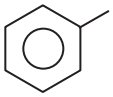
EXERCISE # I

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

(A) –F > –Cl > –Br > –I

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

(C) –F > –OH > $-NH_2$

(D)  > C ≡ > CH > –H

2. What is the correct order of inductive effect?

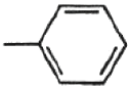
(A) $-O^- > -CH_3 > -CMe_3$

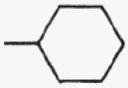
(B) $-CO_2- > -O- > CHMe_2$

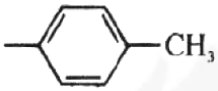
(C) $-O^- > -CH_2Me > -D > -H$

(D) None

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

(A) 

(B) 

(C) 

(D) $-CH = CH_2$

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

(A) –OH

(B) $-\underset{\underset{O}{\|}}{C}-OH$

(C) $-CH_3$

(D) $-OCH_3$

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

(a) –OH

(b) $-O^{\Theta}$

(c) $-NH_2$

(d) $-\overset{\Theta}{N}H$

(e) –COOH

(f) $-COO^{\Theta}$

(g) –Me

(h) –OMe

(i) –F

(j) $-\overset{\Theta}{N}H_3$

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

(a) Resonance is an intramolecular process.

(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.

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 existence

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

8. Which of the following is most stable?

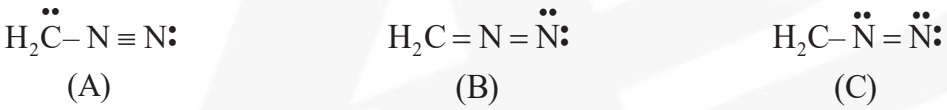
(A) Conjugated alkadiene ($CH_2 = CH–CH = CH_2$)

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

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

(D) All are equally stable

9. Consider structural formulas A, Band C:



(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?

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 $(4n)\ 7\pi$-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.

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

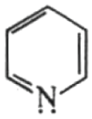
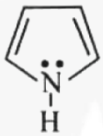
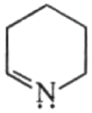
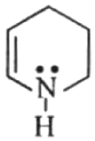
(A) $H_2C=CH-\overset{\overset{O}{\|}}{C}-H;\ CH_2^{+}-CH-\overset{\overset{O^-}{|}}{C}-H$

(B) $CH_3=CH-CH^{+}Cl;CH_2^{+}-CH=CH-Cl$

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

(D) $(CH_3)_2CH_2-\overset{\overset{O}{\|}}{C}-CH_3;CH_3-CH=\overset{\overset{O^-}{|}}{C}=CH_3$

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

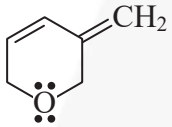
(a)  (b)  (c)  (d) 

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

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) 

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

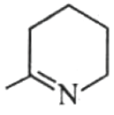
15. Identify electron donating groups in resonance among the following :

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

(e) –CHO (f) $-NHCOCH_3$

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

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

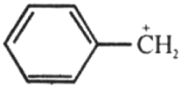
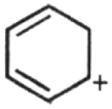
(e) $-O-CH=CH_2$ (f) 

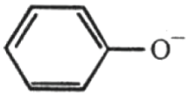
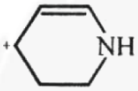
17. Which of the following groups can either donate or witl).draw a pair of electrons in resonance depending upon situation :

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

(e) $-NH_2$ (f) $-N=NH$

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

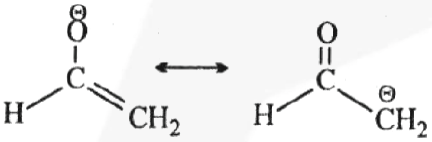
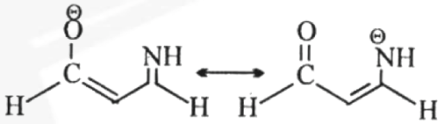
(a) $CH_3-\overset{O}{\overset{\|}{C}}-\overset{\ominus}{C}H_2$ (b) $H-\overset{O}{\overset{\|}{C}}-CH=CH-\overset{\ominus}{C}H_2$ (c)  (d) 

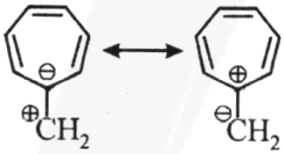
(e)  (f)  (g)  (h) 

(i) $CH_3-CH=CH-CH=CH-\overset{+}{C}H-CH_3$ (j) $CH_3-CH=CH-CH=CH-\overset{+}{C}H_2$

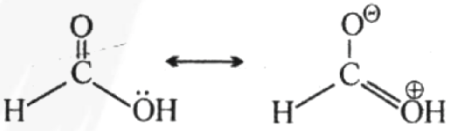
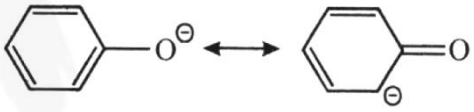
19. Identify less stable canonical structure in each of the following pairs:

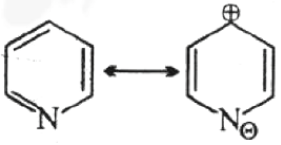
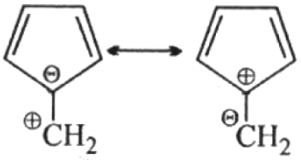
(a) $\overset{\oplus}{C}H_2-O-CH_3 \longleftrightarrow CH_2=\overset{\oplus}{O}-CH_3$ (b) 

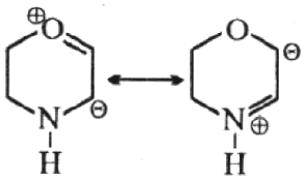
(c)  (d) 

(e) 

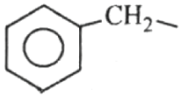
20. Identify more stable canonical structure in each of the following pairs :

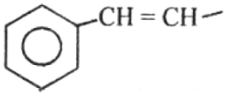
(a)  (b) 

(c)  (d) 

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

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

(a) –OH (b) $-CH_2-\bar{C}H_2$ (c) $-CH_2-\overset{\oplus}{C}H_2$ (d) 

(e)  (f) $-BH_2$ (g) $-\overset{\oplus}{P}Ph_3$

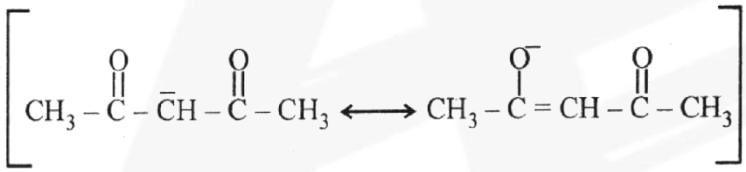
22. Arrange the following resonating structure according to their contribution towards resonance hybrid?

