QUESTION 8

A toxicology professor is using highly toxic di-methyl-mercury in an experiment. The experiment and the apparatus, as designed, result in a steady-state air concentration of 0.005 mg/m^3 for organic mercury. The professor now wishes to include a tracer study in her research using Hg-203 tagged $Hg(CH_3)_2$. The specific activity used is 5-microcurie per milligram of the $Hg(CH_3)_2$ compound.

GIVEN

- DAC for organic Hg-203 is 7×10^{-5} μCi/ml
- Permissible Exposure Limit (PEL) for organic Hg compounds is 0.01 mg/m^3
- Atomic weight of Hg = 200.6
- Atomic weight of C = 12
- Atomic weight of H = 1
- The half-life of Hg-203 is 47 days
- Assume the presence of the radioactive mercury has an insignificant effect on the molecular weight of the tagged $Hg(CH_3)_2$.

POINTS

30 A Calculate the fraction of Hg atoms that are tagged? **Show all work**.

40 B What is the activity concentration, $\mu Ci/m^3$, corresponding to the PEL? Is this concentration below the DAC? **Show why or why not.**

30 C Assume OSHA requires that the fraction of DAC and the fraction of PEL is additive and should be less than or equal to one. i.e.:

$$f(DAC) + f(PEL) \leq 1$$

What is the highest specific activity of the tagged compound that can be used to assure compliance with the requirement?