ELECTRONIC DISPLACEMENT EFFECTS

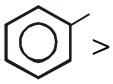
EXERCISE # O-1

1. Which of the following is false order of – I effect ?

(A) –F > –Cl > –Br > –I

(B) $-\overset{\oplus}{N}R_3 > -\overset{\oplus}{N}H_3 > -NO_2$

(C) –F > –OH > $-NH_2$

(D)  > –C ≡ CH > –H

GC0001

2. What is the correct order of inductive effect ?

(A) $-O^- > -CH_3 > -CMe_3$

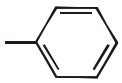
(B) $-CO_2^- > -O^- > CHMe_2$

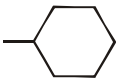
(C) $-O^- > -CH_2Me > -D > -H$

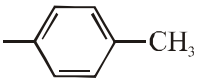
(D) None

GC0002

3. Which of the following groups have + I effect :

(A) 

(B) 

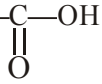
(C) 

(D) —CH = CH_2

GC0003

4. Which of the following groups have –I effect :

(A) —OH

(B) 

(C) $-CH_3$

(D) $-OCH_3$

GC0004

5. How many of the following groups have + I effect :

(a) —OH (b) $-O^{\ominus}$ (c) $-NH_2$ (d) $-\overset{\ominus}{N}H$

(e) —COOH (f) $-COO^{\ominus}$ (g) —Me (h) —OMe

(i) —F (j) $-\overset{\oplus}{N}F_3$

GC0005

6. Which of the following statements is (are) true about resonance.

(a) Resonance is an intramolecular phenomenon.

(b) Resonance involves delocalization of both σ and π electrons.

(c) Resonance involves delocalization of π electrons only.

(d) Resonance decreases potential energy of an acyclic molecule.

(e) Resonance has no effect on the potential energy of a molecule.

(f) Resonance is the only way to increase molecular stability.

(g) Resonance is not the only way to increase molecular stability.

(h) Any resonating molecule is always more stable than any non resonating molecule.

(i) The canonical structure explains all features of a molecule.

(j) The resonance hybrid explains all features of a molecule.

(k) Resonating structures are real and resonance hybrid is imaginary.

(l) Resonance hybrid is real and resonating structures are imaginary.

(m) Resonance hybrid is always more stable than all canonical structures.

GC0006

7. Which of the following statement is incorrect ?

(A) Resonating structure are real & have real existence

(B) Equivalent contributing structures make resonance hybrid very stable.

(C) Contributing structures are hypothetical having no real existance

(D) Contributing structures are less stable than the resonance hybrid.

GC0007

8. Which of the following is most stable.

(A) Conjugated alkadiene ($CH_2 = CH—CH = CH_2$)

(B) Isolated alkadiene ($CH_2 = CH—CH_2—CH = CH_2$)

(C) Cumulated alkadiene ($CH_2 = C = CH_2$)

(D) All are equally stable

GC0008

9. Arrange the following resonating structure according to their contribution towards resonance hybrid?

(a) $CH_2 = \overset{\oplus}{N} = \overset{\ominus}{N}$ (b) $\overset{\ominus}{C}H_2–N=\overset{\oplus}{N}$ (c) $\overset{\oplus}{C}H_2–\underset{\cdot\cdot}{N}=\overset{\ominus}{N}$ (d) $\overset{\ominus}{C}H_2–\overset{\oplus}{N}\equiv\ddot{N}$

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

GC0024

10. A canonical structure will be more stable if

(A) it involves cyclic delocalization of $(4n + 2)\ \pi$ – electrons than if it involves acyclic delocalization of $(4n + 2)\ \pi$ – electrons.

(B) it involves cyclic delocalization $(4n)\ \pi$ – electrons than if it involves acyclic delocalization of $(4n)\ \pi$ – electrons.

(C) +ve charge is on more electronegative atom than if +ve charge is on less electronegative atom provided atoms are in the same period.

(D) –ve charge is on more electronegative atom than if –ve charge is on less electronegative atom provided atoms are in the same period.

GC0010

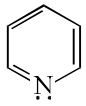
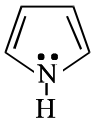
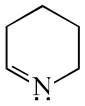
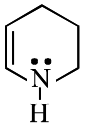
11. Which one of the following pair of structures does not represent the phenomenon of resonance?

(A) $H_2C=CH-\overset{\overset{O}{\|}}{C}-H$; $\overset{+}{C}H_2-CH=\overset{\overset{O^-}{|}}{C}-H$ (B) $CH_2=CH-\overset{+}{C}HCl$; $\overset{+}{C}H_2-CH=CH-Cl$

(C) $(CH_3)_2CH-\overset{\overset{O}{\|}}{C}-O^-$; $(CH_3)_2CH-\overset{\overset{O^-}{|}}{C}=O$ (D) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$; $CH_3-CH=\overset{\overset{O^-}{|}}{C}-CH_3$

GC0011

12. In which of the following, lone-pair indicated is involved in resonance :

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

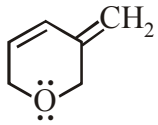
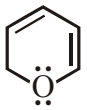
(e) $CH_2= CH - \overset{\Theta}{C}H_2$ (f) $CH_2 = CH - CH = \ddot{N}H$

GC0012

13. In which of the following lone-pair indicated is not involved in resonance :

(a) $CH_2 = CH - \ddot{N}H - CH_3$ (b) $CH_2 = CH - CH = \ddot{O}$

(c) $CH_2 = CH - \ddot{O} - CH = CH_2$ (d) $CH_2 = CH - C \equiv N:$

(e)  (f) 

GC0013

14. Which of the following groups cannot participate in resonance with other suitable group :

(a) – COOH (b) $-COOCH_3$ (c) – COCl (d) $-\overset{\oplus}{N}H_3$

(e) $-\overset{\oplus}{C}H_2$

GC0014

15. Identify electron donating groups in resonance among the following :

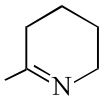
(a) $-CONH_2$ (b) $-NO_2$ (c) $-OCOCH_3$ (d) $-COOCH_3$

(e) – CHO (f) $-NHCOCH_3$

GC0015

16. Identify electron withdrawing groups in resonance among the following :

(a) –COOH (b) $-CONHCH_3$ (c) – COCl (d) – CN

(e) $-O-CH=CH_2$ (f) 

GC0016

17. Which of the following groups can either donate or withdraw a pair of electrons in resonance depending upon situation :

(a) $-NO_2$ (b) – NO (c) $-CH=CH_2$ (d) – CHO

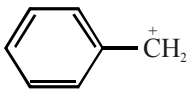
(e) $-NH_2$ (f) – N = NH

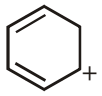
GC0017

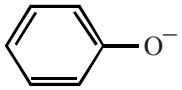
18. Draw the resonance forms to show the delocalization of charges in the following ions

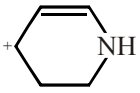
(a) $CH_3-\overset{\overset{O}{\|}}{C}-\overset{\Theta}{C}H_2$ **GC0018**

(b) $H-\overset{\overset{O}{\|}}{C}-CH=CH-\overset{\Theta}{C}H_2$ **GC0018**

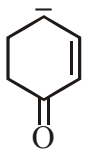
(c)  **GC0018**

(d)  **GC0018**

(e)  **GC0018**

(f)  **GC0019**

(g)  **GC0019**

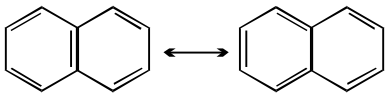
(h)  **GC0019**

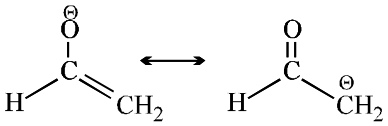
(i) $CH_3 - CH = CH - CH = CH - \overset{+}{C}H - CH_3$ **GC0019**

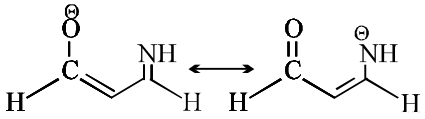
(j) $CH_3 - CH = CH - CH = CH - \overset{+}{C}H_2$ **GC0019**

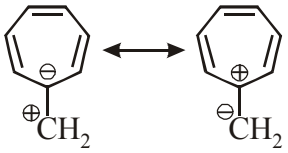
19. Identify less stable canonical structure in each of the following pairs :

(a) $\overset{\oplus}{C}H_2 - O - CH_3 \longleftrightarrow CH_2 = \overset{\oplus}{O} - CH_3$

(b) 

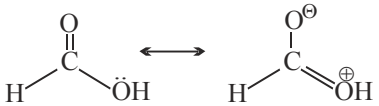
(c) 

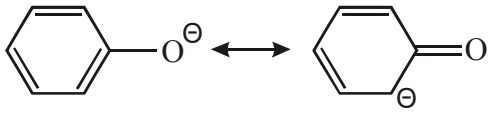
(d) 

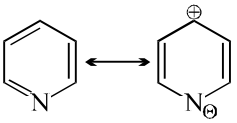
(e) 

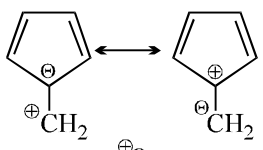
GC0020

20. Identify more stable canonical structure in each of the following pairs :

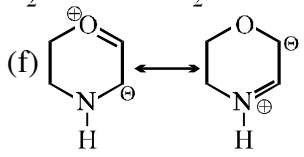
(a) 

(b) 

(c) 

(d) 

(e) $\overset{\oplus}{C}H_2 - CH = CH - \overset{\ominus}{O} \longleftrightarrow CH_2 = CH - CH = O$

(f) 

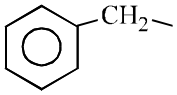
GC0021

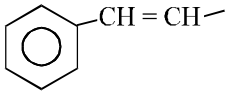
21. Which of the following group can participate in resonance with other suitable group :

(a) –OH **GC0022**

(b) $-CH_2-\overline{C}H_2$ **GC0022**

(c) $-CH_2-\overset{\oplus}{C}H_2$ **GC0022**

(d)  **GC0022**

(e)  **GC0023**

(f) $-BH_2$ **GC0023**

(g) $-\overset{\oplus}{P}Ph_3$ **GC0023**

22. Consider structural formulas A, B and C:

$H_2\ddot{C}-N\equiv N:$ $H_2C=N=\ddot{N}:$ $H_2C-\ddot{N}=\ddot{N}:$

(A) (B) (C)

(a) Are A, B and C isomers, or are they resonance forms ?

