

Take-Home Quiz 2
CHEM 325
Spring 2009

Name: _____

1. (10 Points) On the take-home portion of Exam 1 you determined the rotational constant for HCl from the microwave absorption data (given below) assuming that D_J was negligible. Determine D_J , a new value for B and a value for $\tilde{\nu}$ from the data at 95% confidence. Tape a graph showing the data and the best fit line through the data in the space below. Hint: you will need to use an equation that you derived in Post-Exam 1.

Wavenumber (cm^{-1})	83.32	104.13	124.73	145.37	165.89	186.23	206.60	226.86
$J_{\text{initial}} \rightarrow J_{\text{final}}$	3 \rightarrow 4	4 \rightarrow 5	5 \rightarrow 6	6 \rightarrow 7	7 \rightarrow 8	8 \rightarrow 9	9 \rightarrow 10	10 \rightarrow 11

2. (20 Points) Determine the normal modes for N_2O_4 . Indicate which modes are IR active and which are Raman active and qualitatively describe the spectrum obtained by each method. Use the coordinate system shown below with the z component of the displacement vector of each atom out of the plane (parallel to the molecular z axis) with the x and y components of the displacement vector in the plane defined by the atoms. Be careful not to confuse the atomic displacement vector components with the molecular axes! I have defined the displacement vector components in such a way so that each is parallel to the corresponding molecular axis.

