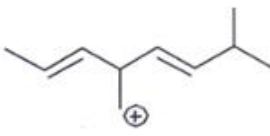
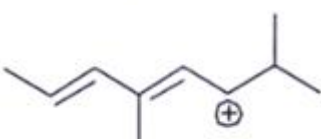
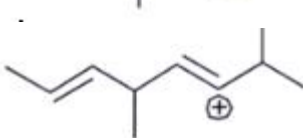
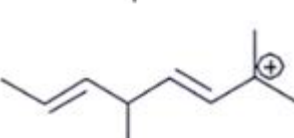


Questions and Answers – Reaction Intermediates

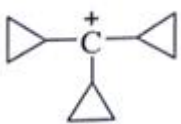
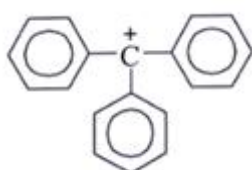
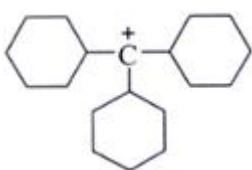
1. Which carbocation is the most stable?

- a) 
- b) 
- c) 
- d) 

Answer: b

Explanation: This is stabilized by extended conjugation. The more adjacent methyl groups there are, the larger hyperconjugation stabilization is because of the increased number of adjacent C–H bonds.

2. Which one among the following carbocations has the longest half-life?

- a) 
- b) 
- c) 
- d) $\text{H}_3\text{C}-\overset{+}{\text{C}}-\text{CH}_3$
 CH_3

Answer: a

Explanation: Higher the stability of cation more will be its half-life. As, in the carbocation, p orbital overlap with the compound, will be more stabilizing factor than aromaticity.

3. The order of decreasing stability of the following cations is:

(I) $\text{CH}_3\text{C}^+\text{HCH}_3$ (II) $\text{CH}_3\text{C}^+\text{HOCH}_3$ (III) $\text{CH}_3\text{C}^+\text{HCOCH}_3$

a) III > II > I

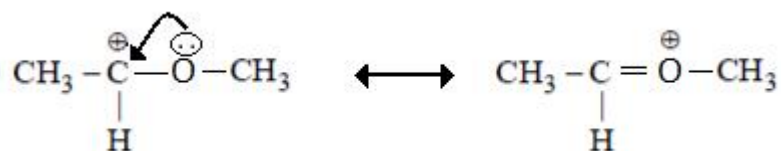
b) I > II > III

c) II > I > III

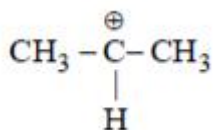
d) I > III > II

Answer: a

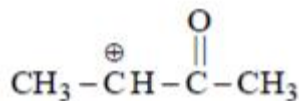
Explanation: (II) Here, Mesomeric effect stabilizes carbocation. So, it is highly stabilized.



(I) It is stabilized by hyperconjugation.

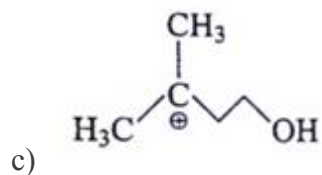
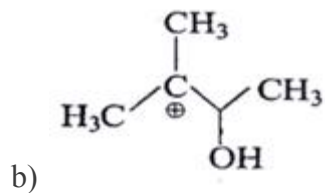
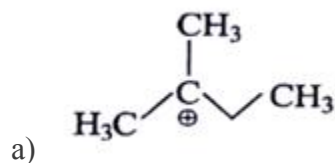


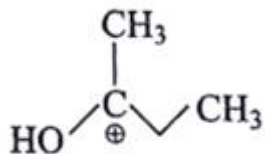
(III) It is destabilized as because of carbonyl group; more electronegative Oxygen is present it



will decrease electron density of C^+ .

4. Which of the following is most stable intermediate?

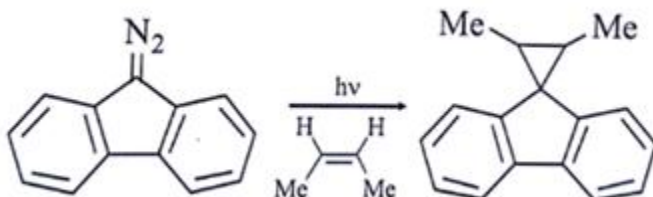




Answer: c

Explanation: Stabilized by +M effect of OH and hyperconjugation effect (5 α H).