(b) Which structures have a negatively charged carbon?

(c) Which structures have a positively charged carbon?

(d) Which structures have a positively charged nitrogen?

(e) Which structures have a negatively charged nitrogen?

(f) What is the net charge on each structure?

(g) Which is a more stable structure, A or B? Why?

(h) Which is a more stable structure, B or C? Why?

GC0009

23. In each of the following pairs of resonating structure which resonating structure is more stable :

(a) $\left[CH_3-\ddot{\overset{\cdot\cdot}{C}}H-C\equiv N: \longleftrightarrow CH_3-CH=C=\ddot{N}:^{-}\right]$

(b) $\left[CH_3-\overset{O}{\overset{\|}{C}}-\overline{C}H-\overset{O}{\overset{\|}{C}}-CH_3 \longleftrightarrow CH_3-\overset{O^-}{\overset{|}{C}}=CH-\overset{O}{\overset{\|}{C}}-CH_3\right]$

(c) $\left[CH_3-CH_2-\overset{NH_2}{\overset{|}{\underset{+}{C}}}-NH_2 \longleftrightarrow CH_3-CH_2-\overset{NH_2}{\overset{|}{C}}=\overset{+}{N}H_2\right]$

GC0025

24. Formic acid is considered as a hybrid of the four structures

$H-\overset{O}{\overset{\|}{C}}-OH \leftrightarrow H-\overset{O^{\ominus}}{\overset{|}{C}}=\overset{\oplus}{O}H \leftrightarrow H-\overset{O^{\ominus}}{\overset{|}{\underset{\oplus}{C}}}-O-H \leftrightarrow H-\overset{O^{\oplus}}{\overset{|}{\underset{\ominus}{C}}}-O-H$

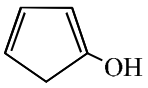
I II III IV

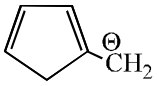
Which of the following order is correct for the stability of four contributing structures.

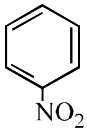
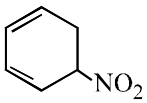
(A) I > II > III > IV (B) I > II > IV > III (C) I > III > II > IV (D) I > IV > III > II

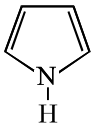
GC0026

25. In the given pair of compounds select the one in each pair having lesser resonance energy :

(a)  and 

(b)  and 

(c)  and 

(d)  and 

GC0027

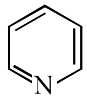
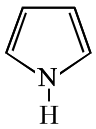
26. Resonance energy of resonance hybrid of a molecule will be more if :

(a) canonical structures are equivalent than if canonical structures are non-equivalent

(b) molecule is aromatic than if molecule is not aromatic.

GC0028

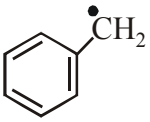
27. In the given pair of compounds select the one in each pair having higher resonance energy :

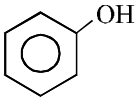
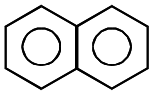
(i)  and  **GC0029**

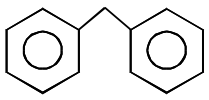
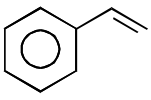
(ii) $CH_2 = CH - O - CH = CH_2$ and $CH_2 = CH - NH - CH = CH_2$ **GC0029**

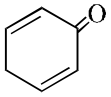
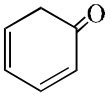
(iii) $CH_2 = CH - \overset{\Theta}{N}H$ and $HN = CH - \overset{\Theta}{N}H$ **GC0029**

(iv) $CH_2 = CH - F$ and $CH_2 = CH - Br$ **GC0029**

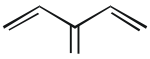
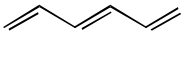
(v)  and $CH_2 = CH - \dot{C}H_2$ **GC0029**

(vi)  and  **GC0029**

(vii)  and  **GC0030**

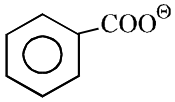
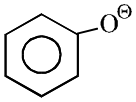
(viii)  and  **GC0030**

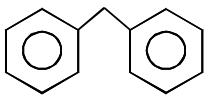
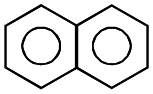
(ix) $CH_2 = CH - OH$ and $CH_2 = CH - CH = CH - OH$ **GC0030**

(x)  and  **GC0030**

(xi) CH_3COOH and CH_3COONa **GC0030**

(xii) $CH_2 = CH - \overset{\Theta}{O}$ and $CH_2 = CH - OH$ **GC0030**

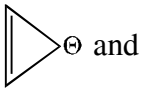
(xiii)  and  **GC0030**

(xiv)  and  **GC0030**

(xv)  and $CH_2 = CH - CH = CH - CH = CH_2$ **GC0030**

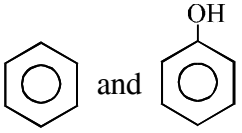
28. In the given pair of compounds select the one in each pair having lesser resonance energy :

(a) CO_3^{2-} and $HCOO^-$

(b)  and $CH_2 = CH - \overset{-}{C}H_2$

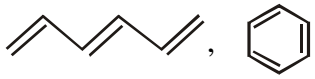
(c)  and $CH_2 = CH - CH = CH_2$

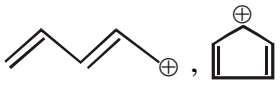
(d)  and $CH_2 = CH - \overset{\oplus}{C}H_2$

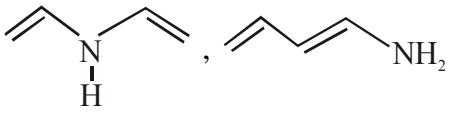
(e) 

GC0031

29. In which of the following pairs first one is having more resonance energy than the second one -

(A) 

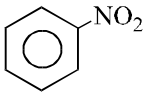
(B) 

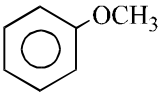
(C) 

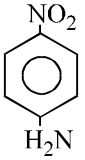
(D) None of these

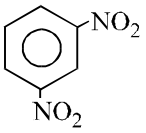
GC0032

30. In which of the following molecules π – electron density in ring is minimum :

(A) 

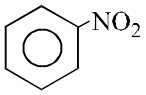
(B) 

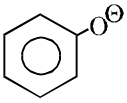
(C) 

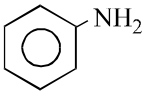
(D) 

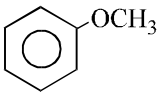
GC0033

31. In which of the following molecules π – electron density in ring is maximum :

(A) 

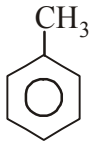
(B) 

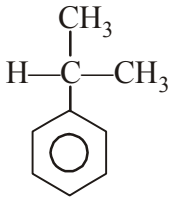
(C) 

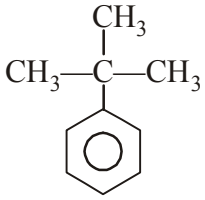
(D) 

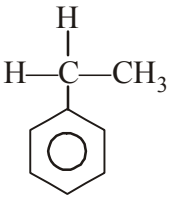
GC0034

32. Arrange following compounds in decreasing order of reactivity of ring towards attack of electron deficient species -

(i) 

(ii) 

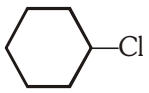
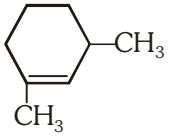
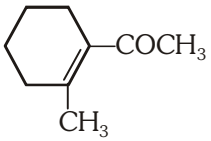
(iii) 

(iv) 

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

GC0035

33. In which of the following molecule all the effect namely inductive, mesomeric & hyperconjugation operate:

(A)  (B)  (C)  (D) 

GC0036

34. Which one of the following molecules has all the effect, namely inductive, mesomeric and hyperconjugative?

(A) CH_3Cl (B) $CH_3–CH = CH_2$

(C) $CH_3 - CH = CH - \underset{\underset{O}{\|}}{C} - CH_3$ (D) $CH_2 = CH - CH = CH_2$

GC0037

35. Select the correct statement.

(i) Delocalisation of σ-electron is hyperconjugation.

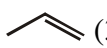
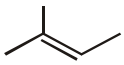
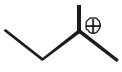
(ii) Delocalisation of π-electron is resonance.

(iii) Permanent partial displacement of σ-electron is inductive effect.

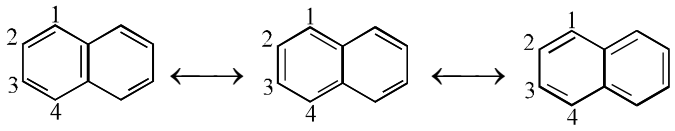
(A) i & iii (B) ii & iii (C) i & ii (D) i, ii, iii

GC0038

36. Which of the following compound is correctly matched with number of hyperconjugating structures (involving C—H bond) :

(A)  (3) (B)  (9) (C)  (8) (D) $CH_3–C\equiv C–CH_3$ (5)

GC0039

37. 

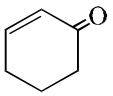
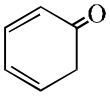
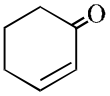
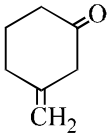
These are three canonical structures of naphthalene. Examine them and find correct statement among the following :

(A) All C – C bonds are of same length (B) C1 – C2 bond is shorter than C2 – C3 bond.

