Ch 24 – Nuclear Chemistry

Selected NChO Problems

1999-30.	**(C) 34 y** Roughly, the tritium decays from 100%→50%→25%→12.5% so the answer is between 2 and 3 half-lives, that is, between 25 years and 37.5 years. There is only one answer in that range.
1995-30.	**(A) 9.6 x 10^{-3} s^{-1}** $\ln 2 = kt_{½}$ so, $k = \frac{\ln 2}{t_{½}} = \frac{0.693}{72s} = 0.009625\ s^{-1}$ = **9.6 x 10^{-3} s^{-1}**
1994-29.	**(B) first** I guess you just have to memorize this idea. Remember that radioactivity is first order and the half life is constant (i.e., does not depend on the concentration of the reactant).
1993-39.	**(A) $_{26}Fe^{59}$** (A) 59 – 26 = 33 (C) 61 – 30 = 31 (B) 61 – 29 = 32 (D) 60 – 30 = 30
1993-40.	**(A) alpha** Alpha decay example: $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$ mass number changes: 238 → 234 atomic number changes: 92 → 90
1992-1.	**(C) $92p^+$ $92e^-$ 143n°** U = 92 protons; neutral species means $\#e^- = \#p^+$; 235 – 92 = 143n°
1992-65.	**(B) 0.00462** $\ln 2 = kt_{½}$ so, $k = \frac{\ln 2}{t_{½}} = \frac{0.693}{150\,\text{min}} = 0.00462\ \text{min}^{-1}$
1991-59.	**(C) 18,600 years** "90% of a sample to decompose" translates into "10% remains" 100% → 50% → 25% → 12.5% → 6.25% The estimate is roughly between 3 & 4 half-lives, that is, between 16,710 yrs and 22,800 yrs. Two answers fit that range so we need to ***calculate*** the actual answer. $\ln 2 = kt_{½}$ so, $k = \frac{\ln 2}{t_{½}} = \frac{0.693}{5570\ yrs} = 1.244\text{x}10^{-4}\ \text{yrs}^{-1}$ $\ln\left(\frac{[A]_0}{[A]_t}\right) = kt$ $\ln\left(\frac{100\%}{10\%}\right) = (1.244\text{x}10^{-4}\text{yrs}^{-1})t$ $\ln 10 = (1.244\text{x}10^{-4}\text{yrs}^{-1})t$ $2.302 = (1.244\text{x}10^{-4}\text{yrs}^{-1})t$ $t = \frac{2.302}{(1.244\text{x}10^{-4}\ \text{yrs}^{-1}} =$ **18,509 years**
1990-26.	**(A) 40.0 mg** $\frac{12.00}{6.00}$ = 2 half lives x → x → 10.0 mg **40.0 mg** → 20.0 mg → 10.0 mg
1990-36.	**(D) 26 electrons, 26 protons, 30 neutrons** Fe (atomic number = 26) This is a neutral atom, so $\#e^- = \#p^+ = 26$. #n° = 56 – 26 = 30 neutrons