# kd education academy (9582701166)

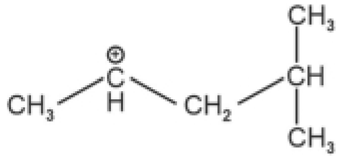
Time : 5 Hour | STD 11 Science | Total Marks : 640

## kd 700+ neet target ch-8 organic chemistry reaction mechanism part-4

*** Chemistry** **[640]**

1. The most stable carbocation among the following is :

(A)



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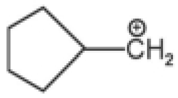

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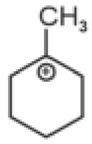

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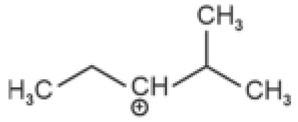
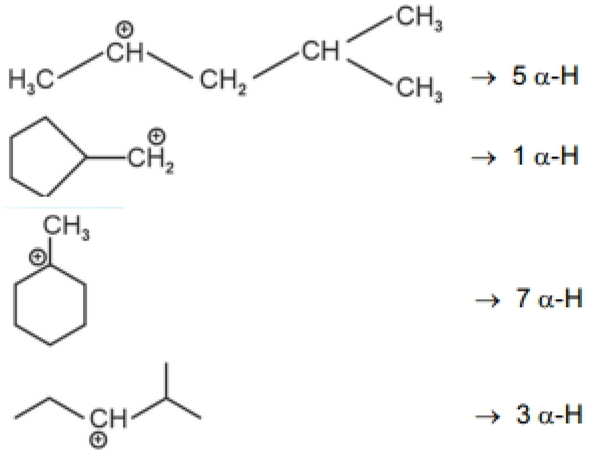


**Ans. :** The stability of carbocation can be described by the hyperconjugation. Greater the extent of hyperconjugation, more is the stability of carbocation.

$Image$

Stability order of carbocations $= (3) > (1) > (4) > (3)$



2. The major product formed in dehydrohalogenation reaction of $2-$Bromo pentane is Pent$-2-$ene. This product formation is based on ?

(A) Saytzeffs Rule (B) Hund's Rule (C) Hofmann Rule (D) Huckel's Rule

**Ans. :** a

$$\mathrm{CH_3-CH_2-CH_2-\underset{\underset{\textit{Br}}{|}}{CH}-CH_3} \xrightarrow[\mathrm{E_2}]{Base} \mathrm{CH_3-CH_2-CH=CH-CH_3} +$$

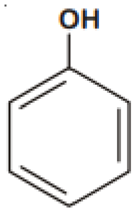
Major,More stable, Saytzeff's product

$\mathrm{CH_3-CH_2-CH_2-CH=CH_2}$

Minor,less stable, Hofomann's product

3. Which of the following compound is most reactive in electrophilic aromatic substitution?

(A)



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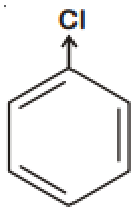

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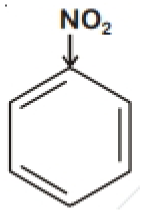

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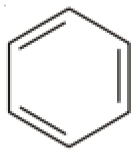
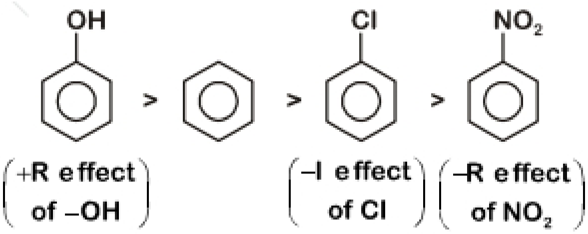


**Ans. :** a

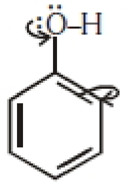


4. The compound that is most difficult to protonate is

   (A) $H-O-H$ (B) $H_3C-O-H$ (C) $H_3C-O-CH_3$ (D) $Ph-O-H$

   **Ans. :** d

   In case of phenol lone pair of oxygen is delocalized in ring.



5. The most stable carbocation, among the following is

   (A) $(CH_3)_3C-\overset{\oplus}{C}H-CH_3$

   (B) $CH_3-CH_2-\overset{\oplus}{C}H-CH_2-CH_3$

   (C) $CH_3-\overset{\oplus}{C}H-CH_2-CH_2-CH_3$

   (D) $CH_3-CH_2-\overset{\oplus}{C}H_2$

   **Ans. :** c

   Due to $+H$ effect of alkyl group (more $\alpha H$)

6. Which of the following is correct with respect to $-I$ effect of the substituents ? ( $R=$ alkyl)

(A) $-\mathrm{NH_2} < -\mathrm{OR} < -\mathrm{F}$

(B) $-\mathrm{NR_2} < -\mathrm{OR} < -\mathrm{F}$

(C) $-\mathrm{NH_2} > -\mathrm{OR} > -\mathrm{F}$

(D) $-\mathrm{NR_2} > -\mathrm{OR} > -\mathrm{F}$

**Ans. :** a

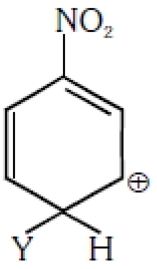
(Based on EN)

$\therefore \quad -\mathrm{NH_2} < -\mathrm{OR} < -\mathrm{F} \quad -\mathrm{I}$ effect

Ato $\quad -\mathrm{NR_2} < -\mathrm{OR} < -\mathrm{F} \quad -\mathrm{I}$ eflect

7. Which of the following carbocations is expected to be most stable ?

(A)



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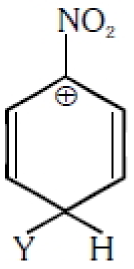

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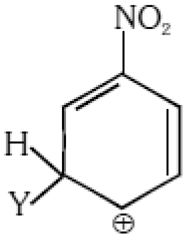

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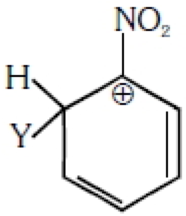
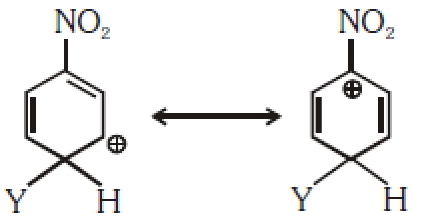
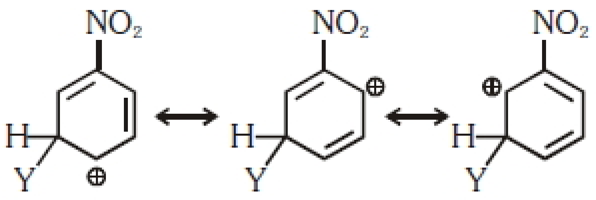


**Ans. :** c

$-\mathrm{NO_2}$ group is meta-directing group



(Less stable due to more $e^-$ withdrawing effect of $-\mathrm{NO_2}$)



(More stable due to less $e^-$ withdrawing effect of $-\mathrm{NO_2}$)

8. The correct statement regarding electrophile is

(A) electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile

(B) electrophiles are generally neutral species and can form a bond by accepting a pair of electrons from a nucleophile

(C) electrophile can be either neutral or positively charged species and can form aIIbond by accepting a pair of electrons from a nucleophile

(D) electrophile is a negatively charged species and can form a bond by accepting a pair of

**Ans. :** c

Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electron from a nucleophile.

9. Which of the following statements is not correct for a nucleophile?

(A) Ammonia is a nucleophile.

(B) Nucleophiles attack low $e^-$ density sites.

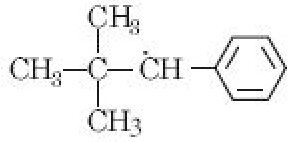
(C) Nucleophiles are not electron seeking.

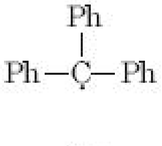
(D) Nucleophile is a Lewis acid.

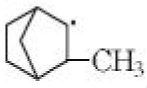
**Ans. :** d

Nucleophiles are electron rich species so act as Lewis base.

10. Consider the following compounds :
Hyperconjugation occurs in


(I)


(II)


(III)

(A) $III$ only (B) $I$ and $III$ (C) $I$ only (D) $II$ only.

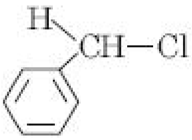
**Ans. :** a

Hyperconjugation occurs through the $H-$ atoms present on the carbon atom next to the double bond i.e alpha hydrogen atoms. There is no alpha $-H$ in the structure $I$ and $II$.

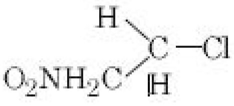
So, hyperconjugation occurs in structure $III$ only ie.

11. In which of the following compounds, the $C-Cl$ bond ionisation shall give most stable carbonium ion?

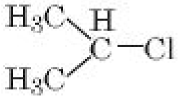
(A)



(B)



(C)



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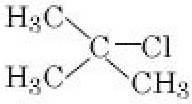
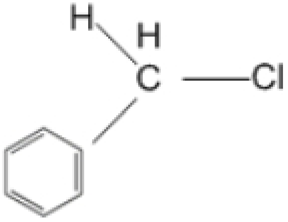


**Ans. :** d

The stability of carbocation follow the order $3>2>1>$ methyl. More the number of alkyl group attached with the carbon atom carrying the positive charge greater would be the tendency to stabilise positive charge via inductive effect, and hence more stable. Due to the presence of benzence group, there is more resonance possibility than others hence it forms a more stable compound.



12. Arrange the following in increasing order of stability

1. $(CH_3)_2-\overset{+}{C}-CH_2-CH_3$
2. $(CH_3)_3-\overset{+}{C}$
3. $(CH_3)_2-|\overset{+}{C}H|$
4. $CH_3-\overset{+}{C}H_2$
5. $\overset{+}{C}H_3$

(A) $5<4<3<1<2$
(B) $4<5<3<1<2$
(C) $1<5<4<3<2$
(D) $5<4<3<2<1$

**Ans. :** a

stability of carbocations follows following trendmethyl
$<1^{\circ}<2^{\circ}<3^{\circ}$
Given carbocations $(\mathrm{CH_3})_3\mathrm{C}\cdot \Rightarrow 3^{\circ}$ carbocation
$(\mathrm{CH_3})_2\mathrm{CH}\cdot => 2^{\circ}$ carbocation
$\mathrm{CH_3CH_2}\cdot \Rightarrow 1^{\circ}$ carbocation
Therefore, increasing order of stability of carbocations $\mathrm{CH_3CH_2}\cdot(1^{\circ})<(\mathrm{CH_3})_2\mathrm{CH}\cdot(2^{\circ})<(\mathrm{CH_3})_3\mathrm{C}\cdot(3^{\circ})$

13. Homolytic fission of the following alkanes forms free radicals
$CH_3-CH_3, CH_3-CH_2-CH_3, (CH_3)_2CH-CH_3,$

$CH_3-CH_2-CH(CH_3)_2$.

Increasing order of stability of the radicals is

(A) $(CH_3)_2\dot{C}-CH_2CH_3 < CH_3-\dot{C}H-CH_3 < CH_3-\dot{C}H_2 < (CH_3)_3\dot{C}$

(B) $CH_3-\dot{C}H_2 < CH_3-\dot{C}HH-CH_3 < (CH_3)_2\dot{C}-CH_2-CH_3 < (CH_3)_3\dot{C}$

(C) $CH_3-\dot{C}H_2 < CH_3-\dot{C}H-CH_3 < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}-CH_2CH_3$

(D) $(CH_3)_3\dot{C} < (CH_3)_2\dot{C}-CH_2CH_3 < CH_3-\dot{C}H-CH_3 < CH_3-\dot{C}H_2$

**Ans. :** b

More the number of hyperconjugative structures, the greater is the stability.

14. Which of the following compounds are not arranged in order of decreasing reactivity towards electrophilic substitution

(A) Fluoro benzene > chloro benzene > bromo benzene

(B) Phenol > $n-$propyl benzene > benzoic acid

(C) Chloro toluene > para-nitro toluene > $2-$chloro$-4-$nitro toluene

(D) Benzoic acid > phenol > $n-$propyl benzene

**Ans. :** d

(d) $-COOH$ group is a deactivating group, hence benzoic acid is less reactive towards electrophilic substitution than phenol.

15. Number of $\sigma$ and $\pi$ bonds present in $1-$butene$-3-$yne respectively are

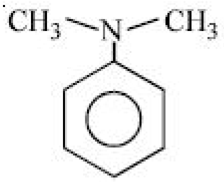
(A) $7\sigma, 3\pi$ (B) $5\sigma, 2\pi$ (C) $8\sigma, 3\pi$ (D) $6\sigma, 2\pi$

**Ans. :** a

(a) $CH_2 = \underset{7\sigma,\,3\pi}{CH - C} \equiv CH$

16. Which of the following is strongest base.

(A)



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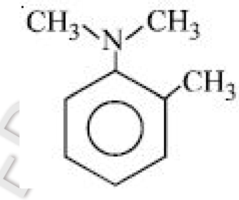
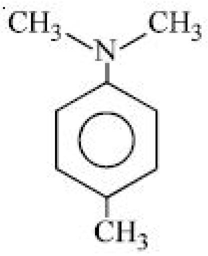
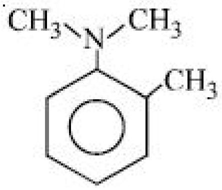


(C)

(D)



**Ans. :** (B)

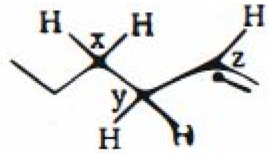


17. In carbyl amine reaction, electrophile is

(A) Nitrene (B) Carbene (C) Carbanion (D) Carbocation

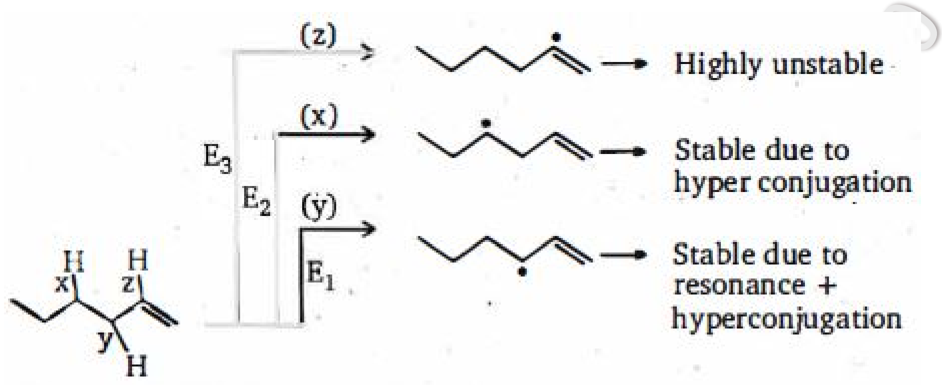
**Ans. :** (B) Carbene

18. Arrange the $(C-H)$ bonds $x, y$ and $z$ in decreasing order of their bond dissociation energies in homolysis.



(A) $y > x > z$ (B) $z > x > y$ (C) $z > y > x$ (D) $y > z > x$

**Ans. :** b



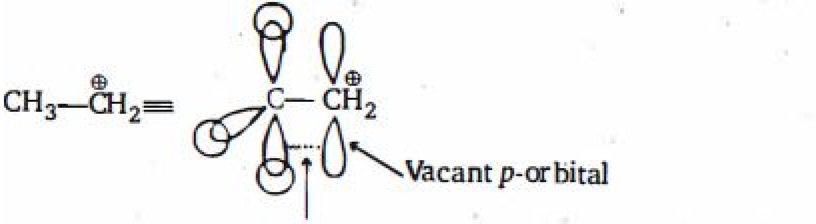
so bond dissociation energy order is

$E_1 < E_2 < E_3$ *i.e*, $(z) > (x) > (y)$

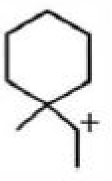
19. How many carbon-hydrogen bond orbitals are available for overlap with the vacant $p$-orbital in ethyl carbocation ?

