23) $k = \frac{0.693}{t_{\frac{1}{2}}}$ $\quad 1.0 \times 10^{-3}\ h^{-1} = \frac{0.693}{t_{\frac{1}{2}}}$

$t_{\frac{1}{2}} = 690\ h$

25) $100\% \xrightarrow[t_{\frac{1}{2}}]{} 50\% \xrightarrow[t_{\frac{1}{2}}]{} 25\% \xrightarrow[t_{\frac{1}{2}}]{} 12.5\%$ leftover

$Kr-81$ most stable (longest half-life)

$Kr-73$ "hottest" (shortest half-life)

$Kr-73$: $t = 3(27s) = 81\ s$ $\quad Kr-74$: $t = 3(11.5\ min) = 34.5\ min$

$Kr-76$: $t = 3(14.8\ h) = 14.8\ h$ $\quad Kr-81$: $t = 3(2.1 \times 10^5\ yr) = 6.3 \times 10^5\ yr$

27) original $\left(\frac{1}{2}\right)^x$ = Final

$x \left(\frac{1}{2}\right)^{0.44} = 5.0\ mg$

$x\ (0.74) = 5.0\ mg$

$\frac{2}{4.5} = 0.44$ half lives

$x = 6.8\ mg\ Ca^{+2} \frac{107.0\ mg\ CaCO_3}{40.08\ g\ Ca^{+2}} = 15\ mg\ CaCO_3$

29) $k = \frac{0.693}{t_{\frac{1}{2}}}$ $\frac{0.693}{28.9\ yr} = 0.0240\ yr^{-1}$

$$\ln\left(\frac{N}{N_0}\right) = -kt$$

$$\ln\left(\frac{N}{N_0}\right) = -(0.0240\ yr^{-1})(64\ yr)$$

$$\ln\left(\frac{N}{N_0}\right) = -1.53$$

$$\frac{N}{N_0} = 0.217 \qquad 21.7\%\ \text{remains}$$

31) $1.0 \times 10^3\ min \left|\frac{1\ hr}{60\ min}\right|\frac{1\ day}{24\ hrs} = 0.69\ days = t_{\frac{1}{2}}$

$$k = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{0.69\ days} = 1.00\ days^{-1}$$

$$\ln\left(\frac{N}{N_0}\right) = -kt$$

$$\ln\left(\frac{1.0}{x}\right) = -(1.00\ days^{-1})(3\ days)$$

$$\ln\frac{1.0}{x} = -3$$

$$\frac{1.0}{x} = 0.050$$

$$1.0 = 0.050x$$

$$x = 20.g\ Br.82$$

$20.g\ Br.82 \left|\frac{1\ mole\ Br}{82.0\ g}\right|\frac{1\ mole\ NaBr}{1\ mole\ Br}\left|\frac{104.99\ g}{1\ mole}\right| = \boxed{26g}$

33) $k = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{5730\ yrs} = 1.2 \times 10^{-4}\ yrs^{-1}$

$$\ln \frac{N}{N_0} = -kt$$

$$\ln \frac{x}{13.6} = -(1.2 \times 10^{-4}\ yr^{-1})(15,000\ yrs)$$

$$\ln \frac{x}{13.6} = -1.8$$

$$\frac{x}{13.6} = 0.17$$

$x = 2.2$ counts per min per gram

35) original U-238 : final U-238 + Pb-206

1.688 mg 1.000 mg 0.688 mg

$$k = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{4.5 \times 10^9\ yrs} = 1.54 \times 10^{-10}\ yr^{-1}$$

$$\ln \frac{N}{N_0} = -kt$$

$$\ln \frac{1.000}{1.688} = -(1.54 \times 10^{-10}\ yrs^{-1})(t)$$

$$t = 3.4 \times 10^9\ yrs$$

3.) $E = mc^2$

$3.9 \times 10^{23} \frac{J}{s} = m \left(3.00 \times 10^8 \frac{m}{s}\right)^2$

$m = 4.3 \times 10^6 \frac{kg}{s}$

4.) C-12

expected mass: $6(1.00782 \text{ amu}) + 6(1.00866 \text{ amu})$

$= 12.09888 \text{ amu}$

actual mass = 12.0000

mass loss: $12.0000 - 12.09888 = -0.09888 \text{ amu}$

$0.09888 \text{ amu} \left(\frac{1.66054 \times 10^{-27} kg}{1 \text{ amu}}\right) = 1.64194 \times 10^{-28} kg$

$E = mc^2$

$= (1.64194 \times 10^{-28} kg)\left(3.00 \times 10^8 \frac{m}{s}\right)^2$

$E = 1.4777 \times 10^{-11} \frac{J}{\text{nucleus}}$

$1.4777 \times 10^{-11} \frac{J}{\text{nucleus}} \left(\frac{\text{nucleus}}{12 \text{ nucleons}}\right) = 1.2315 \times 10^{-12} \frac{J}{\text{nucleon}}$

43) ^{6}Li has 3 protons + 3 neutrons

expected mass = 3(1.00728 amu) + 3(1.00866 amu)

= 6.04782 amu

$$6.04782\ \text{amu} \times \frac{1.66054 \times 10^{-27}\ \text{kg}}{1\ \text{amu}} \times \frac{1000\ \text{g}}{1\ \text{kg}} = 1.00426 \times 10^{-23}\ \frac{\text{g}}{\text{nucleus}}$$

$$1.00426 \times 10^{-23}\ \frac{\text{g}}{\text{nucleus}} \times \frac{6.02 \times 10^{23}\ \text{nuclei}}{1\ \text{mole}} = 6.04567\ \frac{\text{g}}{\text{mol}}$$

$$-0.03434\ \frac{\text{g}}{\text{mol}} = x - 6.04567\ \frac{\text{g}}{\text{mol}}$$

$$x = 6.0113\ \frac{\text{g}}{\text{mol}}$$

48) too involved... not on test !!

YOU WILL SEE THE FOLLOWING ON YOUR TEST:

WRITING HALF LIFE REACTIONS

SIMPLE HALF LIFE PROBLEMS…. ORIGINAL $(1/2)^X$ = FINAL

CALCULATING AGE OF SAMPLE… $\ln (N/N_O) = -kt$

BINDING ENERGY

FISSION AND FUSION