a) (5 points) Figure 2.12 of the Warneck reading shows the photodissocation frequency of O$_2$, termed $J_{O2}$ as a function of altitude. What causes the strong decrease of $J_{O2}$ toward lower altitudes by more than 5 orders of magnitude?

b) (5 points) For what spectral region does incoming solar radiation from the overhead sun reach the surface, nearly in its entirety?

c) (5 points) We shall see that electronically excited oxygen atoms, O($^1$D), play a central role in atmospheric chemistry because the reaction O($^1$D)+H$_2$O is a major source of HO$_x$ radicals. O($^1$D) is formed by the photolysis of O$_3$.

   What is the wavelength limit for production of O($^1$D) by photolysis of O$_3$?
   i.e., production of O($^1$D) occurs only for wavelengths less than this limit.

d) (5 points) Where would you expect higher levels of O($^1$D) to reside: the stratosphere or the troposphere and briefly why would you expect this behavior?

   Hint: the figures in the reading helpful to answering parts b) & c) should be helpful.