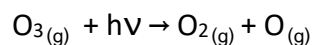


1. (22 points) Ionization involves completely removing an electron from an atom or ion. How much **energy** is required to ionize a hydrogen atom in its ground (or lowest energy) state? What **wavelength of light** contains enough energy in a single photon to ionize this atom?

2. (27 points) Textbook Problem 8-101: Ozone, absorbs ultraviolet radiation and dissociates into O₂ molecules and O atoms:



A 1.00 L sample of air at 22 °C and 748 mmHg contains 0.25 ppm of O₃. How much energy, in joules, must be absorbed if all the O₃ molecules in the sample of air are to dissociate? Assume that each photon absorbed causes one molecule to dissociate, and that the wavelength of the radiation is 254 nm.

3. (21 points) Write the **electron configuration and orbital diagram** for the following elements using the noble gas shorthand. Give the **quantum numbers (n, l, m_l, m_s)** of the last electron to be filled in each.

a. silver

b. gadolinium

c. arsenic

4. (25 points) **Balance** the reaction for the combustion of 4-hydroxyhexanal and estimate its **enthalpy of reaction (in kJ)** using bond energies.

5. (25 points) The Li^{2+} ion has a line in its spectrum at 102.51 nm due to the electron dropping from the $n = 9$ energy level to a lower one. To which lower energy level is the electron dropping?

6. (30 points) Formic acid is responsible for the sting of ant bites. By mass, formic acid is 26.10% C, 4.38% H, and 69.52% O. The molar mass of formic acid is 46.02 g/mol. Find the molecular formula of formic acid and draw its Lewis structure with the optimum formal charges, state whether or not the ion has **resonance** (yes or no), state the **electron group and molecular geometries**, determine the **polarity** (polar or nonpolar), state the **hybridization** on the central atom and give the number of **σ and π bonds** in the structure, and give its IUPAC systematic name. (Hint: remember that in oxygen containing acids the acidic hydrogen is attached to an oxygen.)