(A) $0$ (B) $3$ (C) $5$ (D) $6$

**Ans. :** b



20. Which of the following will rearrange ?

(1)


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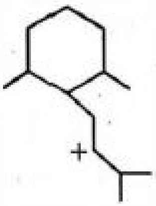

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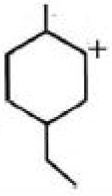

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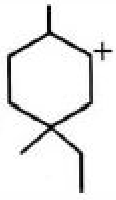


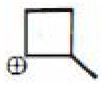
(A) $1$ (B) $1$ and $3$ (C) All (D) $1, 2, 4$

**Ans. :** c

$(c)$ $(1)$ Methyl shift $(2)$ Hydride shift $(3)$ Hydride shift $(4)$ Hydride shift

21. Which of the following is most likely to undergo a favorable hydride shift?

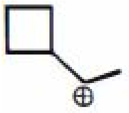
(A)



(B)

(C)

(D)

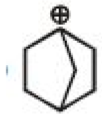


**Ans. :** a

$(b)$ methyl shift $(c)$ No rearrangement $(d)$ Ring expension.

22. Which of the following carbocation is most stable

(A)



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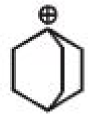

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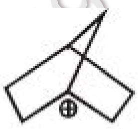
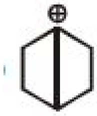
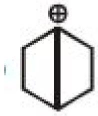


(D)



**Ans. :** (D)



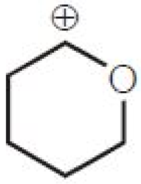
23. How many propenyl radical is possible from propene

(A) $1$ (B) $2$ (C) $3$ (D) $4$

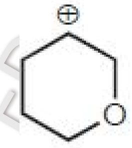
**Ans. :** (C) $3$

24. Most stable carbocation among following is

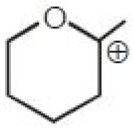
(A)



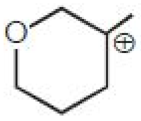
(B)



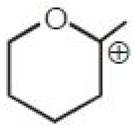
(C)



(D)



**Ans. :** (C)



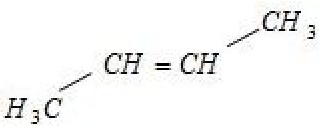
25. Which has zero dipole moment

(A) cis$-2-$butene (B) trans$-2-$butene

(C) $1-$butene (D) $2-$methyl$-1-$propene

**Ans. :** b

(b) $\mu = 0$ symmetrical structure.



26. Dipole moment is shown by

(A) $1,4-$dichloro benzene

(B) Cis$-1,2-$dichloro ethane

(C) Trans$-1,2-$dichloro, $2-$pentene

(D) Trans$-1,2-$dichloro ether

**Ans. :** b

(b) Due to presence of two chlorine atom on the same side of carbon atom produces dipole moment in molecule.

27. Aromatic properties of benzene are proved by

(A) Aromatic sextet theory

(B) Resonance theory

(C) Molecular orbital theory

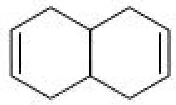
(D) All of these

**Ans. :** d

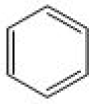
It’s obvious.

28. Which of the following will show aromatic behaviour

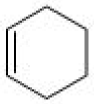
(A)



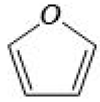
(B)



(C)



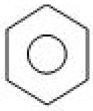
(D)



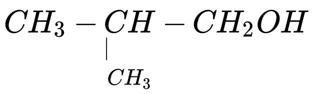
**Ans. :** b

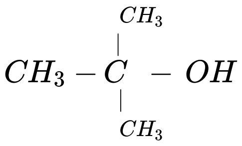
(b) $(1)$ Molecule is planar.

$(2)$ $6$ $\pi$ electrons are present.

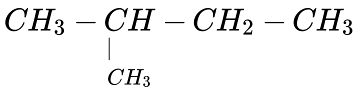


29. The compound, which gives the most stable carbonium on dehydrogenation

(A)

$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2OH$

(B) 
$CH_3 - \underset{CH_3}{\overset{CH_3}{C}} - OH$

(C) $CH_3 - CH_2 - CH_2 - CH_2OH$

(D) 
$CH_3 - \underset{CH_3}{CH} - CH_2 - CH_3$

**Ans. :** b

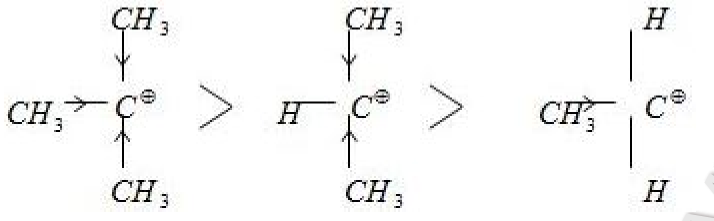
(b) $3^\circ$ alcohol on dehydrogenation gives most stable carbonium ion.

30. The $+I$ effect of alkyl groups is in the order

(A) $2^\circ > 3^\circ > 1^\circ$ (B) $1^\circ > 2^\circ > 3^\circ$ (C) $3^\circ > 2^\circ > 1^\circ$ (D) None of these

**Ans. :** c

(c)$3^\circ > 2^\circ > 1^\circ$



31. The only $o,p-$ directing group which is deactivating in nature is

(A) $-NH_2$ (B) $-OH$

(C) $-X$ (halogens) (D) $-R$ (alkyl groups)

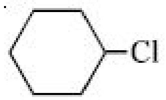
**Ans. :** c

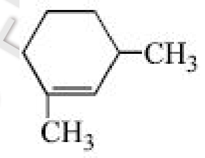
(c) Electron accepting groups which make the substitution difficult are known or deactivating groups.

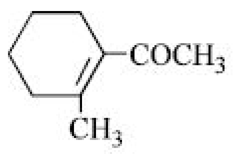
o. p. directing groups are as follow :

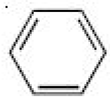
$-CH_3, C_2H_5(-R), -NH_2, -OH$, halogens $(Cl, Br, I)$.

32. In which of the following molecule all the effect namely inductive, mesomeric $\&$ hyperconjugation operate

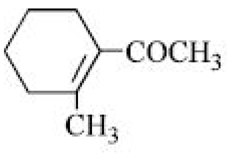
(A)


(B)


(C)


(D)


**Ans. :** (C)



33. The resonance energy of following heterocycles is in the order

(A) pyrole $>$ furan $>$ pyridine

(B) furan $>$ pyrole $>$ pyridine

(C) pyridine $>$ pyrole $>$ furan

(D) pyridine $>$ furan $>$ pyrole

**Ans. :** (C) pyridine $>$ pyrole $>$ furan

34. Which of the following is the strongest $o,p-$ directing group?

(A) $OH$ (B) $Cl$ (C) $Br$ (D) $C_6H_5$

**Ans.:** (A) $OH$

35. In a reaction of $C_6H_5Y$, the major product $(>60\%)$ is $m-$ isomer, so the group $Y$ is :

(A) $-COOH$ (B) $-Cl$ (C) $-OH$ (D) $-NH_2$

**Ans.:** (A) $-COOH$

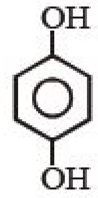
36. Which of the following can show $+M$ or $+R$ effect

(A) $-COCH_3$ (B) $-CH_3$ (C) $-NH_2$ (D) $-COOH$

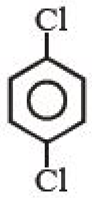
**Ans. :** (C) $-NH_2$

37. Which of the following is polar?

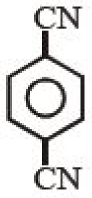
(A)



(B)

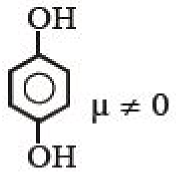


(C)

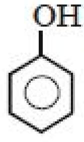


(D) All

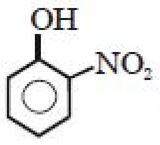
**Ans. :** a



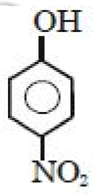
38. Correct order of $K_a$ value for given compound



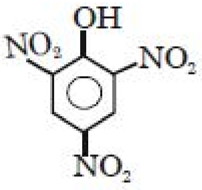
(I)



(II)



(III)



(IV)

(A) $IV > II > III > I$

(B) $III > IV > II > I$

(C) $IV > III > II > I$

(D) $IV > III > I > II$

**Ans. :** c

Acidic strength $\propto \mathrm{K_a} \propto \frac{1}{\mathrm{Pk_a}} \propto \frac{-\mathrm{M}}{+\mathrm{M}} \propto \frac{-\mathrm{I}}{+\mathrm{I}}$

39. Arrange the following compound in order of their acidic strength :-

$(i)\, CF_3SO_3H \quad (ii)\, C_6H_5COOH \quad (iii)\, C_6H_5OH$

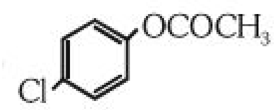
(A) $i > ii > iii$ (B) $iii > ii > i$ (C) $iii > i > ii$ (D) $i > iii > ii$

**Ans.:** (A) $i > ii > iii$

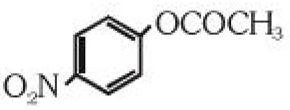
40. Which one of the following esters gets hydrolysed most easily under alkaline conditions?

(A)

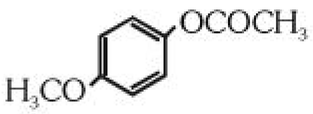
(B)



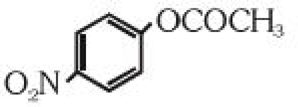
(C)



(D)

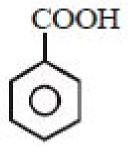


**Ans. :** (C)

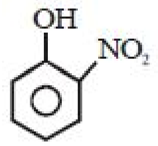


41. Which of the following is most acidic

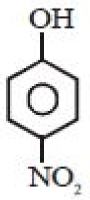
(A)



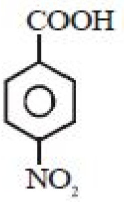
(B)



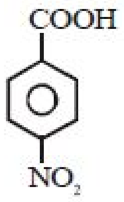
(C)



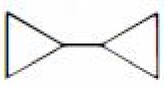
(D)

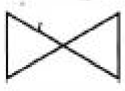


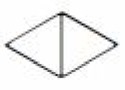
**Ans. :** (D)



42. Correct order of the heats of combustion of above compounds is


(i)


(ii)


(iii)

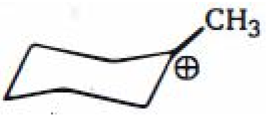
(A) $(i) > (ii) > (iii)$ (B) $(i) > (iii) > (ii)$ (C) $(ii) > (i) > (iii)$ (D) $(ii) > (iii) > (i)$

**Ans. :** a

$(a)$ More the numbers of carbons more will be the heat of combustion.

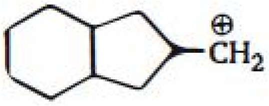
43. Most stable carbocation among the following is

(A)



(B)

(C)



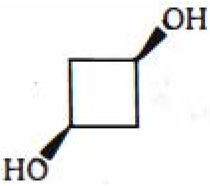
(D) $^{\oplus}CH_3$

**Ans. :** a

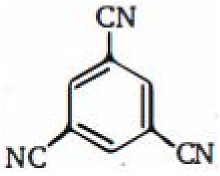
$(a)$ $C^{\oplus}$ stability $\propto$: $+H$ on carbocation

44. Which one of the following compounds has non zero dipole moment?

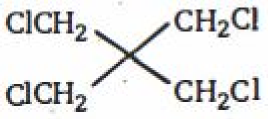
(A)



(B)



(C)



(D)

**Ans. :** a

$(a)$ Cis molecule has non-zero dipole moment

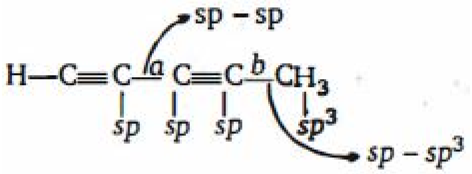
45. $H-C\equiv C\overset{a}{-}C\equiv C\overset{b}{-}CH_3$

Compare the bond lengths $a$ and $b$

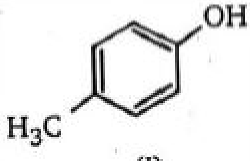
(A) $a=b$ (B) $a>b$ (C) $b>a$ (D) $a>>>b$

**Ans. :** c

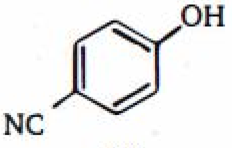
bond $'a'$ has more $s$ characters



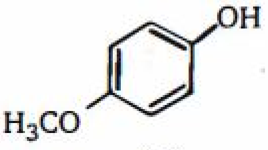
46. Increasing order of acidic strength of given compounds is



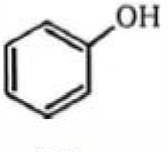
(I)



(II)



(III)



(IV)

(A) $III<I<IV<II$ (B) $II<I<IV<III$

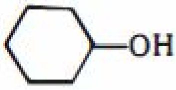
(C) $I<III<IV<II$ (D) $I<III<II<IV$

**Ans. :** a

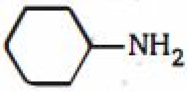
$(a)$ Acidic strength $\propto -I;-H;-M \propto \frac{1}{+I;+H;+R}$

47. Rank in the order of increasing acidity

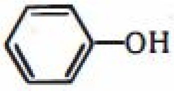
(I)



(II)



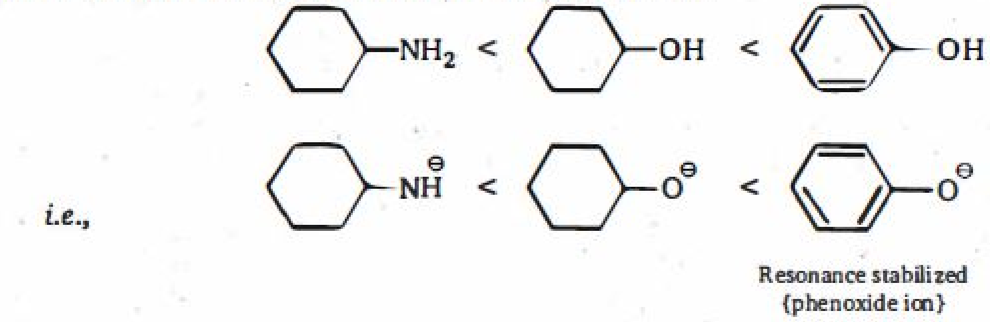
(III)



(A) $III<I<II$ (B) $I<III<II$ (C) $III<II<I$ (D) $II<I<III$

**Ans. :** d

Order of Acidic strength $\propto$ stability of conjugate base.



48. Heat of combustion of two isomer $x$ and $y$ are $17\,kJ/mol$ and $12\,kJ/mol$ respectively. From this information it may be concluded that

(A) isomer $x$ is $5\,kJ/mol$ more stable

(B) isomer $y$ is $5\,kJ/mol$ less stable

(C) isomer $y$ has $5\,kJ/mol$ more potential energy

(D) isomer $x$ is $5\,kJ/mol$ less stable

**Ans. :** d

$(d)$ Stability $\propto \frac{1}{heat\ of\ combution}$

49. Decreasing order of acid strengths is

$$\underset{(A)}{Ph-OH},\ \underset{(B)}{Ph-CH_2-OH},\ \underset{(C)}{Ph-CO_2H},\ \underset{(D)}{Ph-CH_2-\overset{\oplus}{N}H_3}$$

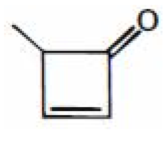
(A) $B>A>C>D$ (B) $C>A>B>D$ (C) $C>A>D>B$ (D) $C>B>A>D$

**Ans. :** c

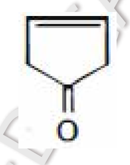
$(c)$ Acidic strength $\propto$ Stability of resulting anion.

50. Dipole moment of which ketone is maximum ?

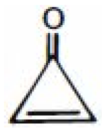
(A)



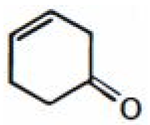
(B)



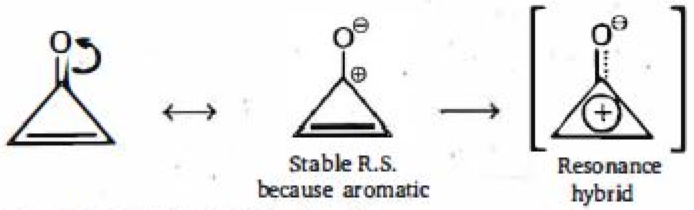
(C)



(D)



**Ans. :** c



so molecule has high dipole.