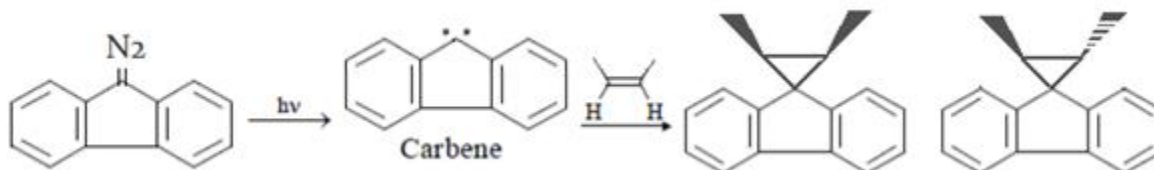
5. Which intermediate is involved in the reaction given below?



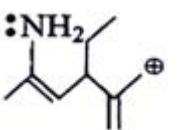
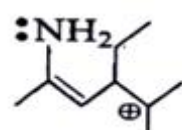
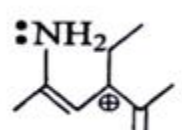
- a) free radical
- b) carbocation
- c) carbanion
- d) carbene

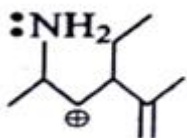
Answer: d

Explanation: As we can see, in first step in presence to light carbene is formed.



6. Among the following which is most stabilized cation?

- a) 
- b) 
- c) 

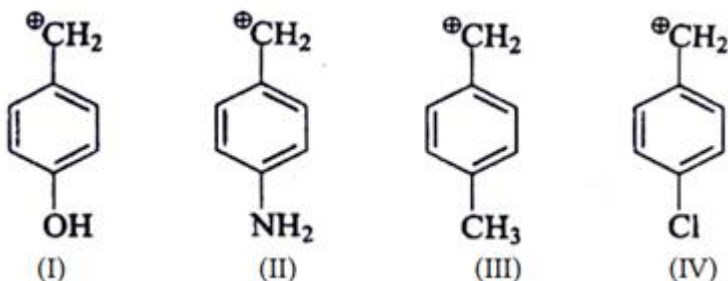


d)

Answer: c

Explanation: The positive charge of carbon will be stabilised by mesomeric effect of -NH₂ group.

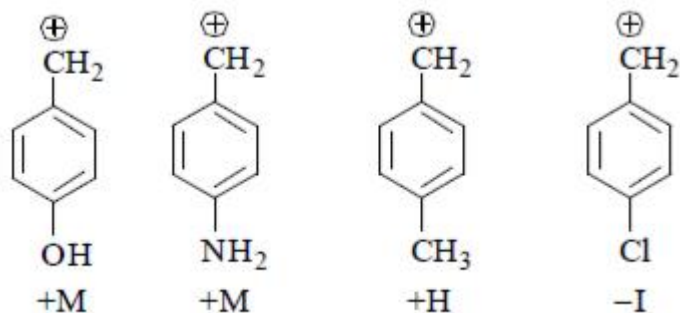
7. Arrange the following intermediate into decreasing order of stability.



- a) I > II > III > IV
- b) II > IV > III > I
- c) II > I > IV > III
- d) II > I > III > IV

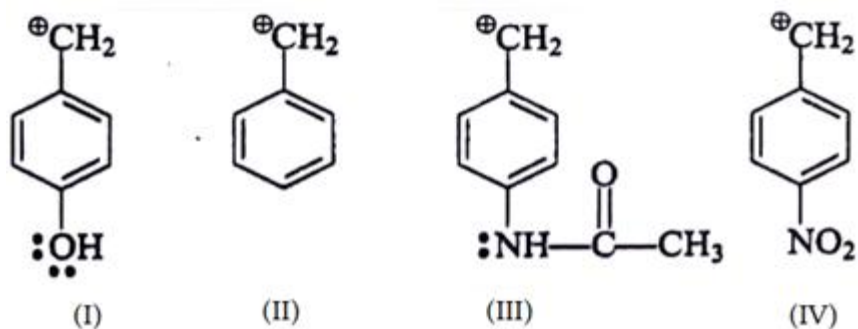
Answer: d

Explanation: Mesomeric effect will stabilize carbocation is highly stable.



