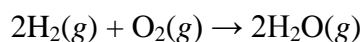


## Series 2

### Exercise 1:

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



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



Experiment Number	[NO] (mol/l)	[H <sub>2</sub> ] (mol/l)	Initial Rate (mol/l.s)
1	0.10	0.10	1.23 x 10 <sup>-3</sup>
2	0.10	0.20	2.46 x 10 <sup>-3</sup>
3	0.20	0.10	4.92 x 10 <sup>-3</sup>

- Determine the rate law for this reaction.
- Calculate the rate constant.
- 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:



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  $A \rightarrow \text{Products}$  at 20 °C is 50.5 seconds

when  $[A]_0 = 0.84 \text{ mol/L}$ .

- Calculate the amount of time required so that the concentration of A is reduced to one fifth of its initial value.
- If the rate of the reaction is doubled when temperature increases from 20°C to 28°C, calculate the activation energy in joule of the process.