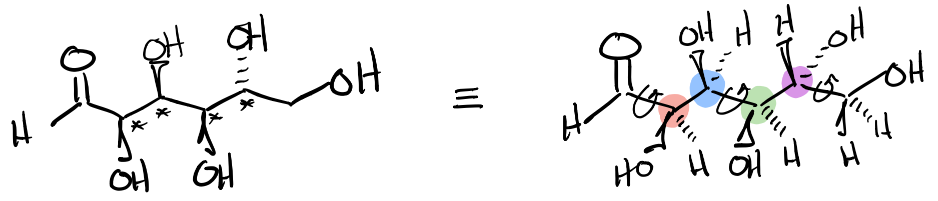
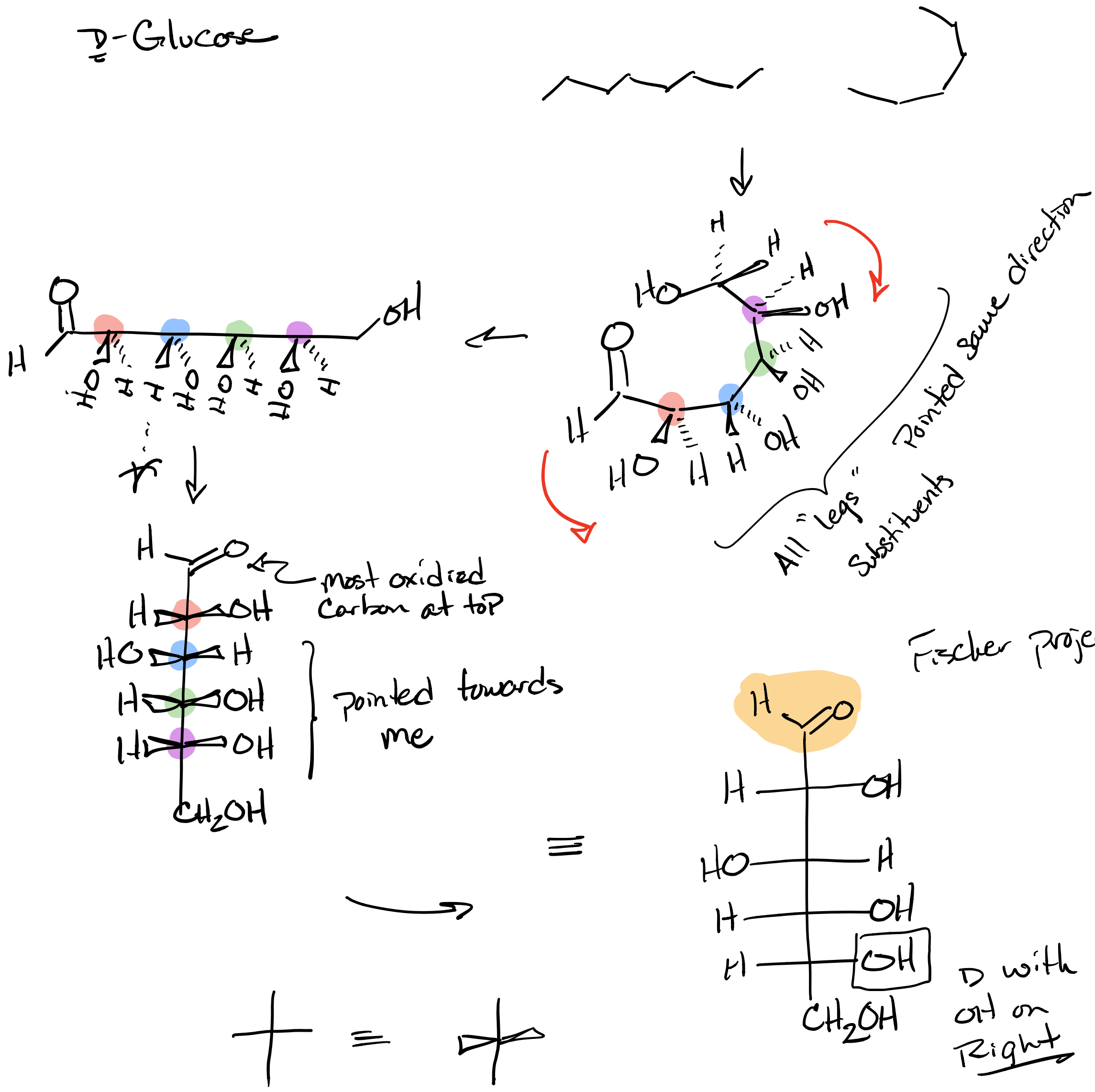
Chapter 5

