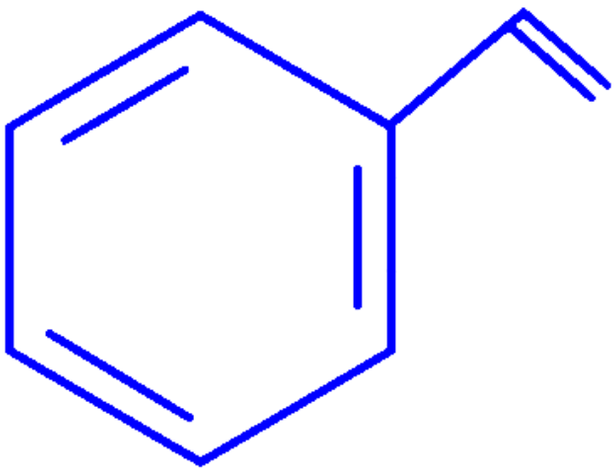
General Organic Chemistry

Question1

What is the number of moles of ' C ' and ' H ' atoms respectively present in n mole molecule represented by following structure?



MHT CET 2025 5th May Evening Shift

Options:

A.

$6n$ and $6n$

B.

$6n$ ad $8n$

C.

$8n$ and $8n$

D.

$7n$ and $9n$

Answer: C

Solution:

The given compound has a molecular formula C_8H_8. Therefore, number of moles of ' C′ and ' H ' atoms present in n mole molecule will be 8 n and 8 n respectively.

Question2

Identify least stable species from following.

MHT CET 2025 26th April Evening Shift

Options:

A. NH_4^+

B. $R-NH_3$

C. $R_2\overset{+}{N}H_2$

D. $R_3\overset{+}{N}H$

Answer: A

Solution:

An alkyl group exerts electron releasing inductive effect (+I) which stabilizes positive charge on atom bonded to it. As we move from conjugate acid of ammonia (NH_4^+) to that of tertiary amine $\left(R_3NH^+\right)$, the number of alkyl groups (R) bonded to nitrogen goes on increasing steadily. This results in increasing stabilization of the conjugate acids and thereby an increasing order of basic strength is expected. Order of stabilization:

$\overset{+}{N}H_4 < R-\overset{+}{N}H_3 < R_2\overset{+}{N}H_2 < R_3\overset{+}{N}-H$

Question3

What is the expected order of basic strength of different compounds from following.

MHT CET 2025 26th April Morning Shift

Options:

A.

$R_3 N < R_2NH < R - NH_2 < NH_3$

B.

$NH_3 < R - NH_2 < R_2NH < R_3 N$

C.

$R_2NH < R_3 N < R - NH_2 < NH_3$

D.

$NH_3 < R_3 N < R_2NH < R - NH_2$

Answer: B

Solution:

Order of basicity in gaseous medium: $NH_3 < 1^{\circ}$ Amine $< 2^{\circ}$ Amine $< 3^{\circ}$ Amine Order of basicity in aqueous medium: $NH_3 < 1^{\circ}$ Amine $< 2^{\circ}$ Amine $> 3^{\circ}$ Amine Given question has one option as 3° amine having highest basicity and no option with 2° amine having highest basicity.

Question4

Which from following is a correct increasing order of basic strength of compounds?

MHT CET 2025 23rd April Morning Shift

Options:

A.

$(CH_3)_2NH < CH_3NH_2 < (CH_3)_3\ N < NH_3$

B.

$NH_3 < (CH_3)_2NH < CH_3NH_2 < (CH_3)_3\ N$

C.

$CH_3NH_2 < (CH_3)_2NH < (CH_3)_3\ N < NH_3$

D.

$NH_3 < (CH_3)_3\ N < CH_3NH_2 < (CH_3)_2NH$

Answer: D

Solution:

Basic strength increases as we move from NH_3 to CH_3NH_2 and from CH_3NH_2 to $(CH_3)_2NH$, but basic strength decreases as we move from $(CH_3)_2NH$ to $(CH_3)_3\ N$ in aqueous medium.

