LECTURE 31

1. Technetium has not been found in nature. It can be obtained readily as a product of uranium fission in nuclear power plants, however, and is produced in quantities of many kilograms per year. MIT Chemistry Professor Alan Davison pioneered the use of techneticum in the diagnosis of heart disease. Calculate the total activity (in disintegrations per second) caused by the decay of 0.5 microgram of ^{99m}Tc (an excited nuclear state of ^{99}Tc), which has a half-life of 6.0 hours.

1×10^{11} disintegrations s^{-1}

2. You find an ancient text book and want to know how old it is. The book has a ^{14}C activity of 28.3 counts per minute. A standard which is considered to be zero age has a ^{14}C activity of 32.5 counts per minute. Calculate the age of the book, given that the half-life of ^{14}C decay is 5715 years.

1.14×10^{3} years

3. The rate constants for the following reaction, both forward and reverse, were experimentally determined.

$$ClNO_2 + NO \rightleftharpoons NO_2 + ClNO$$

The value of k_f is 7.3×10^3 $M^{-1}s^{-1}$ and the value of k_r is 0.55 $M^{-1}s^{-1}$ at 25 °C. Calculate the equilibrium constant for this reaction at 25 °C.

1.3×10^{4}

4. If the equilibrium constant for a reaction is 5.2×10^3 at 25 °C, would you expect the rate contact for the forward reaction to be greater than or less than the rate constant for the reverse reaction at 25 °C.

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