2012-2013
PS # 1 - Reaction Kinetics

Question 1 :

In a study of the natural die-off of coliform organisms in a stream, it was found that 36% of the organisms died within 10 hours and 59% died within 20 hours. If the rate of die-off followed first order kinetics and were proportional to the number remaining, how long would it take to obtain a 99 percent reduction in coliform organisms?

Question 2 :

The decomposition of a radioactive element is the simplest example of a true first-order reaction. The radioactive nuclide P^{32} has a half life of 14.3 days. How long would a waste containing 10 mg/L of this nuclide have to be stored in order to reduce the concentration 0.3 mg/L?

Question 3 :

A chemical reaction occuring in a batch reactor can be described by the following rate equation:

$r_a = -k_2 (C_{a\,(o)} - 0.5\, C_a)^2$

where $C_{a\,(o)}$ and C_a are the mass concentrations (in g/m^3) of A present initially and at time t , respectively. Determine the value of k_2 if $C_{a\,(o)} = 100\ g/m^3$ and C_a (t=10 d)= $10\ g/m^3$.

Question 4 :

The reaction rate data given below were obtained using a batch reaction system for the reaction A→products. Determine an appropriate rate expression and the rate coefficient.

t, min	**[A], g/m^3**
0	30
0.5	12
1	7.5
2	4.29
4	2.31
8	1.2
16	0.61
32	0.31