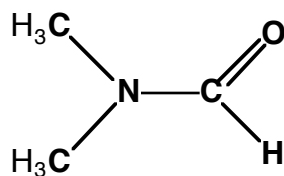


Problem 14, Chemistry 301X-2006

N,N-dimethylformamide (DMF, **1**) is flat as a pancake. One hydrogen, the three carbons, the oxygen, and the nitrogen are in the same plane. These atoms are shown in bold in the structure.



DMF, **1**

Make a good orbital drawing of the π system of **1** and explain why this molecule is flat.

^{13}C NMR spectroscopy reveals that there are two different methyl groups when the spectrum is taken at 25 °C. At 111° C, things change and there is only one methyl group. Explain the change in the NMR spectrum with temperature!