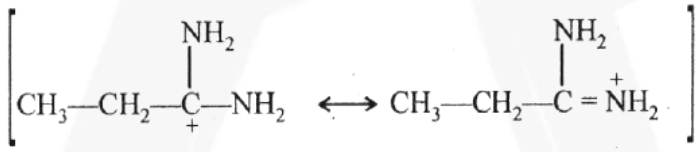
(a) $CH_2=\overset{\oplus}{N}=\overset{\oplus}{N}$ (b) $\overset{\ominus}{C}H_2-N=\overset{\oplus}{N}$ (c) $\overset{\oplus}{C}H_2-\underset{\cdot\cdot}{N}=\overset{\ominus}{N}$ (d) $\overset{\ominus}{C}H_2-\overset{\oplus}{N}\equiv\ddot{N}$

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

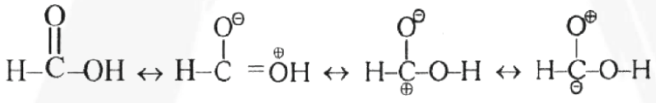
23. In each of the following pairs of resonating structure which resonating structure is more stable:

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

(b) 

(c) 

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

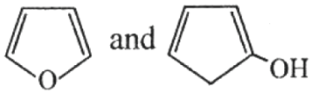
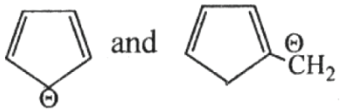


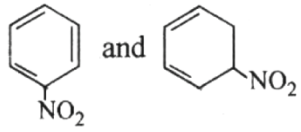
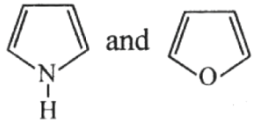
I II III IV

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

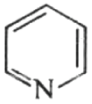
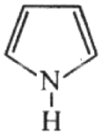
25. In the given pair of compounds select the one in each pair having lesser resonance energy :

(a)  (b) 

(c)  (d) 

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.

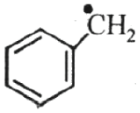
27. In the given pair of compounds select the one in each pair having higher resonance energy :

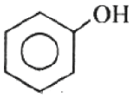
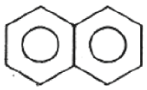
(i)  and 

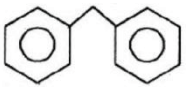
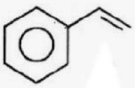
(ii) $CH_2 = CH - O - CH = CH_2$ and $CH_2 = CH - NH - CH = CH_2$

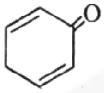
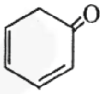
(iii) $CH_2 = CH - \overset{\ominus}{N}H$ and $HN = CN - \overset{\ominus}{N}H$

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

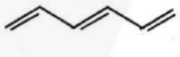
(v)  and $CH_2 = CH - \dot{C}H_2$

(vi)  and 

(vii)  and 

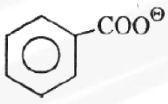
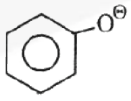
(viii)  and 

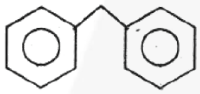
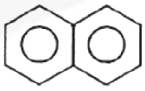
(ix) $CH_2 = CH - OH$ and $CH_2 = CH - CH = CH - OH$

(x)  and 

(xi) CH_3COOH and CH_3COONa

(xii) $CH_2 = CH - \overset{\ominus}{O}$ and $CH_2 = CH - OH$

(xiii)  and 

(xiv)  and 

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

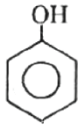
28. In the given pair of compounds select the one in each pair having lesser resonance energy :

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

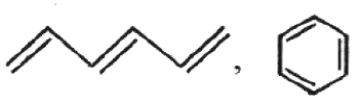
(b)  and $CH_2 = CH - CH_2^-$

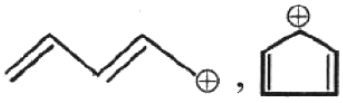
(c)  and $CH_2 = CH - CH - CH_2$

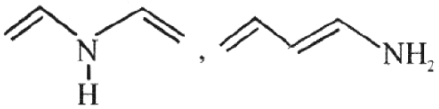
(d)  and $CH_2 = CH - \overset{\oplus}{C}H_2$

(e)  and 

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

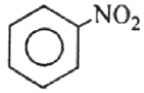
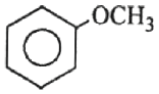
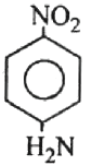
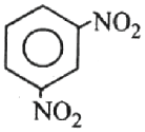
(A) 

(B) 

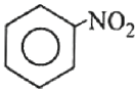
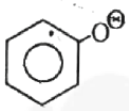
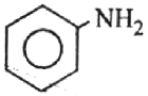
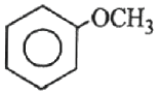
(C) 

(D) None of these

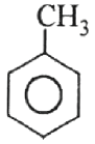
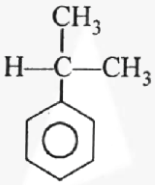
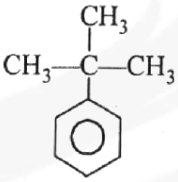
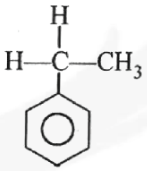
30. In which of the following molecules π - electron density in ring is minimum:

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

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

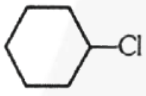
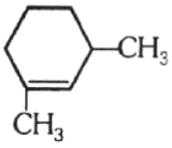
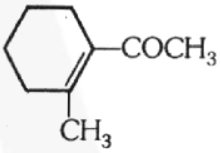
(A)  (B)  (C)  (D) 

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

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

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

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) $CH_2 = CH - CH = CH_2$

35. Select the correct statement.

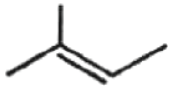
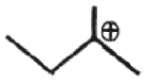
(i) Delocalisation of σ-electron is hyperconjugation.

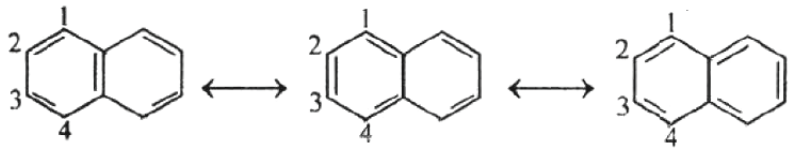
(ii) Delocalisation of π-electron is resonance.

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

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

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)

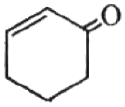
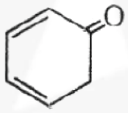
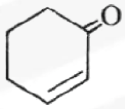
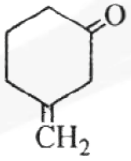
37. 

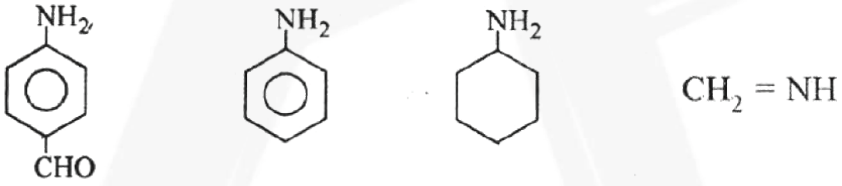
These are three canonical structures.of naphthalene. Examine them and find correct statement among the following :

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

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

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

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

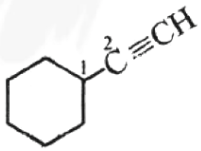
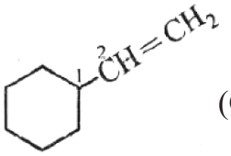
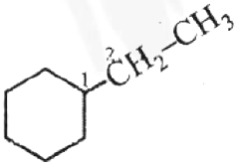
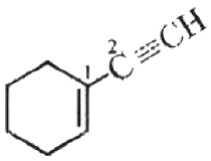
39. 

I II III IV

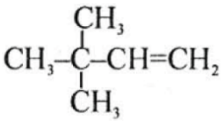
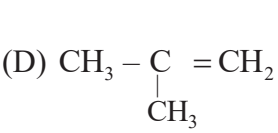
Among these compounds, the correct order of C–N bond lengths is :

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

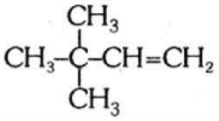
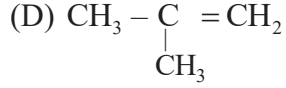
40. Cl–C2 bond is shorter in

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

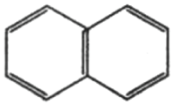
41. Which of the following molecule has longest C=C bond length?