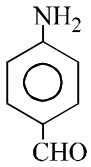
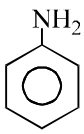
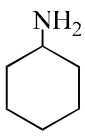
(C) C1 – C2 bond is longer than C2 – C3 bond (D) None

GC0040

38. Which of the following has longest C – O bond :

(A)  (B)  (C)  (D) 

GC0041

39.    $CH_2 = NH$

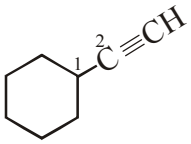
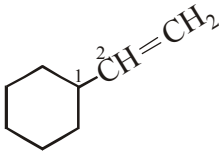
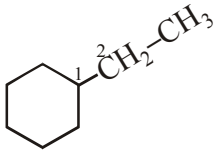
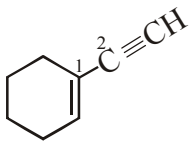
I II III IV

Among these compounds, the correct order of C – N bond lengths is :

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

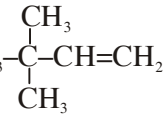
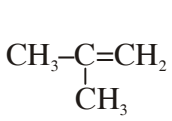
GC0042

40. C1 – C2 bond is shortest in

(A)  (B)  (C)  (D) 

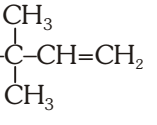
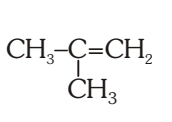
GC0043

41. Which of the following molecule has longest C=C bond length ?

(A) $CH_2=C=CH_2$ (B) $CH_3–CH=CH_2$ (C)  (D) 

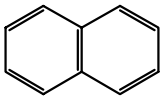
GC0044

42. Which of the following molecule has shortest C=C bond length ?

(A) $CH_2=C=CH_2$ (B) $CH_3–CH=CH_2$ (C)  (D) 

GC0045

43. C—C and C=C bond lengths are unequal in :

(A) Benzene (B) 1,3-buta-di-ene (C) 1,3-cyclohexa-di-ene (D) 

GC0046

44. Among the following molecules, the correct order of C – C bond length is (C_6H_6 is benzene)

(A) $C_2H_6 > C_2H_4 > C_6H_6 > C_2H_2$ (B) $C_2H_6 > C_6H_6 > C_2H_4 > C_2H_2$

(C) $C_2H_4 > C_2H_6 > C_2H_2 > C_6H_6$ (D) $C_2H_6 > C_2H_4 > C_2H_2 > C_6H_6$

GC0047

45. $CH_3O - CH = CH - NO_2$ I

$CH_2 = CH - NO_2$ II

$CH_2 = CH - Cl$ III

$CH_2 = CH_2$ IV

Which of the following is the correct order of C – C bond lengths among these compounds :

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

GC0048

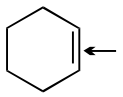
46. Which of the following is (are) the correct order of bond lengths :

(A) C – C > C = C > C ≡ C > C ≡ N (B) C = N > C = O > C = C

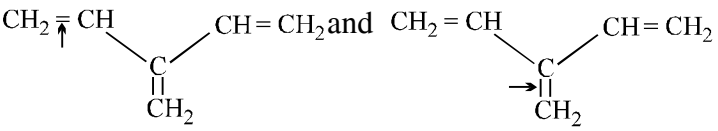
(C) C = C > C = N > C = O (D) C – C > C = C > C ≡ C > C – H

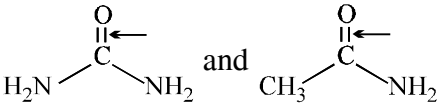
GC0049

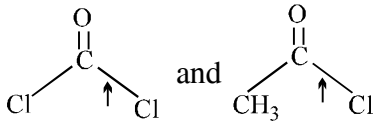
47. In which of the following pairs, indicated bond having less bond dissociation energy :

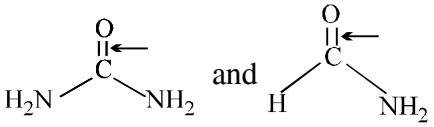
(a)  and $CH_2 \overset{\uparrow}{\equiv} CH_2$ **GC0050**

(b) $CH_3 - C \overset{\uparrow}{\equiv} CH$ and $HC \overset{\uparrow}{\equiv} CH$ **GC0050**

(c)  **GC0050**

(d)  **GC0051**

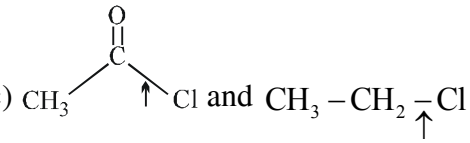
(e)  **GC0051**

(f)  **GC0051**

48. In which of the following pairs, indicated bond is of greater strength :

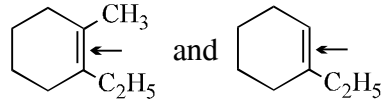
(a) CH_3-CH_2-Br and CH_3-CH_2-Cl **GC0052**

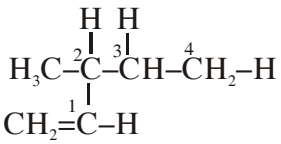
(b) $CH_3-CH=CH-Br$ and $CH_3-\underset{\underset{Br}{|}}{CH}-CH_3$ **GC0052**

(c)  **GC0052**

(d) $CH_2=CH-CH=CH_2$ and $CH_2=CH_2-CH_2-CH_3$ **GC0052**

(e) $CH_2=CH-CH=CH_2$ and $CH_2=CH-NO_2$ **GC0053**

(f)  **GC0053**

49. 

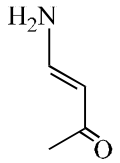
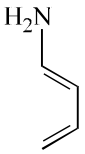
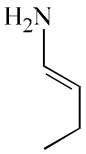
the correct order of bond dissociation energy (provided bond undergoes homolytic cleavage):

(A) C^2–H > C^3– H > C^4 –H > C^1 – H (B) C^2–H > C^3– H > C^1 –H > C^4 – H

(C) C^1–H > C^4– H > C^2 –H > C^3 – H (D) C^1–H > C^4– H > C^3 –H > C^2 – H

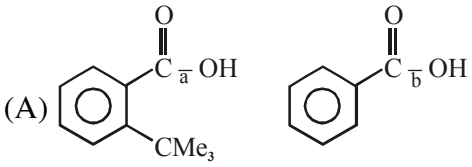
GC0054

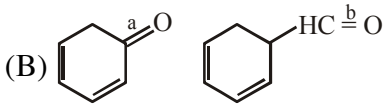
50. Compare the C–N bond-length in the following species:

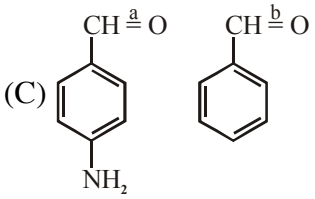
(A)  (B)  (C) 

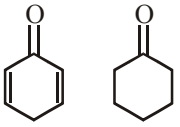
GC0055

51. In which case, C – O bond length is shorter for Ist compound :

(A) 

(B) 

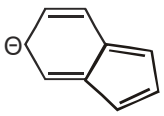
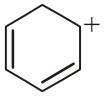
(C) 

(D) 

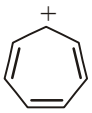
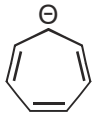
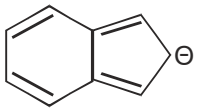
GC0056

EXERCISE # O-2

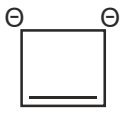
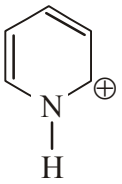
1. In each set of species select the aromatic species.

(i) (a)  (b)  (c) 

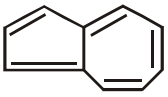
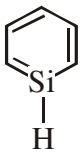
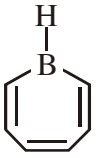
GC0057

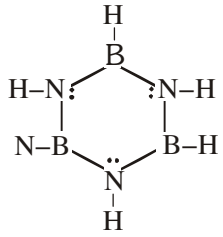
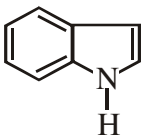
(ii) (a)  (b)  (c)  (d) 

GC0058

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

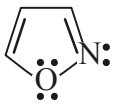
GC0059

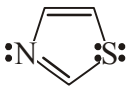
(iv) (a)  (b)  (c)  (d) 

(e)  (f) 

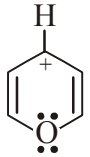
GC0060

2. Which of the given compound is aromatic, antiaromatic or nonaromatic.

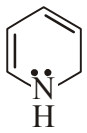
(a) 
isoxazole

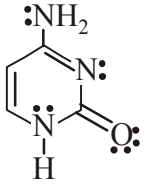
(b) 
1,3-thiazole

(c) 
pyran

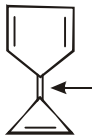
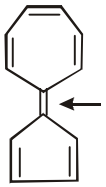
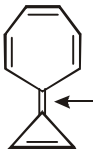
(d) 
pyrylium ion

(e) 
γ-pyrone

(f) 
1,2-dihydropyridine

(g) 
cytosine

GC0061

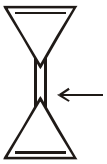
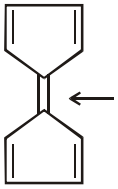
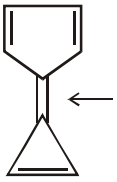
3. (I)  (II)  (III) 

Compare carbon-carbon bond rotation across I, II, III.

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

GC0062

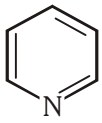
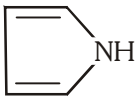
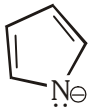
4. Which of the given compunds has minimum rotation energy barrier across indicated carbon-carbon bond.