+M effect of -NH₂ > -OH

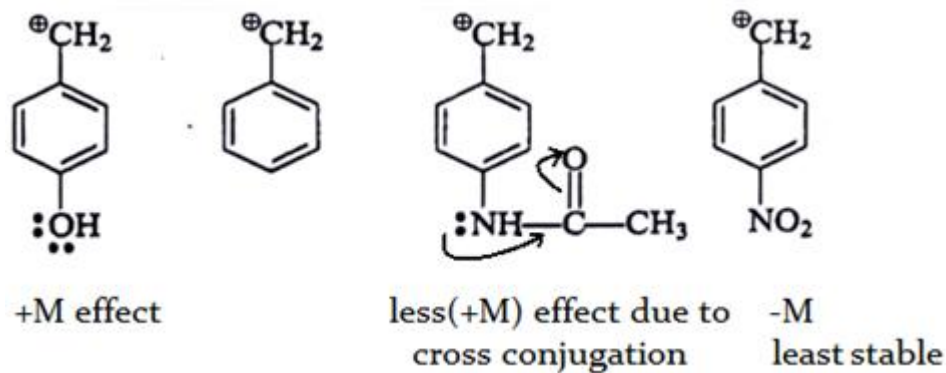
8. Arrange the following intermediate into decreasing order of stability.



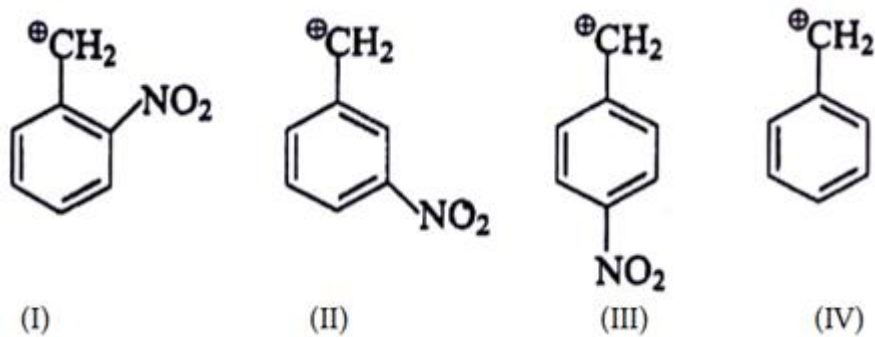
- a) I > III > II > IV
 b) II > III > IV > I
 c) III > IV > II > I
 d) I > III > IV > II

Answer: a

Explanation: Mesomeric effect will stabilize carbocation is highly stable.



9. What is the correct decreasing order of stability of following cation?

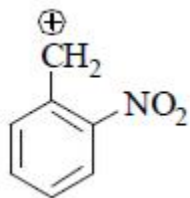


- a) II > III > I > IV
 b) IV > II > III > I
 c) IV > III > I > II
 d) III > I > II > IV

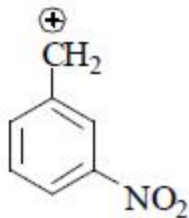
Answer: b

Explanation:

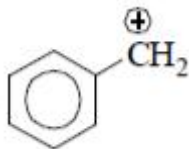
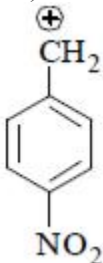
(I) It is destabilized by -M and high -I effect.



(II) It is destabilized by -I nature only at meta position -M effect.

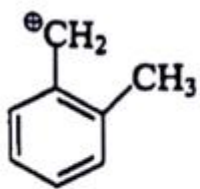


(III) It is destabilized by $-M$ and less $-I$ effect.

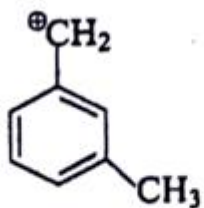


(IV) There is no destabilisation by group.

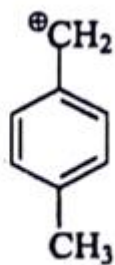
10. What is the correct decreasing order of stability of following cation?



