10.20

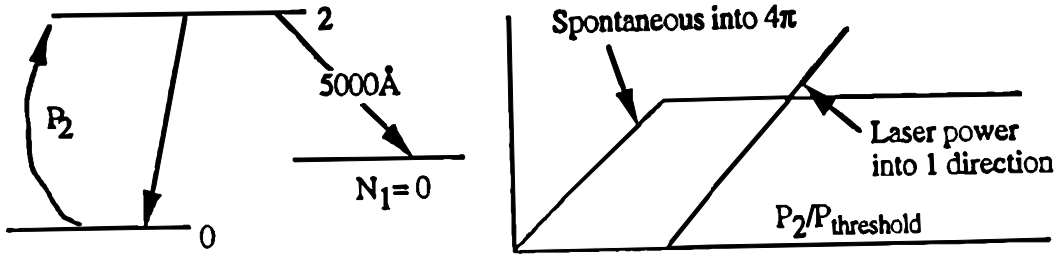
$$\frac{dN_2}{dt} = P_2 - \frac{N_2\phi}{\tau} + N_2\frac{(1-\phi)}{\tau};\ \therefore N_2 = P_2\tau.$$

For a threshold calculation: $\gamma_0 = \frac{1}{2l_g}\ln\frac{1}{R_1R_2T_a^2T_b^2} = 1.84\times10^{-2}\ \text{cm}^{-1}$;

$\therefore N_2\ (\text{threshold}) = 1.84\times10^{+13}\ \text{cm}^{-3}$. Spontaneous power $= \frac{h\nu N_2\phi}{\tau}V$;

$$P_{sp} = \frac{h\nu N_2\phi}{\tau}VN_{2(th)}\cdot\frac{1}{N_{2(th)}} = 790\left(\frac{P_2}{P_{2th}}\right)\text{watts};$$

$$I_s = \frac{h\nu}{\sigma\tau_2} = 7.95\ \text{kW/cm}^2;\ P_{LASER} = \frac{T_2I_s}{2}\left(\frac{P_2}{P_{2th}} - 1\right) = 994\left(\frac{P_2}{P_{2th}} - 1\right)$$



10.21

Potential energy $V(r) = 10.55 - \frac{e}{4\pi\varepsilon_0 r} + V_0\left(\frac{a_0}{r}\right)^6$; $V(\infty)$ = I.P. – E.A. = 10.55 eV;

at r_e: $\frac{dV(r)}{dr} = 0 = \frac{+e}{4\pi\varepsilon_0 r_e^2} - \frac{6V_0}{a_0}\left(\frac{a_0}{r_e}\right)^7$; or $\left(\frac{a_0}{r_e}\right)^5 = \frac{e/4\pi\varepsilon_0 a_0}{6V_0} = 0.02922$;

$r = 2.03\ a_0 = 3.04$ Å; $h\nu/e = 6.612 - 0.789 = 5.823$ eV. $\therefore$ $\lambda = 2129$Å