(I)  (II)  (III) 

(A) I (B) II (C) III (D) All are equal

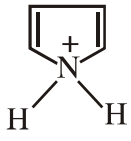
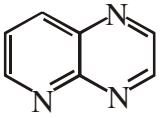
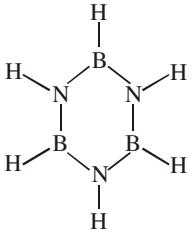
GC0063

5. Which species is not aromatic ?

(A)  (B)  (C)  (D) 

GC0064

6. Which of the following are non-aromatic

(A)  (B)  (C)  (D) 

GC0065

7. Write down the structure of the following molecule and comment on aromaticity ?

(a) $B_3H_3O_3$ (b) $C_3N_3(NH_2)_3$ (c) Trimer of isocyanic acid $(HN = C = O)_3$

GC0066

8. Select the least stable one :

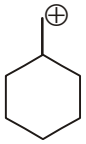
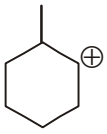
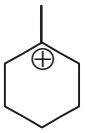
(A) $CH_3-\overset{\oplus}{C}H_2$ (B) $CH_3-CH_2-\overset{\oplus}{C}H_2$

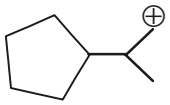
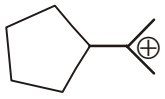
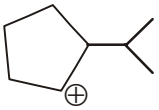
(C) $\begin{matrix}H_3C\\H_3C\end{matrix}\!\!>\!CH-CH_2^{\oplus}$ (D) $\begin{matrix}H_3C\\H_3C\\H_3C\end{matrix}\!\!>\!C=\overset{\oplus}{C}H_2$

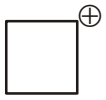
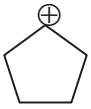
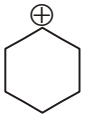
GC0067

9. Write stability in decreasing order of following intermediates:

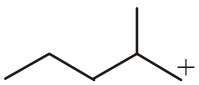
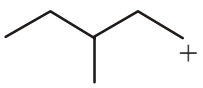
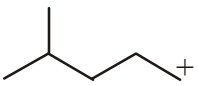
(i) (a) $CH_3-\overset{\oplus}{C}H_2$ (b) $CH_3-\overset{\oplus}{C}H-CH_3$ (c) $CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}\oplus$ **GC0068**

(ii) (a)  (b)  (c)  **GC0069**

(iii) (a)  (b)  (c)  **GC0070**

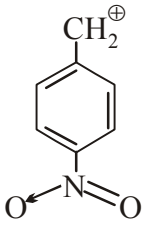
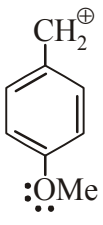
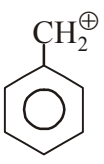
(iv) (a)  (b)  (c)  (d)  **GC0071**

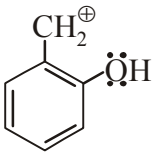
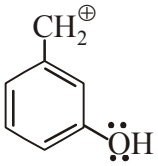
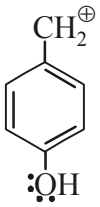
(v) (a) $CF_3-\overset{+}{C}H_2$ (b) $CCl_3-\overset{+}{C}H_2$ (c) $CBr_3-\overset{+}{C}H_2$ **GC0072**

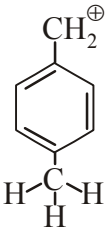
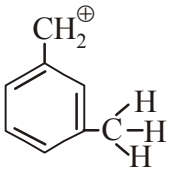
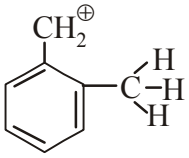
(vi) (a)  (b)  (c)  **GC0073**

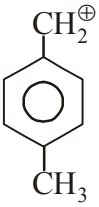
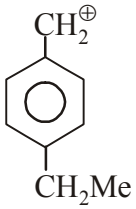
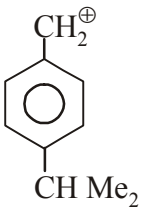
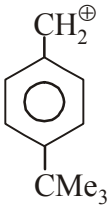
(vii) (a) $HC\equiv\overset{\oplus}{C}$ (b) $CH_2=\overset{\oplus}{C}H$ (c) $CH_3-\overset{\oplus}{C}H_2$ **GC0074**

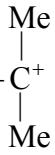
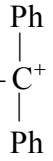
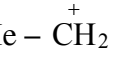
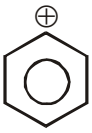
(viii) (a) $C_6H_5^+$ (b) $p\text{–}NO_2(C_6H_4)^+$ (c) $p\text{–}CH_3\text{–}(C_6H_4)^+$ (d) $p\text{–}Cl\text{–}C_6H_4^+$ **GC0075**

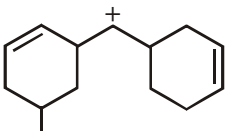
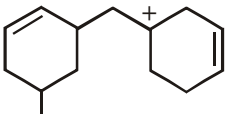
(ix) (a)  (b)  (c)  **GC0076**

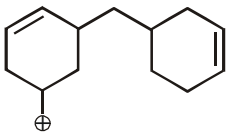
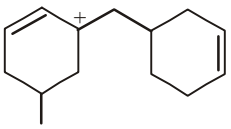
(x) (a)  (b)  (c)  **GC0077**

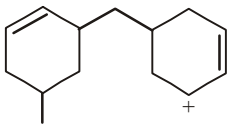
(xi) (a)  (b)  (c)  **GC0078**

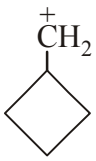
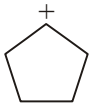
(xii) (a)  (b)  (c)  (d)  **GC0079**

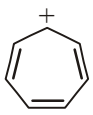
(xiii) (a)  (b)  (c)  (d)  **GC0080**

(xiv)(a)  (b) 

(c)  (d) 

(e)  **GC0081**

(xv) (a)  (b)  (c)  **GC0082**

(xvi) (a)  (b)  (c)  **GC0083**

10. Consider the following statements:

(I) $CH_3O\overset{\oplus}{C}H_2$ is more stable than $CH_3\overset{\oplus}{C}H_2$

(II) $Me_2\overset{\oplus}{C}H$ is more stable than $CH_3CH_2\overset{\oplus}{C}H_2$

(III) $CH_2=CH-\overset{\oplus}{C}H_2$ is more stable than $CH_3CH_2\overset{\oplus}{C}H_2$

(IV) $CH_2=\overset{\oplus}{C}H$ is more stable than $CH_3\overset{\oplus}{C}H_2$

Of these statements:

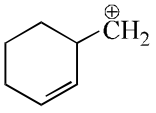
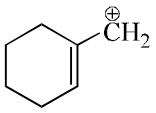
(A) I and II are correct (B) III and IV are correct

(C) I, II and III are correct (D) II, III and IV are correct

GC0084

11. In each of the following pairs of ions which ion is more stable:

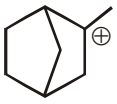
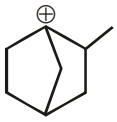
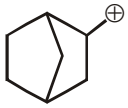
(a) (I) $C_6H_5-\overset{\oplus}{C}H_2$ and (II) $CH_2=CH-\overset{\oplus}{C}H_2$ (b) (I) $CH_3-\overset{\oplus}{C}H_2$ and (II) $CH_2=\overset{\oplus}{C}H$

(c) (I)  and (II) 

(d) (I) $CH_3-\underset{\underset{CH_3-\overset{\oplus}{C}-CH_3}{|}}{CH}-CH_3$ and (II) $CH_3-\underset{\underset{CH_3-\overset{\oplus}{C}-CH_3}{|}}{N}-CH_3$

GC0085

12. 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

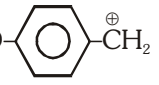
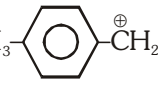
GC0086

13. Which of the following carbonium ion is most stable ?

(A) Ph_3C^+ (B) $(CH_3)_3\ C^+$ (C) $(CH_3)_2\ CH^+$ (D) $CH_2=CH—CH_2^+$

GC0087

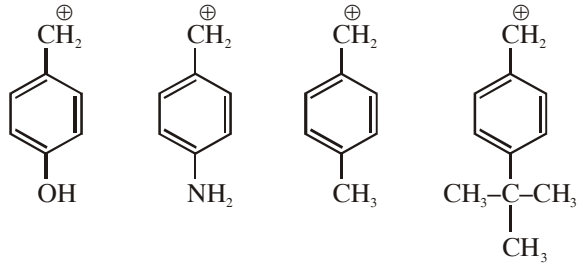
14. Consider the following carbocations

(a) CH_3O-  (b)  (c) CH_3-  (d) $CH_3—\overset{\oplus}{C}H_2$

The relative stabilities of these carbocations are such that :-

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

GC0088

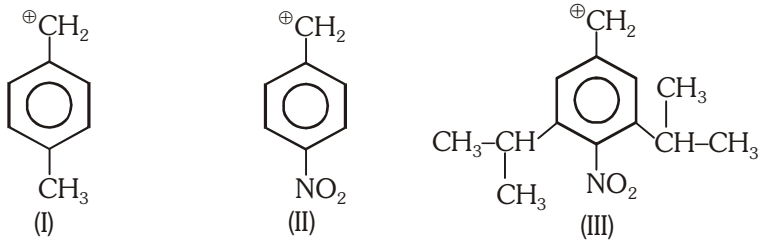
15. 

Correct order of carbocation stability is :

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

GC0089

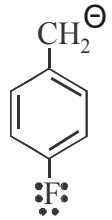
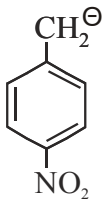
16. Arrange the following carbocation in the increasing order of stability :

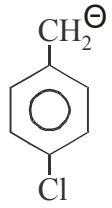
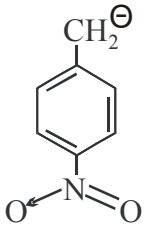
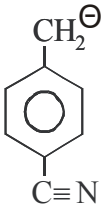
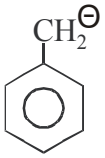


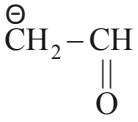
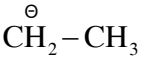
(A) I < II < III (B) II < III < I (C) III < II < I (D) III < I < II

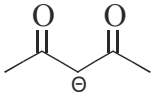
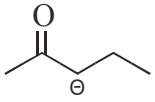
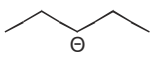
GC0090

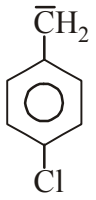
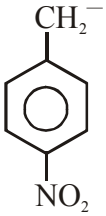
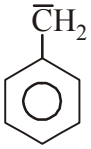
17. Rank the following sets of intermediates in increasing order of their stability.