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

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

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

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) 

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) $C_6H_4 > C_2H_6 > C_2H_2 > C_6H_6$ (D) $C_2H_6 > C_2H_4 > C_2H_2 > C_6H_6$

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

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

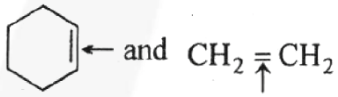
(A) C–C > C = C > C ≡ C > C ≡ N

(C) C = C > C = N > C = O

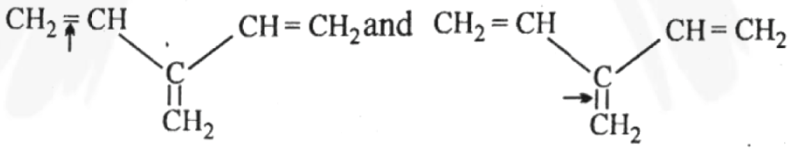
(B) C = N > C = O > C = C

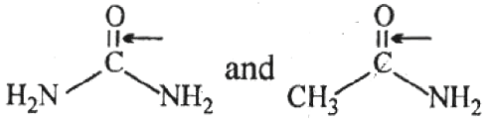
(D) C–C > C = C > C ≡ C > C–H

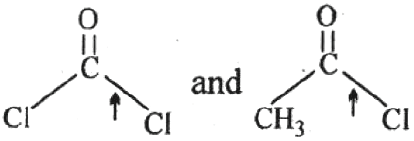
47. In which of the following pairs, indicated bond having less bond dissociation energy:

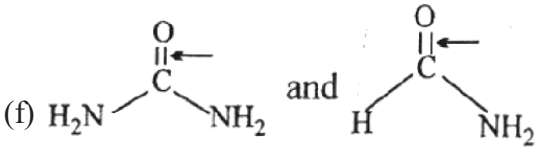
(a) 

(b) 

(c) 

(d) 

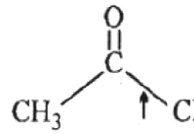
(e) 

(f) 

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

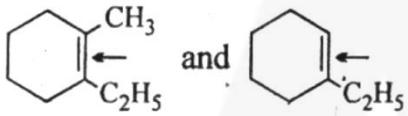
(a) CH_3-CH_2-Br and CH_3-CH_2-Cl

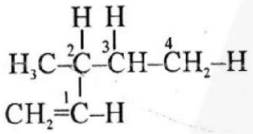
(b) $CH_3-CH=CH-Br$ and $CH_3-CH(Br)-CH_3$

(c)  and CH_3-CH_2-Cl

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

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

(f) 

49. 

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

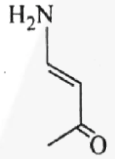
(A) C^2–H > C^3– H > C^4–H > C1–H

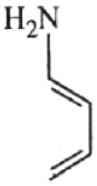
(B) C^2–H > C^3–H > C^1–H > C^4

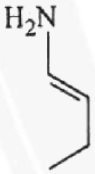
(C) C^1–H > C^4–H > C^2–H > C^3–H

(D) C^1–H > C^4–H > C^3–H > C^2 – H

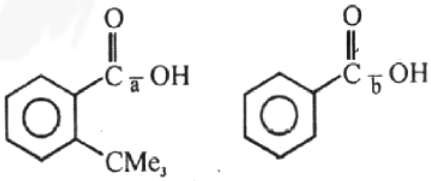
50. Compare the C–N bond-length in the .following species:

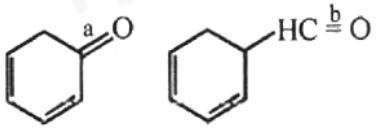
(A) 

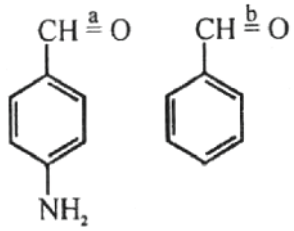
(B) 

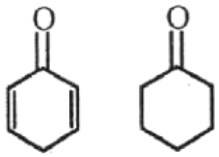
(C) 

51. In which case, C–O bond length is shorter for I[st] compound:

(A) 

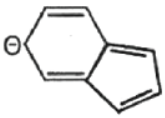
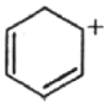
(B) 

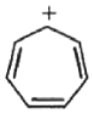
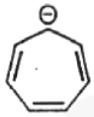
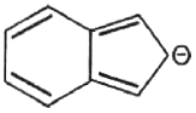
(C) 

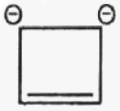
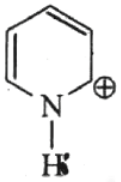
(D) 

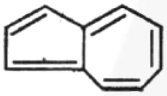
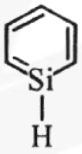
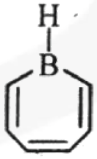
EXERCISE # II

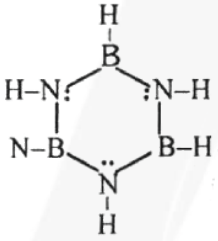
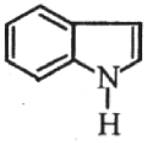
1. In each set of species select the aromatic species.

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

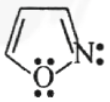
(ii) (a)  (b)  (c)  (d) 

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

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

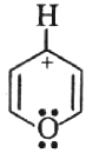
(e)  (f) 

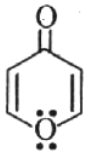
2. Which of the given compound is aromatic, antiaromatic or nonaromatic.

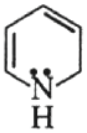
(a)  isoxazole

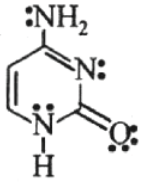
(b)  1,3-thiazole

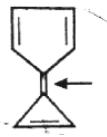
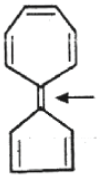
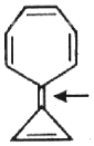
(c)  pyran

(d)  pyrylium ion

(e)  γ-pyrone

(f)  1,2-dihydropyridine

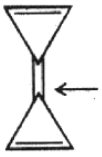
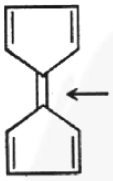
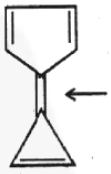
(g)  cytosine

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

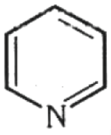
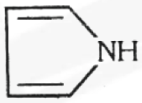
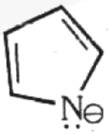
4. Which of the given compunds has minimum rotation energy barrier across indicated carbon-carbon bond.

(I)  (II)  (III) 

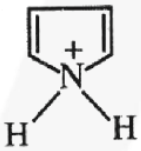
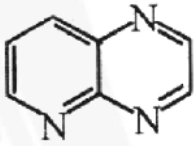
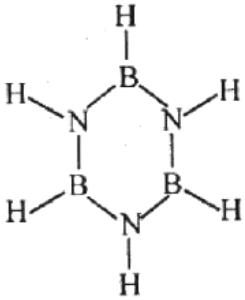
Compare carbon-carbon bond rotation across I, II, III.