51. Correct order of basic strengths of given amines is

(A) $\underset{2^o}{Me_2NH} > \underset{1^o}{MeNH_2} > \underset{3^o}{Me_3N} > NH_3$ (Protic solvent)

(B) $\underset{2^o}{Et_2NH} > \underset{3^o}{Et_3H} > \underset{1^o}{EtNH_2} > NH_3$ (Protic solvent)

(C) $Me_3N > Me_2NH > Me - NH_2 > NH_3$ (Gas phase)

(D) All are correct

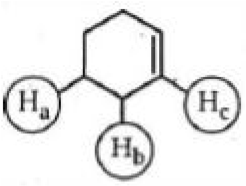
**Ans. :** d

$(d)$ $(a)$ $\underset{2^o}{Me_2NH} > \underset{1^o}{MeNH_2} > \underset{3^o}{Me_3N} > NH_3$ if $(R = -$ Meor Butyl) (in polar protic solvent)

$(b)\, 2^o > 3^o > 1^o > NH_3$ if $(R = -Et)$

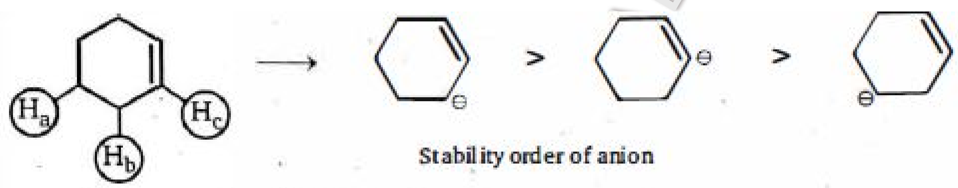
$(c)\, 3^o > 2^o > 1^o > NH_3$ (Gas phase)

52. Rank the hydrogen atoms $(H_a, H_b, H_c,)$ in the following molecules according to their acidic strengths



(A) $a > b > c$ (B) $b > a > c$ (C) $b > c > a$ (D) $a > c > b$

**Ans. :** c



Stability order of anion

So acidic strength order $H_b > H_c > H_a$

53. Rank the following alkenes in order of decreasing heats of hydrogenation largest first)


1


2


3

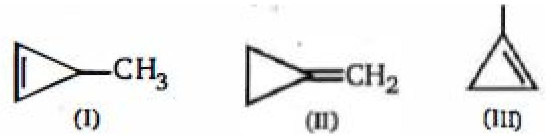

4

(A) $2 > 3 > 4 > 1$ (B) $2 > 4 > 3 > 1$ (C) $1 > 3 > 4 > 2$ (D) $1 > 4 > 3 > 2$

**Ans. :** d

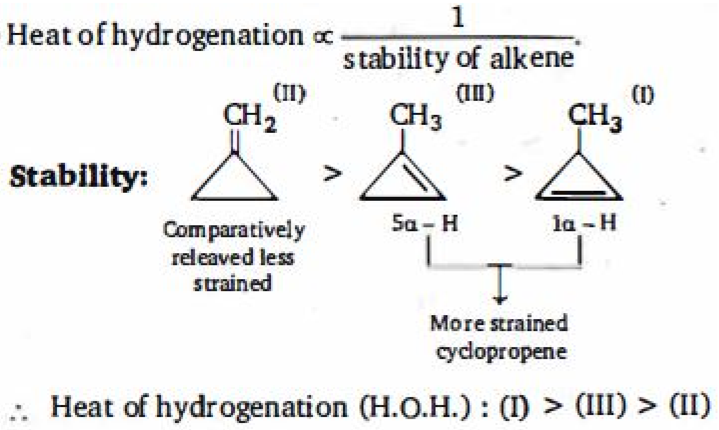
$(d)$ Heat of hydrogenation or heat of combution $\propto \frac{1}{Stability\ of\ alkene}$

54. Which of the following orders is correct for heat of hydrogenation of these compounds ?



(A) $I > III > II$  (B) $III > II > I$  (C) $III > I > II$  (D) $II > I > III$

**Ans. :** a



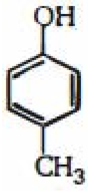
Heat of hydrogenation $\propto \frac{1}{\text{stability of alkene}}$.

∴ Heat of hydrogenation (H.O.H.) : (I) > (III) > (II)

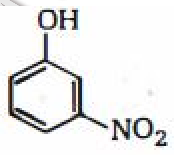
55. Most acidic is

(A)

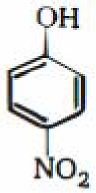
(B)



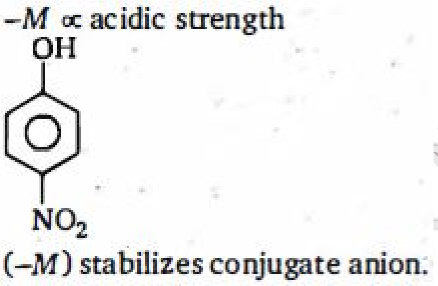
(C)



(D)



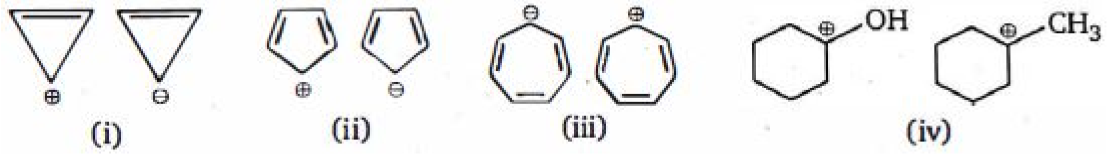
**Ans. :** d



$-M \propto$ acidic strength

$(-M)$ stabilizes conjugate anion.

56. In which pair second ion is more stable than first?



(A) $(i)$ and $(ii)$  (B) $(ii)$ and $(iii)$  (C) $(ii)$ and $(iv)$  (D) $(iii)$ and $(iv)$

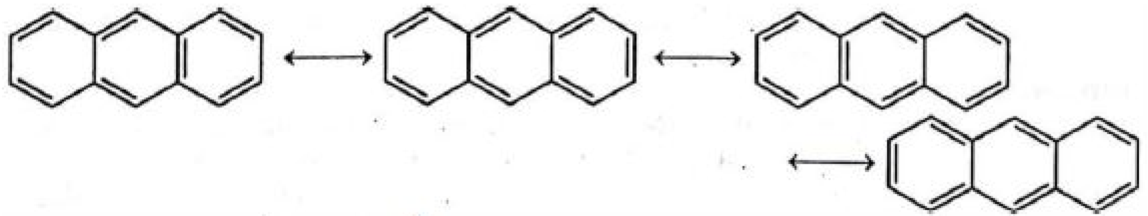
**Ans. :** b

$(b)\,(ii)$ and $(iii)$ $2^{nd}$ ion is aromatic

57. How many resonance structures are there for anthracene ?

(A) $6$ (B) $5$ (C) $4$ (D) $2$

**Ans. :** c



58. Which of the following molecules have non-zero dipole moments ?

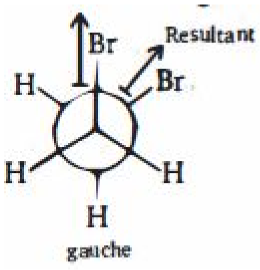
$(I)$ gauche conformation of $1,2$ -dibromoethane
$(II)$ anti conformation of $1,2$ -dibromoethane
$(III)$ trans- $1,4$ -dibromocyclohexane
$(IV)$ cis- $1,4$ -dibromocyclohexane
$(V)$ tetrabromomethane
$(VI)$ $1,1$ -dibromocyclohexane

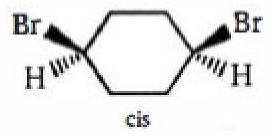
(A) $I$ and $II$ (B) $I$ and $IV$ (C) $II$ and $V$ (D) $I,IV$ and $VI$

**Ans. :** d

$(d)$ Non-zero dipole has following molecules

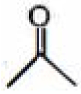
Dibromocyclohexane $\rightarrow$ stereo chemistry and position are not mentioned so maybe cis.



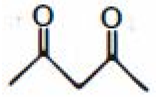


59. Maximum enol content is in

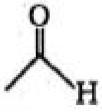
(A)



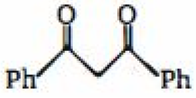
(B)



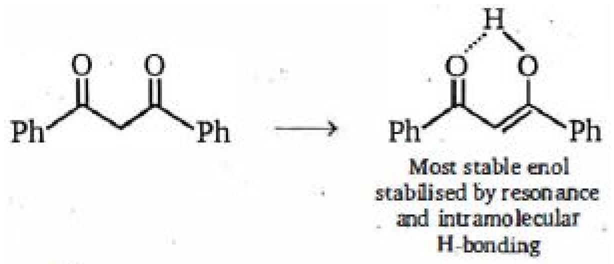
(C)



(D)

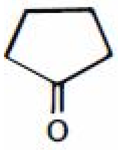


**Ans. :** d

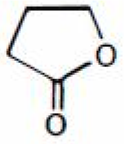


Most stable enol stabilised by resonance and intramolecular H-bonding

60. Among the given compounds, the correct order of enol content is


(I)


(II)

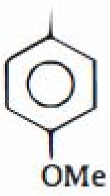

(III)

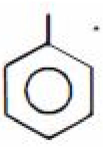
(A) $I > II > III$ (B) $III > II > I$ (C) $II > I > III$ (D) $II > III > I$

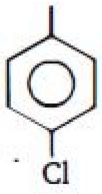
**Ans. :** c

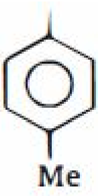
$(c)\, II > I > III$ Stability order of enol form.

61. Migratory aptitude of the following in decreasing order is


(a)


(b)

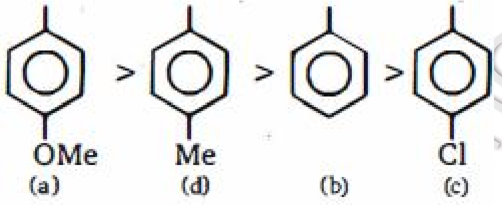

(c)


(d)

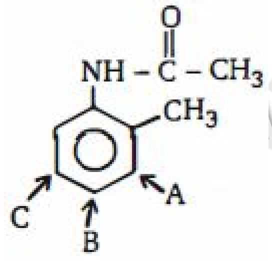
(A) $a > c > b > d$ (B) $a > d > b > c$ (C) $a > d > c > b$ (D) $b > c > a > b$

**Ans. :** b

$(b)$ Migratory aptitude $\propto e^{-}$ density in benzene ring



62. Identify the position where electrophilic aromatic substitution $(EAS)$ is most favourable.



(A) $A$

(B) $B$

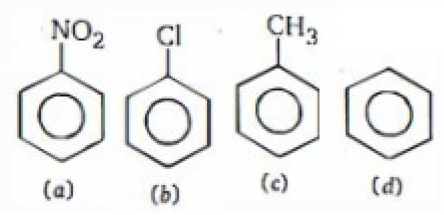
(C) $C$

(D) $A$ અને $C$

**Ans. :** b

$(b)$ $-NH-\overset{\overset{O}{||}}{C}-CH_3$ $(+M$ group) (More activating group)

63. Correct order of rate of $EAS$ (electrophilic aromatic substitution) is

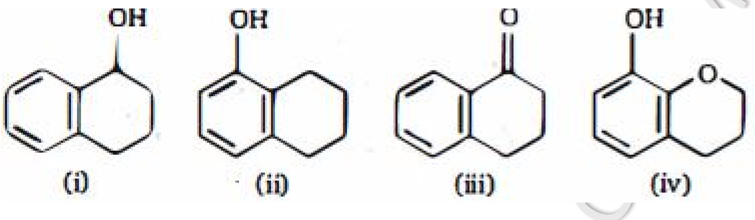


(A) $c > b > a > d$
(B) $c > d > a > b$
(C) $a > b > c > d$
(D) $c > d > b > a$

**Ans. :** d

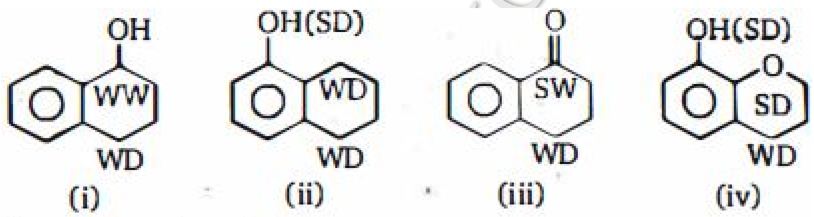
$(d)$ More electron density of ring more is the rate of electrophilic aromatic substitution.

64. Increasing order of rate of reaction with $Br_2/AlCl_3$ is



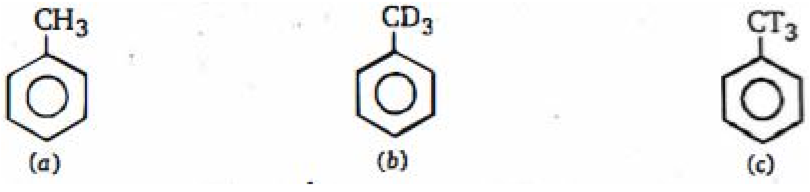
(A) $iii < i < ii < iv$
(B) $iv < ii < i < iii$
(C) $ii < iv < iii < i$
(D) $iv < ii < iii < i$

**Ans. :** a



SD = strong donating
WW = weak withdrawing ∴ iv > ii > i > iii
WD = weak donating

65. Arrange the following in decreasing order of reactivity towards $EAS$ (electrophilic aromatic substitution)



(A) $a > b > c$
(B) $c > b > a$
(C) $a > c > b$
(D) $c > a > b$

**Ans. :** a

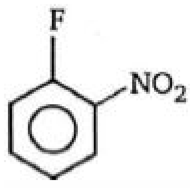
$(a)\ -CH_3 > -CD_3 > -CT_3$

Order of hyperconjugation on the basis of bond energy.

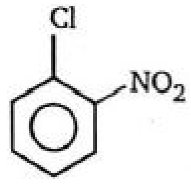
Strong bond means less hyperconjugation.

66. Which of the following $2-$ halo nitrobenzene is most reactive towards nucleophilic aromatic substitution ?

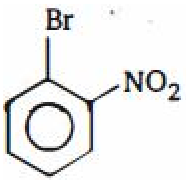
(A)



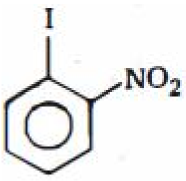
(B)



(C)

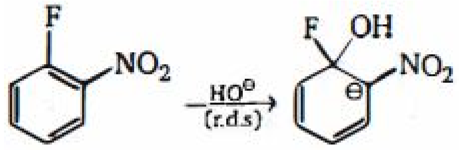


(D)

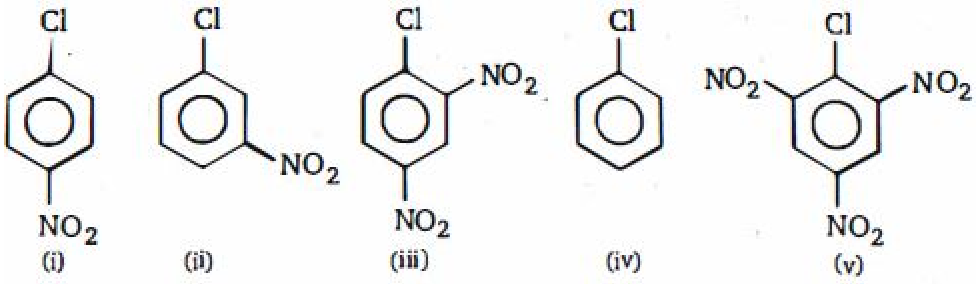


**Ans. :** a

In rate determining step $(r.d.s.)$ only $(-I)$ effect of halogen will operate maximum $(-I)$ effect of $-F$. more rate of reaction.