Thus, the order of basic strength is:

$NH_3 < CH_3NH_2 < (CH_3)_2NH > (CH_3)_3\ N$

OR

$NH_3 < (CH_3)_3\ N < CH_3NH_2 < (CH_3)_2NH$

Question5

Which from following is a non benzenoid aromatic compound?

MHT CET 2025 22nd April Morning Shift

Options:

A. Aniline

B. Tropone

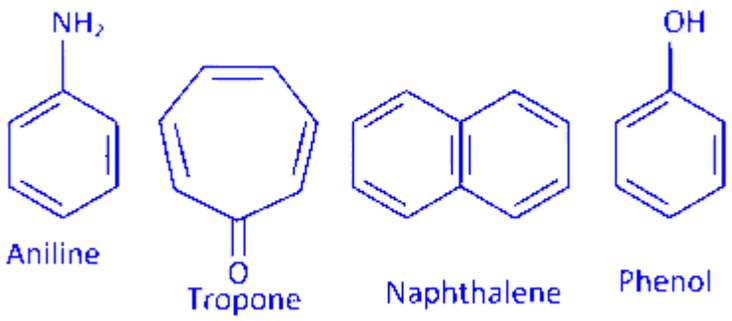
C. Naphthalene

D. Phenol

Answer: B

Solution:

Non-benzenoid compounds contain an aromatic ring other than benzene.



Question6

Which from following is the most stable species?

MHT CET 2025 20th April Evening Shift

Options:

A. NH_4^+

B. $R-\overset{+}{N}H_3$

C. $R_2\overset{+}{N}H_2$

D. $R_3\overset{+}{N}H$

Answer: D

Solution:

An alkyl group exerts electron releasing inductive effect (+I) which stabilizes positive charge on atom bonded to it. As we move from conjugate acid of ammonia $\left(NH_4^+\right)$to that of tertiary amine $\left(R_3\overset{+}{N}-H\right)$, the

number of alkyl groups (R) bonded to nitrogen goes on increasing steadily. This results in increasing stabilization of the positive charge.

Order of stabilization:

$\overset{+}{N}H_4 < R-\overset{+}{N}H_3 < R_2\overset{+}{N}H_2 < R_3\overset{+}{N}-H$

Question7

Which among following is a strongest base?

MHT CET 2024 15th May Evening Shift

Options:

A. Benzenamine

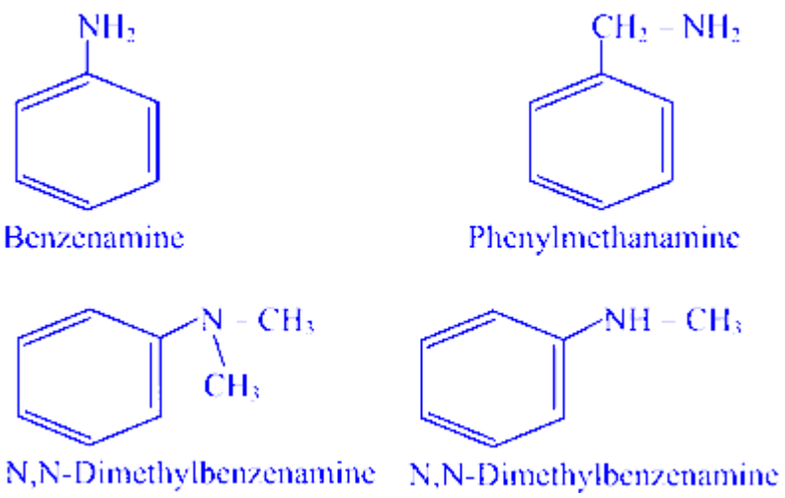
B. Phenylmethanamine

C. N, N-Dimethylbenzenamine

D. N-Methylbenzenamine

Answer: B

Solution:



In arylamines, the $-NH_2$ group is attached directly to an aromatic ring. The lone pair of electrons on nitrogen is conjugated to the aromatic ring and is less available for protonation. In phenylmethanamine (aliphatic amine), lone pair of electrons on nitrogen is available for protonation. Hence, phenylmethanamine is the strongest base among the given amines.