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

5 Which species is not aromatic?

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

6 Which of the following are non-aromatic

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

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 $(HN = C = O)_3$

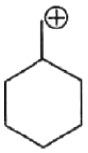
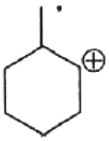
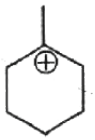
8. Select the least stable one :

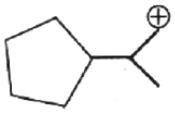
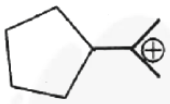
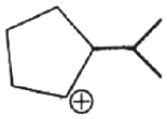
(A) $CH_3 - \overset{\oplus}{C}H_2$ (B) $CH_3 - CH_2 - \overset{\oplus}{C}H_2$

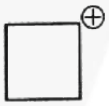
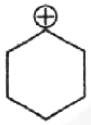
(C) $H_3C > CH - \overset{\oplus}{C}H_2$ (D) $H_3C > C = \overset{\oplus}{C}H_2$ (H_3C)

9. Write stability in decreasing order of following intermediates:

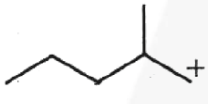
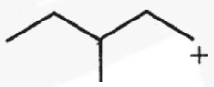
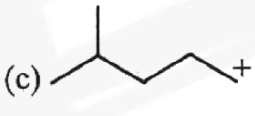
(i) (a) $CH_3-\overset{\oplus}{C}H_2$ (b) $CH_3-\overset{\oplus}{C}H-CH_3$ (c) $CH_3-\underset{CH_3}{\overset{CH_3}{C}}\oplus$

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

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

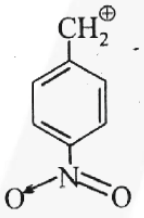
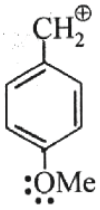
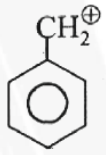
(iv) (a)  (b)  (c)  (d) 

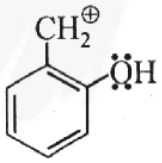
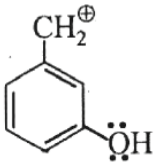
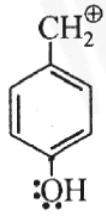
(v) (a) $CF_3-\overset{+}{C}H_2$ (b) $CCl_3-\overset{+}{C}H_2$ (c) $CBr_3-\overset{+}{C}H_2$

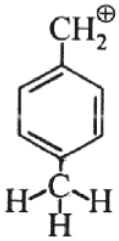
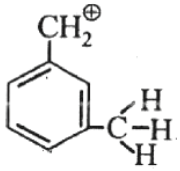
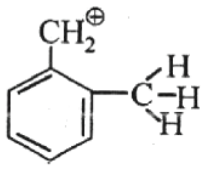
(vi) (a)  (b)  (c) 

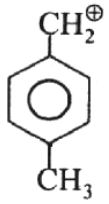
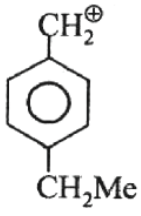
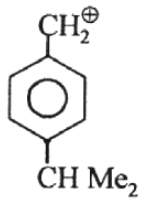
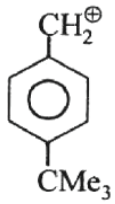
(vii) (a) $HC\equiv\overset{\oplus}{C}$ (b) $CH_2=\overset{\oplus}{C}H$ (c) $CH_3-\overset{\oplus}{C}H_2$

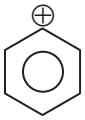
(viii) (a) $C_6H_5^+$ (b) $p\text{–}NO_2(C_6H_4)^+$ (c) $p\text{-}CH_3\text{–}(C_6H_4)^+$ (d) $p\text{–}Cl\text{–}C_6H_4^+$

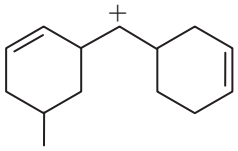
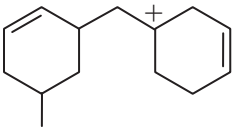
(ix) (a)  (b)  (c) 

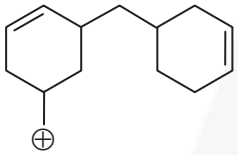
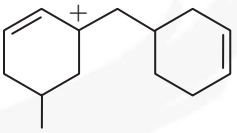
(x) (a)  (b)  (c) 

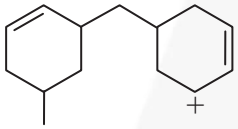
(xi) (a)  (b)  (c) 

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

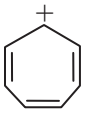
(xiii) (a)  (b) (c)  (d) 

(xiv) (a)  (b) 

(c)  (d) 

(e) 

(xv) (a)  (b)  (c) 

(xvi) (a)  (b)  (c) 

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 $CH_3CH_2\overset{\oplus}{C}H_2$

(VI) $CH_2=\overset{\oplus}{C}H$ 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

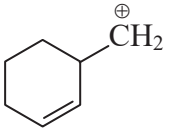
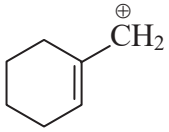
(C) I, II and III are correct

(D) II, III and IV are correct

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

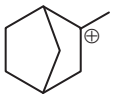
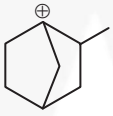
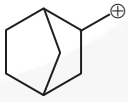
(a) (I) $C_6H_5-\overset{\oplus}{C}H_2$ and (II) $CH_2=CH-\overset{\oplus}{C}H_2$

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

(c) (I)  and (II) 

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

12. Find out correct stability order in the following carbocations-

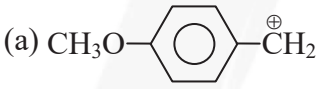
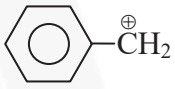
(I)  (II)  (III)  (IV) 

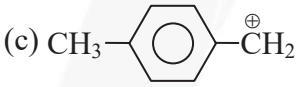
(A) IV > I > III > II (B) IV > III > I > II (C) I > IV > III > II (D) I > III > IV > II

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

(A) Ph_3C^+ (B) $(CH_3)_3C^+$ (C) $(CH_3)_2CH^+$ (D) $CH_2=CH-CH_2^+$

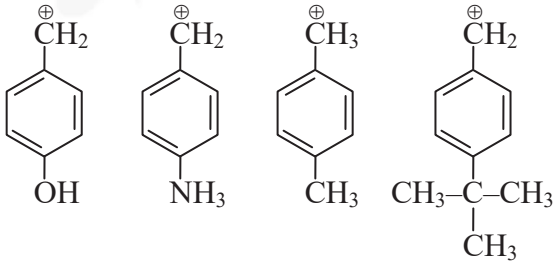
14. Consider the following carbocations

(a)  (b) 

(c)  (d) $CH_3-\overset{\oplus}{C}H_2$

The relative stabilities of these carbocations are such that :-

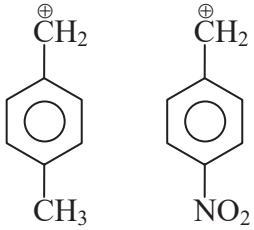
(A) d < b < c < a (B) b < d < c < a (C) d < b < a < c (D) b < d < a < c

15. 