Fischer Projections

Carbohydrates have many stereocenter



D-Glucose



All "legs" substituents Pointed same direction

most oxidized carbon at top

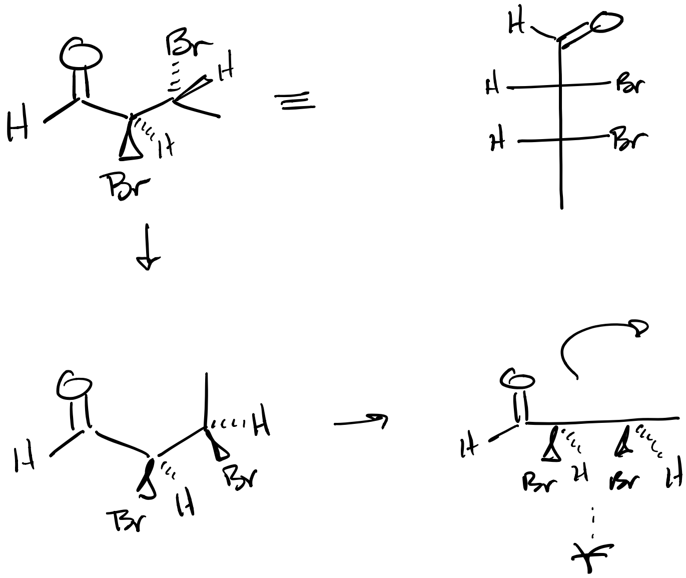
pointed towards me

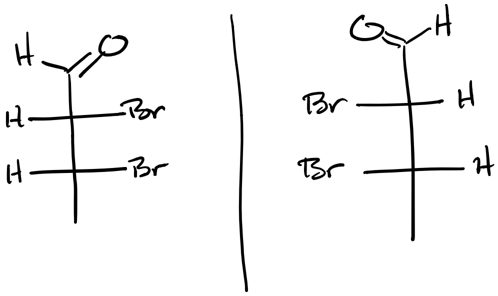
Fischer Projection

D with OH on Right

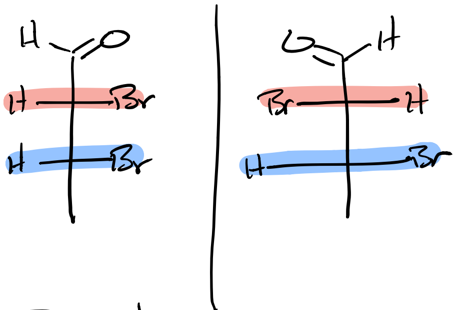
Oxidation   Loss of H or gain of Oxygen

$C-H \longrightarrow C-O-H \longrightarrow C=O$

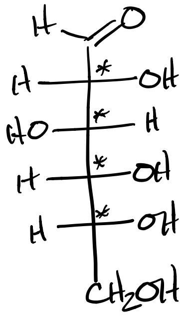




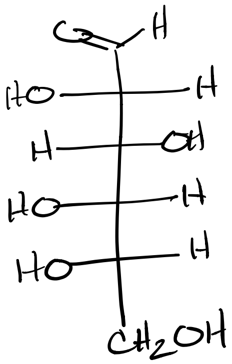
Enantiomers



Diastereomers



D-Glucose



L-Glucose

aldohexose

Aldehyde

6 carbon Carbohydrate

Enantiomers

$2^4 = 2\cdot2\cdot2\cdot2 = 16$ Isomers

End of Chapter 5

Chapter 6 - Energy

Enthalpy ΔH

$\Delta H = q$ heat

Bond breaking requires Energy

Homolytic  free Radical

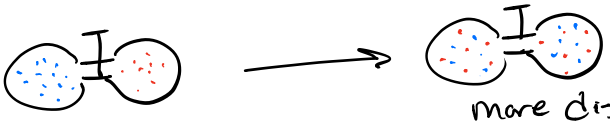
Heterolytic  Ions

$\Delta H^\circ = -$ Exothermic
Energy give off

$\Delta H^\circ = +$ Endothermic
Energy absorbed
by System

Predicting ΔH° of reaction is important, but we aren't going to do that.

