## Solutions Atomic Physics for FYSC11 180316.

1b. $\tau_{3s} = 0.16$ μs, $\tau_{3p} = 5.2$ ns and $\tau_{3d} = 15$ ns

1c. $\dfrac{N_{2s}}{N_{3p}} = \dfrac{A(\text{2s-3p})}{A(\text{1s-3p}) + A(\text{2s-3p})} = A(\text{2s-3p}) \cdot \tau_{3p} = 0.11$

2b. $A_{6s} = 0.0562$ cm$^{-1}$, $A_{6p} = 0.0084$ cm$^{-1}$

2c. $T = 7100$ K

3. First determine the quantum defect for the s-series. $\delta_s = 0.1 \Rightarrow E_{ion} = 1493956$ cm$^{-1}$

4a. $\beta = 73.4$ cm$^{-1}$.

4b. The intercombination arise because the state *labeled* $^3\text{P}_1$ is actually a mixture of the 3p $^3\text{P}_1$ and 3p $^1\text{P}_1$ LSJ-basis functions. $\Psi(^3\text{P}_1) = a\left|{}^3\text{P}_1\right\rangle + b\left|{}^1\text{P}_1\right\rangle$ and $2\text{s}^2\ {}^1\text{S}_0 - 2\text{s3p}\ {}^1\text{P}_1$ is allowed.

5. See slides on the home page.

6. See slides on the home page