NEET Important Questions with Solutions from Organic Chemistry - Some Basic Principles and Techniques

Q.1. An example for a nucleophile is

A) OH^-

B) $\ddot{N}H_3$

C) $R-C\equiv N$

D) All of these.

Answer: All of these.

Solution: Electron rich molecules or ions are known as nucleophiles, as they can donate electrons to electron-deficient molecules.

All the given molecules and ions are nucleophiles.

Q.2. $\overset{1}{H_3C}-\overset{2}{C}H=\overset{3}{C}=\overset{4}{C}H_2$

In the given compound, which carbon atom will show the maximum electronegativity?

A) Fourth

B) First

C) Third

D) Electronegativity of all the carbon atoms is same

Answer: Third

Solution: When the s character is higher, so is the electronegativity.

The % of the s character increases in the order: sp^3 hybridised$(25\%)< sp^2$ hybridised $(33\%)<$ sp hybridised (50%). Thus, the third carbon is sp hybridised and will exhibit the maximum electronegativity.

$c_1 \rightarrow sp^3$, $c_2 \rightarrow sp^2$, $c_3 \rightarrow sp$, $c_4 \rightarrow sp^2$.
So, the third carbon has the highest electronegativity.

Q.3. A permanent effect in carbon chain compounds, in which the electrons forming a bond between a carbon atom and another atom are partially displaced towards the atom with the greater electronegativity, is called

A) inert pair effect.

B) resonance.

C) inductive effect.

D) peroxide effect.

Answer: inductive effect.

Solution: A permanent effect in carbon chain compounds, in which the electrons forming a bond between a carbon atom and another atom is partially displaced towards the atom with the greater electronegativity, is called an inductive effect. There are two types of inductive effects, positive $(+I)$ and negative $(-I)$.

When chemical species release or donate electrons, it shows a positive inductive effect and vice versa.

Q.4. The effect in which atoms or groups in a compound can push away the electrons is called ____ effect.

A) $-\mathrm{I}$

B) $+\mathrm{I}$

C) mesomeric

D) electromeric

Answer: $+\mathrm{I}$

Solution: When chemical species have tendency to release or donate electrons, it shows a positive inductive effect ($+\mathrm{I}$).

Q.5. In a carbonium ion, the central carbon atom is _____.

A) positively charged

B) negatively charged

C) neutral

D) any of the above depending upon the other atoms present along with carbon

Answer: positively charged

Solution: Carbonium ion is the previously used term for carbocation. The term 'cation' is used for denoting positively charged ions; also, the suffix '-ium' is used for ions that are positively charged.

Carbocations act as electrophiles due to their electron deficient nature and attract electron rich species. On the basis of number of alkyl groups substituted on the positively charged carbon of carbocation, they are classified as primary, secondary and tertiary; out of which tertiary carbocation is the most stable.

Q.6. Carbanion contains _____ electrons in valence shell.

A) six

B) ten

C) eight

D) five

Answer: eight

Solution: A carbon intermediate which contains three bond pairs and a negative charge on it, is called carbanion. Each bond pair is formed by sharing of total of two electrons, i.e., three bond pairs will make up a total of six electrons. The fourth valence electron on carbon along with the negative charge makes up two more electrons. Thus, the carbon atom in total has eight valence electrons.

Q.7. Which compound is known as oil of winter green?

A) Phenyl benzoate

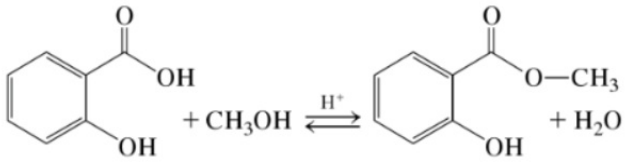
B) Phenyl salicylate

C) Phenyl acetate

D) Methyl salicylate

Answer: Methyl salicylate

Solution: Oil of winter green is formed by esterification reaction of salicylic acid with methanol.



The product is methyl salicylate and also known as oil of winter green. It is the methyl ester of salicylic acid.

Q.8. How many C-atoms are there in isopropyl propionate?

A) 5

B) 4

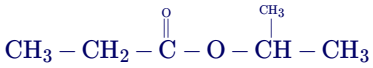
C) 6

D) 7

Answer: 6

Solution: The isopropyl propionate is an ester compound. Esters are named as alkyl alkanoate. Alkyl group is one which is directly bonded to oxygen atom and alkanoate is carboxylic part.

