# CH1011 Tutorial 5

**Name:**

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

1. For the above reaction write down an expression for the **rate law** in terms of the concentration dependence of nitrogen dioxide (the product).

2. Assume that the **half-life** for the above reaction at 300$^{o}$C is 250 ms and that the reaction is first order with respect to NO and overall first order.
   - How long will it take, in milliseconds, for the NO concentration to fall from an initial value of 0.130 mol dm$^{-3}$ to a value of 0.0325 mol dm$^{-3}$?
   - Calculate the **activation energy**, $\mathbf{E_a}$, for the above reaction given that k = 2.4x10$^{-5}$ at 30$^{o}$C and k = 5.3x10$^{-4}$ at 80$^{o}$C.

3. What is an enzyme and how does an **enzyme** function as a **catalyst**?
   Use an example to illustrate your answer.

**Additional information:**

$T(K) = T(^{o}C) + 273$ $\ln(k_2/k_1) = -Ea/R(1/T_2 - 1/T_1)$ First order: $\ln[Ao] - \ln[A] = kt$

Second order: $1/[A] - 1/[Ao] = kt$ $R = 8.314$ J / mol K

4. Using the **radionuclide $^{222}$Rn** illustrate the processes of **alpha decay** and with the **radionuclide $^{210}$Pb** the process of **beta decay**. In both cases assume that in the decay process only a daughter nuclide and the given decay particle are formed.

5. The atmospheric testing of thermonuclear weapons had some un-intentional scientific use, it dosed the atmosphere with trace amounts of **radioactive tritium ($^{3}$H)** an isotope of hydrogen which has a relatively short half-life (12.3yr).
   - Assuming that an iguana in atoll in the Pacific accumulated 24.10μg of on the day of the testing (based on breathing in contaminated air) and when it died it was found to have 2.53μg of tritium in the body mass – how long did it take for the iguana to die?

6. What differentiates **stable isotopes** from radioisotopes?
   Why are stable isotopes of oxygen useful in **paleoclimatology**?