67. Arrange in their decreasing order of rate in $SN$Ar



(A) $i > ii > iv > iii > v$

(B) $ii > i > iii > v > iv$

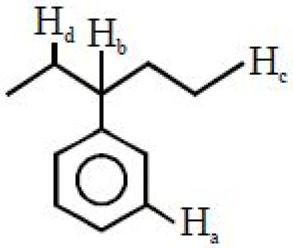
(C) $v > iii > i > ii > iv$

(D) $v > iii > ii > i > iv$

**Ans. :** c

$(c)\, v > iii > i > ii > iv$

68. Correct order of case of replacement of hydrogen atom by chlorine atom in following compound by photochlorination



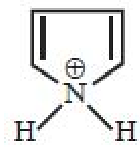
(A) $H_a > H_b > H_c > H_d$ (B) $H_b > H_d > H_a > H_c$

(C) $H_b > H_d > H_c > H_a$ (D) $H_d > H_b > H_c > H_a$

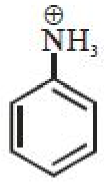
**Ans. :** (C) $H_b > H_d > H_c > H_a$

69. In which of the molecule $\pi-$ electrons are not delocalized ?

(A)

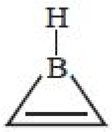


(B)



(C) $H_2C = C = CH_2$

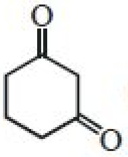
(D)



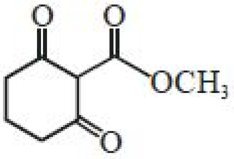
**Ans. :** (C) $H_2C = C = CH_2$

70. Arrange the following in increasing order of their acidic strength

(I)



(II)

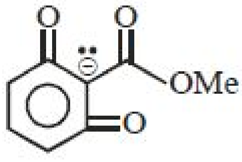


(III)

(A) $II > I > III$ (B) $III > II > I$

(C) $I > II > III$ (D) $III > I > II$

**Ans. :** a



(Most stable anion)

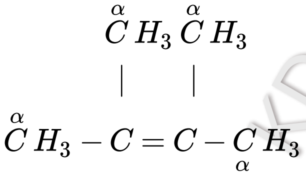
71. The effect that makes $2{,}3-$ dimethyl $-2-$ butene more stable than $2-$ butene is

(A) Resonance (B) Hyperconjugation

(C) Steric effect (D) Inductive effect

**Ans. :** b

Stability $\propto$ Hyperconjugation $\propto$ No. of $\alpha - H$



$$\overset{\alpha}{C}H_3 - \underset{\underset{\overset{\alpha}{C}H_3}{|}}{C} = \underset{\underset{\overset{\alpha}{C}H_3}{|}}{C} - \underset{\alpha}{C}H_3$$

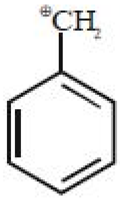
$12\ \alpha-Hydrogen$
$More\ hyperconjugation$

$$\overset{\alpha}{C}H_3 - CH = CH - \overset{\alpha}{C}H_3$$

$6\ \alpha-Hydrogen$
$Less\ Hyperconjugation$

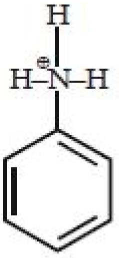
72. Which of the following compounds $+ve$ charge is not show resonance ?

(A)

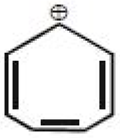


(B) $CH_2 = CH - CH = CH - \overset{\oplus}{C}H_2$

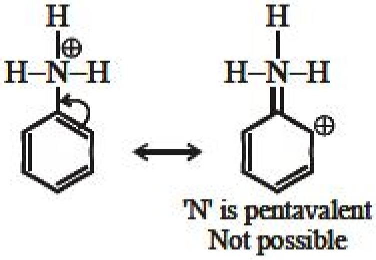
(C)



(D)



**Ans. :** c



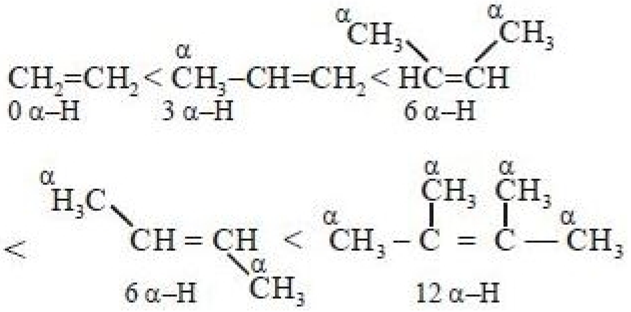
73. Arrange the following according to the increasing order of stability :- Propene $(I)$, cis but $-2-$ ene $(II)$, trans-but $-2-$ ene $(III)$, $2{,}3-$ dimethylbut $-2-$ ene $(IV)$, ethene $(V)$

(A) $V < IV < III < II < I$ (B) $V < I < II < III < IV$

(C) $V < IV < III < I < I$ (D) $IV < III < II < I < V$

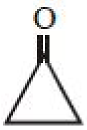
**Ans. :** b

Stability $\alpha$ No. of $\alpha - \mathrm{H}$ atoms trans but$-2-$ene is more stable than cis but$-2-$ene due to less steric hindrance



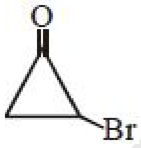
74. Which carbonyl compound has maximum dipole moment

(A)

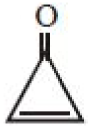


(B)

(C)

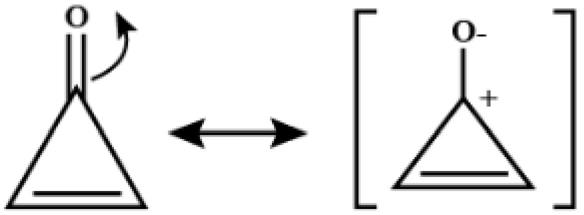


(D)



**Ans. :** d

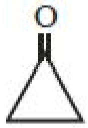
Double bond oxygen can undergo resonance so that $3$ - membered ring species has $2\pi - e^{-}$ and has aromatic character, as a result of this, this species exist in ' $B$ ' form and hence has more dipole because of more charge separation.



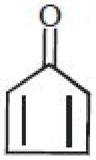
(A) (B)

75. Which carbonyl compound has maximum dipole moment

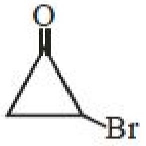
(A)



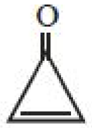
(B)



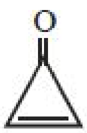
(C)



(D)

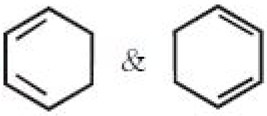


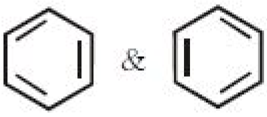
**Ans. :** (D)



76. Which of the following pair of structure does not represent resonating structure

(A) 

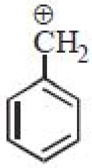
(B) 

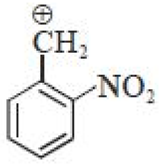
(C) 

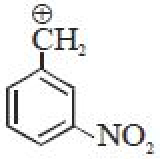
(A) $(A)$ and $(B)$ (B) $(B)$ and $(C)$ (C) $(A)$ and $(C)$ (D) $(A),(B)$ and $(C)$

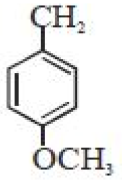
**Ans.:** (A) $(A)$ and $(B)$

77. Which of the following carbocation is least stable

(A)


(B)


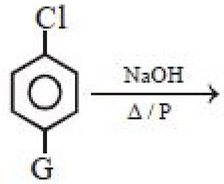
(C)


(D)


**Ans. :** b

due to $-M$ effect of $-NO_2$ group at ortho postion

78. Rate of reaction is maximum if $G$ is

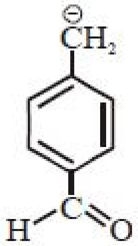


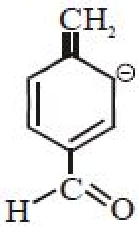
(A) $-OCH_3$ (B) $-CH_3$ (C) $-NO_2$ (D) $-H$

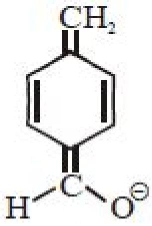
**Ans. :** c

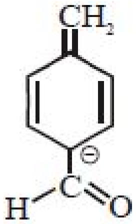
The given reaction is a nucleophilic substitution reaction. This will be more favored is the electron density of the ring is reduced by some electron withdrawing group. Hence, the rate of given reaction is maximum if $G$ is $NO_2$.

79. The most stable resonating structure is

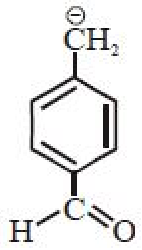
(A)


(B)


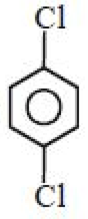
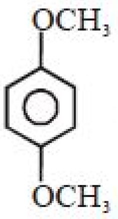
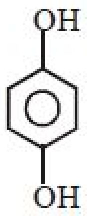
(C)


(D)


**Ans.:** (A)



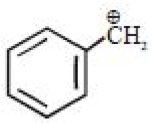
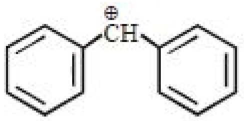
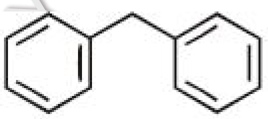
80. In which of the following dipole moment of species are non zero

(i)

(ii)

(iii)

(iv) $SF_4$

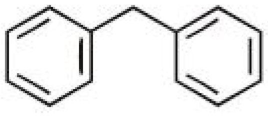
(A) $i, ii, iii$ (B) Only $iv$ (C) $ii, iii$ and $iv$ (D) All

**Ans. :** (C) $ii, iii$ and $iv$

81. Which of the following has hyperconjugation effect

(A)

(B)

(C)

(D) None of these

**Ans. :** (C)



82. Which of the following orders of relative strength of acid is correct

(A) $CH_3COOH > HCN > HOH > C_2H_5OH$

(B) $CH_3COOH < HCN < HOH < C_2H_5OH$

(C) $CH_3COOH > HCN < HOH < C_2H_5OH$

(D) $CH_3COOH < HCN < HOH > C_2H_5OH$

**Ans. :** a

$CH_3COOH > HCN > HOH > C_2H_5OH$

83. Which type of the overlap of orbitals involves in hyperconjugation ?

(A) $\pi - \pi$ (B) $\sigma - \pi$ (C) $\sigma - \sigma$ (D) $p - p$

**Ans. :** b

Hyperconjugation involves delocalization of $\sigma$ and $\pi$ bonds orbitals. it undergoes $\sigma - \pi$ conjugation. The kind of delocalization involving sigma electrons of single bond and $\pi -$ electrons of multiple bond is called hyperconjugation. Hence $B$ is the correct answer.

84. The correct order of acidic strength is

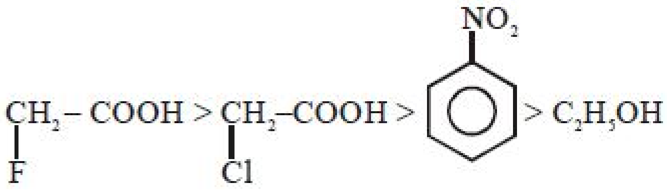
(A) Chloroacetic acid $>$ Fluoroacetic acid $>$ Phenol $>$ Ethanol

(B) Ethanol $>$ Phenol $>$ Chloroacetic acid $>$ Fluoroacetic acid

(C) Fluoroacetic acid $>$ Chloroacetic acid $>$ phenol $>$ Ethanol

(D) Fluoroacetic acid $>$ Chloroacetic acid $>$ Ethanol $>$ Phenol

**Ans. :** c



85. Decreasing$(-I)$ power of given groups is

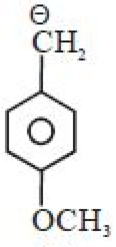
$(A)-CN\ (B)-NO_2\ (C)-NH_2\ (D)-F$

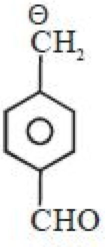
(A) $B>A>D>C$ (B) $B>C>D>A$ (C) $C>B>D>A$ (D) $C>B>A>D$

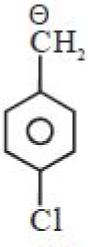
**Ans. :** a

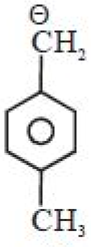
$-I$ effect order $\rightarrow\ -NO_2>\ -CN>\ -F>\ -NH_2$

86. The decreasing order of stability of following anions is


(P)


(Q)


(R)


(S)

(A) $Q>R>S>P$ (B) $R>Q>P>S$ (C) $S>P>R>Q$ (D) $P>Q>R>S$

**Ans. :** a

Stability of carbanion $\propto EWG \propto \frac{1}{ERG}$

87. Dehydrohalogenation of an alkyl halide is a/an

(A) Nucleophilic substitution reaction

(B) Elimination reaction

(C) Both nucleophilic substitution and elimination reaction

(D) Rearrangement

**Ans. :** b

(b)Dehydrohalogenation of an alkyl halide on presence of alcoholic potash is an example of elimination reaction.

$R-CH_2CH_2-Cl+\underset{\text{alc.}}{KOH}\xrightarrow{\Delta}$

$RCH=CH_2+KCl+H_2O$

88. Which of the following applies in the reaction,

$CH_3CHBrCH_2CH_3\xrightarrow{alc.\,KOH}$

$(i)\ CH_3CH=CHCH_3$ (major product)

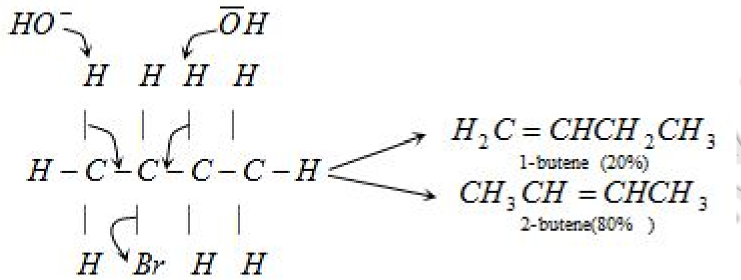
$(ii)\ CH_2=CHCH_2CH_3$ (minor product)

(A) Markovnikov's rule (B) Saytzeff's rule

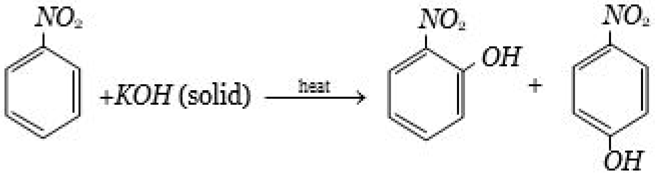
(C) Kharasch effect (D) Hofmann's rule

**Ans. :** b

(b) If the dehydrohalogenation of an alkyl halide can yield more than one alkene, then according to the saytzeff rule, the main product is the most highly substituted alkene.



89. The following reaction is

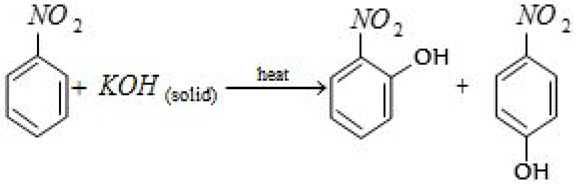


(A) Nucleophilic substitution (B) Electrophilic substitution

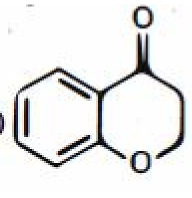
(C) Free radical substitution (D) None of these

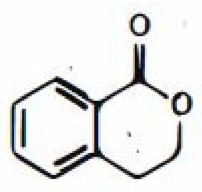
**Ans. :** a

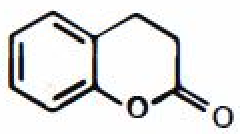
(a) Because $OH^-$is nucleophile.



90. Rank in order of increasing rate of reaction towards $EAS$ with bromine in the presence of $FeBr_3$

(A)


(B)


(C)


(A) $B < A < C$  (B) $B < C < A$  (C) $A < B < C$  (D) $A < C < B$

**Ans. :** a

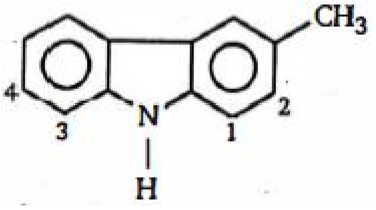
$(a)$ $C > A > B$

$+M$  $+M$  $-M$

$+H$  $-M$  $+H$

$+H =$ hyperconjugation, $M =$ Mesomeric effect.

91. Identify the position where $E.A.S.$ can take place



(A) $1$

(B) $2$

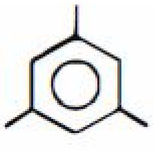
(C) $3$

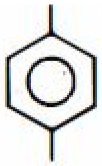
(D) $4$

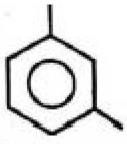
**Ans. :** a

$(a)$ More activated ring will undergo electrophilic attack.