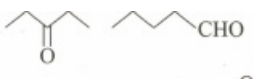
Hence, the structure of compound is:



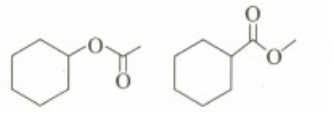
It contains six carbons.

Q.9. Which of the following are a pair of metamers?

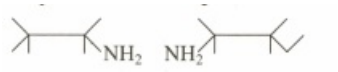
A)



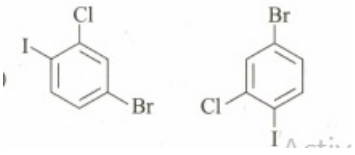
B)



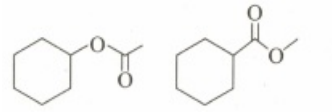
C)



D)



Answer:



Solution: Metamers are the compounds that have the same molecular formula, but different number of carbon atoms or alkyl groups on either side of the functional groups and the phenomenon is called metamerism.

The functional groups which show metamerism are $-\mathrm{O}-,\ >\mathrm{C}=\mathrm{O},\ -\mathrm{S}-,>\mathrm{NH},\ -\mathrm{O}-\mathrm{CO}-$.

In metamers, both the compounds should have the same functional group.

Q.10. Vacuum distillation is used to purify the liquids which _____.

A) are highly volatile

B) are explosive in nature

C) decompose at their boiling points

D) have a low boiling point

Answer: decompose at their boiling points

Solution: Vacuum distillation is the process of lowering the column's pressure above the solvent to less than the vapour pressure of the mixture; it creates a vacuum. It causes the elements with lower vapour pressures to evaporate off.
This technique separates the compounds based on the differences in boiling points. This technique is used when the boiling point of the desired compound is difficult to achieve or will cause the compound to decompose. The reduced pressure decreases the boiling point of compounds.

Q.11. Which of the following statements regarding adsorption chromatography is correct?

A) Different compounds are adsorbed on an adsorbent to different degrees

B) Paper chromatography is a type of adsorption chromatography

C) The stationary phase used is a gas

D) The technique involved is based on the continuous differential partitioning

Answer: Different compounds are adsorbed on an adsorbent to different degrees

Solution: Adsorption chromatography is a type of liquid chromatography in which chemicals are retained based on their adsorption and desorption at the support's surface, which acts as the stationary phase. This method is sometimes also known as liquid-solid chromatography. In this method, the mobile phase is either liquid or gaseous form. A stationary phase is a solid form. Paper chromatography is partition chromatography.

Q.12. Which of the following is the correct test for detecting nitrogen in the sodium fusion extract of an organic compound containing C, H and N?

A) Sodium fusion extract is boiled with ferrous sulphate and then acidified with concentrated $\mathrm{H_2SO_4}$.

B) Sodium fusion extract is boiled with concentrated $\mathrm{HNO_3}$, and then treated with silver nitrate.

C) Sodium fusion extract is treated with sodium nitroprusside.

D) Sodium fusion extract is boiled with concentrated $\mathrm{HNO_3}$, and then treated with ferrous sulphate.

Answer: Sodium fusion extract is boiled with ferrous sulphate and then acidified with concentrated $\mathrm{H_2SO_4}$.

Solution: Lassaigne's test is used for the detection of elements, like nitrogen, sulfur, chlorine, bromine and iodine. For the test of nitrogen, sodium extract is treated with freshly prepared ferrous sulphate solution, and then $2-3$ drops of $FeCl_3$ is added, and acidified with concentrated H_2SO_4 or HCl. The appearance of the Prussian blue colour due to the formation of complex ferric ferro cyanide indicates the presence of nitrogen.

Q.13. The sodium extract of an organic compound, on acidification with acetic acid and addition of lead acetate solution, gives a black
precipitate. The organic compound contains_____.

A) nitrogen

B) halogen

C) sulphur

D) phosphorus

Answer: sulphur

Solution: Lassaigne's test is used for the detection of elements, like nitrogen, sulfur, chlorine, bromine and iodine. For the test of sulphur, the sodium extract is treated with lead acetate, and acidified with acetic acid. The formation of black precipitate indicates the presence of sulphur.

$$Pb\left(CH_3COO\right)_2 + S^{-2} \rightarrow \overset{PbS}{\underset{\text{Black ppt}}{}} + CH_3COO^-$$

Q.14. Which of the following series contains ONLY nucleophiles?

