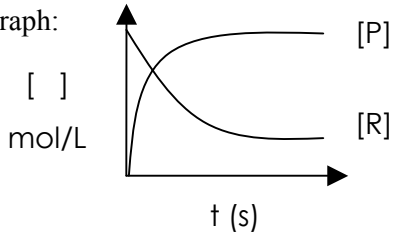
# Review: Rate of Reaction

- Consider the following reaction: $2\ H_2O_2 \rightarrow 2\ H_2O + O_2$
- What is the definition of :
  - Reactant = $-\frac{\Delta[R]}{\Delta t}$
  - Products = $+\frac{\Delta[P]}{\Delta t}$
  - Graph:




- Experimental methods to follow the progress of reactions
  - Volume of gas- Find volume of oxygen using a gas syringe
  - Pressure of gas- Find pressure of oxygen using a manometer
  - Gravimetric- Find changes in mass
  - pH
  - Conductivity
  - Thermometric
- Rate Expressions for the above reaction are:
  - $+\frac{\Delta[O_2]}{\Delta t}$
  - $+\frac{1}{2}\frac{\Delta[H_2O]}{\Delta t}$
  - $-\frac{1}{2}\frac{\Delta[H_2O_2]}{\Delta t}$
- Calculations:
  - E.g. Rate of Production of $O_2$ = 0.15 mol/L.s.

    $H_2O_2$ = ?
  - mol : mol

    $O_2 : H_2O_2$

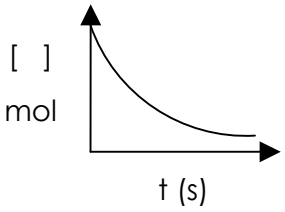
    1/0.15 : 2/*x*

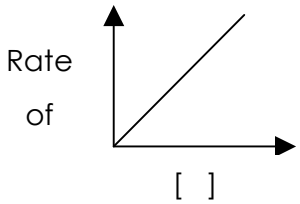
    *x* = - 0.30 mol/L.s. (negative because it is a reactant and $[H_2O_2]$ goes down as $[O_2]$ goes up)

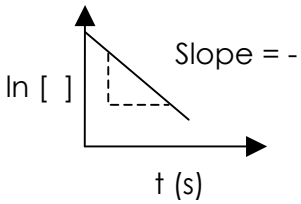
- Factors that affect the rate of reaction:
  - Concentration
  - Surface area
  - Temperature
  - Catalyst
  - Pressure of gases
  - Nature of reactants
  - Explanation of these factors in terms of:
  - Collision Theory
  - Maxwell-Boltzmann Distribution of Kinetic Energies
- Reaction Mechanism:
  - Define:
  - Rate
  - Rate Determining step
  - Elementary step
  - Intermediate step
  - Order
  - Molecularity
  - Rate Law
  - Rate Constant
  - Overall Equation

  - Be able to draw Potential Energy diagrams: given Ea (forward) = 120 kJ, Ea (reverse) = 260 kJ
  - Determination of Order .: Rate Law
  - Derive Mechanism given Rate Law and Overall Equation
- Integrated Rate Law:
  - $\ln [A]_t = - k\, t + \ln [A]_O$
  - Half Life: $t (½) = 0.693 / k$
  - Calculation Type: (a)(b)(c)(d): for the above reaction, given initial concentration of $H_2O_2 = 0.11$ mol/L and its half life is 300 s.
  - a) Calculate k
  - b) Calculate $[H_2O_2]$ after 2 minutes
  - c) Calculate how long it will take for $[H_2O_2] = 0.11$ mol/L
  - d) Calculate how long it will take for $[H_2O_2]$ to decompose 76%?

- Graphs
  - 1st Order Reactions




  - For graphs on Zero Order: Please check your notes

- Catalysis:
  - Homogeneous
  - Heterogeneous
  - Mechanism of each type of catalysis
- Arrhenius Equation (IB only)