92. Decreasing order of rate of electrophilic aromatic substitution is


(a)


(b)

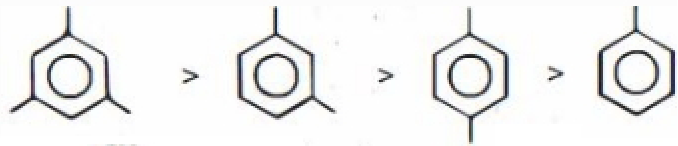

(c)

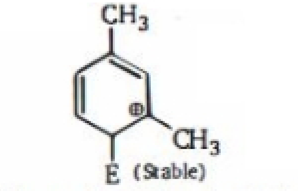

(d)

(A) $a > b > c > d$  (B) $a > c > b > d$  (C) $b > a > c > d$  (D) $b > c > a > d$

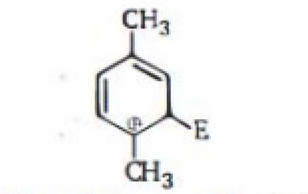
**Ans. :** b

$m-$ xylene is more reactive than $p-$ xylene toward electrophilic aromatic substitution, because of stable $o-$ complex.





(One methyl reinforce the other)



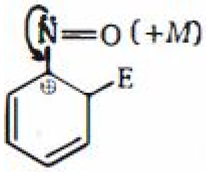
(One methyl countenact the other)

93. Which of the following substitution of benzene is ortho-para in electrophilic substitution and ortho-para in nucleophilic substitution ?

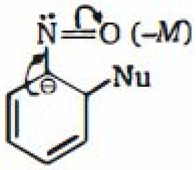
(A) $-NO_2$ (B) $-NO$ (C) $-SO_3H$ (D) $-SO_2Me$

**Ans. :** b

$(b)$ $-N=O$ has $+M$ and $-M$ effect depend upon type of group attached.

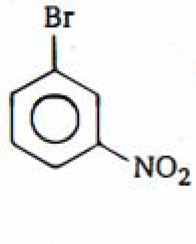


(stable)

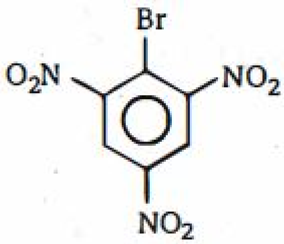


(stable)

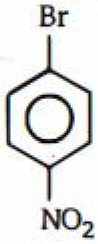
94. The decreasing order of reactivity of given compound towards nucleophilic substitution with aqueous $NaOH$ is



(I)



(II)



(III)

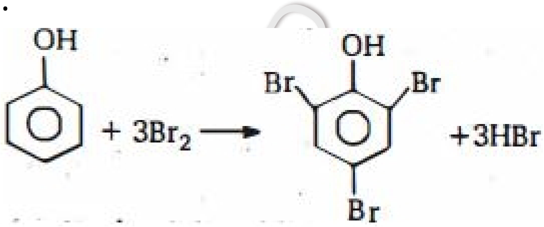
(IV)

(A) $I > II > III > IV$ (B) $II > IV > III > I$ (C) $IV > II > III > I$ (D) $II > IV > I > III$

**Ans. :** b

$(b)$ More $NO_2$ group, more $S_NAr$.

95. .



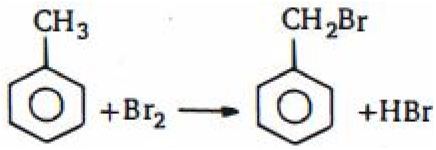
(A) Nucleophilic addition (B) Nucleophilic substitution

(C) Electrophilic addition (D) Electrophilic substitution

**Ans. :** d

$(d)$ Aromatic electrophilic substitution.

96. .

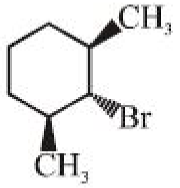


(A) Nucleophilic addition
(B) Nucleophilic substitution
(C) Electrophilic addition
(D) Free radical substitution

**Ans. :** d

$(d)$ Free radical substitution.

97. Why is the alkyl halide below not capable of undergoing an $E_2$ reaction upon treatment with sodium ethoxide



(A) $Br^-$ is too poor leaving group

(B) To much angle strain would be present in the alkene product

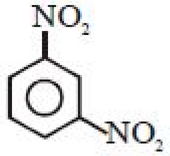
(C) Sodium ethoxide is a poor base to use in $E_2$ reaction.

(D) The $C-H$ and $C-Br$ bond which need to break cannot achieve an anti periplanar orientation.

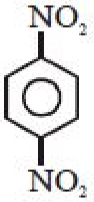
**Ans. :** (D) The $C-H$ and $C-Br$ bond which need to break cannot achieve an anti periplanar orientation.

98. Most reactive compound in following toward electrophilic substitution reaction is

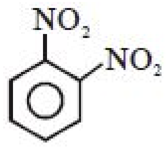
(A)



(B)

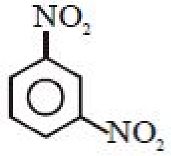


(C)



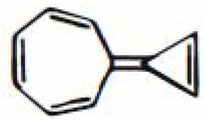
(D) All are equally reactive

**Ans.:** (A)

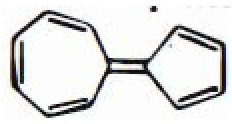


99. Which of the following molecules is expected to have the greatest resonance stabilization ?

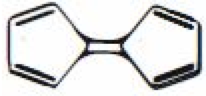
(A)



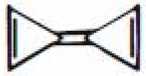
(B)



(C)



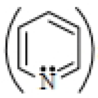
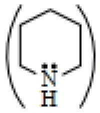
(D)



**Ans. :** b

$(b)$ Both ring will be aromatic after $\pi$ -bond breaking.

100.

Correct order of basic strength of Pyrrole , Pyridine  and Piperidine  is:

(A) Piperidine $>$ Pyridine $>$ Pyrrole

(B) Pyrrole $>$ Pyridine $>$ Piperidine

(C) Pyridine $>$ Piperidine $>$ Pyrrole

(D) Pyrrole $>$ Piperidine $>$ Pyridine

**Ans. :** a

Order of basic strength is

$\mathrm{N}\left(\mathrm{sp}^3\right.$, localized lone pair $)>\mathrm{N}\left(\mathrm{sp}^2\right.$, localized lone pair $)>\mathrm{N}\left(\mathrm{sp}^2\right.$, delocalized lone pair, aromatic)

$\therefore$ Piperidine $>$ Pyridine $>$ Pyrrole

101. Match List $I$ with List $II$

| List $I$ (Amines) | List $II$ $(pK_b)$ |
|---|---|
| $A$ Aniline | $I$ 3.25 |
| $B$ Ethanamine | $II$ 3.00 |

| | |
|---|---|
| $C$ $N-$Ethylethanamine | $III$ 9.38 |
| $D$ $N,N-$Diethylethanamine | $IV$ 3.29 |

Choose the correct answer from the options given below :-

(A) $A-I, B-IV, C-II, D-III$

(B) $A-III, B-II, C-I, D-IV$

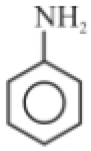
(C) $A-III, B-II, C-IV, D-I$

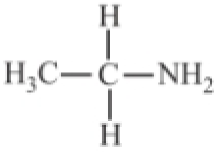
(D) $A-III, B-II, C-IV, D-I$

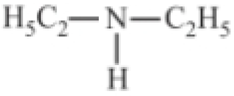
**Ans. :** d

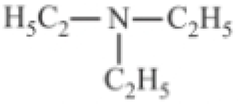
Basic Strength $\alpha \frac{1}{pK_b}$

Order for $pK_b : A > B > D > C$

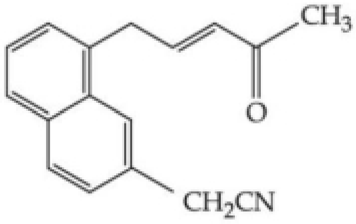

(A) Aniline


(B) Ethanamine


(C) N-Ethylethanamine

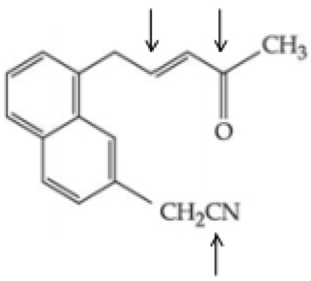

(D) N, N-Diethylethanamine

102. Number of electrophilic centre in the given compound is …… .



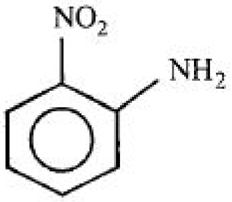
(A) 1 (B) 2 (C) 6 (D) 3

**Ans. :**

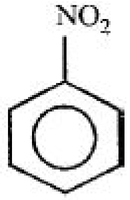


103. Which compound exhibits maximum dipole moment among the following ?

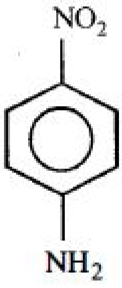
(A)



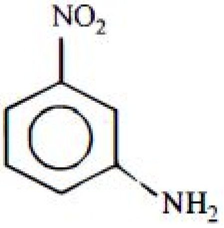
(B)



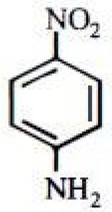
(C)



(D)



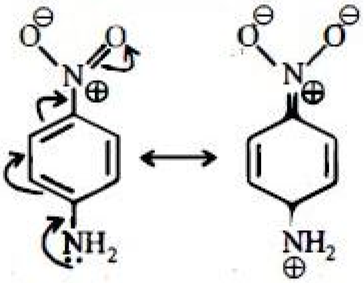
**Ans. :** c



Dipole moment = (Distance between opposite charges) × (charge, q)

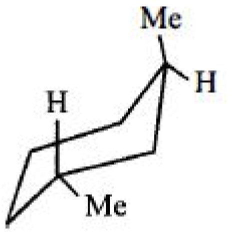
$$\mu = q \times d$$

So, greater the distance between the opposite charges higher the dipole. Due to the resonance the greater charge separation occurs between charges due to linearity.

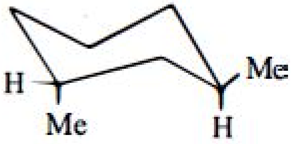


104. Arrange in the correct order of stability (decreasing order) for the following molecules

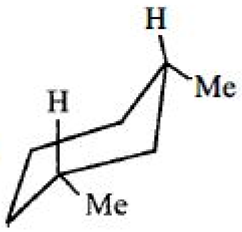
(I)



(II)



(III)



(IV)

(A) $(I) > (II) > (III) > (IV)$

(B) $(IV) > (III) > (II) \approx (I)$

(C) $(I) > (II) \approx (III) > (IV)$ (D) $(III) > (I) \approx (II) > (IV)$

**Ans. :** c

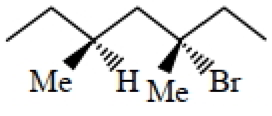
Disequatorial cis $-1, 3-$ Dimethylcyclohexane is more stable as both methyl groups are equatorial and are away from each other. (Refer to Image $I$)

It is followed by trans $-1, 3-$ Dimethylcyclohexane where one $-CH_3$ group is equatorial and other is axial (Refer to Image $II$)

Diaxial cis $-1, 3-$ Dimethylcyclohexane is less stable due to large amount of steric strain due to the interaction of axial - $CH_3$ groups. (Refer to Image $III$ )

$(I) > (II) \approx (III) > (IV)$

105. Match the reactions in List-$I$ with the features of their products in List-$II$ and choose the correct option.

| | **List-I** | | **List-II** |
|---|---|---|---|
| (P) | (-)-1-Bromo-2-ethylpentane (single enantiomer) $\xrightarrow[S_N2 \text{ reaction}]{\text{aq. NaOH}}$ | (1) | Inversion of configuration |
| (Q) | (-)-2-Bromopentane (single enantiomer) $\xrightarrow[S_N2 \text{ reaction}]{\text{aq. NaOH}}$ | (2) | Retention of configuration |
| (R) | (-)-3-Bromo-3-methylhexane (single enantiomer) $\xrightarrow[S_N1 \text{ reaction}]{\text{aq. NaOH}}$ | (3) | Mixture of enantiomers |
| (S) |  <br>(Single enantiomer) $\xrightarrow[S_N1 \text{ reaction}]{\text{aq. NaOH}}$ | (4) | Mixture of structural isomers |
| | | (5) | Mixture of diastereomers |

(A) $\mathrm{P \rightarrow 1; Q \rightarrow 2; R \rightarrow 5; S \rightarrow 3}$

(B) $\mathrm{P \rightarrow 2; Q \rightarrow 1; R \rightarrow 3; S \rightarrow 5}$

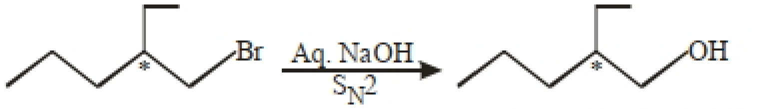
(C) $\mathrm{P \rightarrow 1; Q \rightarrow 2; R \rightarrow 5; S \rightarrow 4}$

(D) $\mathrm{P \rightarrow 2; Q \rightarrow 4; R \rightarrow 3; S \rightarrow 5}$

**Ans. :** b

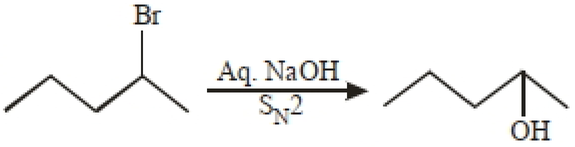
$P \rightarrow 2, \mathrm{Q} \rightarrow 1, R \rightarrow 3,\ \mathrm{S} \rightarrow 5$

(P)



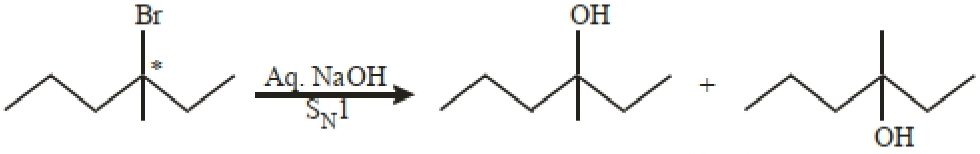
Retention of configuration

(Q)



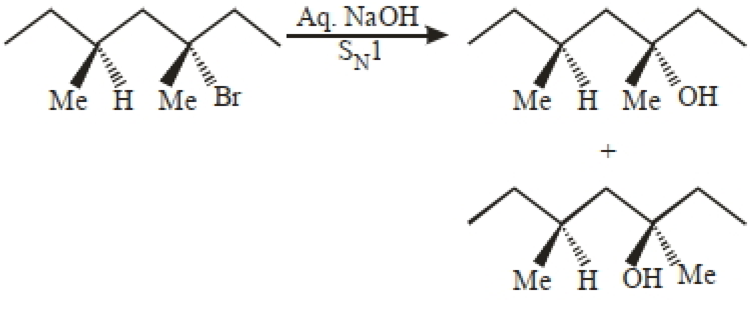
Inversion of configuration

(R)



Mixture of enantiomers

(S)



Diastereomeric mixture

106. Hyperconjugation involves overlap of the following orbitals

(A) $\sigma - \sigma$ (B) $\sigma - \mathrm{p}$ (C) $\mathrm{p} - \mathrm{p}$ (D) $\pi - \pi$

**Ans. :** b

Hyperconjugation involves overlap of $\sigma - p$ orbitals.

107. Which of the following resonating structures of $1-$methoxy$-1,3-$butadiene is least stable

(A) $\overset{\ominus}{C}H_2 - CH = CH - CH = \overset{\oplus}{O} - CH_3$

(B) $CH_2 = CH_2 - \overset{\ominus}{C}H - CH = \overset{\oplus}{O} - CH_3$

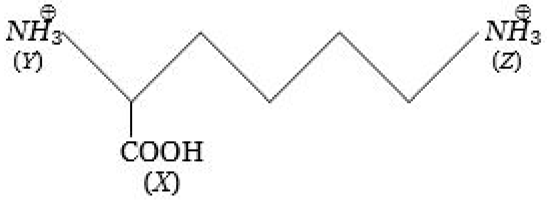
(C) $CH_3 - CH_2 - \overset{\ominus}{C}H - CH = \overset{\oplus}{O} - CH_3$

(D) $CH_2 = CH - \overset{\ominus}{C}H - \overset{\oplus}{C}H - O - CH_3$

**Ans. :** c

(c) The octet of all atoms are complete in structures $(a)$ and $(b)$. In structure $(d)$ electron deficiency of positively charged carbon is duly compensated by lone pair electrons of adjacent oxygen atom while such neighbour group support is not available in structure $(c)$.

