

## CLASS EXERCISE #25 - 2 August 2005

**1. A radioactive atom has a half-life of 20.0 seconds.**

**(a) What is its decay constant?**

$$\lambda = 0.693/T_{1/2} = 0.693/(20.0 \text{ s}) = 0.0346/\text{s}$$

**(b) What fraction of an initial number of these atoms remain after exactly one minute?**

One minute equals three 20.0-second periods, or three half-lives. The fraction of remaining atoms is then  $(1/2)^3 = 1/8$ .

**(c) How long will it take for 75% of the initial number to decay?**

75% decayed means 25% = 1/4 undecayed, which means two half-lives have passed. The time is 40.0 seconds.

**2. Estimate (do not calculate) what percentage of a certain radioactive atom would decay in 30 minutes if its half-life is 9 minutes.**

$30/9 = 3.3$ , so 3.3 half-lives have elapsed. After three half-lives the amount left would be  $100\% \times 0.50 \times 0.50 \times 0.50 = 12.5\%$ . After four half-lives it would be half as much, or 6.25%. A third of the way down from the larger percentage would be about 10%, so the amount that decayed would have been about 90%.