Entropy ΔS -> the degree of disorder

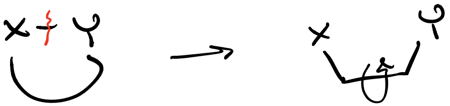


more disorder

$$\Delta S_{tot} = \Delta S_{sys} + \Delta S_{surr}$$

$\Delta S_{Tot} = + =$ Spontaneous process

Systems that demonstrate an increase in ΔS

$AB \rightarrow A + B$ or 

decomposition
1 thing 2 things

more degrees
of freedom

$$\Delta S_{Tot} = \Delta S_{sur} + \Delta S_{sys}$$

$$\Delta S_{surr} = -\frac{\Delta H_{sys}}{T}$$

$$-T \times \Delta S_{Tot} = \left(\cancel{-}\frac{\Delta H_{sys}}{\cancel{T}} + \Delta S_{sys}\right) \times \cancel{-T}$$

$$\underbrace{-T\Delta S_{Tot}} = \Delta H_{sys} - T\Delta S_{sys}$$

$$\Delta G = \underset{\substack{\downarrow \\ \sim \Delta S_{surr}}}{\Delta H_{sys}} - \underset{\substack{\downarrow \\ \Delta S_{sys}}}{T\Delta S_{sys}}$$

For Spontaneous $\Delta S_{Tot} = +$ value

$\therefore$ $\underset{\uparrow}{-}T\Delta S = \Delta G = -$ value for Spontanaity

$\Delta G = -$ Exergonic Release of Energy

$+$ Endergonic Energy absorbed

Equilibria

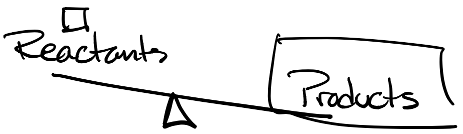
$$aA + bB \rightleftharpoons cC + dD$$

$$Q = \frac{[C]^c[D]^d}{[A]^a[B]^b} \quad \text{at eq} \quad Q = K_{eq} = \frac{[C]_{eq}^c\,[D]_{eq}^d}{[A]_{eq}^a\,[B]_{eq}^b}$$