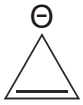
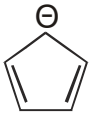
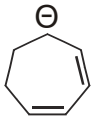
(i) (a)  (b)  **GC0091**

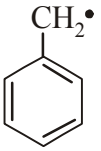
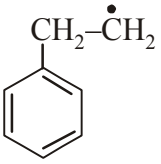
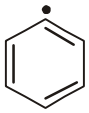
(ii) (a)  (b)  (c)  (d)  **GC0092**

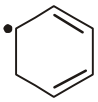
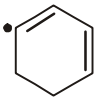
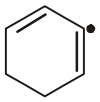
(iii) (a)  (b)  **GC0093**

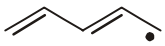
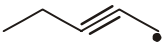
(iv) (a)  (b)  (c)  **GC0094**

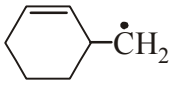
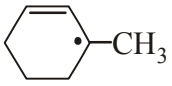
(v) (a)  (b)  (c)  **GC0095**

(vi) (a)  (b)  (c)  **GC0096**

(vii)(a)  (b)  (c)  **GC0097**

(viii) (a)  (b)  (c)  **GC0098**

(ix) (a)  (b)  **GC0099**

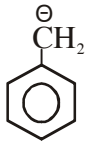
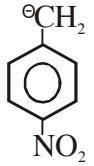
(x) (a) $CH_2=\dot{C}H$ (b) $CH_2=CH-\dot{C}H_2$ (c)  (d)  **GC0100**

18. Most stable carbanion is :-

(A) $HC\equiv C^{\ominus}$ (B) $C_6H_5^{\ominus}$ (C) $(CH_3)_3C—CH_2^{\ominus}$ (D) $(CH_3)_2C=CH^{\ominus}$

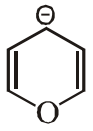
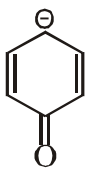
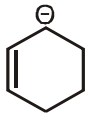
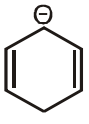
GC0101

19. Most stable carbanion is :

(A) $CH_3^{\ominus}$ (B) $CH_2=CH-\overset{\ominus}{C}H_2$ (C)  (D) 

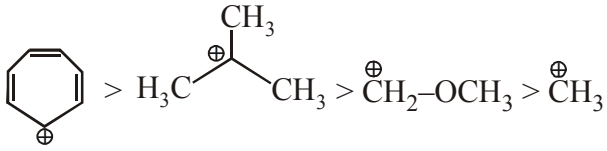
GC0102

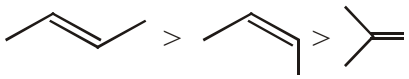
20. Identify the most stable anion.

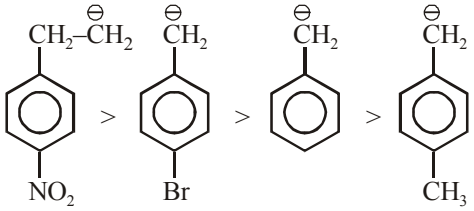
(A)  (B)  (C)  (D) 

GC0103

21. Correct order of stability :

(A)  > H_3C CH_3 > CH_2–OCH_3 > CH_3

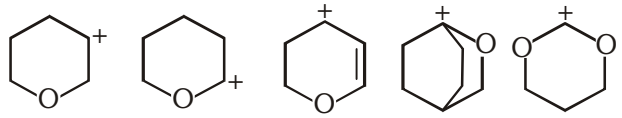
(B) 

(C) 

(D) $CH_2=CH-\dot{C}(CH_3)_2 > CH_2=CH-\dot{C}H_2 > CH_3-\dot{C}H_2 > CH_2=\dot{C}H$

GC0104

22. Rank the following sets of intermediates in increasing order of their stability giving appropriate reasons for your choice.

(a) 

(b) $\bar{C}H_2-C(=O)-CH_3$, $\bar{C}H_2-C(=O)-H$, $\bar{C}H_2-C(=O)-NH_2$, $\bar{C}H_2-C(=O)-OCH_3$

GC0105

23. Select the correct order of stability of carbon free radicals :

I. $Ph-\dot{C}H_2$

II. $Ph-\dot{C}H-CH_2-CH_3$

III. $Ph-\dot{C}H-CH=CH_2$

IV. $Ph-\dot{C}(CH_3)-CH=CH_2$

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

GC0106

24. $CH_2 = CH - CH = CH - CH_3$ is more stable than $CH_3 - CH = C = CH - CH_3$ because

(I) (II)

(A) there is resonance in I but not in II

(B) there is tautomerism in I but not in II

(C) there is hyperconjugation in I but not in II

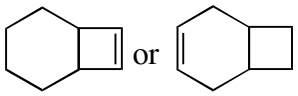
(D) II has more cononical structures than I.

GC0107

25. Choose the more stable alkene in each of the following pairs. Explain your reasoning.

(a) 1-Methylcyclohexene or 3-methylcyclohexene

(b) Isopropenylcyclopentane or allylcyclopentane

(c)  or

GC0108

26. Match each alkene with the appropriate heat of combustion:

Heats of combustion (kJ/mol) : 5293 ; 4658; 4650; 4638; 4632

(a) 1-Heptene

(b) 2,4-Dimethyl-1-pentene

(c) 2,4-Dimethyl-2-pentene

(d) 4,4-Dimethyl-2-pentene

(e) 2,4,4-Trimethyl-2-pentene

GC0109

27. Stability of :

(I) $CH_3–CH=CH–CH_3$

(II) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}=C-CH_3$

(III) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH_2$

(IV) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH-CH_3$

in the increasing order is :

(A) I < III < IV < II

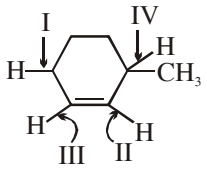
(B) I < II < III < IV

(C) I < IV < III < I

(D) II < III < IV < I

GC0110

28. Which of the following C-H bonds participate in hyperconjugation ?



(A) I and II

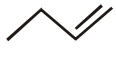
(B) I and IV

(C) I and III

(D) III and IV

GC0111

29. Rank the following alkenes in decreasing order of heat of combustion values :


(I)


(II)


(III)


(IV)

(A) II > III > IV > I

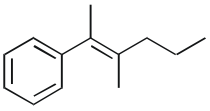
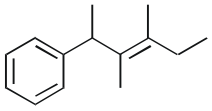
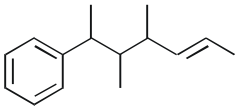
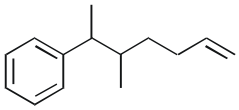
(B) II > IV > III > I

(C) I > III > IV > II

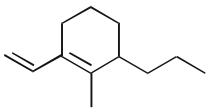
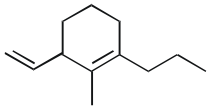
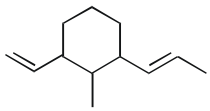
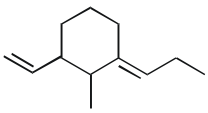
(D) I > IV > III > II

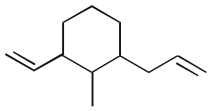
GC0112

30. Write decreasing order of heat of hydrogenation :

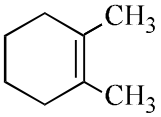
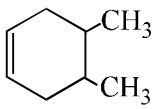
(i) (a)  (b)  (c)  (d) 

GC0113

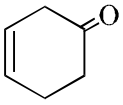
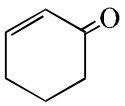
(ii) (a)  (b)  (c)  (d) 

(e) 

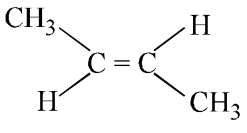
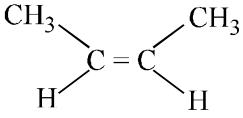
GC0114

(iii) (a)  (b) 

GC0115

(iv) (a)  (b) 

GC0116

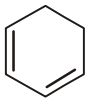
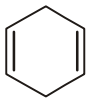
(v) (a)  (b) 

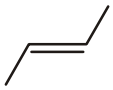
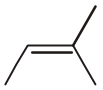
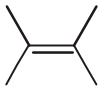
GC0117

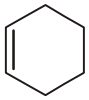
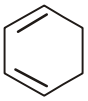
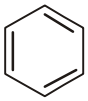
(vi) (a) $CH_2 = CH - CH\begin{matrix}CH_3\\CH_3\end{matrix}$ (b) $CH_2 = C\begin{matrix}CH_3\\CH_2-CH_3\end{matrix}$

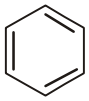
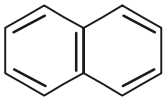
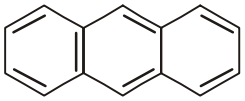
GC0118

31. Write increasing order of heat of hydrogenation :

(i) (a)  (b) 

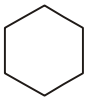
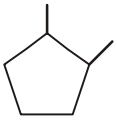
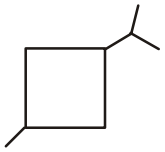
(ii) (a) (b)  (c)  (d)  (e) 

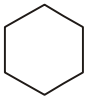
(iii) (a)  (b)  (c) 

(iv) (a)  (b)  (c)  (HOH per benzene ring)

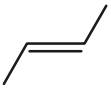
GC0119

32. Give decreasing order of heat of combustion (HOC):

(i) (a)  (b)  (c) 

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

(iii) (a)  (b) 

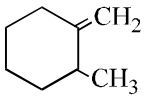
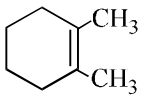
(iv) (a)  (b)  (c) 

GC0120

33. Among the following pairs identify the one which gives higher heat of hydrogenation :

(a)  and  (b)  and 

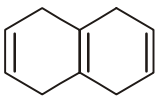
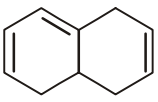
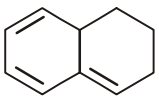
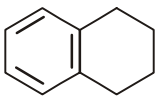
(c) $CH_3 - CH = CH - CH_3$ and $CH_3 - CH_2 - CH = CH_2$

(d)  and 

GC0121

34. Arrange the following compounds in order of :

(I) Stability (II) Heat of hydrogenation

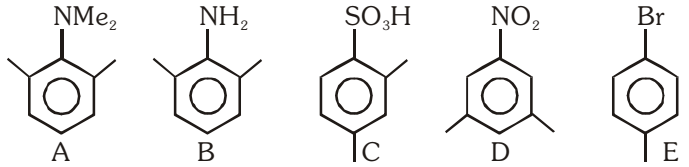
(a)  (b)  (c)  (d) 

GC0122

35. If Heat of hydrogenation of 1-butene is 30 Kcal/mol then heat of hydrogenation of 1,3-butadiene is ?

(A) 30 (B) 60 (C) 57 (D) 25

GC0123

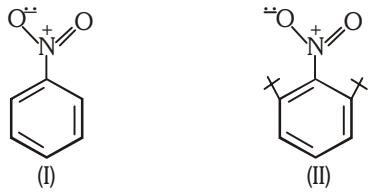
36. 

