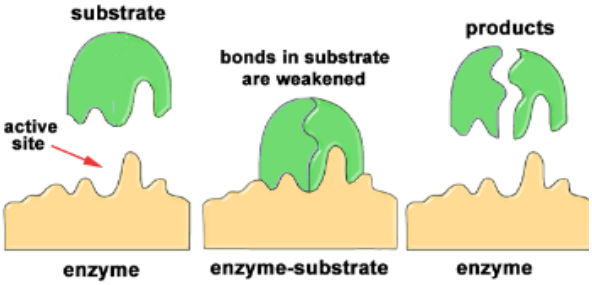
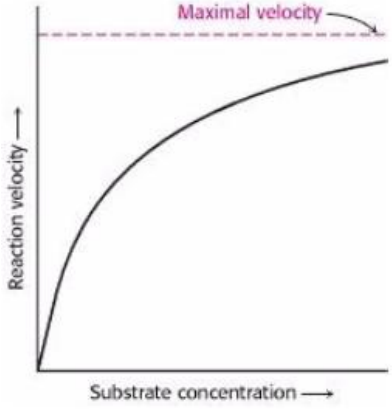
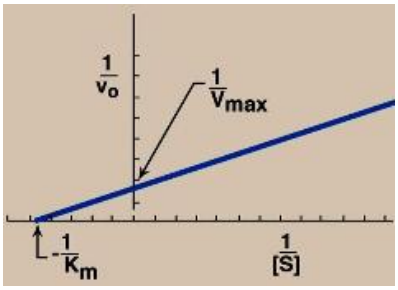
- **Enzyme-substrate complex**: the substrate binds to its enzyme on the active site to form the enzyme-substrate complex.
- **Enzymes:**
  - Most of them are specific (e.g. acting on few types of molecules to give a molecular product).
  - Notice that the enzyme will change its shape as soon as it binds to the substrate (why?) → decreasing the energy of activation which changes the substrate to a transition state. Therefore, the reaction can proceed to form the product and the enzyme will be regenerated.

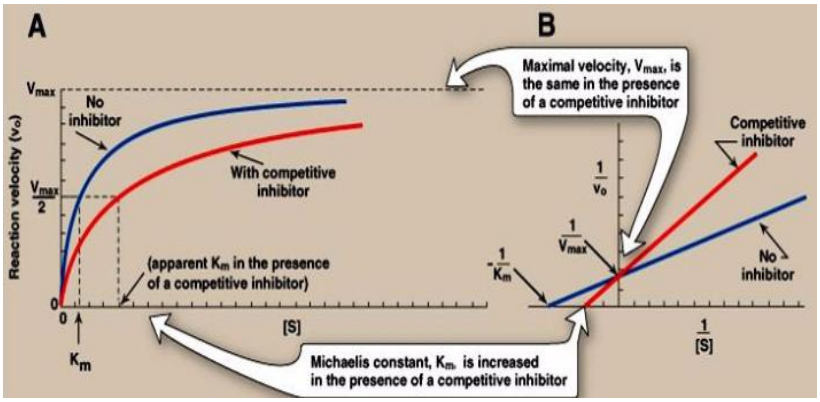


  - Enzyme + Substrate ↔ enzyme-substrate complex → enzyme + product
- **Regulation of enzyme reaction velocity:**
  - **Substrate concentration:**
    - ✓ Increasing the concentration of the substrate will increase the rate of the reaction (first-order) hyperbolically until all active sites are saturated.
    - ✓ The reaction reaches its maximal velocity (V_{max}) and further addition of substrate has no effect of the reaction rate (zero-order).
    - ✓ When it is difficult to determine V_{max} and hence the K_m of a reaction from the normal plot, you should plot the reciprocal of substrate against the reciprocal of velocity ($\frac{1}{V}$ against $\frac{1}{[S]}$).
    - ✓ This changes the hyperbolic curve into a straight line, which intercepts the x-axis at ($-\frac{1}{K_m}$) and the y-axis at ($\frac{1}{V_{max}}$)
    - ✓ This plot is known as: Lineweaver-Burke plot.

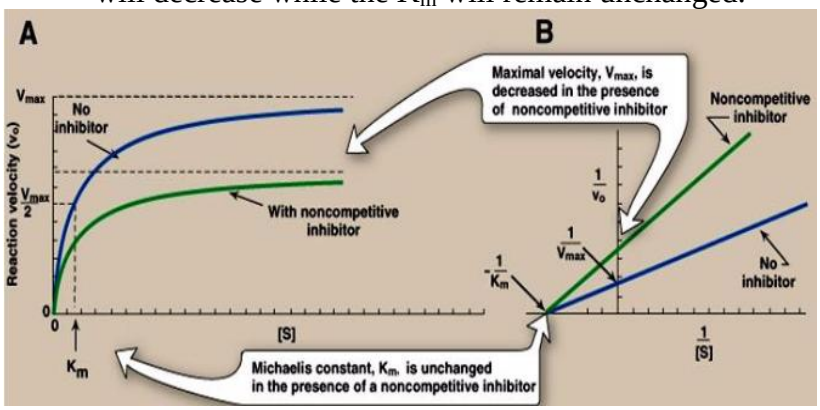




- **Enzyme inhibition:**
  - **Enzyme inhibitors are molecules which interact with enzymes and prevent it from working. They are classified into:**
    - ✓ Non-specific inhibitors: affect all enzymes in the same way.
    - ✓ Specific inhibitors: exert their effects on a single enzyme. They are further classified into:
      - ❖ *Reversible inhibitors*: which can dissociate from the enzyme and catalytic activity is regained:
        - ➢ Competitive:
          - ▪ It is structurally similar to the substrate thus competing with the substrate for binding the active site of the enzyme.
          - ▪ At high substrate concentration or low inhibitor concentration → the inhibitor will cause little disruption to normal enzyme function.
          - ▪ Increasing [S] will displace the inhibitor and allows the reaction to reach V_{max}.
          - ▪ The K_m increases while V_{max} remains unchanged.



- Non-competitive:
  - Do not resemble the enzyme's substrate, thus do not bind the enzyme at the active site but at other sites and inducing the enzyme to undergoe conformational changes.
  - Increasing [S] will not displace the inhibitor thus V_{max} will decrease while the K_m will remain unchanged.



- *Irreversible*: when the enzyme is permanently inactivated.
  - These inhibitors for a covalently-linked enzyme-inhibitor complex.

- **Regulation of enzyme activity:**
  - **Covalent modification:**
    - ✓ Binding a molecule covalently to an enzyme will alter its conformation, and therefore, its activity.
    - ✓ This may result in activation or inhibition of enzyme activity, and the response is usually very fast (acute).
    - ✓ The most common reversible covalent modification is adding a phosphate group to the (-OH) group of tyrosine, serine or threonine.