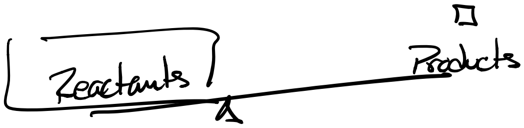
K_{eq} determined by ΔG

$\Delta G = -RT \ln K_{eq}$ | $R = 8.314$ J/mol K

$K_{eq} >> 1$



$K_{eq} << 1$



Kinetics

$$\text{Rate} = k[\text{reactants}] = k[A]^x[B]^y$$

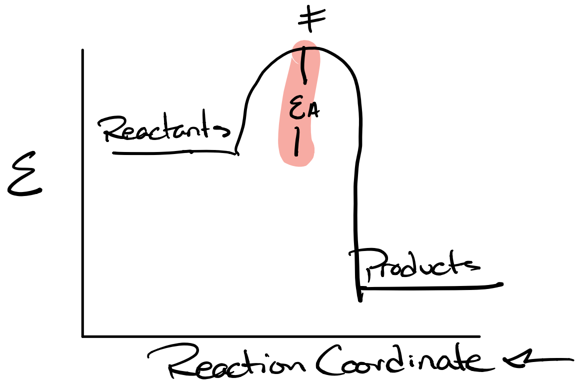
1st order rate $= k[A]$

2nd $= k[A][B]$ or $k[A]^2$

3rd $= k[A]^2[B]$

k affected by E_A, T, sterics

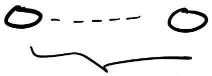
Energy Diagrams



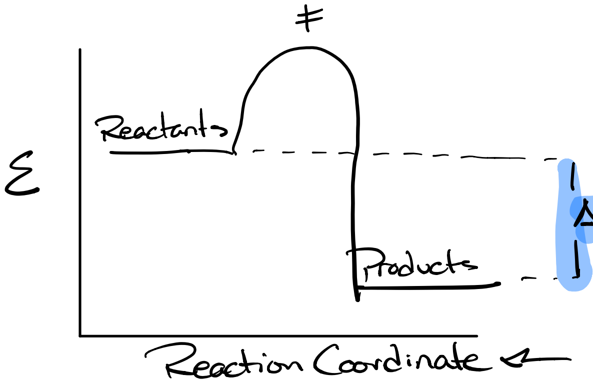
← Nucleus distance

Kinetics

$E_A \propto$ Rate



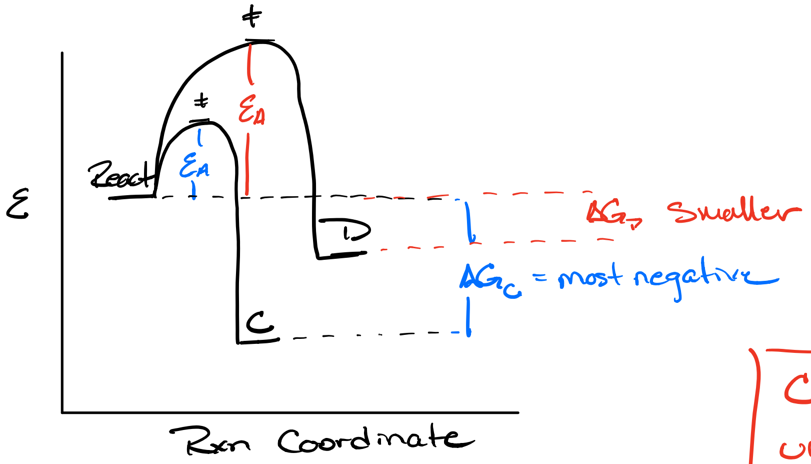
d = Rxn Coordinate



$\Delta G^\circ = G^\circ_{products} - G^\circ_{reactants}$

Thermodynamics

$\Delta G \propto K_{eq}$



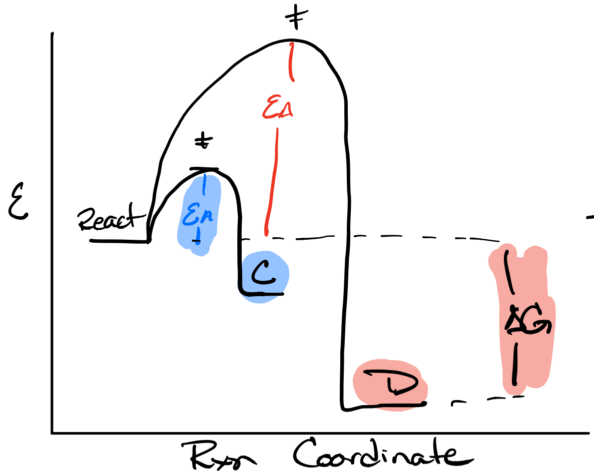
C is favored under all Conditions
Always Major Prod

Product C is Kinetic Product

⇒ fast to form w/ low $\mathcal{E}_A$

Product C is also Thermodynamic Product

⇒ favored in eq



Kinetic Conditions → favored by low temp (lower $\mathcal{E}_A$) & Short Rxn time

⇒ C major

Thermodynamic Conditions → favored by High heat (High $\mathcal{E}_A$) & long Rxn time

⇒ D major

Kinetic product → lowest $\mathcal{E}_A$ → C

Thermodynamic Product → largest ΔG → most Stable → G

$E_{A_{\text{forward}C}} < E_{A_{\text{Reverse}C}} < E_{A_{\text{forward}D}} < E_{A_{\text{Reverse}D}}$

Highest Energy