Steric inhibition of resonance takes place :

(A) In A,B only (B) In A, B, C, E (C) C only (D) In A only

GC0124

37. Consider the following two structures and choose the correct statements -



(A) carbon-nitrogen bond length structure I is greater than that in structure II

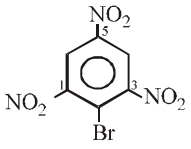
(B) carbon-nitrogen bond length in structure I is less than in structure II

(C) carbon-nitorogen bond length in both structure is same

(D) It can not be compared

GC0125

38. Which of the following statements would be true about this compound :



(A) All three C – N bonds are of same length.

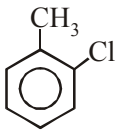
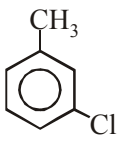
(B) Cl – N and C3 – N bonds are of same length but shorter than C5 – N bond.

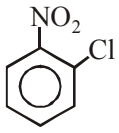
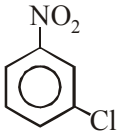
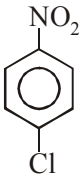
(C) Cl – N and C3 – N bonds are of same length but longer than C5 – N bond.

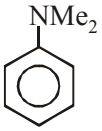
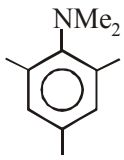
(D) Cl – N and C3 – N bonds are of different length but both are longer than C5 – N bond

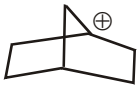
GC0126

39. Arrange given compounds in decreasing order of dipole moment :

(i) (a)  (b)  (c)  **GC0127**

(ii) (a)  (b)  (c)  **GC0128**

(iii) (a)  (b)  **GC0129**

40. Why a cation like  is not possible.

GC0130

EXERCISE # S-1

1. Cyclopentadienyl anion is much more stable than allyl anion because :

(A) Cyclic anion is more stable than acyclic anion

(B) Delocalised anion is more stable than localised anion

(C) Cyclopentadienyl anion is aromatic in nature

(D) None of these

GC0131

2. Select correct statement regarding given compounds :

CH_3OCH_3 (I) C_2H_5OH (II)

(A) Boiling point of II is higher than I

(B) Boiling point of II is lower than I

(C) Compound I forms intramolecular H-bonding

(D) Compound II forms intermolecular H-bonding

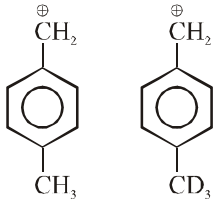
GC0132

3. In the compund, $\overset{I}{CH_3}—\overset{II}{CH}=\overset{III}{CH}—\overset{IV}{C}\equiv N$, the most electronegative carbon is :

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

GC0133

4.



(I) (II)

Carbocation (I) is more stable than carbocation (II), because :

(A) $—CD_3$ has more + I effect than $—CH_3$ (B) $—CH_3$ has more + I effect than $—CD_3$

(C) $—CH_3$ has more + H effect than $—CD_3$ (D) $—CD_3$ has more + H effect than $—CH_3$

GC0134

5. Select correct statement :

(A) Carbon-oxygen bonds are of equal length in acetate ion

(B) Resonating structures of acetate ion are equivalent

(C) Carbon-oxygen bonds are of unequal length in formate ion

(D) Resonating structures of formate ion are equivalent

GC0135

6. Match the column I with column II.

Column-I **(Group attached with benzene ring)**	**Column-II** **(Effect shown by the group)**
(A) $—NO_2$	(P) – R effect
(B) $—O^-$	(Q) + R effect
(C) $—O—CH_3$	(R) + I effect
(D) $—C \equiv N$	(S) – I effect

GC0136

7.

Column- I **(Groups attached to phenyl ring)**	**Column- II** **(Effect shown)**
(A) $—\ddot{N} = O$	(P) +M
(B) $—CH_3$	(Q) –M
(C) $—\ddot{N}H - C(=O)CH_3$	(R) +H
(D) $-C(=O)-OCH_3$	(S) –I

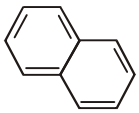
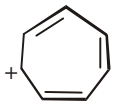
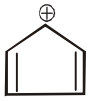
GC0137

8. Match the column :

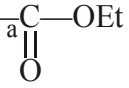
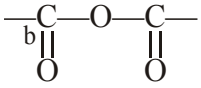
Column-I	**Column-II**
(A) Group donate e^- inductively but does not donate / withdraw by resonance	(P) –OH
(B) Group withdraw e^- inductively but does not donate / withdraw by resonance	(Q) $–NO_2$
(C) Group withdraw e^- inductively & donate e^- by resonance	(R) $–CH_2–CH_3$
(D) Group withdraw e^- inductively & withdraw e^- by resonance	(S) $-\overset{+}{N}H_3$
	(T) $–NH_2$

GC0138

9. Match the column I with column II.

Column-I	**Column-II**
(A) 	(P) Aromatic
(B) 	(Q) Non-aromatic
(C) 	(R) Anti-aromatic
(D) 	(S) Cyclic structure

GC0139

10. **Statement-I :**   bond length a < b

Because

Statement-II : More is the double bond character less is the bond legnth.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

GC0140

11. **Statement-I :** $Me_3\overset{+}{C}$ is more stable than $Me_2\overset{+}{C}H$ and $Me_2\overset{+}{C}H$ is more stable than the $Me\overset{+}{C}H_2$.

Because

Statement-II : Greater the number of hyperconjugative structures, more is the stability of carbocation.

(A)Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

GC0141

12. **Statement-I :** The potential energy barrier for rotation about C = C bond in 2-butene is much higher than that in ethylene.

Because

Statement-II : Hyperconjugation effect decreases the double bond character.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1

(C) Statement-1 is true, statement-2 is false

(D) Statement-1 is false, statement-2 is true.

GC0142

Paragraph for Question 13 to 15

The intramolecular delocalisation of π and non-bonding electrons without any change in the position of atoms is called resonance. Delocalisation may occur in conjugated system involving carbon atom and atom other than carbon. Delocalisation makes system stable. More is the number of resonating structures, more is the stability of the system. A resonating structure is less stable when a higher electronegative atom has positive charge and when identical charges are present on adjacent atoms.

13. The decreasing order of stability of the following resonating structures

$CH_2 = CH-\ddot{\underset{\cdot\cdot}{Cl}}: \longleftrightarrow :\bar{C}H_2 - CH=\overset{+}{\underset{\cdot\cdot}{Cl}}: \longleftrightarrow \overset{+}{C}H_2 - CH=\ddot{\underset{\cdot\cdot}{Cl}}:^-$ is :

(I) (II) (III)

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

GC0143

14. If A is $Ph\overset{+}{C}H_2$ and B is $CH_2=CH-\overset{+}{C}H_2$, the greater number of resonating structure is of -

(A) A (B) B (C) both A and B (D) None of these

GC0144

15. Which of the following pairs represent resonance ?

(A) $CH_2 = CHOH$; CH_3CHO (B) $\overset{\ominus}{C}H_2-CHO$; $H_2C=CH-\overset{\ominus}{O}$

(C) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$; $CH_3-\overset{OH}{\overset{|}{C}}=CH_2$ (D) $CH_3-\overset{+OH}{\overset{\|}{C}}-CH_3$; $CH_3-\underset{H}{\overset{OH}{\overset{|}{\underset{|}{C}}}}-CH_3$

GC0145

Paragraph for Question 16 to 18

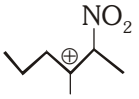
Carbocation is a specie with positively charged carbon atom having six electrons in the valence shell after sharing. Carbocations are formed in the heterolysis of a bond and are planar species. Stability of carbocation is determined by inductive effect, hyperconjugation and resonance effect. Greater the number of contributing structures, more is the stability of a Carbocation. Electron releasing groups (+I effect) increases the stability of a carbocation whereas the electron withdrawing groups (–I effect) have an opposite effect.