108. In the compound given below The correct order of the acidity of the positions $(X)$, $(Y)$ and $(Z)$ is



(A) $(Z) > (X) > (Y)$ (B) $(X) > (Y) > (Z)$ (C) $(X) > (Z) > (Y)$ (D) $(Y) > (X) > (Z)$

**Ans. :** b

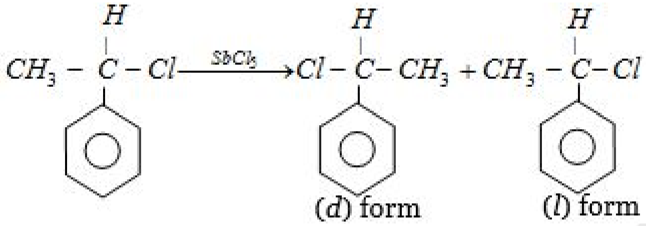
It’s obvious.

109. A solution of $D(+)\ -2-$chloro$-2-$phenylethane in toluene racemises slowly in the presence of small amount of $SbCl_5$, due to the formation of

(A) Carbanion (B) Carbene (C) Free radical (D) Carbocation

**Ans. :** d

(d)



110. In carbonium ion the carbon bearing the positive charge in the

(A) $sp^2$- hybridized state (B) $sp^3d$- hybridized state

(C) $sp$- hybridized state

(D) $sp^3$- hybridized state

**Ans. :** a

(a) The central carbon atom in carbonium ion is $sp^2$ hybridised and it has three $sp^2$ hybrid orbitals for single bonding to three substituents.

111. The shape of carbonium is

(A) Planar (B) Pyramidal (C) Linear (D) None of these

**Ans. :** a

(a) Carbonium ion is planar species

112. Which of the following is a polar compound

(A) $C_2H_6$ (B) $CCl_4$ (C) $HCl$ (D) $CH_4$

**Ans. :** c

(c) We know that there is more difference in the electronegativities of hydrogen and chlorine. Therefore $HCl$ is a polar compound.

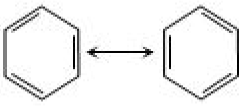
113. All bonds in benzene are equal due to

(A) Tautomerism (B) Inductive effect (C) Resonance (D) Isomerism

**Ans. :** c

(c) All the bonds $(C-C)$ are equal in benzene

The C-C bond length is $1.39\overset{o}{A}$ which is in between $C-C$ bond $(1.34\overset{o}{A})$ and $C-C$ $(1.34\overset{o}{A})$.



114. $'C-C'$ bond length in benzene lies between single and double bond. The reason is

(A) Resonance (B) Isomerism (C) Metamerism (D) Inductive effect

**Ans. :** a

(a) Due to delocalisation of $\pi$ electrons benzene has resonance.

115. Which of the following has strongest $+I$ effect?

(A) $-\overset{\Theta}{O}$ (B) $-CH_2-CH_3$ (C) $-CH_3$ (D) $-CD_3$

**Ans.:** (A) $-\overset{\Theta}{O}$

116. The solvent which neither accepts proton nor donates proton is called

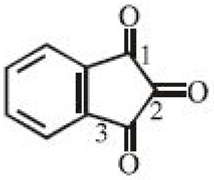
(A) Amphoteric (B) Neutral

(C) Aprotic (D) Amphiprotic

**Ans. :** c

(c)The solvent which neither accept proton nor donates.

117. Which carbonyl group is most reactive for $NAR$ ?



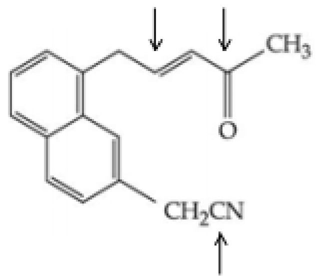
(A) $1$

(B) $2$

(C) $3$

(D) All have same reactivity

**Ans. :** d

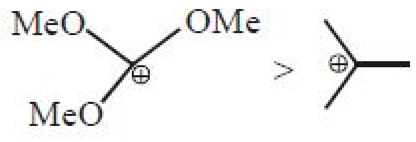


118. Identify correct stability order ?

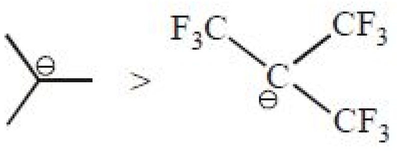
(A)

(B)

(C)

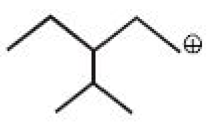


(D)



**Ans. :** (C)

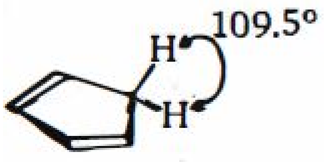
119. How many $1,2-$ shift takes place in following carbocation.



(A) $2$ (B) $1$ (C) $3$ (D) $4$

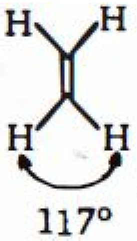
**Ans. :** (C) $3$

120. Selected bond angles for six hydrocarbons are shown below. Arrange these hydrocarbons according to their $pK_a$ values, from the lowest to the highest

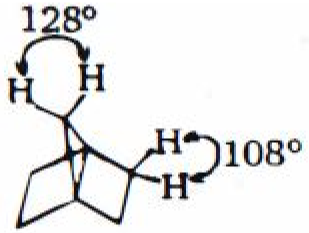


(I)

(II)



(III)



(IV)

(V)

(VI)

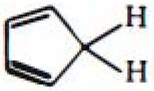
(A) $V < I < VI < II < III < IV$

(B) $IV < I < II < III < V < VI$

(C) $II < IV < I < VI < V < III$

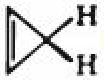
(D) $I < V < IV < III < II < VI$

**Ans. :** d



most acidic because ring is aromatic after deprotonation.

$H—C\equiv C—H$ is next most acidic compound because % s characters are high.



is least acidic because anion is anti aromatic and remaining compounds are arrange on the basis of % s characters.

121. Dichloro carbene form by chloroform and alc. $KOH$, which reaction involve this carbene

(A) Schmidt reaction

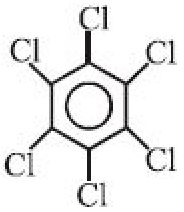
(B) Reimer-tiemann reaction

(C) Carbyl amine reaction

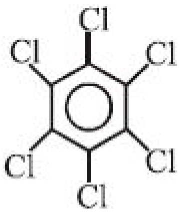
(D) $(B)$ and $(C)$ both

**Ans. :** (D) $(B)$ and $(C)$ both

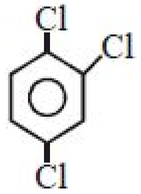
122. Which has maximum dipole moment ?



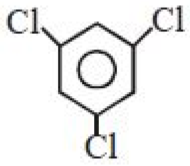
(A)



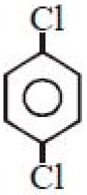
(B)



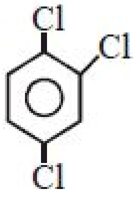
(C)



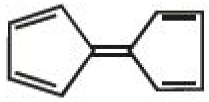
(D)



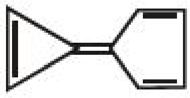
**Ans. :** (B)



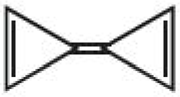
123. Consider the following compounds Which compound possesses highest dipole moment ?



(I)



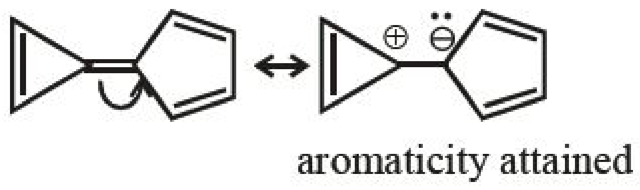
(II)



(III)

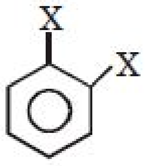
(A) $I$ (B) $II$ (C) Both $I$ and $II$ (D) $III$

**Ans. :** b

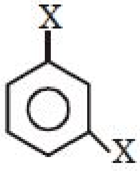


124. Which molecule has maximum dipole moment $(\mu)$ ? { where $X = -NO_2$}

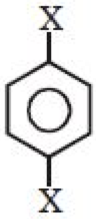
(A)



(B)

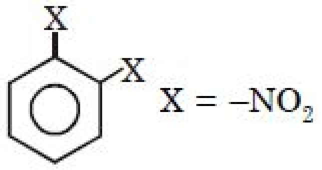


(C)



(D) All has same $'\mu'$

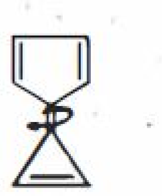
**Ans. :** a



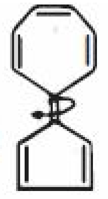
$\mu$ = max because $\theta = 60°$

125. Compare carbon-carbon bond rotation across $A, B$, and $C$

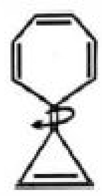
(A)



(B)

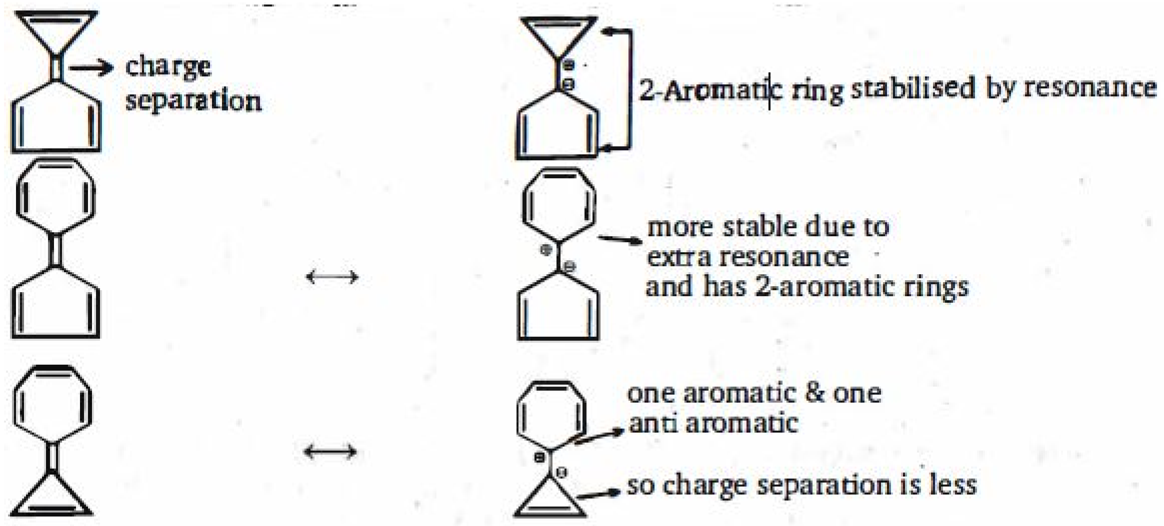


(C)



(A) $A > B > C$ (B) $A > C > B$ (C) $B > A > C$ (D) $B > C > A$

**Ans. :** c



charge separation

2-Aromatic ring stabilised by resonance

more stable due to extra resonance and has 2-aromatic rings

one aromatic & one anti aromatic

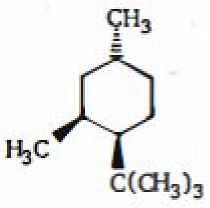
so charge separation is less

so bond rotation energy $C > A > B$

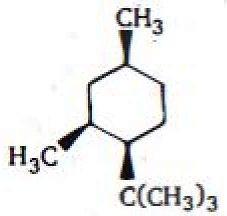
so order of rotation is $B > A > C$

126. Which one of the following has the smallest heat of combustion ?

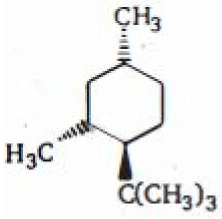
(A)



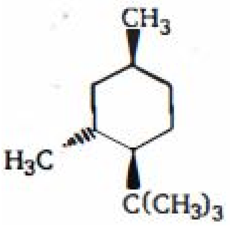
(B)



(C)

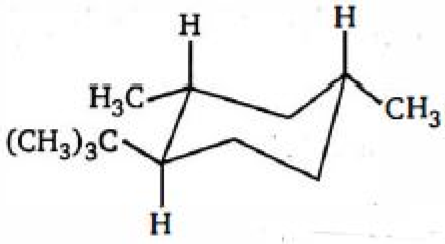


(D)



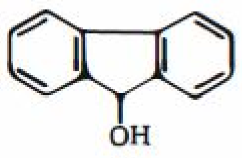
**Ans. :** c

Heat of combustion $\propto \left[\dfrac{1}{\text{Stability of molecule}}\right]$

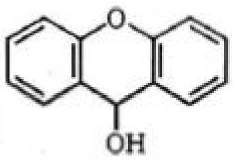


is most stable and so its heat of combustion will be least.

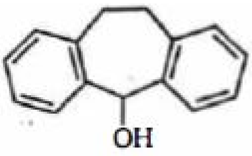
127. Arrange the following alcohols in decreasing order of the ease of ionization under acidic conditions.



(I)



(II)

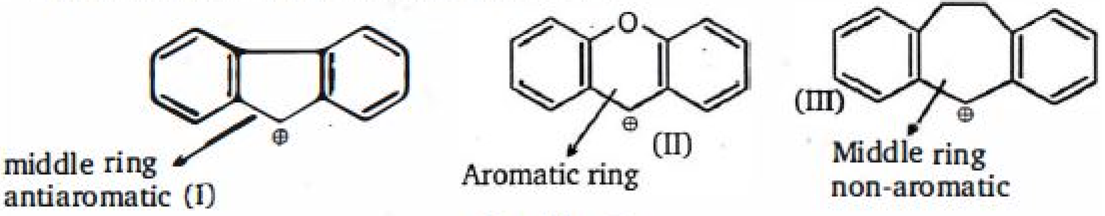


(III)

(A) $I > III > II$ (B) $I > II > III$ (C) $II > III > I$ (D) $II > I > III$

**Ans. :** c

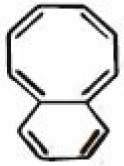
After dehydration carbocations are formed.



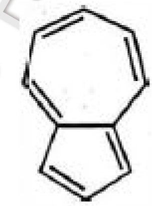
II > III > I

128. Which of the following is most polar?

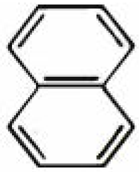
(A)



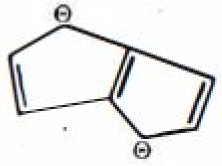
(B)



(C)

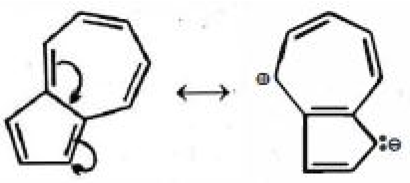


(D)

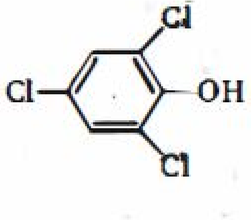


**Ans. :** b

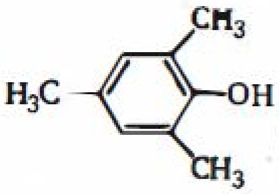
Quasi-aromatic and polar. (Both rings are aromatic)



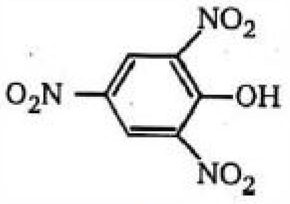
129. Rank the following compounds in order of increasing acidity (weakest acid first).



1



2



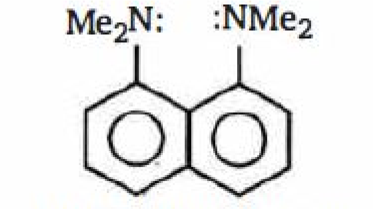
3

(A) $2<3<1$ (B) $3<1<2$ (C) $1<2<3$ (D) $2<1<3$

**Ans. :** d

$(d)$ Acidic strength $\propto$ electron withdrawing groups at acid.

