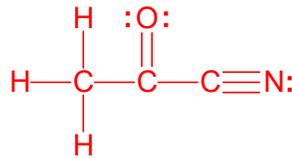
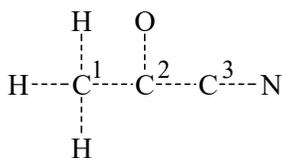
# Chem 10113, Quiz 6

November 20, 2019

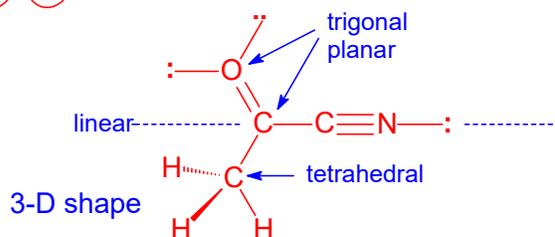
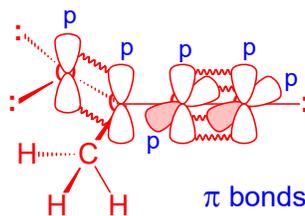
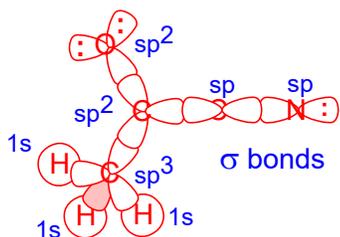
# Answer Key

	IA (1)																	VIIIA (18)
1	1 <b>H</b> 1.0080																	2 <b>He</b> 4.0026
2	3 <b>Li</b> 6.9410	4 <b>Be</b> 9.0122										5 <b>B</b> 10.811	6 <b>C</b> 12.011	7 <b>N</b> 14.007	8 <b>O</b> 15.999	9 <b>F</b> 18.998	10 <b>Ne</b> 20.179	
3	11 <b>Na</b> 22.990	12 <b>Mg</b> 24.305	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIIB (7)	VIIIB (8)	VIIIB (9)	VIIIB (10)	IB (11)	IIB (12)	13 <b>Al</b> 26.982	14 <b>Si</b> 28.086	15 <b>P</b> 30.974	16 <b>S</b> 32.066	17 <b>Cl</b> 35.453	18 <b>Ar</b> 39.948
4	19 <b>K</b> 39.098	20 <b>Ca</b> 40.078	21 <b>Sc</b> 44.956	22 <b>Ti</b> 47.880	23 <b>V</b> 50.942	24 <b>Cr</b> 51.996	25 <b>Mn</b> 54.938	26 <b>Fe</b> 55.847	27 <b>Co</b> 58.933	28 <b>Ni</b> 58.690	29 <b>Cu</b> 63.546	30 <b>Zn</b> 65.380	31 <b>Ga</b> 69.723	32 <b>Ge</b> 72.610	33 <b>As</b> 74.922	34 <b>Se</b> 78.960	35 <b>Br</b> 79.904	36 <b>Kr</b> 83.800
5	37 <b>Rb</b> 85.468	38 <b>Sr</b> 87.620	39 <b>Y</b> 88.906	40 <b>Zr</b> 91.224	41 <b>Nb</b> 92.906	42 <b>Mo</b> 95.940	43 <b>Tc</b> 98.907	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.75	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.29
6	55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57 <b>La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.85	75 <b>Re</b> 186.21	76 <b>Os</b> 190.20	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.09	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.20	83 <b>Bi</b> 208.98	84 <b>Po</b> 208.98	85 <b>At</b> 209.99	86 <b>Rn</b> 222.02
7	87 <b>Fr</b> 223.02	88 <b>Ra</b> 226.03	89 <b>Ac</b> 227.03	104 Unq 261.11	105 Unp 262.11	106 Unh 263.12	107 Uns 262.12											

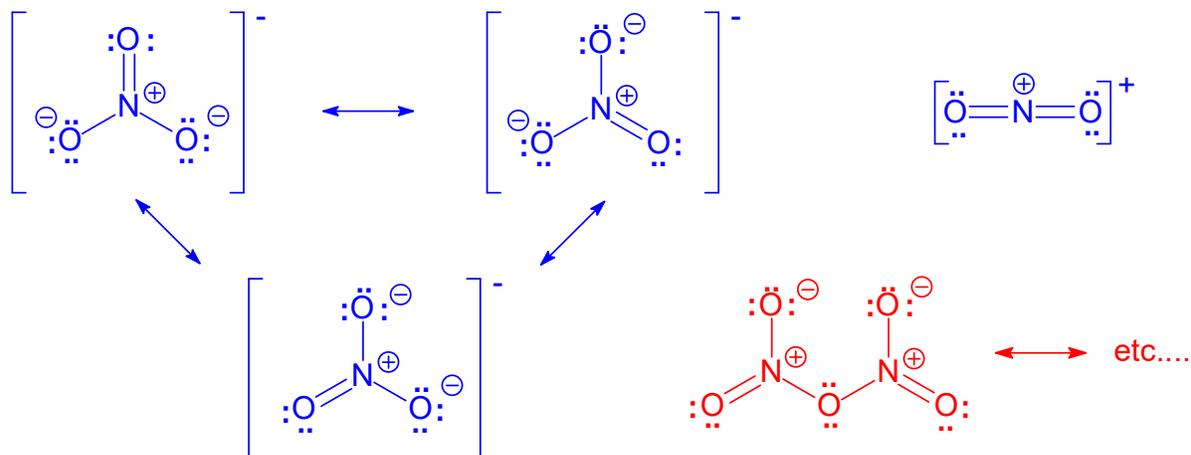
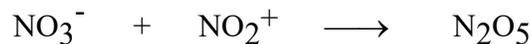
1. A simple organic compound,  $C_3H_3NO$ , commonly known as acetyl cyanide, has a skeletal framework indicated by dotted lines in the figure below. The numbers on the structure are used to distinguish the carbon atoms in the following questions.



- (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* **120** degrees.
- (c) (1 point) The  $N-C^3-C^2$  bond angle is **180** 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  $\sigma$  and/or  $\pi$  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 ( $\text{NO}_2^+$ ) to produce dinitrogen pentoxide  $\text{N}_2\text{O}_5$  as shown below. Write **complete Lewis electron dot formulas** for all three species in this reaction. (*Hint:* The skeletal structure of  $\text{N}_2\text{O}_5$  is chemically consistent with the correct dot formulas of the reactants.)



3. (3 points) The phosphorus-centered molecule  $\text{F}_2\text{PBr}_3$  is known from experiment to be **non-polar**. Write a complete Lewis electron dot formula for  $\text{F}_2\text{PBr}_3$  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.
- The hybridization at N is **sp** in  $\text{NO}_2^+$  and **sp<sup>2</sup>** in  $\text{NO}_3^-$ .
  - The 3-D shape of  $\text{F}_2\text{PBr}_3$  is best described as **trigonal bipyramid**.
  - The hybridization at P in  $\text{F}_2\text{PBr}_3$  is **sp<sup>3</sup>d**.
  - The N-O bond order in  $\text{NO}_3^-$  is **4/3 (1.33)**.
  - Circle any of the following molecules or ions that are both isoelectronic and isostructural with the nitronium cation  $\text{NO}_2^+$ .

