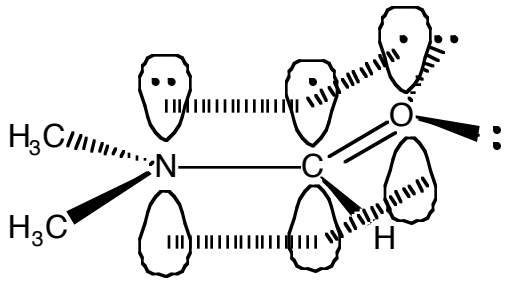
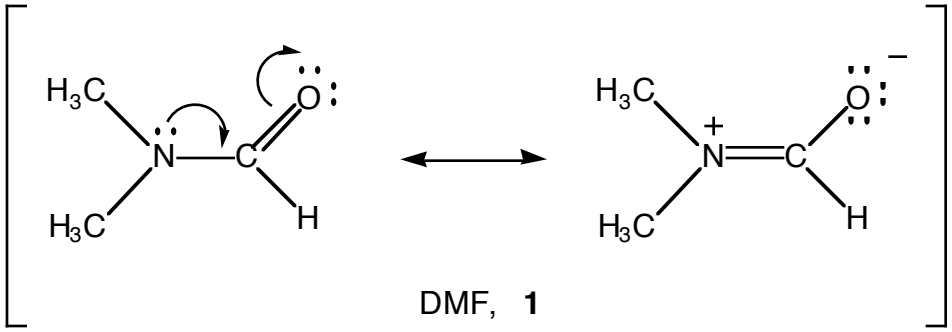
Answers to Problem 14, Chemistry 301X-2006

The three 2*p* orbitals align perfectly in a flat structure, (much like allyl), and delocalization of the lone pair on N is optimal.

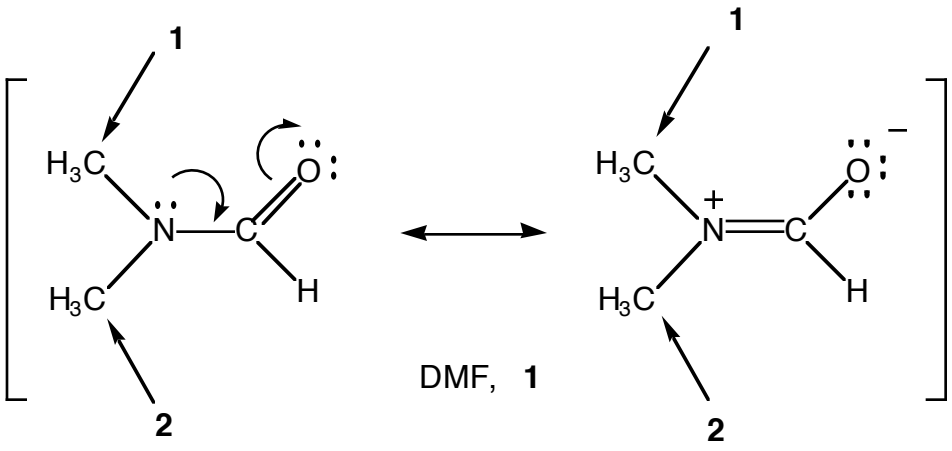


N, C, O all sp^2

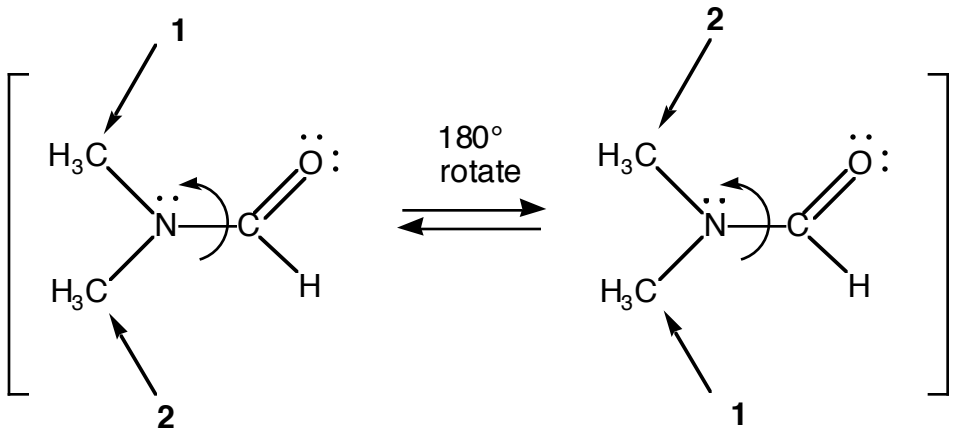
Delocalization of electrons here is highly stabilizing (see resonance forms below).



(c) Unless rotation is fast, there will be two different methyls in the flat structure. Note the "double bond character" to the C—N bond - that partial double bond will make rotation difficult. At room temperature, rotation must be slow. Of course, higher temperature means more energy and eventually rotation becomes possible. At 111° C the two methyls become equivalent through rotation.



at high temperature:


1
H3C
N
C
O
H
H3C
2
180°
rotate
2
H3C
N
C
O
H
H3C
1