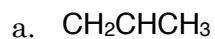


1. (16 pts.) Draw Lewis structures for the following condensed structures.



1. \_\_\_\_\_

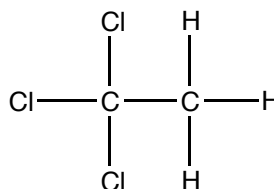
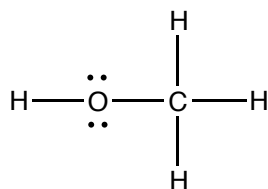
2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

2. (10 pts.) Using wedge ( $\blacktriangleleft$ ) and dashed ( $\cdots$ ) bonds where appropriate, draw three-dimensional representations of the following molecules. One condensed structure and one Lewis structure are provided.



6. \_\_\_\_\_

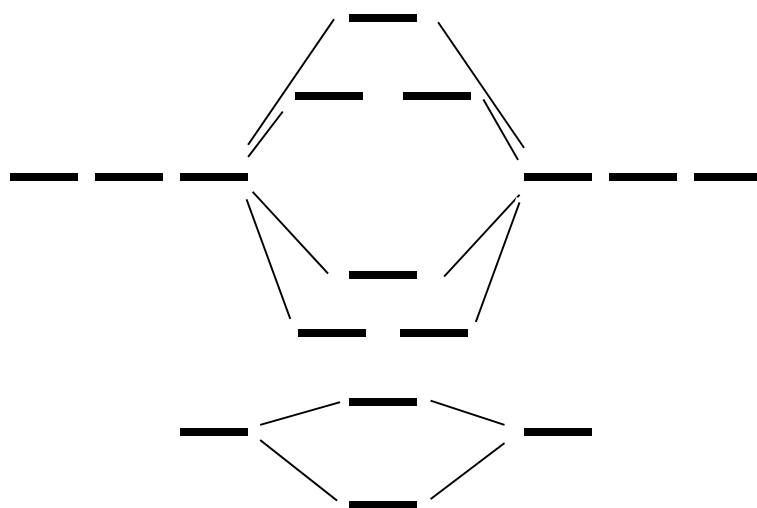
7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

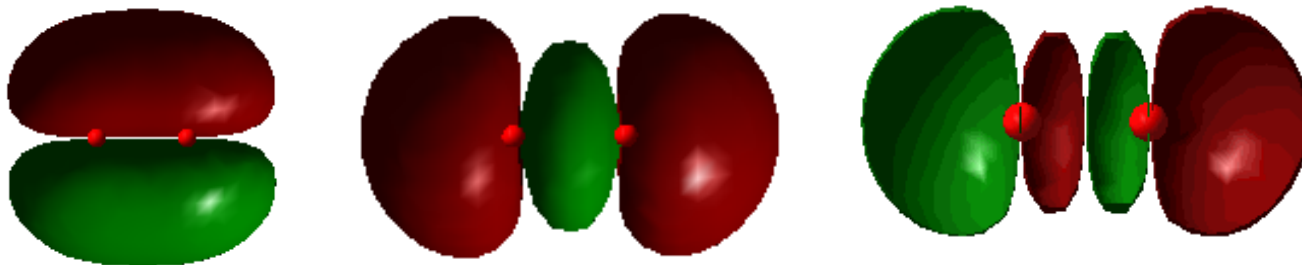
3. An incomplete MO diagram for the molecule  $\text{N}_2$  is drawn below.

- (2 pts.) Label the atomic orbitals.
- (2 pts.) Label the molecular orbitals.
- (2 pts.) Populate the atomic orbitals with the appropriate number of electrons.
- (2 pts.) Populate the molecular orbitals with the appropriate number of electrons.
- (2 pts.) Determine the bond order for  $\text{N}_2$ .



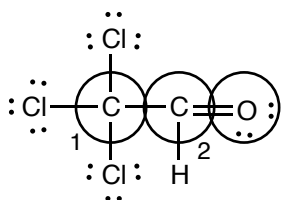
- (4 pts.) Which would have the stronger bond,  $\text{N}_2$  or  $\text{N}_2^+$ ? Explain.

4. (12 pts.) Label ( $\sigma$ ,  $\pi$ , bonding, antibonding) to following molecular orbitals. Cutaway views of the MO's are provided. The two red dots represent the nuclei of the O atoms.



5. (10 pts) Determine the hybridization of the circled atoms in the molecules drawn below. Skeletal, condensed, and Lewis structures have been provided.

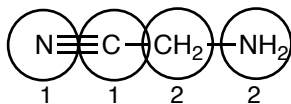
a.