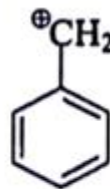
(I)



(II)



(III)

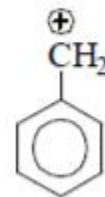
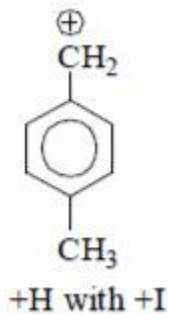
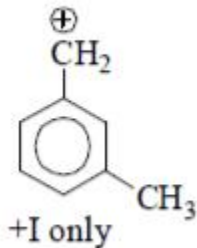
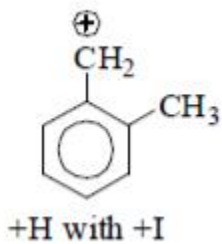


(IV)

- a) I > II > III > IV
- b) I > IV > II > III
- c) I > III > II > IV
- d) IV > III > II > I

Answer: c

stability order I. : Explanation: High +I, > III > II > IV.



Questions and Answers – Nucleophiles

1. Which of the following is not true about nucleophile?

- a) donates an electron pair to an electrophile to form a chemical bond
- b) all molecules or ions with a free pair of electrons or at least one pi bond can act as nucleophiles
- c) nucleophiles are Lewis acids by definition
- d) a nucleophile becomes attracted to a full or partial positive charge

Answer: c

Explanation: Because nucleophiles donate electrons, they are by definition Lewis bases.

2. Which halogen nucleophile is weakest in polar, aprotic solvents?

- a) I^-
- b) F^-
- c) Cl^-
- d) Br^-

Answer: a

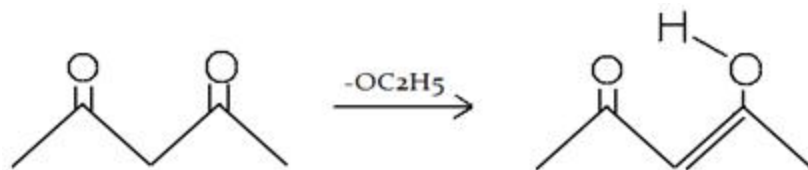
Explanation: In polar, aprotic solvents, I^- is the weakest and this is reversed in polar, protic solvents.

3. Which of the following nucleophiles can be used for partial enolization of a 1,3-dicarbonyl compound?

- a) Lithium di-isopropyl amide (LDA)
- b) Et-O^-
- c) Weak base like NaOH
- d) Sodium acetate

Answer: d

Explanation: Sodium acetate will do partial enolization of a 1,3-dicarbonyl compound. Weak base like NaOH and Et-O^- will form an alcohol and LDA will do complete enolization.



4. What will be the number of products (excluding stereoisomers) in the given reaction?

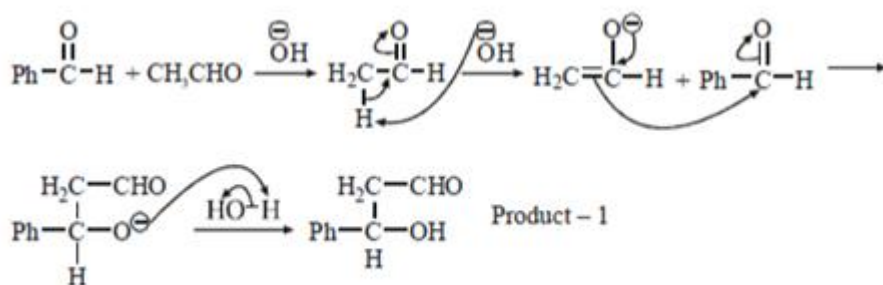


- a) One
- b) Three
- c) Two
- d) Four

Answer: c

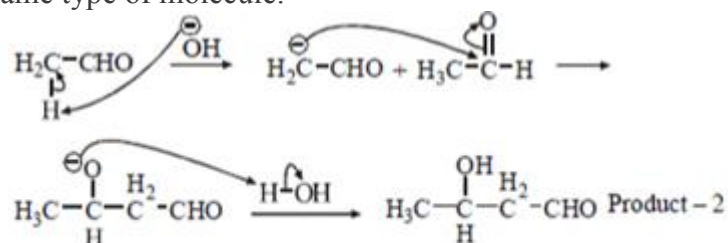
Explanation: First product will be formed by cross aldol where nucleophile (OH^-) will attack at

different type or reactant molecule.



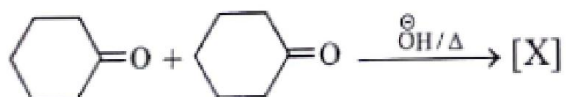
Example of Cross-Aldol

Second type of product will be formed aldol condensation where reaction will occur between same type of molecule.



