

Quiz #11c:

1. [10 pts] An electrical discharge in a neon-filled tube maintains a steady population of 1.0×10^8 atoms in an excited state with a lifetime of $\mu = 30$ ns. How many photons are emitted per second from atoms in this state?

Solution:

The initial number of Atoms in the discharge tube = $N_0 = 1.0 \times 10^8$

the rate of decay is given by $R = -dN/dt = N/\mu$

where N is the number of non decayed particles at some time t given by
 $N = N_0 \exp(-t/\mu)$

since the number of atoms is maintained to $N = N_0$ hence the rate of decay of atoms from excited state to ground state is

$$R = N_0/\mu = 3.33 \times 10^{15} \text{ sec}^{-1}$$

every atom emits one photon to decay to the ground state , therefore the number of photon emitted by atoms in the discharge tube is $R = 3.33 \times 10^{15} / \text{sec}$