Dynamics and Kinetics. Exercise 2

Problem 1

a) The first order gas reaction $SO_2Cl_2 \xrightarrow{k} SO_2 + Cl_2$ has $k = 2.20 \times 10^{-5}{}_s{}^{-1}$ at 593K. What percentage of a sample of SO_2Cl_2 would be decomposed by heating at 593K for 1 hour?

b) How long will it take for half the SO_2Cl_2 to decompose?

Problem 2

The reaction

$$NO_3 + NO \xrightarrow{k} 2NO_2$$

is known to be an elementary process.

a) Write the rate expression for the rate of consumption of NO_3 and NO.

b) Write the rate expression for the rate of production of NO_2.

c) Show how the rate expressions in a) and b) are related.

Problem 3

a) What are the units of the rate constants of first, second and third order reactions if the concentrations are expressed in mol/L and the time is given in seconds? What are the conversion functions that must be used to convert to concentration units of mol/L in each case?

b) If a reaction obeyed the rate law

$$v = k\,[A]^{1/2}\,[B]^{2/3}$$

what would the units of k be?

Problem 4

The half-life time for the radioactive decay of ^{14}C to ^{14}N is 5730 years (emitting β rays with energy 0.16 MeV). Compute the age of an archaeological sample of wood that has only 72% of the ^{14}C present in living trees.