Series 2

Exercise 1:

Hydrogen gas has a nonpolluting combustion product (water vapor). H_2 is used as a fuel abord the space shuttle and in earthbound cars with prototype engines:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

a. Express the rate in terms of changes in $[H_2]$, $[O_2]$, and $[H_2O]$ with time.

b. When $[O_2]$ is decreasing at 0.23 mol/l, at what rate is $[H_2O]$ increasing.

Exercise 2 :

The following data were measured for the reaction of nitric oxide with hydrogen:

$2\ NO_{(g)} + 2\ H_{2(g)} \longrightarrow N_{2(g)} + 2\ H_2O_{(g)}$

Experiment Number	[NO] (mol/l)	$[H_2]$ (mol/l)	Initial Rate (mol/l.s)
1	0.10	0.10	1.23×10^{-3}
2	0.10	0.20	2.46×10^{-3}
3	0.20	0.10	4.92×10^{-3}

a) Determine the rate law for this reaction.

b) Calculate the rate constant.

c) Calculate the rate when [NO] = 0.050 M and $[H_2]$ = 0.150 M.

Exercise 3 :

The following chemical process has been studied in a batch isothermal reactor:
A → Products.
The reaction mix was analyzed at different times, yielding the following concentrations for reactant A

Reaction time (min)	0	5	15	50	80	100	160
[A] (mol/L)	1.00	0.78	0.54	0.26	0.18	0.15	0.10

Determine the kinetic equation of the reaction.

Exercise 4 :

Half-life time for substance A in a second order reaction A → Products at 20 ºC is 50.5 seconds

when $[A]_0$=0.84 mol/L.

a) Calculate the amount of time required so that the concentration of A is reduced to one fifth of its initial value.

b) If the rate of the reaction is doubled when temperature increases from 20ºC to 28ºC, calculate the activation energy in joule of the process.