$$\text{Amt. Remaining} = (\text{Initial Amt.})\left(\frac{1}{2}\right)^{t/T}$$ (t → Time elapsed, T → Half-life)

1.) Amt. Remaining $= (1\text{mg})\left(\frac{1}{2}\right)^{90/30} = \boxed{0.125\text{mg}}$

2.) $\frac{0.625}{2.5} = \frac{(2.5)\left(\frac{1}{2}\right)^{x/28}}{2.5}$

$\log\left[.25 = \left(\frac{1}{2}\right)^{x/28}\right]$

$\log .25 = \left(\frac{x}{28}\right)\log .5$

$2 = \frac{x}{28}$

$x = 56$ $\quad 1960 + 56 = \boxed{2016}$

3.) $\frac{58}{29} = 2$ half-lives

100mg → 1 hl

50mg → 2 hl

$\boxed{25\text{mg}}$

4.) $6\text{ days} \times \frac{24\text{hr}}{1\text{day}} = 144 + 2 = 146\text{ hrs.}$ → 2 hl

4 mg → 1 hl

2 mg → 2 hl

$\boxed{1\text{mg}}$

Amt. remaining $= 4\text{mg}\left(\frac{1}{2}\right)^{146/73} = 1\text{mg}$

5.) $.5 = 4\left(\frac{1}{2}\right)^{x/2}$

$\left[.125 = \left(\frac{1}{2}\right)^{x/2}\right]\log$

$\log .125 = \left(\frac{x}{2}\right)\log .5$

$3 = \frac{x}{2}$

$x = \boxed{6\text{ years}}$

6.) $1.25 = 10\left(\frac{1}{2}\right)^{x/25}$

$\left[.125 = \left(\frac{1}{2}\right)^{x/25}\right]\log$

$\log .125 = \left(\frac{x}{25}\right)\log .5$

$3 = \frac{x}{25}$ $\quad \boxed{x = 75\text{ minutes}}$

7.) Amt. remaining $= (1{,}000{,}000)\left(\frac{1}{2}\right)^{4.5/1.5} = \boxed{31{,}250 \text{ atoms}}$

8.) $.375 = 3\left(\frac{1}{2}\right)^{\frac{1\text{hr}}{x}}$

$\left[.125 = \left(\frac{1}{2}\right)^{1/x}\right] \log$

$\log .125 = \left(\log \frac{1}{2}\right)\left(\frac{1}{x}\right)$

$3 = \frac{1}{x}$

$\boxed{x = \frac{1}{3}}$ $= 20 \text{ min.}$

9.) Make initial sample $= 100\text{g}$

Amt. remaining $= (100)\left(\frac{1}{2}\right)^{32/8} = 6.25$

$\% = \frac{6.25}{100} \times 100 = \boxed{6.25\%}$

10.) Make initial sample $= 100\text{g}$

25% of initial $= 25\text{g}$ remaining

$25 = 100\left(\frac{1}{2}\right)^{x/15}$

$\left[.25 = .5^{x/15}\right] \log$

$-.602 = (-.301)\left(\frac{x}{15}\right)$

$2 = \frac{x}{15}$

$x = \boxed{30 \text{ hours}}$

or To reach 25% original mass two half-lives pass.

11.) $\frac{2\text{g}}{64} = \frac{64\text{g}}{64}\left(\frac{1}{2}\right)^{40/x}$

$\left[.03125 = .5^{40/x}\right] \log$

$-1.505 = (-.301)\frac{40}{x}$

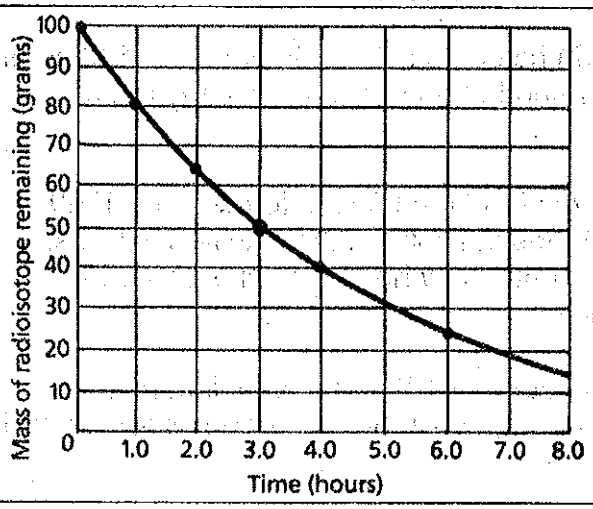
$5 = \frac{40}{x}$

$5x = 40$

$x = \boxed{8 \text{ days}}$

Key

HALF LIFE GRAPHS



1. What is the half life of the graphed material? 3 hrs.
2. What mass of radioisotope will remain after 9.0 hours? 12.5g
   Amt. $= 100\left(\frac{1}{2}\right)^{9/3}$
3. Plot the data from a substance with a half-life of 1.5 hours.