Phys608	KFUPM	Hw-02
181	Physics Department	Due: 4 Oct 2017

Q1.

Assume that all molecules of a gaseous sample of 6 cm thickness are in the lower energy level. A weak monochromatic light beam is attenuated by 15% when passes through the sample when the light is tuned to the center of an absorption transition with absorption cross section $\sigma_0 = 2.5 \times 10^{-16} cm^2$. Calculate the density of the molecules in the gas sample.

Q2.

In Young's experiment, find the maximum slit separation that gives interference fringes, if the light source is A spot light of diameter 10 cm and of 1.0 km distance from the slits. Use $\lambda = 500\, nm$.

Q3.

Find the natural linewidth, the Doppler width, pressure broadening and shifts for the neon transition $3s_2 \rightarrow 2p_4$ at $\lambda = 632.8$ nm in a He-Ne discharge of a temperature of 420 K and with partial pressures of 2 mbar for He and 0.2 mbar for Ne. Use the following data: $\tau(3s_2) = 58\, ns$, $\tau(2p_4) = 18\, ns$, $\sigma_B(Ne - He) = 6 \times 10^{-14}\, cm^2$, $\sigma_S(Ne - He) = 1 \times 10^{-14}\, cm^2$, $\sigma_B(Ne - Ne) = 1 \times 10^{-13}\, cm^2$, $\sigma_S(Ne - Ne) = 1 \times 10^{-14}\, cm^2$.