Aldol reaction

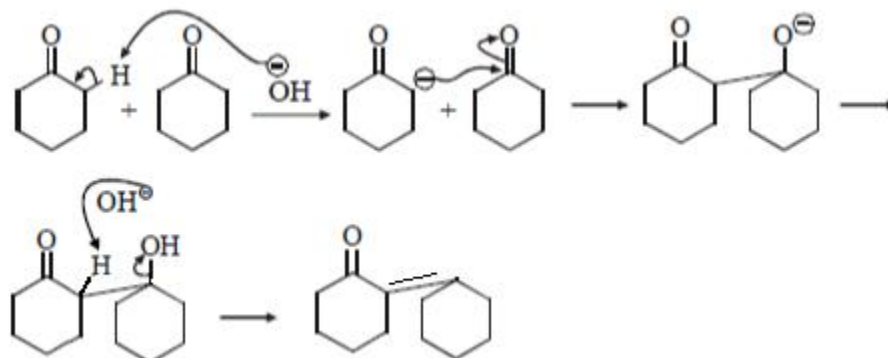
5. Where will nucleophile (-OH) will attack to form which of the following the product X?



- a)
- b)
- c)
- d)

Answer: d

Explanation: Nucleophile (-OH) will attack at carbon adjacent to carbonyl bond and form the



below product.

6. Which reagent is a good nucleophile?

- a) NH_3
- b) BH_3
- c) Br_2
- d) HBr

Answer: a

Explanation: Less electronegative atoms make better nucleophiles as they are more willing to share electrons.

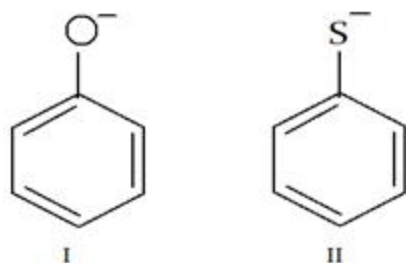
7. Which of the following statements is true about ammonia and water?

- a) ammonia is more basic and more nucleophilic than water
- b) ammonia is less basic and less nucleophilic than water
- c) ammonia is more basic but less nucleophilic than water
- d) ammonia is less basic but more nucleophilic than water

Answer: a

Explanation: Because oxygen is more electronegative than nitrogen, it holds onto its lone pairs more tightly than nitrogen, and hence is less likely to donate its lone pairs to form a covalent bond with a carbon atom during a nucleophilic attack.

8. Which of the following statements is true about the following two anionic molecules?



- a) I is more basic and more nucleophilic than II
- b) I is less basic and less nucleophilic than II
- c) I is more basic but less nucleophilic than II

d) I is less basic but more nucleophilic than II

Answer: c

Explanation: Larger atoms make better nucleophiles due to polarizability so II containing S will be more nucleophilic than I but less basic.

9. Which halide ion is the best nucleophile in dimethyl sulfoxide solution?

- a) I^-
- b) F^-
- c) Cl^-
- d) Br^-

Answer: b

Explanation: In polar, aprotic solvents, F^- strongest is the nucleophile, and I^- the weakest.

10. Which of the following cannot react as a nucleophile?

- a) CH_3NH_2
- b) $(\text{CH}_3)_2\text{NH}$
- c) $(\text{CH}_3)_3\text{N}$
- d) $(\text{CH}_3)_4\text{N}^+$

Answer: d

Explanation: Nucleophile donates electron to the electrophiles and there is no lone pair present on nitrogen $(\text{CH}_3)_4\text{N}^+$, so donation of electron is not possible.

Questions and Answers – Electrophiles

1. Which of the following statement is incorrect about electrophiles?

- a) Electrophiles are positively charged or neutral species having vacant orbitals
- b) The electrophiles are attacked by the most electron-populated part of one nucleophile
- c) Chemical species that do not satisfy the octet rule such as carbenes and radicals are electrophiles
- d) Electrophiles are Lewis base

Answer: d

Explanation: Because electrophiles accept electrons, they are Lewis acids not Lewis base, according to Acid-Base reaction theories.

2. In addition of halogen (Bromine) to an alkene, how can we isolate a bromonium in the reaction?

- a) increasing concentration of bromide ion
- b) decreasing concentration of bromide ion
- c) alkene with cation stabilising groups
- d) alkene with less electrophilic centre

Answer: c

Explanation: A bromo-carbenium ion intermediate may be predominant instead of vicinyl dibromide if the alkene has a cation-stabilizing substituent like phenyl group. There is an example of the isolation of the bromonium ion.

