

### Molecular Spectroscopy Homework Assignment #1

1. Determine the wavelength of maximum spectral emission of a black body at 37°C and name the section of the electromagnetic spectrum this wavelength belongs to.
2. Calculate the Einstein coefficients  $A_{21}$ ,  $B_{12}$ , and  $B_{21}$  for the  $^{138}\text{Ba } ^1\text{P}_1 - ^1\text{S}$  transition which is observed at  $18060.263 \text{ cm}^{-1}$  given that the  $^{138}\text{Ba } ^1\text{P}_1$  state has a lifetime of 8.4 ns (a quantity that is the inverse of  $A_{21}$ ).
3. Calculate the linewidth (FWHM) of CO ir ( $\sim 2000 \text{ cm}^{-1}$ ) and microwave ( $\sim 10 \text{ cm}^{-1}$ ) transitions due to the Doppler effect at 27°C.

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