Question8

Which of the following groups exhibits (+)R effect?

MHT CET 2024 10th May Morning Shift

Options:

A. $-\mathrm{NHR}$

B. $-\mathrm{CN}$

C. $-\mathrm{NO_2}$

D. $-\mathrm{COOR}$

Answer: A

Solution:

The (+)R effect, also known as the positive resonance effect, involves the donation of electrons through resonance, typically by groups that have lone pairs of electrons which can be delocalized into an aromatic system or conjugated system. This effect generally increases electron density on adjacent atoms, providing greater stability to the system.

In the given options:

Option A $-\mathrm{NHR}$**:** This group contains a nitrogen atom with a lone pair that can participate in resonance, donating electrons. Thus, it exhibits a (+)R effect.

Option B $-\mathrm{CN}$**:** The cyano group is a strong electron-withdrawing group due to the presence of a highly electronegative nitrogen atom; it does not exhibit a (+)R effect.

Option C $-\mathrm{NO_2}$**:** The nitro group is also electron-withdrawing due to resonance involving the highly electronegative oxygen atoms; it does not exhibit a (+)R effect.

Option D $-\mathrm{COOR}$**:** The ester group mainly exhibits a (-I) effect rather than contributing significant electron donation through resonance as a substituent; it does not primarily exhibit a (+)R effect.

Therefore, the group that exhibits the (+)R effect is:

Option A $-\mathrm{NHR}$**.**

Question9

Which from following carbocations is least stable?

MHT CET 2024 3rd May Evening Shift

Options:

A. $(R)_3 - C^+$

B. $(R)_2 - \overset{+}{C}H$

C. $R - \overset{+}{C}H_2$

D. $H_3\overset{+}{C}$

Answer: D

Solution:

Order of stability of carbocation is:

$R_3C^+ > R_2\overset{+}{C}H > R - CH_2^+ > CH_3^+$

Question10

Identify nonbenzenoid aromatic compound from following.

MHT CET 2023 11th May Evening Shift

Options:

A. Aniline

B. Tropone

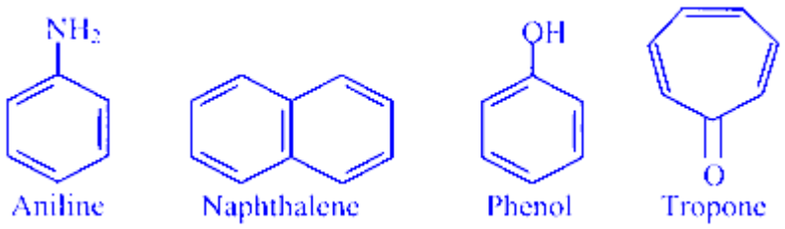
C. Naphthalene

D. Phenol

Answer: B

Solution:

Aniline, naphthalene and phenol are benzenoid aromatic compounds whereas tropone is a nonbenzenoid aromatic compound.



Question11

Which among the following pairs of electronic effect and it's example is NOT correct?

MHT CET 2021 24th September Evening Shift

Options:

A. Hyper conjugation : Propene

B. Resonance : Nitromethane

C. $(-)$R effect: $C_6H_5NH_2$

D. Electromeric effect: Acetone

Answer: C

Solution:

To determine which among the given pairs of electronic effect and its example is not correct, let's analyze each one of them:

Option A: Hyper conjugation : Propene

Hyperconjugation is an effect in which sigma bonds (usually C-H or C-C) adjacent to a positively charged carbon or an unsaturated system donate electron density through overlap with adjacent empty or partially filled p-orbitals or π-orbitals. Propene ($CH_3CH = CH_2$) demonstrates hyperconjugation due to the presence of C-H bonds adjacent to the double bond. Thus, this pairing is correct.

Option B: Resonance : Nitromethane

Resonance occurs when a molecule can be represented by two or more structures differing only in the position of electrons (not atoms). Nitromethane (CH_3NO_2) exhibits resonance due to the delocalization of electrons between nitrogen and oxygen atoms. Therefore, this pairing is correct.