3. Which of the following is not an electrophile?

- a) $(\text{CH}_3)_4\text{N}^+$
- b) Cl_2
- c) HBr
- d) Br_2

Answer: a

Explanation: The ammonium ion cannot react at the N with a nucleophile because the N already has an octet of electrons.

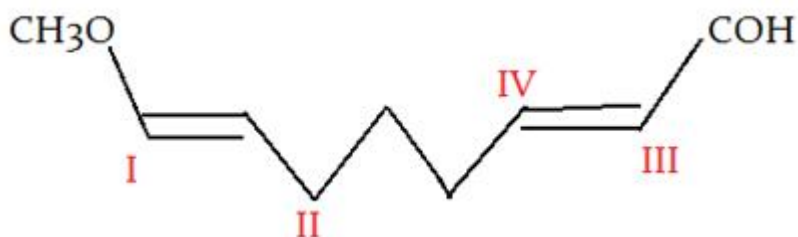
4. Which of the following is not an electrophile?

- a) H_2O
- b) Cl_2
- c) HBr
- d) Br_2

Answer: c

Explanation: Hydrogen bromide is a strong acid, it is able to donate a proton to a molecule or anion with a nucleophilic site.

5. In the given molecule where will electrophile will attack?

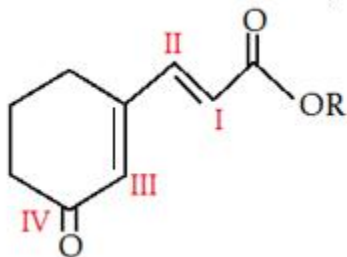


- a) I
- b) II
- c) III
- d) IV

Answer: a

Explanation: $-\text{CH}_3\text{O}$ is a +M group, so it has lone pair to donate to upcoming electrophile.

6. In the given molecule where will electrophile will attack?



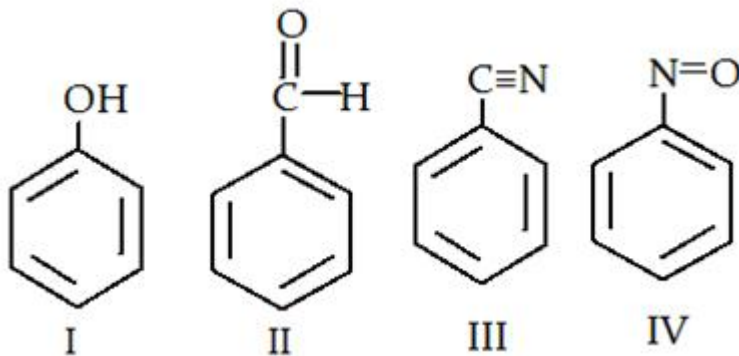
- a) I
- b) II
- c) III

d) IV

Answer: a

Explanation: $-\text{OCOR}$ is a +M group, it is more electron rich than rest of the groups, so it has lone pair to donate to upcoming electrophile.

7. Which of the following is most readily undergo electrophilic attack?

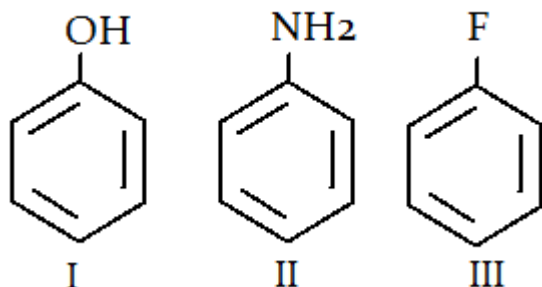


- a) I
- b) II
- c) III
- d) IV

Answer: a

Explanation: I is most reactive towards electrophilic attack, as $-\text{OH}$ is +M group therefore, here benzene will have more e- density than rest of the others.