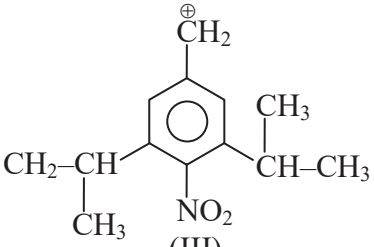
Correct order of carbocation stability is :

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

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


(I)

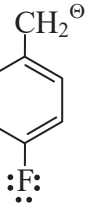
(II)


(III)

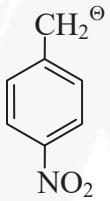
(A) I < II < III (B) II < III < II (C) III < II < I (D) III < I < II

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

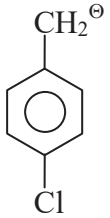
(i) (a)



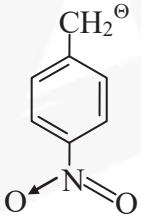
(b)



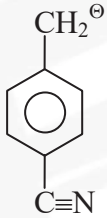
(ii) (a)



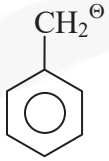
(b)



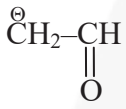
(c)



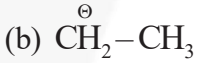
(d)



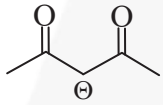
(iii) (a)



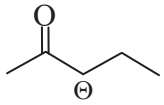
(b)



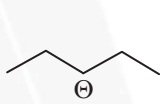
(iv) (a)



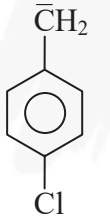
(b)



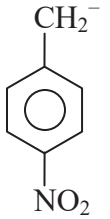
(c)



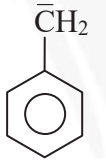
(v) (a)



(b)



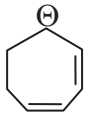
(c)



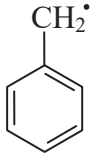
(vi) (a)

(b)

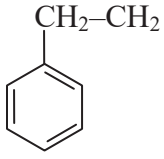
(c)



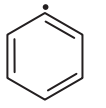
(vii) (a)



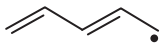
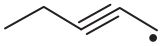
(b)

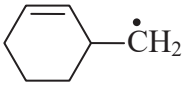
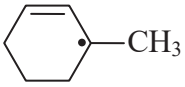


(c)



(viii) (a)  (b)  (c) 

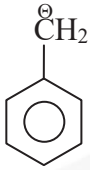
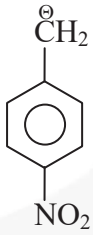
(ix) (a)  (b) 

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

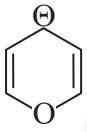
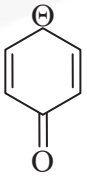
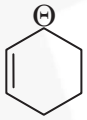
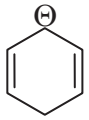
18. Most stable carbanion is :-

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

19. Most stable carbanion is :

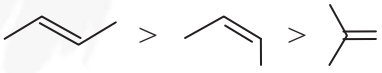
(A) $CH_3^{\ominus}$ (B) $CH_2=CH-\overset{\ominus}{C}H_2$ (C)  (D) 

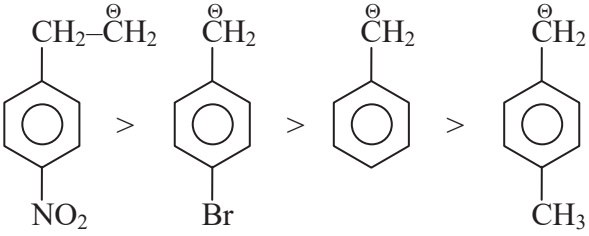
20. Identify the most stable anion.

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

21. Correct order of stability :

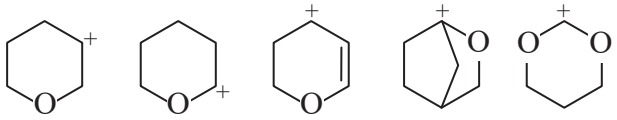
(A)  $> H_3C-\overset{\oplus}{C}(CH_3)-CH_3 > \overset{\oplus}{C}H_2-OCH_3 > \overset{\oplus}{C}H_3$

(B) 

(C) 

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

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

(a) 

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

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

I. $Ph–\dot{C}H_2$

II. $Ph–\dot{C}H–\dot{C}H_2–CH_3$

III. $Ph–\dot{C}H–CH=CH_2$

IV. $Ph–\dot{C}(CH_3)–CH=CH_2$

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

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

(I) (II)

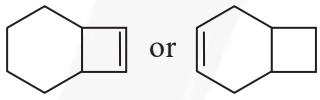
(A) there is resonance in I but not in II (B) there is tautomerism in I but not in II

(C) there is hyperconjugation in I but not in II (D) II has more cononical structures than I

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

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-l-pentene

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

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

27. Stability of:

(I) $CH_3–CH=CH–CH_3$

(II) $CH_3–C(CH_3)=C(CH_3)–CH_3$

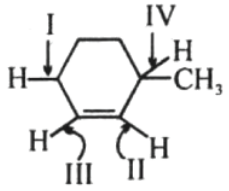
(II) $CH_3–C(CH_3)=CH_2$

(IV) $CH_3–C(CH_3)=CH–CH_3$

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

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



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

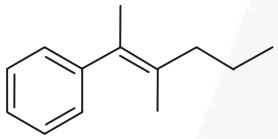
29. Rank the following alkenes in decreasing order of heat of combustion values:

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

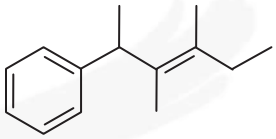
(A) II > III > IV > I (B) II > IV > III > I (C) I > III > IV > II (D) I > IV > III > II

30. Write decreasing order of heat of hydrogenation :

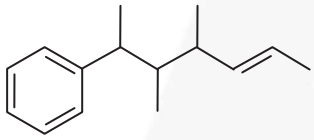
(i) (a)



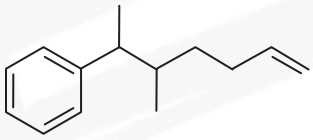
(b)



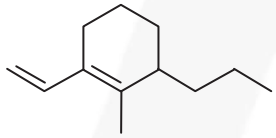
(c)



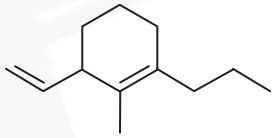
(d)



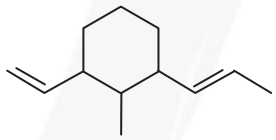
(ii) (a)



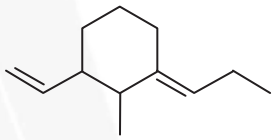
(b)



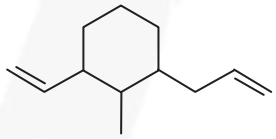
(c)



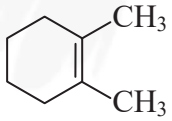
(d)



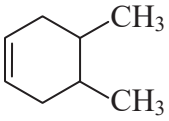
(e)



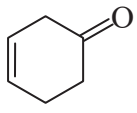
(iii) (a)



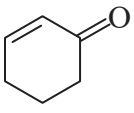
(b)



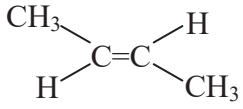
(iv) (a)



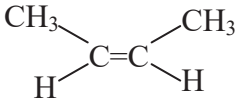
(b)



(v) (a)

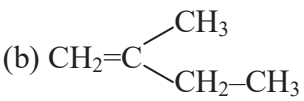


(b)



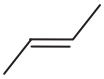
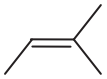
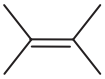
(vi) (a)

(b)

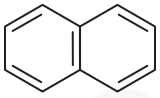
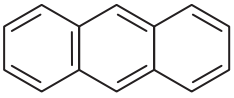


31. Write increasing order of heat of hydrogenation :

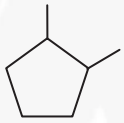
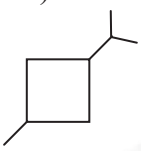
(i) (a)  (b) 

