

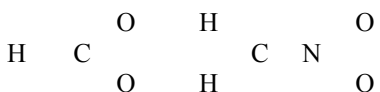
CHAPTER SEVEN

Resonance Structure

7.1 Define bond length, resonance, and resonance structure. What are the rules for writing resonance structures?

7.2 Is it possible to “trap” a resonance structure of a compound for study? Explain.

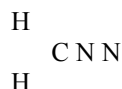
7.3 Write Lewis structures for the following species, including all resonance forms, and show formal charges: (a) HCO_2^- , (b) CH_2NO_2^- . Relative positions of the atoms are as follows:



7.4 Draw three resonance structures for the chlorate ion, ClO_3^- . Show formal charges.

7.5 Write three resonance structures for hydrazoic acid, HN_3 . The atomic arrangement is HNNN . Show formal charges.

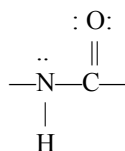
7.6 Draw two resonance structures for diazomethane, CH_2N_2 . Show formal charges. The skeletal structure of the molecule is



7.7 Draw three reasonable resonance structures for the OCN^- ion. Show formal charges.

7.8 Draw three resonance structures for the molecule N_2O in which the atoms are arranged in the order NNO . Indicate formal charges.

7.9 The amide group plays an important role in determining the structure of proteins:



Draw another resonance structure for this group. Show formal charges.

7.10 Most organic acids can be represented as RCOOH , where COOH is the carboxyl group and R is the rest of the molecule. (For example, R is CH_3 in acetic acid, CH_3COOH .) (a) Draw a Lewis structure for the carboxyl group. (b) Upon ionization, the carboxyl group is converted to the carboxylate group, COO^- . Draw resonance structures for the carboxylate group.

7.11 Write three resonance structures for (a) the cyanate ion (NCO^-) and (b) the isocyanate ion (CNO^-). In each case, rank the resonance structures in order of increasing importance.

7.12 The $\text{N}-\text{O}$ bond distance in nitric oxide is 115 pm, which is intermediate between a triple bond (106 pm) and a double bond (120 pm). (a) Draw two resonance structures for NO and comment on their relative importance. (b) Is it possible to draw a resonance structure having a triple bond between the atoms?