Problem 1 – Morse potential

The fundamental vibrational frequencies for $^1\text{H}^{19}\text{F}$ and $^2\text{H}^{19}\text{F}$ are 4138.52 cm$^{-1}$ and 2998.25 cm$^{-1}$, respectively. $D_e = 5.86$ eV for both molecules. Work out the difference in bond energy for these two molecules in kJ/mol.

Problem 2 – Morse oscillator

For HCl (isotopic information not known), you measure the following vibrational transitions:

$n = 0 \rightarrow 1 \quad 2885.64$ cm$^{-1}$
$n = 1 \rightarrow 2 \quad 2781.54$ cm$^{-1}$
$n = 2 \rightarrow 3 \quad 2677.44$ cm$^{-1}$
$n = 3 \rightarrow 4 \quad 2573.32$ cm$^{-1}$

What tells you that this molecule is not a harmonic oscillator?

Estimate its dissociation energy in kJ/mol.

Problem 3

Do problem 5-13 from your textbook.

Problem 4

Do problem 5-22 from your textbook.