Option C: $(-)$R effect: $C_6H_5NH_2$

The $(-)$R effect (negative resonance or mesomeric effect) refers to the withdrawal of electron density through resonance. $C_6H_5NH_2$ (aniline) shows a $(+R)$ effect because the lone pair of electrons on the nitrogen atom is delocalized into the benzene ring, increasing the electron density of the ring. Hence, this pairing is incorrect.

Option D: Electromeric effect: Acetone

The electromeric effect is a temporary effect observed in the presence of an attacking reagent, where the electrons of a π-system are completely transferred to one of the atoms. Acetone (CH_3COCH_3) has a carbon-oxygen double bond that can exhibit the electromeric effect in the presence of a reagent. Thus, this pairing is correct.

So, the option that is NOT correct is:

Option C: $(-)$R effect: $C_6H_5NH_2$.

Question12

identify the species from following that exhibits no bond resonance.

MHT CET 2021 24th September Morning Shift

Options:

A. CH_3CH_2Br

B. $CH_3CH_2(+)$

C. $CH_3CH_2NO_2$

D. C_6H_6

Answer: B

Solution:

The correct choice is Option B: the ethyl cation, $CH_3CH_2^+$.

Why?

“No-bond resonance” (a.k.a. hyperconjugation) arises when a C–H σ bond overlaps with an adjacent empty p orbital.

In $CH_3CH_2^+$ the empty p orbital on the cationic carbon is stabilized by hyperconjugation from its neighbouring C–H bonds.

The other species either have no delocalization at all (A: CH_3CH_2Br) or display classical π-resonance (C: nitroethane; D: benzene).

Hence only $CH_3CH_2^+$ exhibits “no-bond” resonance.

Question13

Which group from following is responsible for $(-)\mathrm{R}$ effect?

MHT CET 2021 24th September Morning Shift

Options:

A. $-\mathrm{COOR}$

B. $-\mathrm{OR}$

C. $-\mathrm{OH}$

D. $-\mathrm{NHR}$

Answer: A

Solution:

The $(-)\mathrm{R}$ effect, or negative resonance effect, refers to the electron-withdrawing nature of certain substituents through resonance. This effect decreases the electron density on the rest of the molecule. Among the given options, the group responsible for the $(-)\mathrm{R}$ effect is $-\mathrm{COOR}$.

Here’s why each option is considered:

Option A: $-\mathrm{COOR}$

The $-\mathrm{COOR}$ group has a carbonyl group ($\mathrm{C}=\mathrm{O}$), which is strongly electron-withdrawing through resonance. The oxygen atom has lone pairs but participates in resonance, pulling electron density away from the rest of the molecule.

Option B: $-\mathrm{OR}$

The $-\mathrm{OR}$ group has lone pairs of electrons on the oxygen, which can donate electron density through resonance, making it electron-donating rather than electron-withdrawing.

Option C: $-\mathrm{OH}$

The $-\mathrm{OH}$ group also has lone pairs of electrons on the oxygen and typically acts as an electron-donating group through resonance.

Option D: $-\mathrm{NHR}$

The $-\mathrm{NHR}$ group has a nitrogen with lone pairs that can donate electron density through resonance, thus acting as an electron-donating group.

Therefore, the group responsible for the $(-)\mathrm{R}$ effect is:

Option A: $-\mathrm{COOR}$

Question14

Identify most stable free radical from following :

MHT CET 2021 23th September Morning Shift

Options:

A. $\mathrm{CH_3CH_2}.$

B. $(\mathrm{CH_3})_3\mathrm{C}.$

C. $(\mathrm{CH_3})_2\mathrm{CH}.$

D. $\mathrm{CH_3}.$

Answer: B

Solution:

To determine the most stable free radical among the given options, we must consider the concept of hyperconjugation and inductive effects, which are key factors in the stabilization of free radicals.

