

PRECIPITATE REACTIONS & INTRODUCTION TO ORGANIC CHEMISTRY
CHEAT SHEET

 SNAPREVISE

Precipitate Reactions of Transition Metals

- A precipitate reaction is when two solutions containing soluble ions are mixed forming an insoluble compound
- Reaction of metal ions with carbonate
 - With carbonate M^{2+} ions, the carbonate will behave as a base by removing protons from the water, forming a hydroxide precipitate: $M^{2+}(aq) + CO_3^{2-}(aq) \rightarrow MCO_3(s) + H_2O(l)$
 - Excess CO_3^{2-} ions would react enough, to form a soluble carbonate: $M^{2+}(aq) + CO_3^{2-}(aq) \rightarrow MCO_3(s) + H_2O(l)$
- Reaction of metal ions with hydroxide

Metal ion (aq)	Reaction with OH ⁻ (aq)	Reaction with OH ⁻ (aq)
M^{2+} (aq)	$M^{2+}(aq) + 2OH^-(aq) \rightarrow MOH_2(s)$	$M^{2+}(aq) + 2OH^-(aq) \rightarrow MOH_2(s)$
M^{3+} (aq)	$M^{3+}(aq) + 3OH^-(aq) \rightarrow MOH_3(s)$	$M^{3+}(aq) + 3OH^-(aq) \rightarrow MOH_3(s)$

Metal ion (aq)	Reaction with OH ⁻ (aq)	Reaction with OH ⁻ (aq)	Reaction with OH ⁻ (aq)	Reaction with OH ⁻ (aq)
M^{2+} (aq)	$M^{2+}(aq) + 2OH^-(aq) \rightarrow MOH_2(s)$	$M^{2+}(aq) + 2OH^-(aq) \rightarrow MOH_2(s)$	$M^{2+}(aq) + 2OH^-(aq) \rightarrow MOH_2(s)$	$M^{2+}(aq) + 2OH^-(aq) \rightarrow MOH_2(s)$
M^{3+} (aq)	$M^{3+}(aq) + 3OH^-(aq) \rightarrow MOH_3(s)$	$M^{3+}(aq) + 3OH^-(aq) \rightarrow MOH_3(s)$	$M^{3+}(aq) + 3OH^-(aq) \rightarrow MOH_3(s)$	$M^{3+}(aq) + 3OH^-(aq) \rightarrow MOH_3(s)$

* Fe^{3+} eventually oxidised to Fe^{4+} making brown (FeO_4^{2-})

Nomenclature

- Hydrocarbons can be:
 - Aliphatic - carbon atoms form straight or branched chains
 - Alcyclic - carbon atoms form a ring
 - Aromatic - carbon atoms form a ring, and have a delocalised electron system
- Homologous series are compounds with the same functional group and similar chemical and physical properties. They differ by the number of repeating units they contain
- A functional group is the group of atoms responsible for the characteristic reactions of a compound
- To name a compound:
 - The stem is the main part of the name derived from the longest carbon chain
 - End suffix after the stem, comes from the most significant functional group
 - The prefix before the stem comes from functional groups attached to the main carbon chain
 - Numbers and Prefixes indicating the position of functional groups on the carbon chain
 - Functional groups are prioritised alphabetically

Number of Carbons	Prefix	Suffix
1	Methyl	
2	Ethyl	
3	Propyl	
4	Butyl	
5	Pentyl	
6	Hexyl	

Compound	Prefix	Suffix
Alkanes	-	-ane
Alkenes	-	-ene
Alkynes	-	-yne
Alcohols	hydroxy-	-ol
Carboxylic acids	-	-oic acid
Halogenoalkanes	halo-	-ane
Aldehydes	-	-al
Ketones	-	-one

Reaction Mechanisms

Bond fission can be homolytic or heterolytic

Homolytic Fission

When the bond breaks, each electron in the bond goes to a different atom

$$X-Y \rightarrow \cdot X + \cdot Y$$

This results in the formation of highly reactive free radicals, each with an unpaired electron, represented by a dot.

Heterolytic Fission

When the bond breaks, both the electrons in the bond go to the same atom

$$X-Y \rightarrow X^- + Y^+$$

This results in the formation of a positively charged cation and a negatively charged anion.

Bonds are formed on the carbon of:

- Two free radicals with unpaired electrons
- Oppositely charged ions

Isomerism

- Isomers are compounds with the same molecular formula but a different arrangement of atoms
- Structural isomers are compounds with the same molecular formula but a different structural formula
 - Chain isomers - These are molecules with the same molecular formula but a different arrangement of the carbon chain. Chains can be straight or branched
 - Position isomers - These are molecules with the same functional group attached to a different position on the carbon chain
 - Functional group isomers - These are molecules with the same molecular formula but different functional groups
- Geometric isomers are organic compounds with the same molecular and structural formula but a different arrangement of atoms in space
- E/Z isomerism is a type of stereoisomerism that can arise in alkenes due to the restricted rotation around the C=C bond
 - If a carbon atom has two of the same substituents attached, it will not show E/Z isomerism
 - Substituents can be assigned priorities based on atomic mass using Cahn-Ingold-Prelog rules to name E/Z isomers. The greater the atomic mass, the higher the priority
 - When the highest priority groups are on different sides of the double bond, the isomer is an E-isomer
 - When the highest priority groups are on the same side of the double bond, the isomer is a Z-isomer

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