**Half-Life Homework #2**

**Given**: T1/2 = -ln(0.5)/k N = Noe-(kt) 1Ci = 3.7x1010 decays/sec

**15.** The half-life of an isotope of phosphorusis 14 days. If a sample contains 3.0 × 1016 suchnuclei, determine its activity. Express your answer incuries (Ci). (1 day = 86400 sec). ***Answer***: 0.46 Ci

**17.** The half-life of 131I is 8.04 days. (a) Calculate the decay constantfor this isotope, in decays/sec. (b) Find the number of 131I nucleinecessary to produce a sample with an activity of 0.50 Ci. (1 day = 86400 sec). ***Answer***: a) 9.98x10-7 decays/sec., b) 1.9x1016

**19.** Suppose that you start with 1.00 × 10−3 g of a pureradioactive substance and 2.0 h later determine that only0.25 × 10−3 g of the substance remains. What is the half-lifeof this substance? ***Answer:*** 1.0 hours

**21.** Many smoke detectors use small quantities of the isotope 241Am in their operation. The half-life of 241Am is 432 yr.How long will it take for the activity of this material todecrease to 1.00 × 10−3 of the original activity? ***Answer:*** 4317 years.

**23.** A freshly prepared sample of a certain radioactive isotopehas an activity of 10.0 Ci. After 4.00 h, the activity is8.00 Ci. (a) Find the decay constant and half-life of theisotope. (b) How many atoms of the isotope were containedin the freshly prepared sample? (c) What is thesample’s activity 30 h after it is prepared? ***Answer:*** a) 0.56 decays/second and half-life of 12.43 hours (44748 sec). b) 2.38x1016 nuclei, c) 1.9 Ci

**Solutions:**

**29.15** The decay constant is , so the activity is  
  
   
  
or 

**29.17** (a) The decay constant is  
  
 

(b) , so the required number of nuclei is  
  
 

**29.19** Recall that the activity of a radioactive sample is directly proportional to the number of radioactive nuclei present, and hence, to the mass of the radioactive material present.  
  
Thus,  when   
  
From , we obtain  and   
  
Then, the half-life is 

**29.21** From , with , we find   
  
and 

**29.23** (a) The initial activity is , and at , . Then, from , the decay constant is  
  
   
  
and the half-life is 

(b) 

(c) 