16. Which of the following is most stable carbocation ?

(A) $\overset{+}{C}H_3$ (B) $CH_3-\overset{+}{C}H-CH_3$ (C) $CH_3-\overset{+}{C}H_2$ (D) $CH_3-\underset{CH_3}{\overset{+}{\underset{|}{C}}}-CH_3$

GC0146

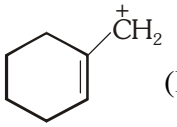
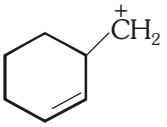
17. The most stable carbocation among the following :

(A)  (B)  (C)  (D) 

GC0147

18. In which of the following cases, the carbocation (I) is less stable than the carbocation (II) ?

(A) $C_6H_5—\overset{+}{C}H_2$ (I), $CH_2=CH—\overset{+}{C}H_2$ (II)

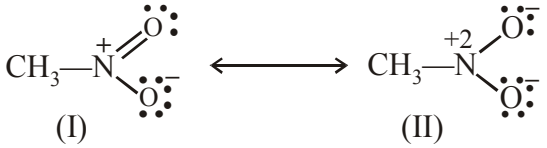
(B)  (I),  (II)

(C) $CH_2=\overset{+}{C}H$ (I), $CH_3—\overset{+}{C}H_2$ (II)

(D) $H_3C—\overset{+}{C}H_2$ (I), $CH_2(F)—\overset{\oplus}{C}H_2$ (II)

GC0148

19. Examine the structures I and II for nitromethane and choose the statement correctly :



(I) (II)

(A) Structure II is unlikely representation because electrons have shifted to oxygen

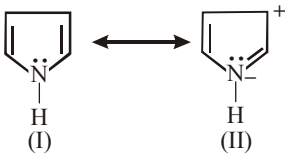
(B) Structure II is unlikely representation because nitrogen has sextet of electrons

(C) Structure II is acceptable and important

(D) None of these

GC0149

20. Examine the following two structures for pyrrole and choose the correct statement given below



(I) (II)

(A) II is not an acceptable resonating structure because carbonium ions is less stable than nitride ion

(B) II is not an acceptable resonating structure because there is charge separation

(C) II is not an acceptable resonating structure because nitrogen has ten valance electrons

(D) II is an acceptable resonating structure

GC0150

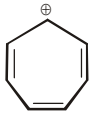
21. Delocalization of electrons increases molecular stability because :

(A) Potential energy of the molecule decreases (B) Electron-electron repulsion decreases

(C) Both (A) and (B) (D) Electron-electron repulsion increases

GC0151

22. The most stable and the least stable carbocation among

(I)  (II) $CH_2=CH-\overset{+}{C}H_2$ (III) $C_6H_5-\overset{+}{C}H_2$ (IV) $CH_3-\overset{+}{C}H-CH_3$

are respectively :

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

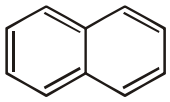
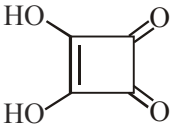
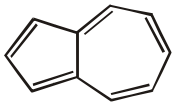
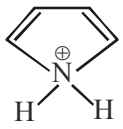
GC0152

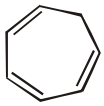
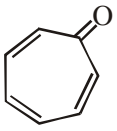
23. Most stable carbocation is formed by the heterolysis of :

(A) $(CH_3)_3CBr$ (B) $(C_6H_5)_3CBr$ (C) $(C_6H_5)_2CHBr$ (D) $C_6H_5CH_2Br$

GC0153

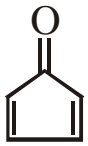
24. Total number of aromatic compounds

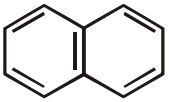
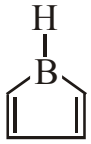
(a)  (b)  (c)  (d) 

(e)  (f) 

GC0154

25. Identify total number of compounds which are unstable at room temperature ?

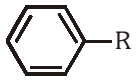
(i)  (ii)  (iii)  (iv) 

(v)  (vi)  (vii) 

GC0155

EXERCISE # J-MAIN

1. In the following benzyl/allyl system **[AIEEE-2002]**

$R–CH=CH_2$ or 

(R is alkyl group)

decreasing order of inductive effect is-

(1) $(CH_3)_3C– > (CH_3)_2CH– > CH_3CH_2–$ (2) $CH_3–CH_2– > (CH_3)_2CH– > (CH_3)_3C–$

(3) $(CH_3)_2CH– > CH_3CH_2– > (CH_3)_3CH–$ (4) None of these

GC0156

2. In the anion $HCOO^-$ the two carbon-oxygen bonds are found to be of equal length. What is the reason for it- **[AIEEE-2003]**

(1) Electronic orbits of carbon atoms are hybridised

(2) The C=O bond is weaker than the C–O bond

(3) The anion $HCOO^-$ has two resonating structure

(4) The anion is obtained by removal of a proton form the acid molecule

GC0157

3. Which one of the following does not have sp^2 hybridised carbon **[AIEEE-2004]**

(1) Acetamide (2) Acetic acid (3) Acetonitrile (4) Acetone

GC0158

4. Due to the presence of an unpaired electron, free radicals are - **[AIEEE-2005]**

(1) Chemically inactive (2) Chemically reactive

(3) Cations (4) Anions

GC0159

5. The increasing order of stability of the following free radicals is **[AIEEE-2006]**

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

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

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

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

GC0160

6. Arrange the carbanions, $(CH_3)_3\overline{C}$, $\overline{C}Cl_3$, $(CH_3)_2\overline{C}H$, $C_6H_5\overline{C}H_2$, in order of their decreasing stability **[AIEEE-2009]**

(1) $\overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_2\overline{C}H > (CH_3)_3\overline{C}$

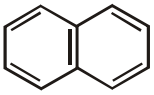
(2) $(CH_3)_3\overline{C} > (CH_3)_2\overline{C}H > C_6H_5\overline{C}H_2 > \overline{C}Cl_3$

(3) $C_6H_5\overline{C}H_2 > \overline{C}Cl_3 > (CH_3)_3\overline{C} > (CH_3)_2\overline{C}H$

(4) $(CH_3)_2\overline{C}H > \overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_3\overline{C}$

GC0161

7. The non aromatic compound among the following is :- **[AIEEE-2011]**

(1)  (2)  (3)  (4) 

GC0162

8. ortho-Nitrophenol is less soluble in water than p– and m– Nitrophenols because :-

(1) Melting point of o–Nitrophenol is lower than those of m– and p– isomers **[AIEEE-2012]**

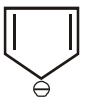
(2) o–Nitrophenol is more volatile in steam than those of m– and p– isomers

(3) o–Nitrophenol shows Intramolecular H–bonding

(4) o–Nitrophenol shows Intermolecular H–bonding

GC0163

9. Which of the following compounds are antiaromatic :- **[AIEEE-2012(Online)]**

(I)  (II)  (III)  (IV) 

(V)  (VI) 

(1) (III) and (VI) (2) (II) and (V) (3) (I) and (V) (4) (V) and (VI)

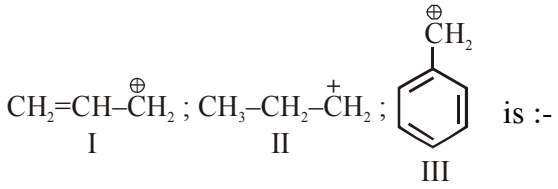
GC0164

10. Among the following the molecule with the lowest dipole moment is :- **[AIEEE-2012(Online)]**

(1) $CHCl_3$ (2) CH_2Cl_2 (3) CCl_4 (4) CH_3Cl

GC0165

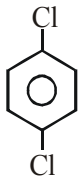
11. The order of stability of the following carbocations **[JEE-MAIN-2013]**



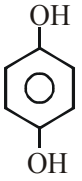
(1) III > II > I (2) II > III > I (3) I > II > III (4) III > I > II

GC0166

12. For which of the following molecule significant $\mu \neq 0$ **[JEE-MAIN-2014]**

(1) 

(2) 

(3) 

(4) 

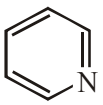
(1) Only (3) (2) (3) and (4) (3) Only (1) (4) (1) and (2)

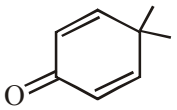
GC0167

13. Which of the following molecules is least resonance stabilized ? **[JEE-MAIN-2017]**

(1) 

(2) 

(3) 

(4) 

GC0168

EXERCISE # J-ADVANCED

1. Which one of the following has the smallest heat of hydrogenation per mole of H_2 ? **[IIT-93]**

(A) 1–Butene (B) trans–2–Butene

(C) cis–2–Butene (D) 1, 3–Butadiene

GC0176

2. Most stable carbonium ion is **[IIT-95]**

(A) p-NO_2—C_6H_4—$\overset{\oplus}{C}H_2$ (B) $C_6H_5\overset{\oplus}{C}H_2$

(C) p-Cl—C_6H_4—$\overset{\oplus}{C}H_2$ (D) p-CH_3O—C_6H_4—$\overset{\oplus}{C}H_2$

GC0177

3. Arrange the following compounds in order of increasing dipole moment : **[IIT-96]**

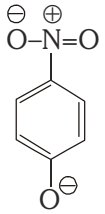
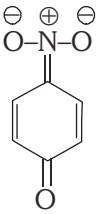
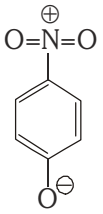
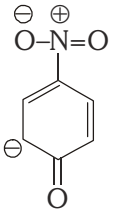
toluene (I) m-dichloroobenzene (II)

o-dichlorobenzene (III) p-dichlorobenzene (IV)

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

GC0178

4. The most unlikely representation of resonance structure of p-nitrophenoxide ion is - **[IIT-99]**

(A)  (B)  (C)  (D) 

GC0179

5. An aromatic molecule will not **[IIT-99]**

(A) have 4n π electrons (B) have (4n + 2)π electrons

(C) be planar (D) be cyclic

GC0180

6. **Statement-I :** p-Hydroxybenzoic acid has a lower boiling point that o-hydroxybenzoic acid.
Because
Statement-II : o-Hydroxybenzoic acid has intramolecular hydrogen bonding. **[IIT 2003]**

(A) Statement-I is True, Statement-II is True ; Statement-II is a correct explanation for Statement-I

(B) Statement-I is True, Statement-II is True ; Statement-II is NOT a correct explanation for Statement-I

(C) Statement-I is True, Statement-II is False.

(D) Statement-I is False, Statement-II is True.