Stability order of free radicals generally follows the order:

Tertiary (3°) > Secondary (2°) > Primary (1°) > Methyl ($\mathrm{CH_3^{\bullet}}$)

Here's the breakdown of each option:

Option A: $\mathrm{CH_3CH_2^{\bullet}}$ (ethyl radical) - This is a primary free radical, which has limited stability.

Option B: $(\mathrm{CH_3})_3\mathrm{C^{\bullet}}$ (tertiary butyl radical) - This is a tertiary free radical, which is highly stabilized due to hyperconjugation and inductive effects from the three methyl groups.

Option C: $(CH_3)_2CH^{\bullet}$ (isopropyl radical) - This is a secondary free radical, which is relatively stable due to hyperconjugation and inductive effects from the two methyl groups.

Option D: $CH_3^{\bullet}$ (methyl radical) - This is the least stable, as it lacks additional alkyl groups to provide stabilization.

Based on this analysis, the most stable free radical is:

Option B: $(CH_3)_3C^{\bullet}$ (tertiary butyl radical).

Question15

Which statement from following is correct for homolytic fission?

MHT CET 2021 23th September Morning Shift

Options:

A. In this single electron of shared pair moves to one of bonded atom and other to other atom,

B. In this electron deficient and electron rich species are formed.

C. In this electronegative atom pulls both electrons of shared pair.

D. In this carbon free radical formed has sp^3 hybridisation.

Answer: A

Solution:

The correct statement for homolytic fission is:

Option A: In this, single electron of shared pair moves to one of bonded atom and other to other atom.

Explanation:

Homolytic fission is a type of bond dissociation in which the two electrons in a covalent bond are split equally between the two atoms involved in the bond. As a result, each atom retains one of the shared electrons, leading to the formation of two radicals. These radicals are species with an unpaired electron.

Therefore, the statement "In this, single electron of shared pair moves to one of bonded atom and other to other atom" correctly describes homolytic fission.

Here are the explanations for the other options:

Option B: "In this electron deficient and electron rich species are formed." is incorrect because homolytic fission produces radicals, which are not necessarily electron deficient or electron rich but are neutral species with unpaired electrons.

Option C: "In this electronegative atom pulls both electrons of shared pair." refers to heterolytic fission, not homolytic fission. In heterolytic fission, the bond breaks in such a way that both bonding electrons are retained by the more electronegative atom, forming a cation and an anion.

Option D: "In this carbon free radical formed has sp^3 hybridisation." is not necessarily correct. A carbon free radical can have sp^2 hybridization if it is part of an alkene or aromatic structure due to the presence of a p-orbital, in addition to sp^3 if it is part of a saturated hydrocarbon chain. So, this statement is too specific and not universally applicable to all carbon free radicals formed by homolytic fission.

Question16

Which among the following compounds is a weakest base?

MHT CET 2021 23th September Morning Shift

Options:

A. Phenymethanamine

B. N-Methylanilline

C. Benzenamine

D. N,N-Dimethylaniline

Answer: C

Solution:

To determine the weakest base among the given compounds, we need to consider the electronic effects and structure of each compound. Let's analyze each option:

Option A: Phenylmethanamine (Benzylamine)

Benzylamine has the structure $C_6H_5 - CH_2 - NH_2$. The lone pair of electrons on the nitrogen in benzylamine is not significantly delocalized into the aromatic ring, making the nitrogen relatively available for protonation.

Option B: N**-Methylaniline**

N-Methylaniline has the structure $C_6H_5 - NH - CH_3$. In this compound, the lone pair on the nitrogen is partially delocalized into the aromatic ring through resonance, which reduces the electron density on the nitrogen and hence its basicity.

Option C: Benzenamine (Aniline)

Aniline has the structure $C_6H_5 - NH_2$. Similar to N-Methylaniline, the lone pair on the nitrogen can delocalize into the aromatic ring through resonance, reducing the nitrogen's availability to accept protons, making it less basic compared to benzylamine.

