(8.7) Assume that 10^9 alcohol molecules are dissociated per discharge in a GM tube of 100 cm^3 filled with 90% Ar and 10% ethyl alcohol vapor at a pressure of 100 mmHg (25 ^{o}C). What is the lifetime of the tube in terms of total counts assuming that this coincides with the dissociation of 95% of the alcohol molecules?

Standard constants:

$$R_{gas} := 0.08206 \cdot liter \cdot atm \cdot mole^{-1} \cdot K^{-1} \qquad\qquad N_A := 6.022 \cdot 10^{23} \cdot mole^{-1}$$

Given data:

$$V := 100 \cdot mL \qquad\qquad p := \frac{100}{760} \cdot atm \qquad\qquad T := (273.15 + 25) \cdot K$$

Calculations:

$$n_{tot} := \frac{p \cdot V}{R_{gas} \cdot T} \qquad\qquad n_{ethanol} := \frac{10}{100} \cdot n_{tot} \qquad\qquad n_{destr} := 10^9$$

$$N := \frac{n_{ethanol} \cdot N_A}{n_{destr}} \cdot 0.95 \qquad N = 3.1 \cdot 10^{10} \qquad\qquad counts$$