130. Its basic strength is $10^{10}$ more than $I$ -dimethyl amino naphthalene. Reason for high basic strength is



1, 8-Bis (dimethylamino) naphthalene is after referred so as (Proton sponge)

(A) resonance

(B) steric inhibitation of resonance

(C) ortho effect

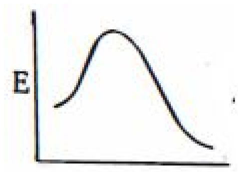
(D) hyperconjugation

**Ans. :** b

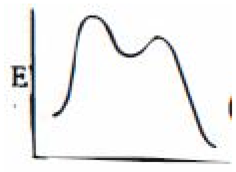
$(b)$ Steric effects can indirectly affect acidity or basicity by affecting the resonance. Steric effects can also be caused by other types of strain. $1,8$ - bis(diethylamino)- $2,7$ -dimethoxynaphthalene $(1)$ is an extremely strong base for a tertiary amine ($pK_a$ of the conjugate acid $=16.3$; compare $N,N$ - dimethylaniline , $pK_a=5.1$), but proton transfers to and from the nitrogen are exceptionaly slow ; enough to be followed by a $uv$ -spectrophotometer. $1$ is severely strained because the two nitrogen lorie pairs are forced to be near each other. Protonation relieves the strain : one lone pair is now connected to a hydrogen, which forms a hydrogen bond to the other lone pair (shown in $2$). The same effects are found in $4,5$ -bis (dimethylamino) fluorene $(3)$ and $4,5$ - bis (dimethylamino).

131. Which energy diagram best represents the given reaction ?

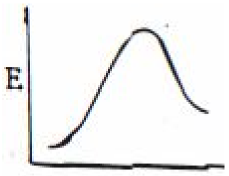
(A)



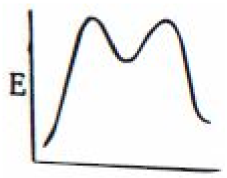
(B)



(C)

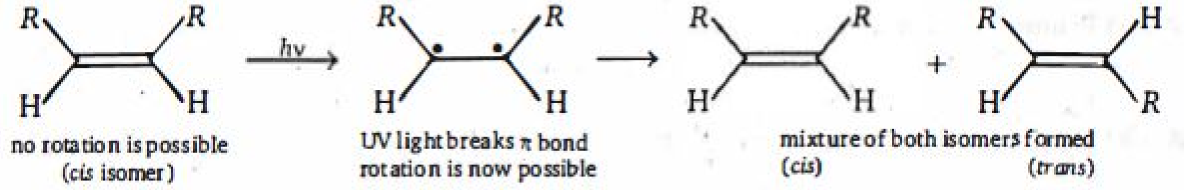


(D)



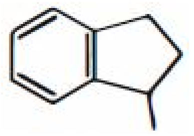
**Ans. :** d

$(d)$ It is possible to interconvert cis and trans alkenes, but the $\pi$ -bond must be broken first. This requires a considerable amount of energy - around $260\,kJ\,mol^{-1}$ .One way to break the $\pi$ -bond would be to promote an electron from the $\pi$ -orbital to the $\pi^*$ -orbital. If this were to happen, there would be one electron in the bonding $\pi$ -orbital and one in the antibonding $\pi^*$ -orbital and hence no overall bonding. Electromagnetic radiation of the correct energy could promote the electron from $HOMO$ to $LUMO$. The correct energy actually corresponds to light in the ultraviolet $(UV)$ region of the spectrum. Thus, shining $UV$ light on an alkene would promote an electron from its bonding $\pi$ -molecular orbital to its antibonding $\pi^*$ -molecular orbital, thereby breaking the $\pi$ -bond (but not the $\sigma$ -bond) and allowing rotation to occur.

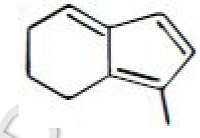


132. Which of the following isomeric hydrocarbons is most acidic ?

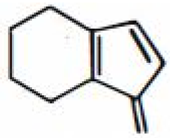
(A)



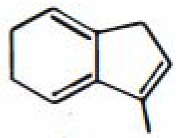
(B)



(C)

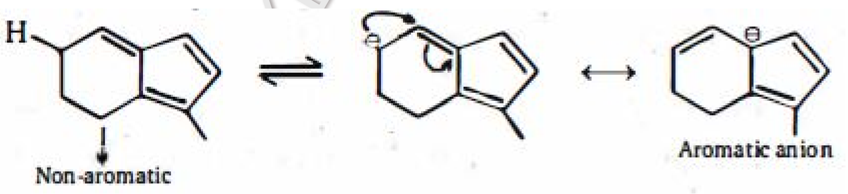


(D)

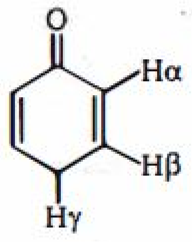


**Ans. :** b

"So" above compound is acidic



133. In the enolization of the given molecule, the $H$ -atom involved is



(A) $\alpha - H$

(B) $\beta - H$

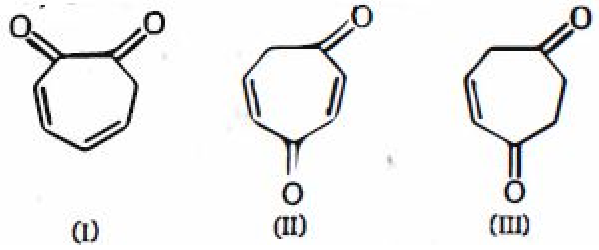
(C) $\gamma - H$

(D) cannot be enolized

**Ans. :** c

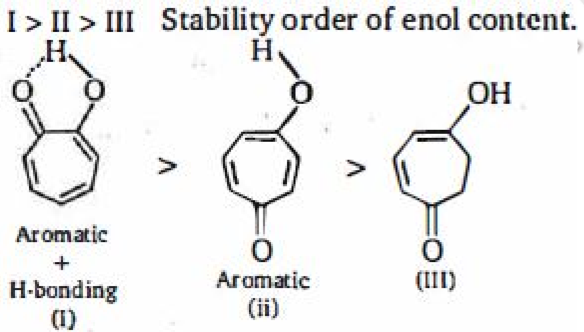
$(c)\, \gamma - H$ attached with $sp^3$ and its conjugate base is resonance stabilized.

134. Among the given compounds, the correct order of enol content is

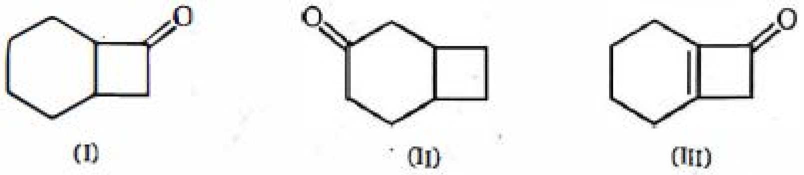


(A) $I > II > III$ (B) $III > II > I$ (C) $II > I > III$ (D) $II > III > I$

**Ans. :** a



135. Among the given compounds, the correct order of enol content is



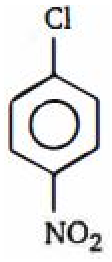
(A) $I > II > III$ (B) $III > II > I$ (C) $III > I > II$ (D) $II > I > III$

**Ans. :** d

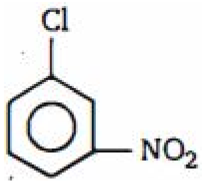
$(d)\, II > I > III$ Stability order of enol form

136. Which one of the following compounds is most reactive for $ArS_{N^2}$ reaction ?

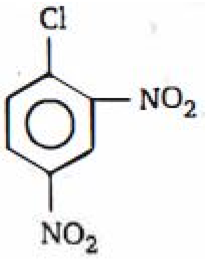
(A)



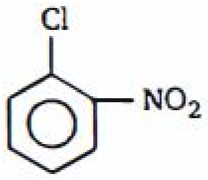
(B)



(C)



(D)

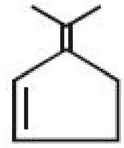


**Ans. :** c

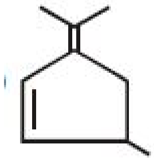
$(c)$ Due to $-M$ of two $-NO_2$ group.

137. Most acidic hydrogen is present in

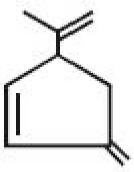
(A)



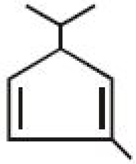
(B)



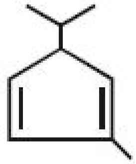
(C)



(D)



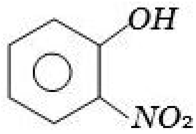
**Ans. :** (D)



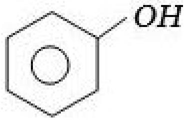
138. Which one of the following compounds is most acidic

(A) $Cl-CH_2-CH_2-OH$

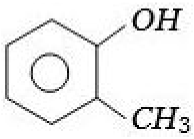
(B)



(C)

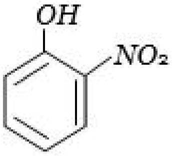


(D)



**Ans. :** b

(b) Electron withdrawing group increases acidic character due to $-I$ and $-R$ effect of $NO_2$ hence orthonitrophenol is most acidic.



139. Which of the following is not an electrophile

(A) $NO_2$ (B) $Na^+$ (C) $H^+$ (D) $BF_3$

**Ans. :** b

(b) $Na^+$ is not an electrophile.

140. Which one of the following orders is correct regarding the inductive effect of the substituents

(A) $-NR_2 < -OR > -F$

(B) $-NR_2 > -OR > -F$

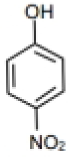
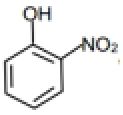
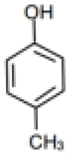
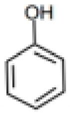
(C) $-NR_2 < -OR < -F$

(D) $-NR_2 > -OR < -F$

**Ans. :** c

Alkyl is an electron releasing group has $+I$ inductive effect. $-F$ has $-I$ inductive effect. Oxygen is more electronegative than nitrogen. Therefore the order of $-I$ effect is $-NR_2 < -OR < -F$

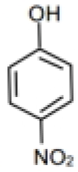
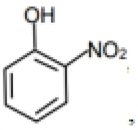
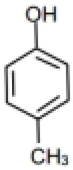
141. Order of acidic nature

(a) 
(b) 
(c) 
(d) 

(A) $a > c > d > b$ (B) $a > b > d > c$ (C) $a > b > c > d$ (D) $d > c > b > a$

**Ans. :** b

In compound $(a)$, $NO_2$ possesses the $-M$ effect at para position due to which it is highly acidic than other three compounds. The compound $(b)$ has intermolecular hydrogen bonding and it is less acidic than $(a)$. In compound $(d)$, there is absence of an electron donating group, due to which it is more acidic than compound $(c)$, which has electron donating methyl group. Therefore, the correct order of acidic nature is $a > b > d > c$

a) 
, (b) 
, (c) 
and (d) 

142. Which of the following are intermediates in Sandmeyer reaction ?

$(i)\ C_6H_5N^+ \equiv NCl^-$ $(ii)\ C_6H_5N^+ \equiv N$

$(iii)\ \dot{C}_6H_5$ $(iv)\ C_6H_5Cl$

(A) $(ii)$ and $(iii)$ (B) $(i)$ and $(iv)$ (C) $(ii)$ and $(iv)$ (D) $(i)$ and $(ii)$

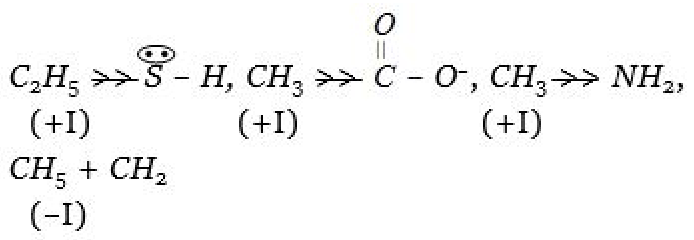
**Ans.:** (A) $(ii)$ and $(iii)$

143. Among the following the strongest nucleophile is

(A) $C_2H_5SH$ (B) $CH_3COO^-$ (C) $CH_3NH_2$ (D) $NCCH_2^-$

**Ans. :** a

(a) Nucleophiles are those substances which can donate a pair of electrons. These can be neutral or negative. The nucleophilic power depends on the tendency of species to donate electrons. This is more, when an electron pushing group ($+I$ group) is present. Among the alkyl groups, those having higher number of $C$ - atoms will push more, hence ethyl $>$ methyl.



$\underset{(+I)}{C_2H_5} \gg \ddot{S} - H$, $\underset{(+I)}{CH_3} \gg \overset{O}{\overset{\|}{C}} - O^-$, $\underset{(+I)}{CH_3} \gg NH_2$,

$\underset{(-I)}{CH_5 + CH_2}$

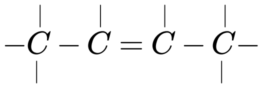
144. The dipole moment is the highest for

(A) Trans$-2-$butene (B) $1{,}3-$Dimethylbenzene

(C) Acetophenone (D) Ethanol

**Ans. :** c

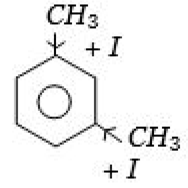
(c) Acetophinone has the highest dipole momentum.

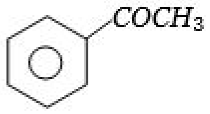
(i) 

$-\overset{|}{\underset{|}{C}} - \overset{|}{C} = \overset{|}{C} - \overset{|}{\underset{|}{C}}-$

Trans - 2 butene ($u$=0)

(iv) $\underset{+I}{C_2H_5}OH$

(ii) 

(iii) 

145. $C-C$ bond length in benzene is......$\overset{o}{A}$

(A) $1.39$

(B) $1.54$

(C) $1.34$

(D) Different in different bonds

**Ans. :** a

(a) $C-C$ bond length in benzene is $1.39\,\overset{o}{A}$ which is in between $C-C$ $(1.54\,\overset{o}{A})$ and $C=C\,(1.34\,\overset{o}{A})$ because of resonance.

146. Dipole moment is shown by

(A) $1,2-$ dichlorobenzene

(B) trans $2,3-$ dichloro $-2-$ butene

(C) $1,4-$ chlorobenzene

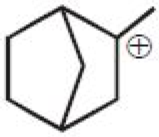
(D) trans $-1,2-$ dinitroethene

**Ans. :** a

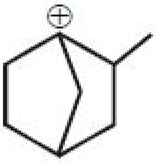
In $1,2$ dichlorobenzene the two dipoles are at $60^o$ (i.e. unsymmetric). Thus possesses dipole moment.

147. Find out correct stability order in the following carbocations

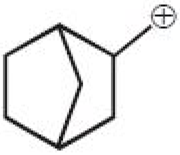
(I)



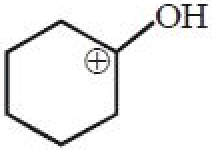
(II)



(III)



(IV)



(A) $IV > I > III > II$

(B) $IV > III > I > II$

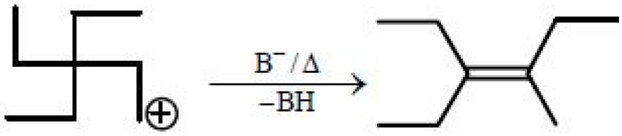
(C) $I > IV > III > II$

(D) $I > III > IV > II$

**Ans. :** a

$iv-$stabilized by back bonding, $3^o$ carbocation more stable than $1^o$ & carbocation in IInd option is at bridge head (Unstable due to angle strain)

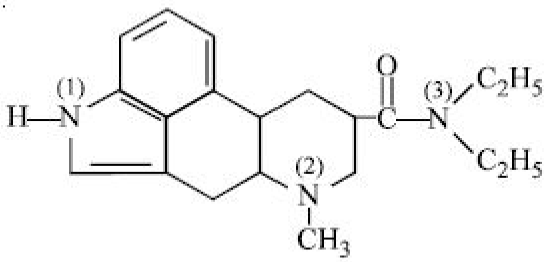
148. Find out the number of $1-2$-shifts during the conversion of



(A) $2$ (B) $3$ (C) $4$ (D) $5$

**Ans. :** (B) $3$

149. Correct order of basicity of various nitrogen in $LSD$ is



(A) $1 > 2 > 3$ (B) $2 > 1 > 3$ (C) $2 > 3 > 1$ (D) $3 > 2 > 1$

**Ans. :** b

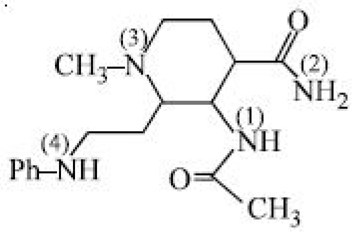
Nitrogen $2$ is most basic because there is no resonance to tie up their electrons and also $3\,R$-groups are electron donating (inductive effect).