Option D: N, N**-Dimethylaniline**

N, N-Dimethylaniline has the structure $C_6H_5 - N(CH_3)_2$. The lone pair on the nitrogen in N, N-Dimethylaniline is also delocalized into the aromatic ring by resonance. Moreover, the presence of two methyl groups on the nitrogen, which are electron-donating groups, slightly increases the electron density on the nitrogen through hyperconjugation and inductive effects. Despite that, the resonance effect predominates, making N, N-Dimethylaniline less basic compared to compounds without such extensive resonance stabilization.

Considering the extent of resonance stabilization leading to a decrease in basicity, the weakest base among the given compounds is:

Option C: Benzenamine (Aniline)

Question17

Identify lowest positive charge developed (indicated by $\partial, \partial_1, \partial_2, \partial_3$) due to inductive effect in following compounds.

$$CH_3 - \overset{\delta_3}{C}H_2 \rightarrow \overset{\delta_2}{C}H_2 \rightarrow \overset{\delta_1}{C}H_2 \rightarrow \overset{\delta}{C}l$$

MHT CET 2021 22th September Evening Shift

Options:

A. ∂_2

B. ∂_3

C. ∂

D. ∂_1

Answer: B

Solution:

$$CH_3 - \overset{\delta_3}{C}H_2 \rightarrow \overset{\delta_2}{C}H_2 \rightarrow \overset{\delta_1}{C}H_2 \rightarrow \overset{\delta}{C}l$$

Where, $\delta_3^{\oplus} < \delta_2^{\oplus} < \delta_1^{\oplus}$

Question18

Which among following functional groups exhibits $-\mathrm{R}$ effect?

MHT CET 2021 22th September Evening Shift

Options:

A. $-\mathrm{CO}-$

B. $-\mathrm{Br}$

C. $-\mathrm{OR}$

D. $-\mathrm{NHR}$

Answer: A

Solution:

The $-\mathrm{R}$ effect, also known as the resonance effect or mesomeric effect, refers to the ability of certain atoms or functional groups connected to a conjugated system to donate or withdraw electron density through resonance. This effect is crucial in determining the stability, reactivity, and acid-base properties of molecular structures. In examining the options given, it is important to differentiate between electron-donating and electron-withdrawing effects in the context of resonance (mesomeric effects). Let's evaluate each option in terms of their capability to exhibit the $-\mathrm{R}$ effect, which is indicative of resonance stabilization by withdrawing electron density.

Option A: $-\mathrm{CO}-$ is the carbonyl group, a highly electronegative group due to the presence of oxygen. The carbonyl carbon is electron-deficient because oxygen, being more electronegative, pulls the shared electron density towards itself. This makes the carbonyl group an electron-withdrawing group capable of exhibiting the $-\mathrm{R}$ or resonance effect by stabilizing adjacent positive charges or withdrawing electron density through resonance.

Option B: $-\mathrm{Br}$, or a bromine atom attached to a hydrocarbon, can exhibit resonance by donating its lone pair of electrons into a π system (if one is present). However, halogens are typically considered $+\mathrm{R}$ groups (electron-donating through resonance) rather than $-\mathrm{R}$ groups because they can donate electron density via their lone pairs into the system. Despite being electronegative, in the context of resonance specifically, they don’t withdraw electron density but rather have the capacity to share it.

Option C: $-\mathrm{OR}$ is an alkoxy group, which is generally an electron-donating group via resonance ($+\mathrm{R}$ effect). The oxygen atom in $-\mathrm{OR}$ can donate electron density into a conjugated π-system through its lone pairs, thus stabilizing the system. This makes it not suitable for the $-\mathrm{R}$ category but rather places it as an electron-donating group.

Option D: $-NHR$, an amino group attached to a hydrocarbon (where R is an alkyl group), is also generally considered an electron-donating group through resonance ($+R$ effect), similar to $-OR$, because the nitrogen atom can donate electron density from its lone pair into the π-system, providing stabilization.

Therefore, among the given options, Option A: $-CO-$ is the one that exhibits the $-R$ effect, as it can withdraw electron density through resonance, unlike the other options which are generally considered electron-donating in the context of resonance effects.

Question19

Which from following statements is true for tetrahydrofuran?