C(1) \_\_\_\_\_ C(2) \_\_\_\_\_

O \_\_\_\_\_

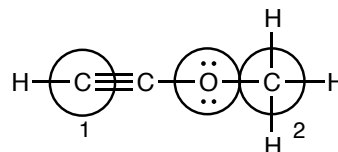
b.



N(1) \_\_\_\_\_ C(1) \_\_\_\_\_

C(2) \_\_\_\_\_ N(2) \_\_\_\_\_

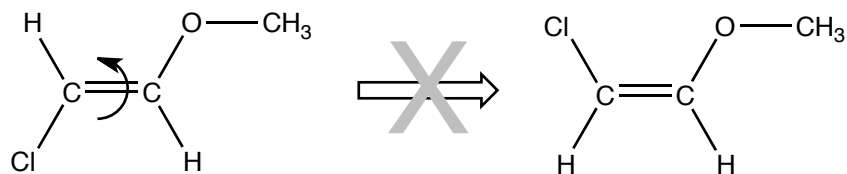
c.



C(1) \_\_\_\_\_ O \_\_\_\_\_

C(2) \_\_\_\_\_

6. (10 pts.) Using the valence bond model, explain why rotation around a double bond is not possible.

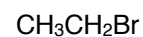
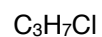
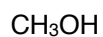


7. (12 pts.) Draw energy level diagrams for F and C (include core and valence  $e^-$ 's) and explain why F is more electronegative C.

8. a. (6 pts.) Draw energy level diagrams for O,  $O^{2-}$ , and  $O^{3-}$ .

b. (6 pts.) Explain why an oxygen atom can become a oxide ion that has a negative two charge ( $O^{2-}$ ) but it is unlikely that an oxygen atom would be able to become an oxide ion with a negative three charge ( $O^{3-}$ ).

9. (12 pts.) Circle all of the ionic compounds in the following list.



1	<b>H</b> 1.0079																	2	<b>He</b> 4.0026																
3	<b>Li</b> 6.941	4	<b>Be</b> 9.012																	10	<b>Ne</b> 20.1797														
11	<b>Na</b> 22.989	12	<b>Mg</b> 24.305																	18	<b>Ar</b> 39.948														
19	<b>K</b>	20	<b>Ca</b>	21	<b>Sc</b>	22	<b>Ti</b>	23	<b>V</b>	24	<b>Cr</b>	25	<b>Mn</b>	26	<b>Fe</b>	27	<b>Co</b>	28	<b>Ni</b>	29	<b>Cu</b>	30	<b>Zn</b>	31	<b>Ga</b>	32	<b>Ge</b>	33	<b>As</b>	34	<b>Se</b>	35	<b>Br</b>	36	<b>Kr</b>
37	<b>Cs</b>	38	<b>Sr</b>	39	<b>Y</b>	40	<b>Zr</b>	41	<b>Nb</b>	42	<b>Mo</b>	43	<b>Tc</b>	44	<b>Ru</b>	45	<b>Rh</b>	46	<b>Pd</b>	47	<b>Ag</b>	48	<b>Cd</b>	49	<b>In</b>	50	<b>Sn</b>	51	<b>Sb</b>	52	<b>Te</b>	53	<b>I</b>	54	<b>Xe</b>
55	<b>Rb</b>	56	<b>Ba</b>	57	<b>La</b>	72	<b>Hf</b>	73	<b>Ta</b>	74	<b>W</b>	75	<b>Re</b>	76	<b>Os</b>	77	<b>Ir</b>	78	<b>Pt</b>	79	<b>Au</b>	80	<b>Hg</b>	81	<b>Tl</b>	82	<b>Pb</b>	83	<b>Bi</b>	84	<b>Po</b>	85	<b>At</b>	86	<b>Rn</b>
87	<b>Fr</b>	88	<b>Ra</b>	89	<b>Ac</b>	104	<b>Rf</b>	105	<b>Db</b>	106	<b>Sg</b>	107	<b>Bh</b>	108	<b>Hs</b>	109	<b>Mt</b>	110		111		112				114					116				118

58	<b>Ce</b>	59	<b>Pr</b>	60	<b>Nd</b>	61	<b>Pm</b>	62	<b>Sm</b>	63	<b>Eu</b>	64	<b>Gd</b>	65	<b>Tb</b>	66	<b>Dy</b>	67	<b>Ho</b>	68	<b>Er</b>	69	<b>Tm</b>	70	<b>Yb</b>	71	<b>Lu</b>
90	<b>Th</b>	91	<b>Pa</b>	92	<b>U</b>	93	<b>Np</b>	94	<b>Pu</b>	95	<b>Am</b>	96	<b>Cm</b>	97	<b>Bk</b>	98	<b>Cf</b>	99	<b>Es</b>	100	<b>Fm</b>	101	<b>Md</b>	102	<b>No</b>	103	<b>Lr</b>