Nitrogen $3$ is least basic because the lone pair on $N$ is in resonance with $C=O$ double bond of carbonyl group.

$1$ is less basic than $2$ because in $1$ , the lone pair on $N$ is in resonance with benzene ring as well as with the double bond.

Correct order of basicity of various nitrogen in LSD (lysergic acid diethylamide) is $2 > 1 > 3$.

150. Correct order of basicity is

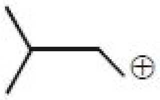


(A) $3 > 1 > 2 > 4$ (B) $3 < 1 < 2 < 4$ (C) $3 < 4 < 1 < 2$ (D) $3 > 4 > 1 > 2$

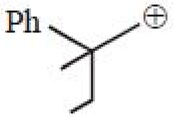
**Ans. :** (D) $3 > 4 > 1 > 2$

151. Which of the following Carbocation will not undergo rearrangement

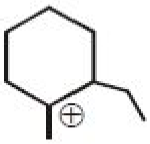
(A)



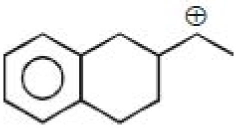
(B)



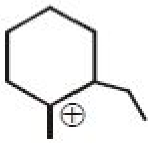
(C)



(D)

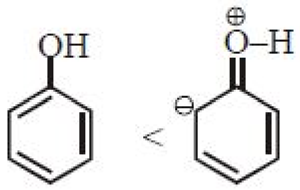


**Ans. :** (C)

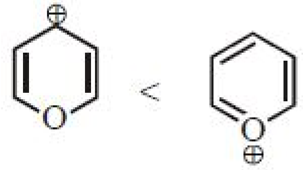


152. Identify correct stability order of resonating structures ?

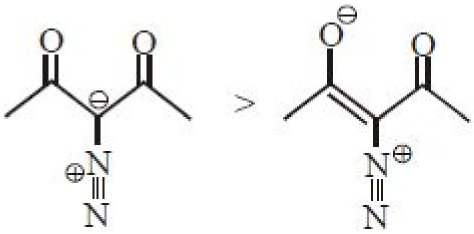
(A)



(B)

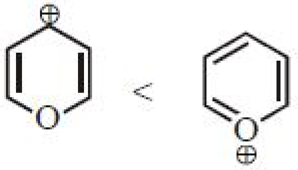


(C)



(D)

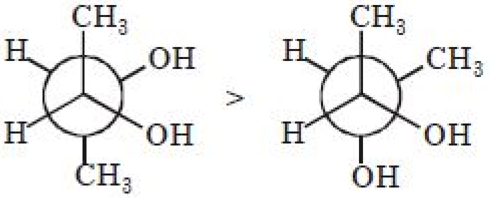
**Ans. :** (B)



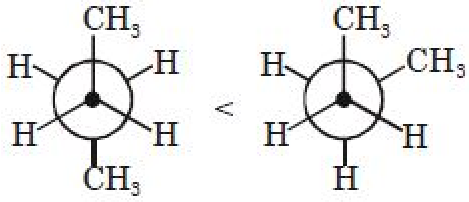
153. Correct stability order is :

(A) $CH_3SO_3^- > CH_3CO_2^- > CH_3CH_2^- > CH_3O^-$

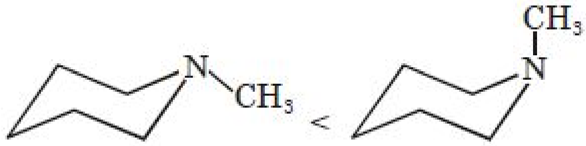
(B)



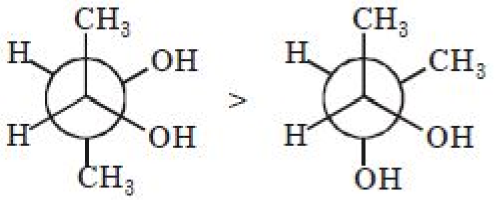
(C)



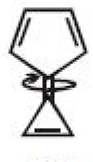
(D)

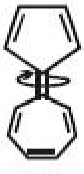


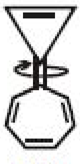
**Ans. :** (B)



154. Compare carbon-carbon bond rotation energy across $A, B$ and $C$


(A)


(B)


(C)

(A) $A > B > C$ (B) $A > C > B$ (C) $B > A > C$ (D) $B > C > A$

**Ans. :** c

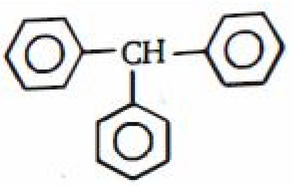
Driving force for breaking of double bond is formation of aromatic species.

Order of stability of ring: $6$ -membered $> 5$- membered $> 7$ membered $> 4$-membered $> 3$-membered

Hence, $(B)$ will break most easily due to formation of stable rings. $(C)$ will not break easily due to formation of antiaromatic ring.

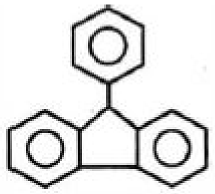
155. Which of the following has lowest $pK_a$ value ?

(A)

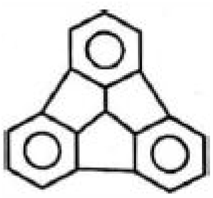


(B)

(C)

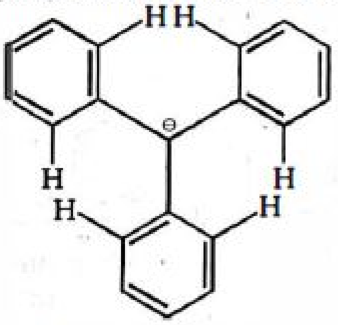


(D)

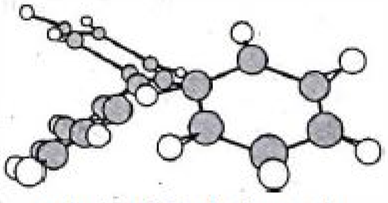


**Ans. :** d

Increasing the number of phenyl groups decreases the $pK_a$ — this is what we expect, since we can delocalize the charge over all the rings. Notice, however, that each successive phenyl ring has less effect on the $pK_a$ : the first ring lowers the $pK_a$ by 8 units, the second by 7, and the third by only 1 unit. In order to have effective delocalization, the system must be planar. Three phenyl rings cannot arrange themselves in a plane around one carbon atom because the ortho-hydrogens clash with each other (they want to occupy the same space) and the compound actually adopts a propeller shape where each phenyl ring is slightly twisted relative to the next.

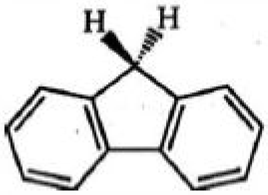


(The hydrogens in the ortho positions try to occupy the same space)

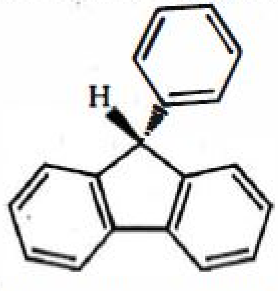


each phenyl ring is staggered relative to the next

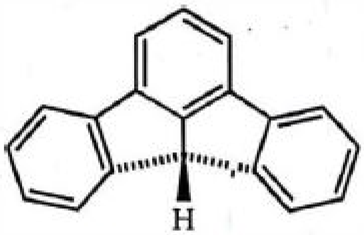
Even though complete delocalization is not possible, each phenyl ring does lower the $pK_a$ because the $sp^2$ carbon on the ring is electron - withdrawing. If we force the system to planar, as in the compounds below, the $pK_a$ is lowered considerably.



fluorene, $pK_a$ 22.8
in the anion, the whole system is planar

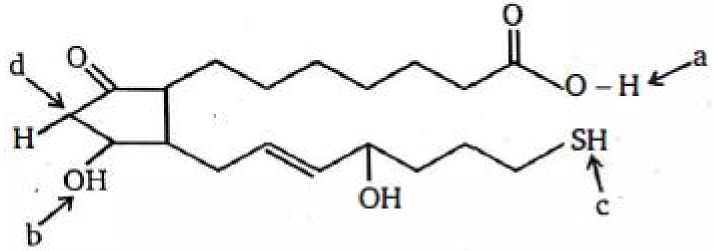


9-phenylfluorene, $pK_a$ 18.5
in the anion, only the two fused fings can be planar



fluoradene $pK_a$ 11
in the anion, the whole system is planar

156. Identify most acidic hydrogen in given compound.

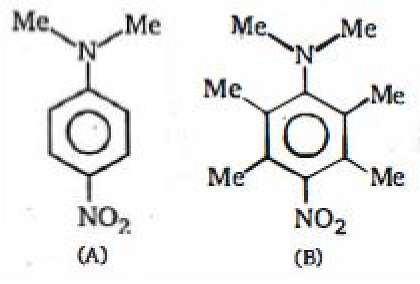


(A) $a$ (B) $b$ (C) $c$ (D) $d$

**Ans. :** a

is most acidic $'H'$ because resulting anion has $2$ -equivalent $R.S$.

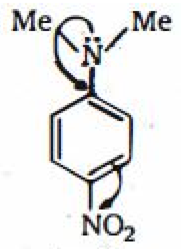
157. Dipole moments of given compound will be



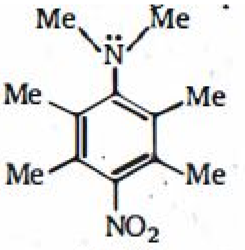
(A) $(A) = 6.87\,D, (B) = 4.11\,D$ (B) $(A) = 4.11\,D, (B) = 6.87\,D$

(C) $(A) = 4.11\,D, (B) = 4.11\,D$ (D) $(A) = 6.87\,D, (B) = 6.87\,D$

**Ans. :** a

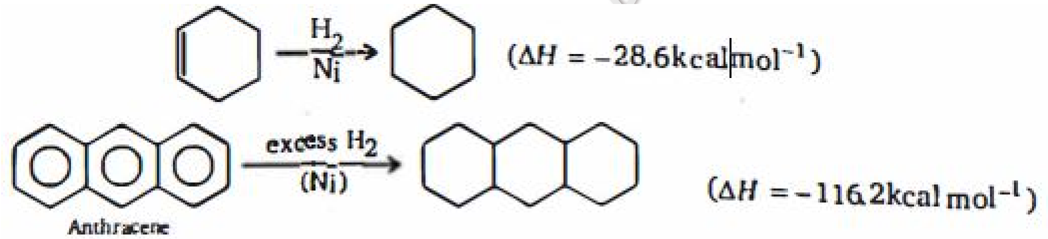


less SIR
so more effective
resonance



more SIR
less effective resonance
so has less dipole.

158. Use the following data to answer the question below.
Calculate the resonance energy of anthracene.......$kcal/mol$



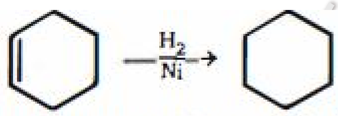
$(\Delta H = -28.6\,\text{kcal mol}^{-1})$

$(\Delta H = -116.2\,\text{kcal mol}^{-1})$

(A) 84 (B) 100 (C) 110 (D) 116

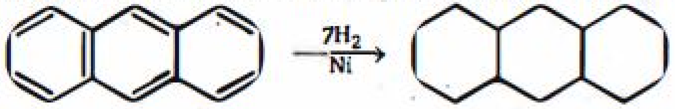
**Ans. :** a

Resonance energy = Theoretical heat of hydrogenation - Experimental heat of hydrogenation



; $\Delta H = -28.6$ kcal/mol

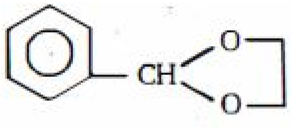
So theoretical heat of hydrogenation (H.O.H.) for anthracene is



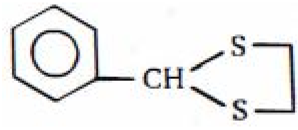
Theoretical $\Delta H = 7 \times (-28.6) = -200.2$ kcal/mol
Experimental $\Delta H = -116.2$ kcal/mol
Resonance energy = 84 kcal/mol

159. Which of the following compounds has most acidic hydrogen ?

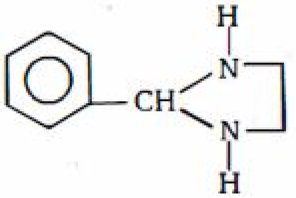
(A)



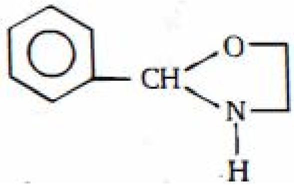
(B)



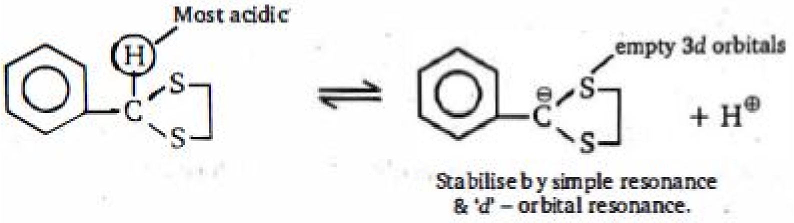
(C)



(D)



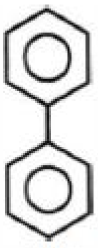
**Ans. :** b

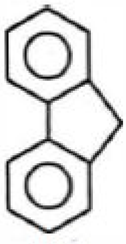


Stabilise by simple resonance & 'd' – orbital resonance.

160. Arrange in their decreasing order of rate of electrophilic aromatic substitution


(i)


(ii)


(iii)

(A) $i > ii > iii$

(B) $iii > ii > i$

(C) $iii > i > ii$

(D) $i > iii > ii$

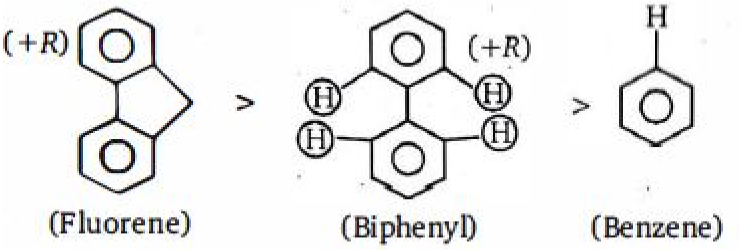
**Ans. :** b

The electron distribution in benzene is symmetrical and a pair of electrons become localised at the requirement of the electrophilic reagent In biphenyl, one ring behaves as a $+R$ group, thereby activating the other ring in the $o-$ and $p-$ positions. Hence, on the charge distribution approach, biphenyl can be expected to be more reactive than benzene towards electrophiles.

The $+R$ effect in biphenyl is transmitted from one ring to the other through the intramolecular bond. Maximum transmission is obtained if the two rings are coplannar, but because of the steric effects (weak) of the hydrogens in the $o-$ positions, the two rings are being hindered from becoming coplanar. At the same time, biphenyl molecules in solution are subject to thermal agitation ('bombardment' by other molecules), and this also tends to prevent the biphenyl molecule from becoming coplanar (in which state the molecule will have a minimum entropy). The overall result is that the resonance effect is partially nullified, i. e., the activation of one ring by the other through resonance is relatively weak.

If we now consider fluorene, its unsaturated system is the same as that of biphenyl, but in the former, because it is a flat molecule due to the presence of the middle ring (formed by the methylene bridge), the $+R$ effect of one benzene ring is completely transmitted to the other ring. Hence, fluorene can be expected to be more reactive than biphenyl towards electrophiles.

If we consider the problem from the carbonium - ion stability approach, then the more extended the conjugation and the more nearly coplanar the resonating structures, the more stable are the resonance hybrids. We therefore arrive at the same order of reactivity as before by using the same arguments.



----- "Start where you are, use what you have, do what you can." -----