MHT CET 2021 21th September Morning Shift

Options:

A. It is homocyclic aromatic.

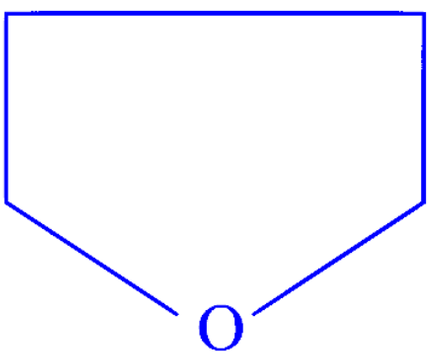
B. It is heterocyclic aromatic.

C. It is aromatic non-benzenoid.

D. It is heterocyclic nonaromatic.

Answer: D

Solution:



Tetrahydrofuran

It is heterocyclic nonaromatic compound.

Question20

Identify $-I$ effect causing group from following.

MHT CET 2021 20th September Evening Shift

Options:

A. $-COOR$

B. $-CH_3$

C. $-C_2H_5$

D. $-C_3H_7$

Answer: A

Solution:

Among the choices, only the ester group (–COOR) withdraws electrons by the inductive effect (–I). Alkyl groups (–CH_3, –C_2H_5, –C_3H_7) all push electron density toward the rest of the molecule (+I).

• –COOR: –I effect

• –CH_3, –C_2H_5, –C_3H_7: +I effect

Answer: Option A (–COOR).

Question21

The Total number of electrons around the carbon atom of methyl free radical are

MHT CET 2020 19th October Evening Shift

Options:

A. nine

B. six

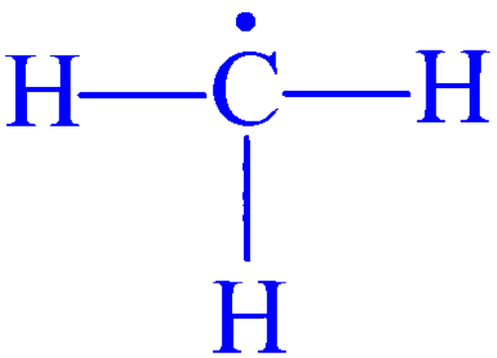
C. seven

D. eight

Answer: C

Solution:

The total number of electrons around the carbon atom of methyl free radical $\left(\dot{C}H_3\right)$ is seven. It's structure is shown below.



Each $C-H$ bond two electrons and one unpaired electron on carbon atom.

Total electrons present $=3 \times 2+1=7$ electrons

Question22

Which among the following carbocation is most reactive?

MHT CET 2020 16th October Evening Shift

Options:

A. CH_3^+

B. $CH_3 - CH_2^+$

C. $(CH_3)_2CH^+$

D. $(CH_3)_3C^+$

Answer: A

Solution:

CH_3^+ carbocation is most reactive, because order of stability of carbocation due to hyperconjugation and inductive effect is, 3° carbocation $> 2^\circ$ carbocation $> 1^\circ$ carbocation. So, 1° carbocation is least stable due to this, it is most reactive.

Question23

Mixture of iodine and sodium sulphate is separated by ..... .

MHT CET 2020 16th October Morning Shift

Options:

A. differential extraction

B. chromatography

C. sublimation

D. distillation

Answer: C

Solution:

Iodine and sodium sulphate is seperated by sublimation. It is a process of transition of a substance from the solid to the gaseous state without passing through the liquid state. To separate mixture that contain a sublimate with volatile component from a non-sublimate impurity, the sublimation process is used. In this mixture iodine use as a sublimate and sodium sulphate is use as a non-sublimate impurity.

Question24

Which among the following is a set of nucleophiles ?

MHT CET 2019 2nd May Evening Shift

Options:

A. H^+, NH_3, Cr^-

B. BF_3, H_2O, NH_3

C. $AlCl_3, BF_3, NH_3$

D. $CN^-, H_2O, R-OH$

Answer: D

Solution:

All molecules or ions with free pair of electrons or at least one π-bond can act as nucleophile.

Among given species

are nucleophiles.