A) H_2O, BF_3, H^+

B) NH_3, H_2O, R-OH

C) NH_3, H_2O, $AlCl_3$

D) CN^-, NO_2^+, OH^-

Answer: NH_3, H_2O, R-OH

Solution: A nucleophile is a chemical species that donates an electron pair to form a chemical bond in a reaction. All molecules or ions with a free pair of electrons or at least one pi bond can act as nucleophiles. Because nucleophiles donate electrons, they are by definition Lewis bases. They may be neutral or negatively charged. Among

$H_2\ddot{O}:$, BF_3, H^+, $\ddot{N}H_3$, $R-\ddot{O}H$, $AlCl_3$, CN^-, NO_2^+, $:\ddot{O}H^-$

$H_2\ddot{O}:$, $\ddot{N}H_3$, $R-\ddot{O}H$, CN^-, $:\ddot{O}H^-$ are electron rich and BF_3, H^+, $AlCl_3$, NO_2^+ are electron deficient species.

Q.15. Urea can be synthesized in a laboratory by heating_____.

A) NH_4Cl and CO_2

B) NH_4CNO

C) NH_2CONH_2

D) $(NH_4)_2SO_4$

Answer: NH_4CNO

Solution: For the first time, urea was produced from Ammonium Cyanate (NH_4CNO). When ammonium cyanate is heated, it isomerizes to produce urea. Thus, an inorganic compound gives rise to an organic compound.

$$NH_4CNO \xrightarrow{\Delta} NH_2CONH_2$$

Q.16. Which of the following is the CORRECT statement?

A) Isomers have same physical and chemical properties.

B) Isomers have different physical and chemical properties.

C) Isomers have the same physical but different chemical properties.

D) Isomers have different physical but same chemical properties.

Answer: Isomers have different physical and chemical properties.

Solution: Isomerism is the phenomenon in which more than one compounds have the same chemical formula, but different chemical structures. Isomers are molecules or polyatomic ions with identical molecular formulas that is, the same number of atoms of each element but differ the arrangement of atoms in the molecule. They have different physical and chemical properties.

Q.17. The IUPAC name of $CH_3-\overset{\overset{OH}{|}}{C}H-CH_2-\overset{\overset{CH_3}{|}}{C}H-COOH$ is:

A) 1 -Hydroxy-4-methylpentanoic acid

B) 1 -Methyl-3-hydroxypentanoic acid

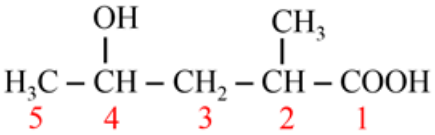
C) 4-Hydroxy-2-methylpentanoic acid

D) 4-Carboxypentanol-2.

Answer: 4-Hydroxy-2-methylpentanoic acid

Solution: As carboxylic acid group $(-COOH)$ is higher in priority than hydroxy group of alcohol $(-OH)$, so the suffix will be '-oic acid'. Parent chain consists of saturated 5 carbon atoms including the $-COOH$ carbon so, the root of name is pentane. The numbering is done according to the lowest locant rule and carbonyl carbon is $C-1$.

Hence, IUPAC name of this compound is $4-$hydroxy$-2-$methylpentanoic acid.



Q.18. All the following IUPAC names are correct except:

A) 1-Chloro-1-ethoxypropane

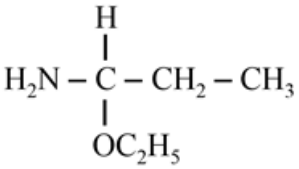
B) 1-Amino-1-ethoxypropane

C) 1-Ethoxy-2-propanol

D) 1-Ethoxy-1-propanamine

Answer: 1-Amino-1-ethoxypropane

Solution: All the given IUPAC names are correct except $1-$amino$-1-$ethoxypropane. As the highest priority functional group in this compound is amine, it will be the suffix. Parent carbon chain is a three carbon chain, and $-OC_2H_5$ is a substituent for which 'ethoxy' is the prefix. So, $IUPAC$ name of the compound is $1-$ethoxypropan$-1-$amine.



Q.19. Which of the following compound is wrongly named?

