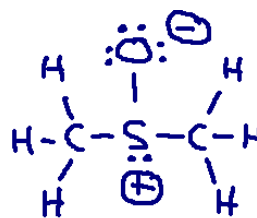
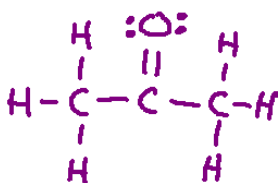
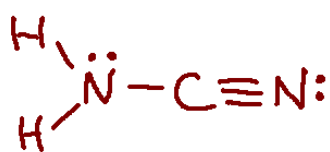


ANSWERS

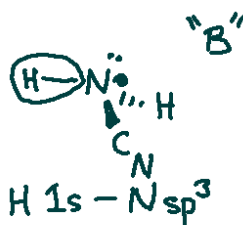
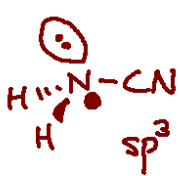
#1.



#2.

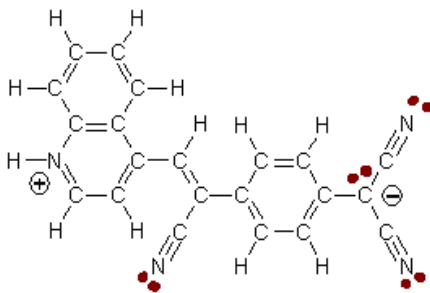
HNH 109° (4 electron domains @ N) CCC 120° (2 domains at C) CSC 109° (4 domains at S)
 NCN 180° (2 domains @ C)

#3.

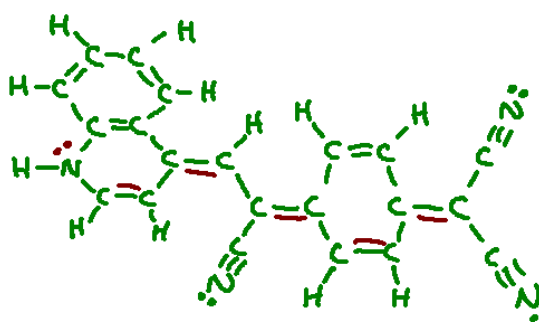


#4.

a. Add 4 lone pairs



b. structure D (6 pairs need to be moved)



#5. Loudon 1.33

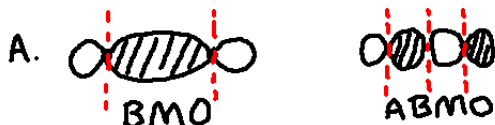
- a. CC bond order = 1.5
- b. +0.5 (ends), 0 (central)
- c. N is surrounded by 10 electrons (octet violation)

#6. Loudon 1.39

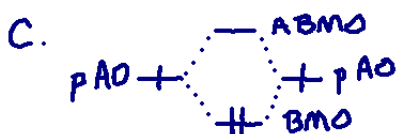
In a classical system made up of two oppositely charged particles, the dipole moment (μ) is the *product* of the charge on one particle (q) and the distance separating the particles (r), or $\mu = qr$. If we know the dipole moment and the distance, we can calculate the charges from $q = \mu/r$.

A neutral diatomic molecule like HF or HCl can, with a little bit of squinting, be viewed as two oppositely charged particles. One “particle” is located at the same location as the H nucleus. The other “particle” is located at the same location as the F (or Cl) nucleus. Experimental measurements show that the H-Cl bond length (1.27 Å) is considerably longer than the H-F bond length (0.92 Å), and these molecules have very similar dipole moments, 1.94 and 1.82 D, respectively. Therefore, the “particle” (or atomic) charges in H-F must be larger than those in H-Cl.

#7. Loudon 1.45



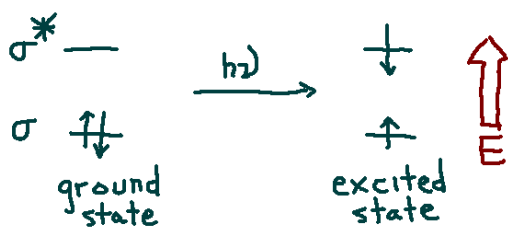
B. dashed lines = nodes



D. 2 electrons occupy BMO and ABMO is empty \rightarrow bond.
 BMO has cylindrical symmetry about bond axis \rightarrow σ (sigma) bond.

#8. Loudon 1.47

The excitation process can be visualized using two MO energy diagrams, one for the lowest energy (or “ground”) state and one for the higher energy excited state. (Note: chemists routinely draw “ $h\nu$ ”, the symbol for one quantum of energy, over a reaction arrow to show a light absorption event.)



The ground state is more stable than two isolated hydrogen atoms by $2E_{\text{stab}}$ (the energy of the H $1s$ orbital is not shown in this diagram, but you *know* where it is). The excited state’s energy is $E_{\text{stab}} + E_{\text{destab}}$ which means this state is less stable than two isolated hydrogen atoms, so the natural tendency of this system would be to dissociate, i.e., turn into two hydrogen atoms.