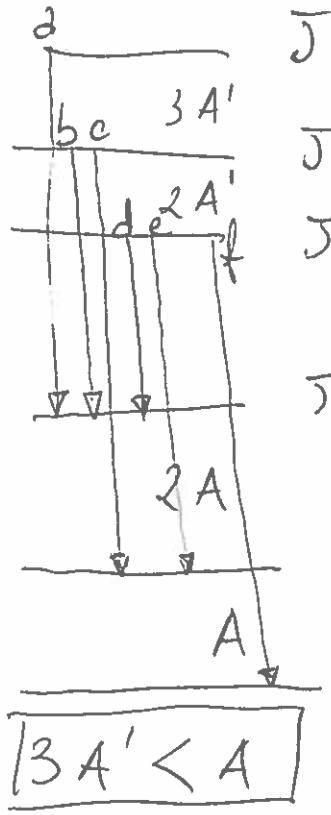
Fisica Atomica e Molecolare A.A. 2017/18
Compito di esame del 3 settembre 2018

Problema 1



^3D
$L = 2$
$S = 1$

^3P
$L = 1$
$S = 1$

$J = 3$ $\quad \xi = 5211\ cm^{-1}$
$J = 2$ $\quad \xi = 5190\ cm^{-1}$
$J = 1$ $\quad \xi = 5176\ cm^{-1}$
$J = 2$ $\quad \xi = 156\ cm^{-1}$
$J = 1$ $\quad \xi = 52\ cm^{-1}$
$J = 0$ $\quad (\xi = 0\ cm^{-1})$

$\boxed{3A' < A}$

$2A' = 14\ cm^{-1} \rightarrow A' = 7\ cm^{-1}$

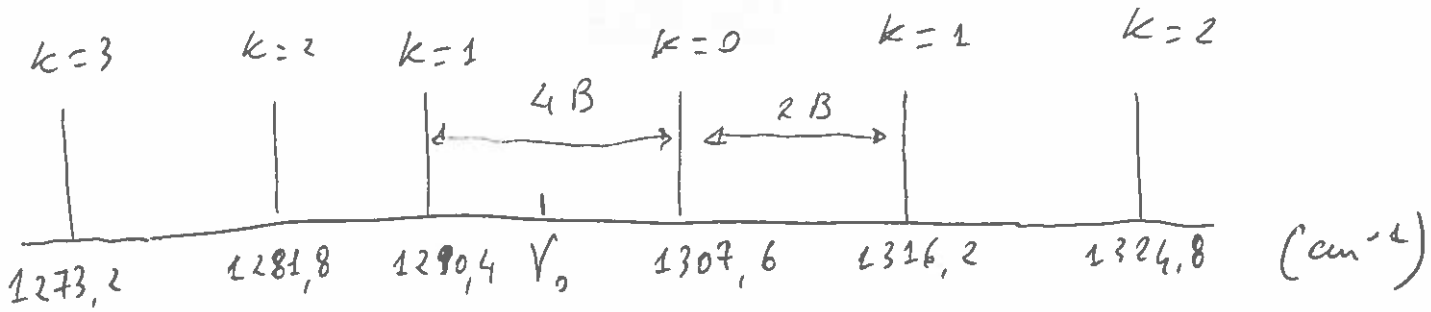
$h\nu_{max}^{(riga\ f)} - h\nu_{min}^{(riga\ d)} = 3A \rightarrow A = 52\ cm^{-1}$

Regole di selezione $\Delta S = 0$; $\Delta L = 0, \pm 1$;
$\Delta J = 0, \pm 1 \quad (0 \not\rightarrow 0)$: 6 transizioni permesse

$$P.R. = \frac{h\nu_{max} + h\nu_{min}}{4A'} = 364$$

Problema 2

CaH



branca P

$(v=0, K) \rightarrow (v=1, K-1)$

branca R

$(v=0, K) \rightarrow (v=1, K+1)$

$B^{CaH} = 4,3\ cm^{-1}$; $h\nu_0^{CaH} = 1299\ cm^{-1}$

$$\nu_0^{CaD} = \sqrt{\frac{\mu^{CaH}}{\mu^{CaD}}}\ \nu_0^{CaH}$$

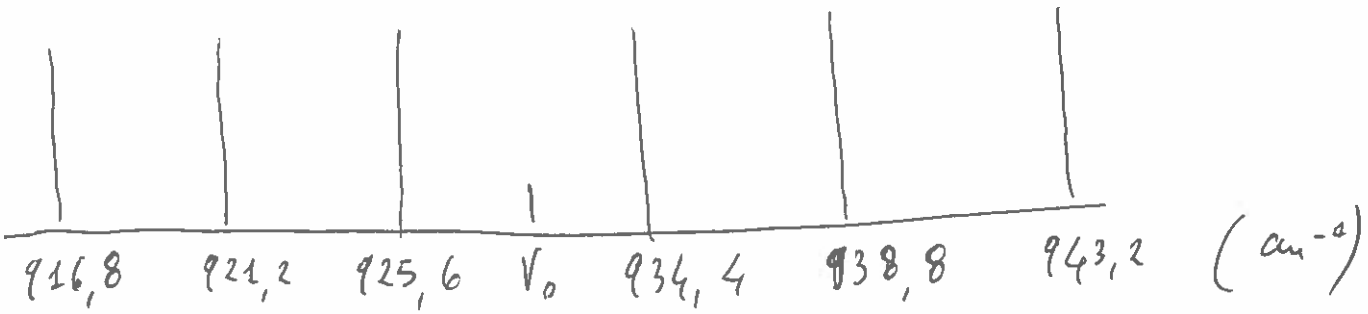
$\mu^{CaH} = 1,62 \cdot 10^{-27}\ Kg$

$\mu^{CaD} = 3,16 \cdot 10^{-27}\ Kg$

$$B^{CaD} = \frac{\mu^{CaH}}{\mu^{CaD}}\ B^{CaH}$$

$B^{CaD} = 2,2\ cm^{-1}$; $h\nu_0^{CaD} = 930\ cm^{-1}$

CaD



$$R_0^2 = \frac{\hbar}{4\pi\mu c B} = 4\,\text{Å}^2 \rightarrow R_0 = 2\,\text{Å}$$

$$\left.\frac{d\mathcal{E}}{dR}\right|_{R=R_0} = 0 \rightarrow b = \frac{2a}{R_0^6}$$

$$\left.\frac{d^2\mathcal{E}}{dR^2}\right|_{R=R_0} = K = \frac{72\,a}{R_0^{14}}$$

$$\nu_0 = \frac{1}{2\pi c}\sqrt{\frac{K}{\mu}} \rightarrow K = 97\,\frac{J}{\mu^2}$$

$$\mathcal{E}(R_0) = -\frac{1}{72} K R_0^2 = -0,34\,eV$$

$$D_0 = -\mathcal{E}(R_0) - \frac{1}{2} R\nu_0$$

$$D_0^{C_6H} = 0,26\,eV \; ; \; D_0^{C_6D} = 0,28\,eV$$