8. What is the correct order for the rate of reaction for the electrophilic attack of the given compounds?



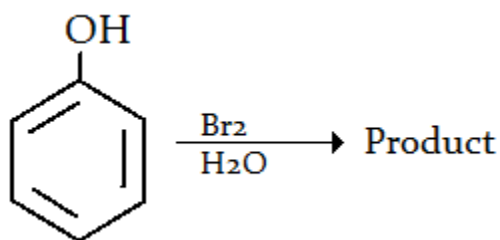
- a) $\text{I} > \text{II} > \text{III}$
- b) $\text{II} > \text{I} > \text{III}$
- c) $\text{I} < \text{II} < \text{III}$
- d) $\text{III} > \text{I} > \text{II}$

View Answer

Answer: b

Explanation: Electronegativity trend is $\text{N} < \text{O} < \text{F}$, so III is the least electron rich ring therefore least favourable for electrophilic attack. Similarly, II is the most electron rich ring therefore most favourable for electrophilic attack.

9. Which of the following is the product for the given reaction?

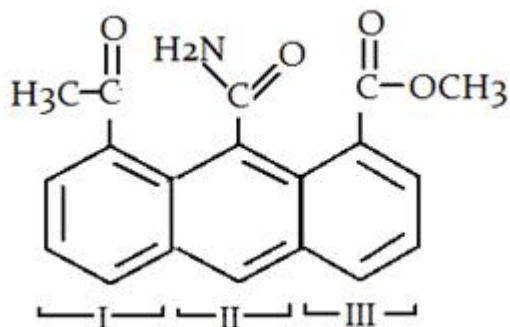


- a) 3-Bromophenol
- b) 4- Bromophenol
- c) 3,5-Dibromophenol
- d) 2,4,6-Tribromophenol

Answer: d

Explanation: The polar solvent (i.e. water) induces a stronger dipole in Br-Br. A stronger electrophile (Br⁺) is produced that undergoes electrophilic aromatic substitution with the benzene ring more readily. Consequently, you get tri-bromination with Br(aq.).

10. Which ring will readily undergo electrophilic attack?



- a) I
- b) II
- c) III
- d) Both I and III

View Answer

Answer: b

Explanation: Due to the presence of -NH₂ group electron will be transferred to the C of -CONH₂ group and that's why it will not withdraw electron from benzene ring. So, electron density of ring II is most in all three rings and that is why electrophile will attack at ring II.

Questions and Answers – Carbanions

1. Select the correct statement from the following option.

- a) Carbanion is the intermediate compound
- b) In carbanion, central carbon atom carries negative charge
- c) It possess an unshared pair of electron
- d) All of the mentioned

Answer: d

Explanation: Carbanion is the intermediate compound in which central carbon atom carries a negative charge and it possess the unshared pair of electron. It is an anion in which carbon has an unshared pair of electrons and bears a negative charge usually with three substituents for a total of eight valence electrons.

2. The hybridisation of carbanion is _____

- a) sp
- b) sp^2
- c) sp^3
- d) sp^3d

Answer: c

Explanation: The hybridisation of carbanion is sp^3 . A carbanion is an anion in which carbon has an unshared pair of electrons and bears a negative charge usually with three substituents for a total of eight valence electrons.

3. The formal charge at the carbanion is _____

- a) +1
- b) -1
- c) 0
- d) +2

Answer: b

Explanation: The formal charge at the carbanion is -1. A carbanion is an anion in which carbon has an unshared pair of electrons and bears a negative charge usually with three substituents for a total of eight valence electrons.

4. The geometry of carbanion is _____

- a) Pyramidal
- b) Linear
- c) Tetrahedral
- d) Trigonal planar

Answer: a

Explanation: The geometry of carbanion is pyramidal. A carbanion is an anion in which carbon has an unshared pair of electrons and bears a negative charge usually with three substituents for a total of eight valence electrons.

5. The structure of carbanion is pyramidal but it undergoes rapid inversion similar to those of amines.

- a) True
- b) False

Answer: a

Explanation: The structure of carbanion is pyramidal but it undergoes rapid inversion similar to

those of amines. The carbanion exists in a trigonal pyramidal geometry. Formally, a carbanion is the conjugate base of a carbon acid.

6. Negative charge of carbanion can be dispersed by _____

- a) (+I) effect and resonance
- b) (-I) effect and resonance
- c) Hyperconjugation
- d) (+M) effect and resonance

Answer: b

Explanation: Negative charge of carbanion can be dispersed by (+I) effect and resonance. A carbanion is a nucleophile. The stability and reactivity of a carbanion is determined by several factors.

7. Which of the following carbanion is least stable?

- a) 1^{\ominus}
- b) 2^{\ominus}
- c) 3^{\ominus}
- d) CH_3

Answer: c

Explanation: 3^{\ominus} carbanion is the least stable carbanion. The same factors that determine the stability of the carbanion also determine the order in pKa in carbon acids.

