

Name: KEY

PHYSICS 2220 - QUIZ #13 - SPRING 2009

1. Consider a sample of radioactive radon,  $^{211}\text{Rn}$ , an isotope that has a half-life of 14.6 hours. The sample initially contains  $3 \times 10^{22}$  atoms of  $^{211}\text{Rn}$ .

- a. What is its initial decay rate (activity)?

$$\lambda = \frac{\ln 2}{\tau} = \frac{\ln 2}{14.6 \text{ hr}} \left( \frac{1 \text{ hr}}{3600 \text{ sec}} \right) = 1.319 \times 10^{-5} \frac{1}{\text{sec}}$$

$$R_0 = \lambda N_0 = (1.319 \times 10^{-5} \frac{1}{\text{sec}}) (3 \times 10^{22})$$
$$= \boxed{3.96 \times 10^{17} \text{ Bq}}$$

- b. How many radon  $^{211}\text{Rn}$  atoms are left 24 hours later?

$$N = N_0 e^{-\lambda t} = N_0 e^{-\frac{t \ln 2}{\tau}}$$

$$N = (3 \times 10^{22}) e^{-\frac{(24 \text{ hr}) \ln 2}{14.6 \text{ hr}}}$$

$$= \boxed{9.6 \times 10^{21}}$$