A) $CH_3CH_2CH\overset{2}{C}l2HCOOH$

2-Chloropentanoic acid

B) $CH_3C\equiv C\overset{C}{C}H_3HCOOH$

2-Methylhex-3-enoic acid

C) $CH_3CH_2CH=CHCOCH_3$
Hex-3-en-2-one

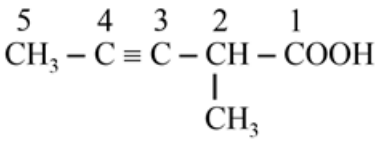
D) $CH_3-C\overset{H}{C}H_3CH_2CH_2CHO$

4-Methylpentana

Answer: $CH_3C\equiv C\overset{C}{C}H_3HCOOH$

2-Methylhex-3-enoic acid

Solution: Option 1, 3 and 4 have correct IUPAC name. In option 2, the main functional group is carboxylic acid, so the secondary suffix is '-oic acid'. The longest carbon chain is the one including the triple bond, i.e., $5-C$ chain, and methyl group is a substituent. Numbering is done in such a manner that carbonyl carbon is $C-1$. Hence, name of the compound is 2-methylpent-3-ynoic acid



Q.20. CH_3CONH_2 & $HCONHCH_3$ are called

A) Position isomers

B) Chain isomers

C) Tautomers

D) Functional isomers

Answer: Functional isomers

Solution: CH_3CONH_2 is an amide group containing compound. Its name is ethanamide. In this, the amino group is the primary amine.

$HCONHCH_3$ is also an amide, but it contains the amino group which is a secondary amine. The name of the compound is N-methylmethanamide.

N-Methyl methanamide and ethanamide are functional isomers as they have the same molecular formula but different functional groups. The functional isomer is an atom or group of atoms which give the compound distinctive chemical properties.

Q.21. Which of the following pair of compounds are not isomers?

A) Propyne and cyclopropene

B) Propyne and propadiene

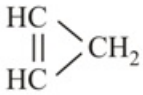
C) Propene and cyclopropene

D) 1-Propanol and methyoxyethane

Answer: Propene and cyclopropene

Solution: Isomers are the compounds with the same molecular formula but different arrangement of atoms.

a)

$CH_3-C\equiv CH$ Propyne $\quad$  Cyclopropene

The molecular formula of both the compounds is C_3H_4, but the structure is different. They show ring chain isomerism.

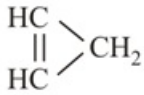
b)

$CH_3-C\equiv CH$ Propyne

$CH_2=C=CH_2$ Propadiene

The molecular formula of both the compounds is C_3H_4 but the structure is different. They show functional group isomerism.

c)

$CH_3-C=CH_2$ Propene $\quad$  Cyclopropene

The molecular formula of propene is C_3H_6 and cyclopropene is C_3H_4. Hence, they are not isomers.

d)

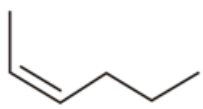
$CH_3-CH_2-CH_2OH$ 1 - propanol

$CH_3O-CH_2-CH_3$ Methoxyethane

The molecular formula of both the compounds is C_3H_8, but the structural formula is different. These are functional isomers.

Q.22. The structure of cis-3-hexene is

A)



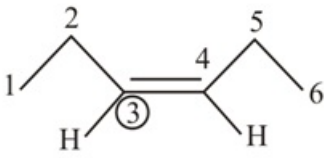
B)

C)

D)

Answer:

Solution: Cis isomer is the isomer of a compound where the two identical groups should be present on the same side of the double bond.
In cis 3-hexene, the two hydrogen atoms should lie on one side, and two ethyl groups should lie on the other side of the double bond like in the given structure.



Q.23. The increasing order of stability of the following free radicals is

A) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_6)_3\dot{C}$

B) $(C_6H_5)_2\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

C) $(C_6H_5)_2\dot{C}H < (C_6H_s)_3\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

D) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H$

Answer: $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_6)_3\dot{C}$

Solution: Free radicals are neutral, electron-deficient chemical species with a partially filled orbital. Being electron deficient, these are stabilized by neighbouring atoms that can donate electron density. Increasing the number of alkyl groups on the carbon bearing the free radical increases its stability due to $+I$ effect. Hence, the order of stability of free radical is as follows:
tertiary $>$ secondary $>$ primary.