8. Which of the following carbanion is most stable?

- a) 1^{\ominus}
- b) 2^{\ominus}
- c) 3^{\ominus}
- d) CH_3

Answer: d

Explanation: CH_3 carbanion is the most stable carbanion. The same factors that determine the stability of the carbanion also determine the order in pKa in carbon acids.

9. On increasing the number of alkyl groups, the stability of carbanions _____

- a) Increases
- b) Decreases
- c) Remains same
- d) None of the mentioned

Answer: b

Explanation: On increasing the number of alkyl groups, the stability of carbanions decreases. The alkyl groups have (-I) effect.

10. Due to (+I) effect, the methyl groups are electron accepting in nature.

- a) True
- b) False

Answer: b

Explanation: Due to (+I) effect, the methyl groups are electron releasing in nature. The same factors that determine the stability of the carbanion also determine the order in pKa in carbon acids.

Questions and Answers – Carbocations

1. Stability of free radicals can be explained on the basis of _____

- a) Inductive effect
- b) Electromeric effect
- c) Hyperconjugation
- d) Mesomeric effect

Answer: c

Explanation: Stability of free radicals can be explained on the basis of hyperconjugation effect and ease of formation.

2. The hybridisation of carbocation is _____

- a) Sp
- b) Sp²
- c) Sp³
- d) Sp³d

Answer: b

Explanation: The hybridisation of carbocation is sp². A carbocation is molecule in which a carbon atom bears three bonds and a positive charge.

3. Arrange the following carbocations in the order of increasing stability.

- a) Benzyl > 3⁰ > 2⁰ > 1⁰
- b) Benzyl > 1⁰ > 2⁰ > 3⁰
- c) 3⁰ > 2⁰ > 1⁰ > Benzyl
- d) 1⁰ > 2⁰ > 3⁰ > Benzyl

Answer: a

Explanation: The correct stability order of carbocation is- Benzyl > 3⁰ > 2⁰ > 1⁰. Benzyl carbocation is the most stable and 1⁰ carbocation is least stable.

4. The shape of carbocation is _____

- a) Pyramidal
- b) Bent
- c) Linear
- d) Trigonal planar

Answer: d

Explanation: The shape of the carbocation is a trigonal planar. It is sp² hybridised. A carbocation is molecule in which a carbon atom bears three bonds and a positive charge.

5. Carbonium ions are the intermediates in which the positive charge is carried by the carbon atom with _____ electrons in the valence shell.

- a) 6
- b) 5
- c) 4
- d) 3

Answer: a

Explanation: Carbonium ions are the intermediates in which the positive charge is carried by the carbon atom with six electrons in the valence shell. It is an organic cation in which the positive charge is located on a carbon atom.

6. Positive charge of carbocations can be dispersed by _____

- a) (+I) effect of alkyl group
- b) Resonance in allyl or benzyl carbocation
- c) Hyperconjugation in 1^o, 2^o and 3^o carbocations
- d) All of the mentioned

Answer: d

Explanation: Positive charge of carbocations can be dispersed by (+I) effect of alkyl group or by resonance in allyl or benzyl carbocation or by hyperconjugation in 1^o, 2^o and 3^o carbocations.

7. Alkyl substitution at the carbon bearing positive charge stabilizes carbocations.

- a) True
- b) False

Answer: a

Explanation: Alkyl substitution at the carbon bearing positive charge stabilizes carbocations. Carbocation is a molecule in which a carbon atom bears three bonds and a positive charge.

8. The formal charge at the carbocation is equal to _____

- a) -1
- b) 0
- c) +1
- d) +2

Answer: c

Explanation: The formal charge at the carbocation is equal to +1. A carbocation is molecule in which a carbon atom bears three bonds and a positive charge.

9. The homolytic bond dissociation energy is inversely proportional to the _____

- a) Bond length
- b) Ease of formation
- c) Dipole moment
- d) All of the mentioned

Answer: b

Explanation: The homolytic bond dissociation energy is inversely proportional to the ease of formation of free radicals. Free radicals do not carry any charge.

10. Which of the following free radical has the maximum ease of formation?

- a) 1°
- b) 2°
- c) 3°
- d) CH_3

Answer: c

Explanation: 3° free radical has the maximum ease of formation. Free radicals do not carry any charge.