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

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

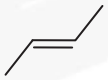
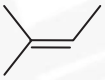
(iv) (a)  (b)  (c)  (HOH per benzene ring)

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

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

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

(iii) (a)  (b) 

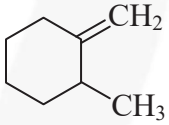
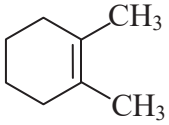
(iv) (a)  (b)  (c) 

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

(a)  and 

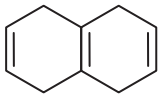
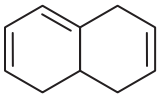
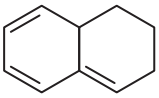
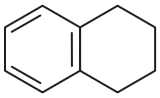
(b)  and 

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

(d)  and 

34. Arrange the following compounds in order of:

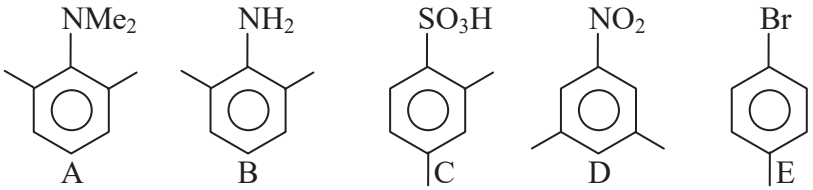
(I) Stability (II) Heat of hydrogenation

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

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

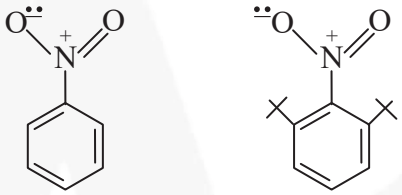
36.



Steric inhibition of resonance takes place :

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

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



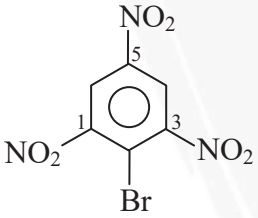
(A) carbon-nitrogen bond length structure I is greater than that in structure II

(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 cannot be compared

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



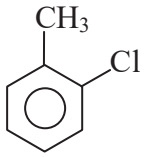
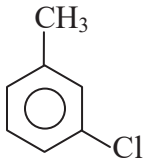
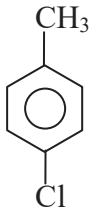
(A) All three C–N bonds are of same length.

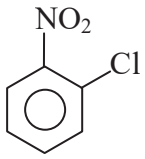
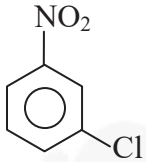
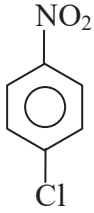
(B) Cl–N and C3–N bonds are of same length but shorter than C5–N bond.

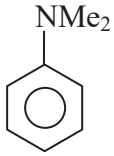
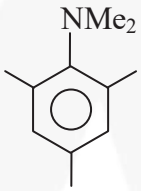
(C) Cl–N and C3–N bonds are of same length but longer than C5–N bond.

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

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

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

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

(iii) (a)  (b) 

40. Why a cation like  is not possible.

EXERCISE # III

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

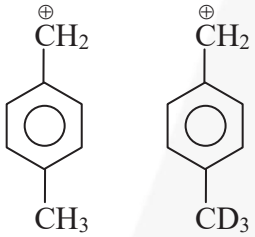
2. Select correct statement regarding given compounds :

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

3. In the compound, $\overset{I}{CH_3}-\overset{II}{CH}=\overset{III}{CH}-\overset{IV}{C}\equiv N$, the most electronegative carbon is :
(A) I (B) II (C) III (D) IV

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 $-CH_3$

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

6. Match the column I with column II.

Column-I (Group attached with benzene ring)		**Column-I (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

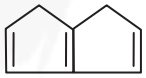
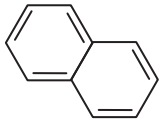
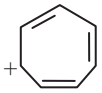
7.

	Column- I (Groups attached to phenyl ring)		**Column- I (Effect shown)**
(A)	$-\ddot{N}=0$	(P)	+M
(B)	$-CH_3$	(Q)	–M
(C)	$-\ddot{N}H-C(=O)-CH_3$	(R)	+H
(D)	$-C(=O)-OCH_3$	(S)	–I

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)	$-NH_2$

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

10. **Statement-I :** $-\overset{a}{C}(=O)-OEt$ $-\overset{b}{C}(=O)-O-C(=O)-$ bond length a < b

Because

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

(A) Statement-I is true, statement-II is true and statement-II is correct explanation for statement-I.

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

(C) Statement-I is true, statement-II is false.

(D) Statement-I is false, statement-II is true.

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-I is true, statement-II is true and statement-II is correct explanation for statement-I .

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

(C) Statement-I is true, statement-II is false.

(D) Statement-I is false, statement-II is true.

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-I is true, statement-II is true and statement-II is correct explanation for statement-I.

(B) Statement-I is true, statement-II is true and statement-II is NOT the correct explanation for statement-I

(C) Statement-I is true, statement-II is false

(D) Statement-I is false, statement-II is true.

Paragraph for Question 13 to 15

The intramolecular delocalisation of n 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

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

(I) (II) (III)

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

14. If A is $PhCH_2^+$ and B is $CH_2=CH-CH_2^+$, the greater number of resonating structure is of-

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

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

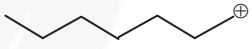
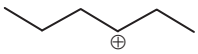
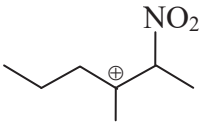
Paragraph for Question 16 to 18

Carbocation is a specie with-positively charged carbon atom having six electrons irrthe 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 (–1 effect) have an opposite effect.

16. Which of the following is most stable carbocation?

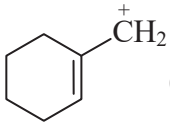
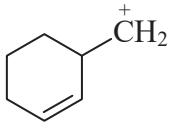
(A) $\overset{+}{C}H_3$ (B) $CH_3-\overset{+}{C}H-CH_3$ (C) $CH_3-\overset{+}{C}H_2$ (D) $CH_3-\overset{\overset{+}{C}}{\underset{CH_3}{\underset{|}{}}}-CH_3$

17. The most stable carbocation among the following :

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

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

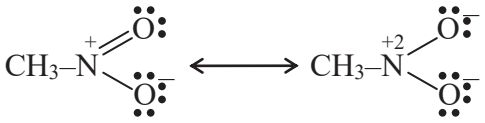
(A) $C_6H_5-\overset{+}{C}H_2(I), CH_2=CH-\overset{+}{C}H_2(II)$

(B)  (I) ,  (II)

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

(D) $H_3C-\overset{+}{C}H_2(I)$, $\underset{CH_3}{\underset{|}{CH_2}}-\overset{\oplus}{C}H_2(II)$

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



(I) (II)

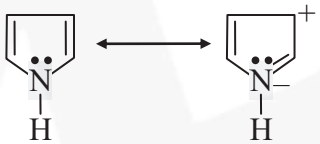
(A) Structure II is unlikely representation because electrons have shifted to oxygen

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

(C) Structure II is acceptable and important

(D) None of these

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

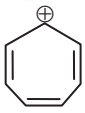
(D) II is an acceptable resonating structure

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

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) $CH_3-\overset{+}{C}H-CH_3$

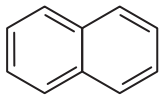
are respectively :

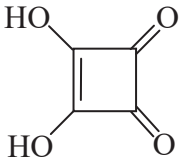
(A) II, I (B) III, IV (C) I, II (D) I, IV

