3. CALCULATE **Substitute the values into the equations and solve:**

$$\lambda = \frac{0.693}{T_{1/2}} = \frac{0.693}{5.0 \times 10^{10}\ \text{s}}$$

$$\boxed{\lambda = 1.4 \times 10^{-11}\text{s}^{-1}}$$

$$\text{activity} = \lambda N = \frac{(1.4 \times 10^{-11}\ \text{s}^{-1})(3.0 \times 10^{16})}{3.7 \times 10^{10}\ \text{s}^{-1}/\text{Ci}}$$

TIP *Always pay attention to units. Here, the activity is divided by the conversion factor $3.7 \times 10^{10}\ s^{-1}/Ci$ to convert the answer from becquerels to curies, as specified in the problem statement.*

$$\boxed{\text{activity} = 1.1 \times 10^{-5}\ \text{Ci}}$$

4. EVALUATE Because the half-life is on the order of 10^{10} s, the decay constant, which approximately equals 0.7 divided by the half-life, should equal a little less than $10^{-10}\ s^{-1}$. Thus, $1.4 \times 10^{-11}\ s^{-1}$ is a reasonable answer for the decay constant.

PRACTICE C

Measuring Nuclear Decay

1. The half-life of $^{214}_{84}$Po is 164 μs. A polonium-214 sample contains 2.0×10^6 nuclei. What is the decay constant for the decay? How many polonium nuclei, in curies, will decay per second?
2. The half-life of $^{214}_{83}$Bi is 19.7 min. A bismuth-214 sample contains 2.0×10^9 nuclei. What is the decay constant for the decay? How many bismuth nuclei, in curies, will decay per second?
3. The half-life of $^{131}_{53}$I is 8.07 days. Calculate the decay constant for this isotope. What is the activity in Ci for a sample that contains 2.5×10^{10} iodine-131 nuclei?
4. Suppose that you start with 1.00×10^{-3} g of a pure radioactive substance and determine 2.0 h later that only 0.25×10^{-3} g of the substance is left undecayed. What is the half-life of this substance?
5. Radon-222 ($^{222}_{86}$Rn) is a radioactive gas with a half-life of 3.82 days. A gas sample contains 4.0×10^8 radon atoms initially.
   a. Estimate how many radon atoms will remain after 12 days.
   b. Estimate how many radon nuclei will have decayed by this time.