3.2 Acid-Base Reactions
3.2A The Brønsted-Lowry Definition of Acids and Bases

- An acid is a substance that can donate (or lose) a proton,
- A base is a substance that can accept (or remove) a proton.
3.2B The Lewis Definition of Acids and Bases

- Acids be defined as electron-pair acceptors
- Bases be defined as electron-pair donors.
3.3 Heterolysis of Bonds to Carbon: Carbocations and Carbanions
Carbocation — an ion with a positive charge on the carbon atom.

Carbanion — an ion with a negatively charged carbon atom.
Carbocations are electron deficient. They have only six electrons in their valence shell, and because of this, carbocations are Lewis acids.

Carbocations occur as intermediates in some organic reactions.

Carbocations react rapidly with Lewis bases.

\[
\text{Carbocation (a Lewis acid)} + \text{anion (a Lewis base)} \rightarrow \text{A electrophile} + \text{A nucleophile}
\]
Carbanions are Lewis bases.

\[ \text{Nucleophile} \]

\[ \text{Carbanion} \quad \text{Lewis acid} \]

(a Lewis base)

\[ \text{Carbanion} \quad \text{Lewis acid} \]

(a Lewis base)
3.4 The Use of Curved Arrows in Illustrating Reactions
A curved arrow is used to show the direction of electron flow in a reaction. The curved arrow begins with a covalent bond or unshared pair of higher electron density.
3.5 The Strength of Acids and Bases: $K_a$ and $pK_a$

3.6 Predicting The Outcome of Acid-Base Reactions
3.7 The Relationship Between Structure and Acidity
The strength of an acid depends on the extent to which a proton can be separated from it and transferred to a base.

Acidity increases as we descend a vertical column.

Acidity increase from left when compare compounds in the same horizontal row of the periodic table.
3.7A The Effect of Hybridization

Having more s character means that the electrons of the anion will, on the average, be lower in energy, and the anion will be more stable.

<table>
<thead>
<tr>
<th>Relative Acidity of the Hydrocarbons</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH≡CH &gt; CH₂=CH₂ &gt; CH₃−CH₃</td>
</tr>
<tr>
<td>pKₐ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative Basicity of the Carbanions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH≡C⁻ &lt; CH₂=CH⁻ &lt; CH₃−CH₂</td>
</tr>
</tbody>
</table>
3.7B Inductive Effects

Electron attracting (or electron withdrawing), -I

Electron releasing, +I

Inductive effects weaken as the distance from the substituent increase.
3.7C Conjugated effects (共轭效应)

$\text{C} = \text{C} - \text{C} = \text{C} - \text{X}

\text{C} - \text{C} = \text{C} - \text{C} - \text{X}

- C and -C effects
3.7D Hyperconjugated effects (超共轭效应)

$\sigma - \rho$ Hyperconjugated  $\sigma - \pi$ Hyperconjugated