CHAPTER 8 QUESTIONS

Try solving these questions *before* viewing the narrated answers online.

1. Draw all possible resonance structures of NO_3^- (nitrate ion) without violating the octet rule. Show non-bonding electrons as dots (:) and bonding electrons as lines (⁻). Show all non-zero formal charges on atoms for all structures.

2. For which one of the following does the best simple description involve more that one Lewis structure (i.e. two or more resonance structures)?

A) CO_3^{2-} B) BF_3 C) I_3 D) OCF_2

3. How many resonance structures (that obey the octet rule) can be drawn for NO_2^+ (nitrogen is the central atom)?

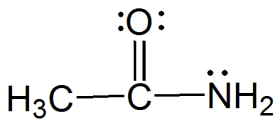
4. The cyanate ion NCO^- is linear. The atoms are connected in the order given. Draw all the Lewis structures for this ion that obey the octet rule. Show all bonding pairs of electrons as a line (⁻), and all non-bonding pairs as dots (:). Write the formal charge beside each atom (in all structures) where it is not equal to zero.

5. Which of the following statements concerning the ion ClO_3^- is INCORRECT?

A) In the real ion, all oxygen atoms are equivalent.
B) In the Lewis structure (octet rule), there are 10 non-bonding electron pairs.
C) In the Lewis structure (octet rule), the formal charge on chlorine is +2.
D) In the Lewis structure (octet rule), there is one non-bonding electron pair on chlorine.
E) The geometry is tetrahedral.

6. Draw the Lewis structures of NO_2 and $[NO_2]^-$. Indicate which has delocalized bonding, which obeys the octet rule and locate the non-bonding electrons.

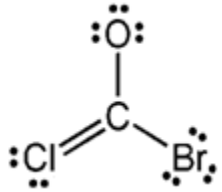
7. Amides are usually drawn as sketched below but another resonance structure that obeys the octet rule is possible.



A) Draw that structure, then suggest why it is usually not pictured.
B) The H-N-H bond angle is found experimentally to be close to 120 . Suggest a reason for this fact.

8. Which molecule is predicted to have the shorter S-O bonds, SO_3 or SO_3^{2-}? Explain briefly. **Hint**: Use Lewis structures in which all atoms satisfy the octet rule to solve this problem.

9. What are the correct formal charges for O, Cl and Br in the Lewis structure below? Is there a better structure? If so, draw it.



10. Arrange the following molecules in order of increasing bond polarity (i.e. least to most polar bonds).

SCl_2 SF_2 S_8 PF_3 NF_3

11. Arrange the following ionic compounds in order of increasing lattice energy (i.e. smallest to largest). Briefly explain your reasoning.

MgO NaCl NaF

12. Using bond enthalpies provided (given as "Average Bond Energies" on the information sheet) estimate ΔH for the following gas-phase reaction:

$$CHBr_3 + Cl_2 \rightarrow CClBr_3 + HCl$$