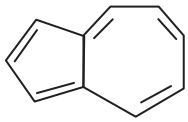
23. Most stable carbocation is formed by the heterolysis of:

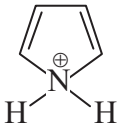
(A) $(CH_3)_3CBr$ (B) $(C_6H_5)_3CBr$ (C) $(C_6H_5)_2CHBr$ (D) $C_6H_5CH_2Br$

24. Total number of aromatic compounds

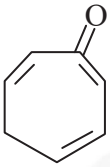
(a) 

(b) 

(c) 

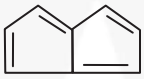
(d) 

(e) 

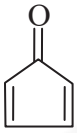
(f) 

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

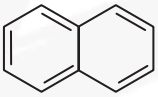
(i) 

(ii) 

(iii) 

(iv) 

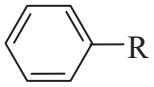
(v) 

(vi) 

(vii) 

EXERCISE # IV (JEE-MAINS)

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

$R–CH=CH_2$ or  R

(R is alkyl group)

decreasing order ofinductive effect is-

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

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

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

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

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

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

(1) Chemically inactive (2) Chemically reactive

(3) Cations (4) Anions

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

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

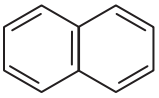
(1) $\bar{C}Cl_3 > C_6H_5\bar{C}H_2 > (CH_3)_2\bar{C}H > (CH_2)_3\bar{C}$

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

(3) $C_6H_5\bar{C}H_2 > CCl_3 > (CH_3)_3\bar{C} > (CH_3)_2\bar{C}H$

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

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

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

8. ortho-Nitrophenol is less soluble in water than ir-and m- Nitrophenols because : **[AIEEE-2012]**

(1) Melting point of o-Nitrophenol is lower than those of m- and p–isomers

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

(3) o-Nitrophenol shows lntramolecular H–bonding

(4) o-Nitrophenol shows Intermolecular H–bonding

9. Which of the following compounds are antiaromatic :- **[AIEEE-2012(0nline)]**

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

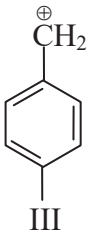
(V)  (VI) 

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

10. Among the following the molecule with the lowest dipole moment is :- **[AIEEE-2012(0nline)]**

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

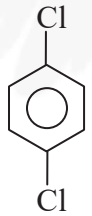
11. The order of stability of the following carbocations **[JEE-MAIN-2013]**

$CH_2=\overset{\oplus}{C}H-CH_2$; $CH_3-\overset{+}{C}H-CH_2$;  is :

I II III

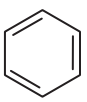
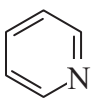
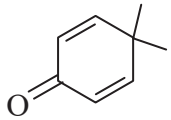
(l) III > II > I (2) II > III > I (3) I > II > III (4) III > I > II

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)

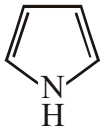
13. Which of the following molecules is least resonance stabilized ? **[JEE-MAIN-2017]**

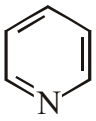
(1)  (2)  (3)  (4) 

14. Which of the following compounds is not aromatic ? **[JEE MAIN-2019]**

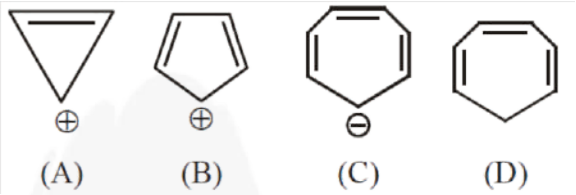
(1) 

(2) 

(3) 

(4) 

15. Which compound(s) out of the following is/are not aromatic ? **[JEE MAIN-2019]**



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

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

EXERCISE # V (JEE-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) I, 3–Butadiene

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) $p-CH_3O-C_6H_4-\overset{\oplus}{C}H_2$

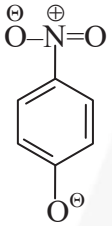
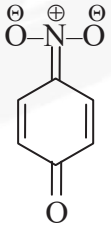
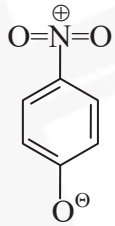
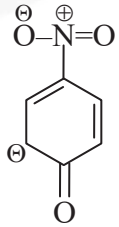
3. Arrange the following compounds in order of increasing dipole moment : **[IIT-96]**

toluene (I) m-dichloroobenzerie (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 < Ill

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

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

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

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

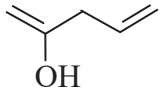
(C) Statement-I is True, Statement-II is False.

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

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

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

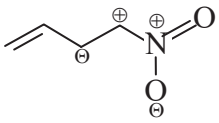
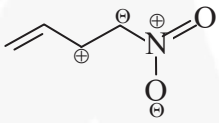
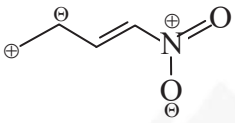
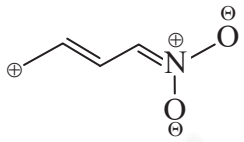


9 Which of the following is least stable : **[IIT-2005]**

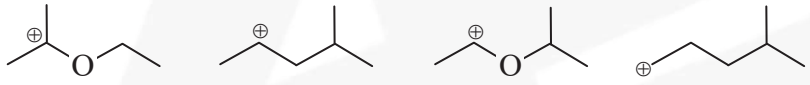
(A) $CH_3-\overset{\oplus}{C}=CH-\overset{\ominus}{C}H-HC=CH_2$ (B) $CH_3-\overset{\oplus}{O}=CH-HC=HC-\overset{\ominus}{C}H_2$

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

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

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

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

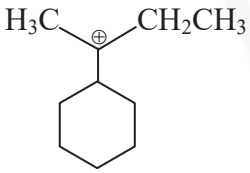
12 The correct stability order of the following resonance structures is **[IIT-2009]**

(I) $H_2C=\overset{+}{N}=\overset{-}{N}$ (B) $H_2\overset{+}{C}-N=\overset{-}{N}$ (C) $H_2\overset{-}{C}-\overset{+}{N}\equiv N$ (D) $H_2\overset{-}{C}-N=\overset{+}{N}$

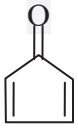
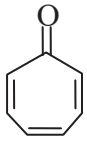
(A) (I) > (II) > (IV) > (III) (B) (I) > (III) > (II) > (IV)

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

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



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

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

Q.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]**

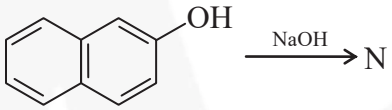
(B) $\sigma \rightarrow \sigma$ and $\sigma \rightarrow \pi$ electron delocalisations

(C) $\sigma \rightarrow p$ (filled) and $\sigma \rightarrow \pi$ electron delocalisations

(D) p (filled) $\rightarrow \sigma$ and $\sigma \rightarrow \pi$ electron delocalisations

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

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



Q.18 Among the following the number of aromatic compound(s) is **[JEE ADV. 2017]**

ANSWER KEY

EXERCISE # I

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

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 **19.** a-I, b-II, c-II, d-II, e-1

20. a-I,b-I,c-I,d-I,e-II,f-II **21.** a,e,f,g **22.** (A) **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)

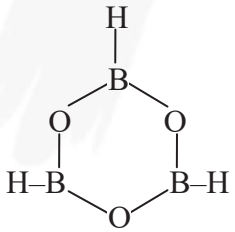
EXERCISE # II

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

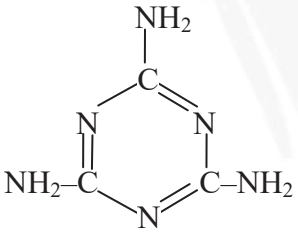
2. Aromatic→a, b, d, e, g; Non-aromatic→c, f **3.** (C) **4.** (C) **5.** (B)

6. (A)

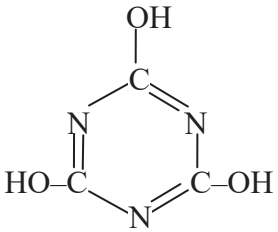
7. (a)



(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 # III

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 # IV (JEE-MAINS)

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) **14.** (1)
15. (2)

EXERCISE # V (JEE-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)

SOLUTIONS : ELECTRONIC DISPLACEMENT EFFECTS

EXERCISE # I

Note : Check series of –I.