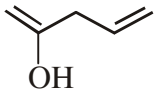
GC0181

7. Among the following, the molecule with the highest dipole moment is **[IIT-2003]**

(A) CH_3Cl (B) CH_2Cl_2 (C) $CHCl_3$ (D) CCl_4

GC0182

8. Give resonating structures of following compound. **[IIT 2003]**



GC0183

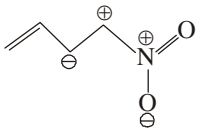
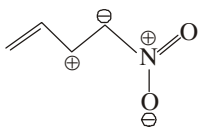
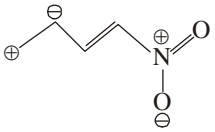
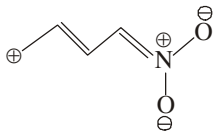
9. Which of the following is least stable **:** **[IIT-2005]**

(A) $CH_3-\overset{\oplus}{O}=CH-\overset{\ominus}{C}H-HC=CH_2$ (B) $CH_3-\overset{\oplus}{O}=CH-CH=HC-\overset{\ominus}{C}H_2$

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

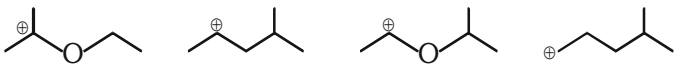
GC0184

10. Among the following, the least stable resonance structure is - **[IIT-2007]**

(A)  (B)  (C)  (D) 

GC0185

11. The correct stability order for the following species is : **[IIT-2008]**



(I) (II) (III) (IV)

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

GC0186

12. The correct stability order of the following resonance structures is **[IIT-2009]**

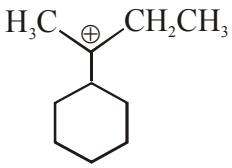
(I) $H_2C=\overset{+}{N}=\overline{N}$ (II) $H_2\overset{+}{C}-N=\overline{N}$ (III) $H_2\overline{C}-\overset{+}{N}\equiv N$ (IV) $H_2\overline{C}-N=\overset{+}{N}$

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

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

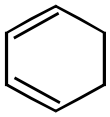
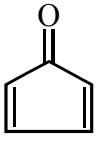
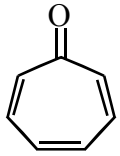
GC0187

13. The total number of contributing structures showing hyperconjugation (involving C–H bonds) for the following carbocation is. **[IIT-2011]**



GC0188

14. Which of the following molecules, in pure from , is (are) **unstable** at room temperature ? **[IIT-2012]**

(A)  (B)  (C)  (D) 

GC0189

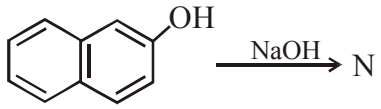
15. The hyperconjugative stbilities of tert-butyl cation and 2-butene, respectively, are due to
(A) $\sigma \rightarrow p$ (empty) and $\sigma \rightarrow \pi$ electron delocalisations **[IIT-2013]**
(B) $\sigma \rightarrow \sigma$ and $\sigma \rightarrow \pi$ electron delocalisations
(C) $\sigma \rightarrow p$ (filled) and $\sigma \rightarrow \pi$ electron delocalisations
(D) p (filled) $\rightarrow \sigma$ and $\sigma \rightarrow \pi$ electron delocalisations

GC0190

16. The total number of lone-pairs of electrons in melamine is **[IIT-2013]**

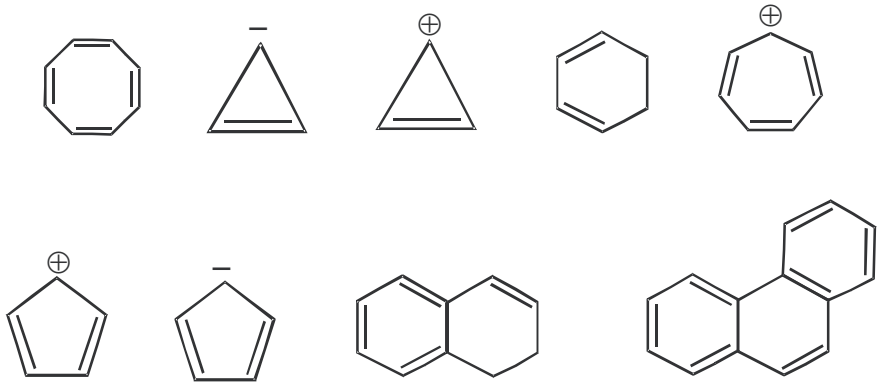
GC0191

17. The number of resonance structures for N is : **[IIT-2015]**



GC0192

18. Among the following, the number of aromatic compound (s) is- **[JEE - Adv. 2017]**



GC0193

ANSWER-KEY

EXERCISE # O-1

1. (D) **2.** (C) **3.** (B) **4.** (A,B,D) **5.** 4(b, d, f, g)

6. (a), (c), (d), (g), (j), (ℓ), (m) **7.** (A) **8.** (A) **9.** (A)

10. A,D **11.** (D) **12.** b, d, e **13.** b d e **14.** (d) **15.** c , f

16. a, b, c, d, f **17.** b, c, f **18.** **19.** a-I , b-II , c-II , d-II , e-I

20. a-I ,b-I, c-I, d-I, e-II, f-II **21.** a, e, f, g

22. (a) Resonance forms, (b) A , (c) C , (d) A & B, (e) B & C , (f) 0 , (g) B , (h) B

23. (a) II ; (b) II ; (c) II **24.** (A) **25.** a-II , b-II , c-II , d-II **26.** a & b

27. (i)-I , (ii)-II, (iii)-II, (iv)-I, (v)-I, (vi)-II , (vii)-I, (viii)-II, (ix)-II, (x)-II, (xi)-II ,(xii)-I, (xiii) -I , (xiv)-I, (xv)-I

28. a-II ,b-I, c-I, d-II, e-I **29.** (B) **30.** (D) **31.** (B) **32.** (C)

33. (C) **34.** (C) **35.** (D) **36.** (A,B,C) **37.** (B) **38.** (B)

39. (C) **40.** (D) **41.** (D) **42.** (A) **43.** (B,C,D) **44.** (B)

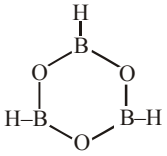
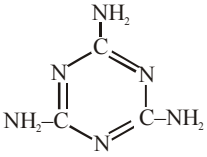
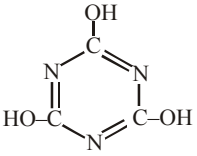
45. (A) **46.** (A,C,D) **47.** a-I ,b-I, c-II, d-I, e-I, f-I

48. a-II ,b-I, c-I, d-I, e-II, f-II **49.** (D) **50.** C>B>A **51.** (A)

EXERCISE # O-2

1. (i) a, b ; (ii) a ,c ; (iii) b, c, d ; (iv) a, b, c, d, e, f

2. Aromatic→a, b, d, e, g ; Non-aromatic→c, f **3.** (C) **4.** (C) **5.** (B)

6. (A) **7.** (a)  (b)  (c) 

8. (D)

9. (i) c > b > a (ii) c > b > a (iii) b > c > a (iv) d > c > b > a (v) c > b > a
(vi) b > c > a (vii) c > b > a (viii) c>a>d>b (ix) b > c > a (x) c > a > b
(xi) c > a > b (xii) a > b > c > d (xiii) b>a>c>d (xiv) d > e > b > a > c
(xv) a > c > b (xvi) b > c > a

10. (C) **11.** (a) I ; (b) I ; (c) II ; (d) II ; **12.** (C) **13.** (A) **14.** (A)

15. (D) **16.** (B)

17. (i) a < b (ii) d < a < c < b (iii) b < a (iv) c < b < a (v) c < a < b (vi) a<c< b
(vii) c < b < a (viii) c < b < a (ix) b < a (x) a < c < b < d

18. (A) **19.** (D) **20.** (B) **21.** (D)

22. (a) IV<I<II < III < V (b) III < IV < I < II **23.** (B) **24.** (A)

25. (a) -I ; (b) - I ; (c) - II **26.** (a) 4658 ; (b) 4638 (c) 4632 ; (d) 4650 ; (e) 5293

27. (A) **28.** (B) **29.** (D)

30. (i) d > c > b > a ; (ii) e > c > d > b > a ; (iii) b > a (iv) a > b (v) b > a ; (vi) a > b

31. (i) a < b ; (ii) e < d < c < b < a ; (iii) a < c < b ; (iv) a > b > c

32. (i) c > b > a ; (ii) a > b > c > d ; (iii) a > b ; (iv) c > b > a

33. a - I ; b - I ; c - II, d - I **34.** Stability order : d>c>b> a ; HOH order : a > b > c > d

35. (C) **36.** (D) **37.** (B) **38.** (C)

39. (i) c > b > a (ii) a > b > c (iii) a > b

EXERCISE # S-1

1. (C) **2.** (A,D) **3.** (D) **4.** (C) **5.** (A,B,D)

6. (A) → P, S ; (B) → Q,R ; (C) → Q,S ; (D) → P,S

7. (A) → P, Q, S ; (B) → R ; (C) → P, S ; (D) → Q, S

8. (A) → R ; (B) → S ; (C) → P, T ; (D) → Q

9. (A) → Q,S ; (B) → P,S ; (C) → P,S ; (D) → R,S

10. (D) **11.** (A) **12.** (D) **13.** (A) **14.** (A) **15.** (B)

16. (D) **17.** (C) **18.** (C) **19.** (B) **20.** (C) **21.** (C)

22. (D) **23.** (B) **24.** (4) **25.** (4)

EXERCISE # J-MAIN

1. (1) **2.** (3) **3.** (3) **4.** (2) **5.** (4) **6.** (1)

7. (1) **8.** (3) **9.** (4) **10.** (3) **11.** (4) **12.** (2)

13. (4)

EXERCISE # J-ADVANCED

1. (D) **2.** (D) **3.** (B) **4.** (C) **5.** (A) **6.** (D)

7. (A) **9.** (D) **10.** (A) **11.** (D) **12.** (B) **13.** (6)

14. (B,C) **15.** (A) **16.** (6) **17.** (9) **18.** (5)