Secondly, any factor which can lead to the electron deficient site being delocalized over a larger area will also stabilize electron poor species. So, benzyl free radicals are stabilised by resonance and hence are more stable than alkyl free radicals. Further, as the number of phenyl group attached to the carbon atom holding the odd electron increases, the stability of a free radical increases accordingly.
$(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$

Q.24. The correct order of increasing basicity of the given conjugate bases $(R = CH_3)$ is:

A) $RCO\overset{\ominus}{O} < HC \equiv \overset{\ominus}{C} < \overset{\ominus}{R} < \overset{\ominus}{N}H_2$

B) $\overset{\ominus}{\mathrm{R}} < \mathrm{HC} = \overset{\ominus}{\mathrm{C}} < \mathrm{RCO}\overset{\ominus}{\mathrm{O}} < \overset{\ominus}{\mathrm{N}}\mathrm{H}_2$

C) $\mathrm{RCO}\overset{\ominus}{\mathrm{O}} < \overset{\ominus}{\mathrm{N}}\mathrm{H}_2 < \mathrm{HC} \equiv \overset{\ominus}{\mathrm{C}} < \overset{\ominus}{\mathrm{R}}$

D) $\mathrm{RCO}\overset{\ominus}{\mathrm{O}} < \mathrm{HC} \equiv \overset{\ominus}{\mathrm{C}} < \overset{\ominus}{\mathrm{N}}\mathrm{H}_2 < \overset{\ominus}{\mathrm{R}}$

Answer: $\mathrm{RCO}\overset{\ominus}{\mathrm{O}} < \mathrm{HC} \equiv \overset{\ominus}{\mathrm{C}} < \overset{\ominus}{\mathrm{N}}\mathrm{H}_2 < \overset{\ominus}{\mathrm{R}}$

Solution: Basicity is defined as the ability to donate pair of electrons to an electron deficient species.

Basicity $\propto \frac{1}{\text{Electronegativity of atom}}$ (In period)

Since, all the options given are the conjugate base. Stronger is the acid, weaker is the conjugate base. Since, RCOOH is the strongest acid amongst all, its conjugate base is the weakest base.

Secondly, due to sp hybridised carbon, acetylene is also acidic and hence, a weak base but stronger than $\mathrm{RCO}\overset{\ominus}{\mathrm{O}}$.

As sp^3 hybridised carbon is less electronegative than sp^3 hybridised nitrogen, hence $\overset{\ominus}{\mathrm{R}}$ is more basic than $\overset{\ominus}{\mathrm{N}}\mathrm{H}_2$.

If lone pair of electron takes part in conjugation then availability of lone pair of electron decrease and basic strength decrease.

Q.25. Base strength is in the order of

(i) $\mathrm{CH}_3\overset{\ominus}{\mathrm{C}}\mathrm{H}_2$

(ii) $\mathrm{H}_2\mathrm{C} = \overset{\ominus}{\mathrm{C}}\mathrm{H}$ and

(iii) $\mathrm{H} - \mathrm{C} \equiv \mathrm{C}^{\ominus}$

A) $(\mathrm{ii}) > (\mathrm{i}) > (\mathrm{iii})$

B) $(\mathrm{iii}) > (\mathrm{iii}) > (\mathrm{i})$

C) $(\mathrm{i}) > (\mathrm{iii}) > (\mathrm{ii})$

D) $(\mathrm{i}) > (\mathrm{ii}) > (\mathrm{iii})$

Answer: $(\mathrm{i}) > (\mathrm{ii}) > (\mathrm{iii})$

Solution: Basic strength is dependent on several factors one of which is the percentage $\mathrm{s}-$character of anionic carbon.

Hybridisation of anionic carbon in $\mathrm{CH}_3\overset{\ominus}{\mathrm{C}}\mathrm{H}_2$, $\mathrm{CH}_2 = \overset{\ominus}{\mathrm{C}}\mathrm{H}$ and $\mathrm{CH} \equiv \overset{\ominus}{\mathrm{C}}$it is sp^3, sp^2 and sp respectively, so percentage $\mathrm{s}-$character is 25%, 33% and 50%, respectively.

More the $\mathrm{s}-$character, less is the tendency of anion to donate electrons. So, the order of basicity is:

$\mathrm{CH}_3\overset{\ominus}{\mathrm{C}}\mathrm{H}_2 > \mathrm{CH}_2 = \overset{\ominus}{\mathrm{C}}\mathrm{H} > \mathrm{CH} \equiv \overset{\ominus}{\mathrm{C}}$.

Practice more on Organic Chemistry - Some Basic Principles and Techniques