1. **Ans. (D)**

2. **Ans. (C)**

3. **Ans. (B)**

4. (A) $C-C-C-\overset{\delta+}{C}-\overset{\delta-}{O}H$ (E.N. – I more)

(B) $C-C-C-\overset{\delta+}{\underset{\underset{O}{\|}}{C}}-O-H$ ($O^{\delta-}$ – I)

(C) $C-C-\overset{+I}{C}H_3$

(D) $-O-CH_3$ (E.N. – I)

5. + I effect group

$-\ddot{O}^{\ominus}$, $-\ddot{N}H^{\ominus}$, $-COO^{\ominus}$, $-Me$ `

6. True statement about resonance

(c) Resonance involves delocalization of π electrons only.

$C=C-C=C-C=O$

(d) Resonance decreases potential energy of an acyclic molecule.
(Due to resonance stability of molecular ↑ in acyclic mol so potential energy) ↓ (mol cyclic A.B.)

(g) Resonance is not the only way to increase molecular stability.
(+I, H·C also increases stability) (Aromaticity)

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

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

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

7. Incorrect statement-
Resonating structure are real & have real existence
(Resonating structure is a hypothetical structure which is imaginary)

8. (A) Conjugated alkadiene ($CH_2=CH-CH=CH_2$) (resonance)

10. Canonical structure will more stable if

(A) It involves cyclic delocalization of (4n + 2) π-electrons than if it involves acyclic delocalization of (4n + 2) π-electrons.

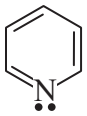
$4n + 2 = 6\pi e^-$

Non aromatic

11. $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3 \longleftrightarrow CH_3-CH=\overset{\overset{O^-}{|}}{C}=CH_3$

Its not a resonance phenomena tautomeris-

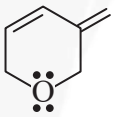
For resonance 3 parallel P orbital is necessary.

12. (a)  (b)  (d) 

l. p localised l. p delocalised l. p delocalised

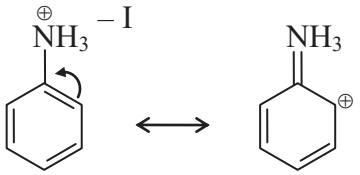
When l. p is adjacent position of two parallel P-orbital, then l. p is delocalized.

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

(e) 

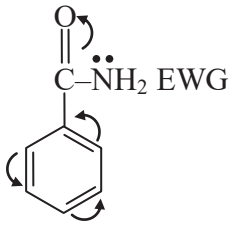
l. p localised

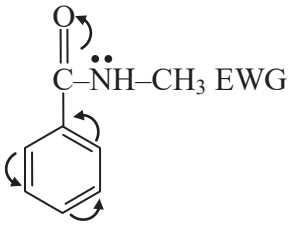
14. $-\overset{\oplus}{N}H_3$

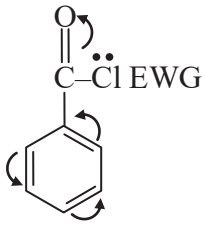


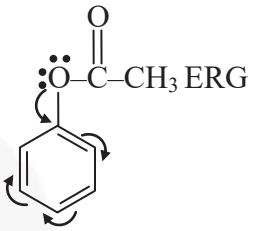
(not possible)
N can't form
S bond

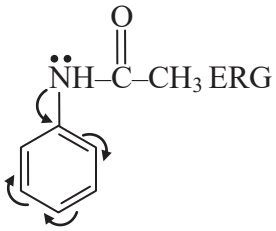
So not involved in resonance only inductive effect.

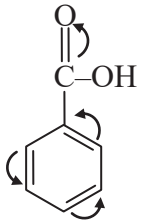
15. (a) 

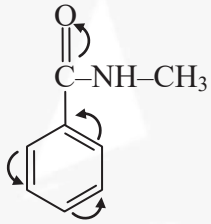
(b) 

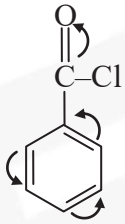
(c) 

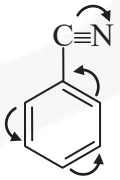


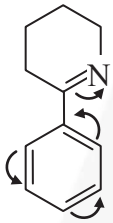


16. (a) 

(b) 

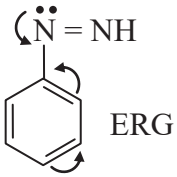
(c) 

(d) 

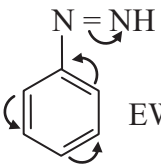
(f) 

17. (b) $-\ddot{N}=O$ $CH_2-\overset{\ominus}{N}=O$ EWG $\overset{\oplus}{C}H_2-\ddot{N}=O$ ERG

(c) $-CH=CH_2$ $CH_3-\overset{+}{C}H_2-CH=CH_2$ ERG $CH_3-\overset{\ominus}{C}H-CH=CH_2$ EWG

(f) $-\ddot{N}=NH$ 

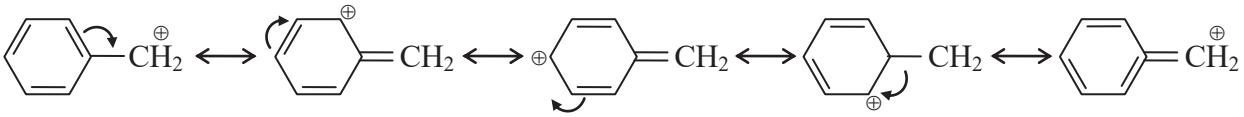
ERG

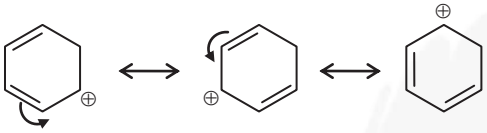


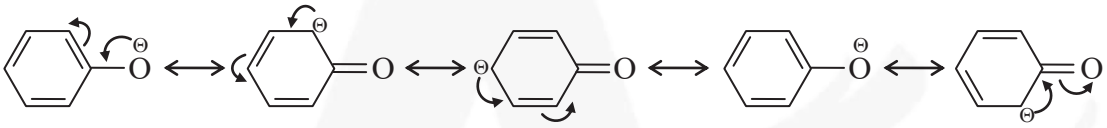
EWG

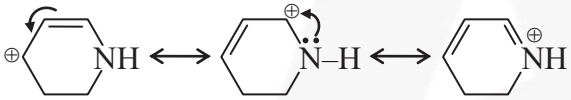
18. (a) $CH_3 - \overset{\overset{O}{\|}}{C} - \overset{\ominus}{C}H_2 \longleftrightarrow CH_3 - \overset{\overset{\ominus}{O}}{\underset{|}{C}} = CH_2$

(b) $H - \overset{\overset{O}{\|}}{C} - CH = CH - \overset{\ominus}{C}H_2 \longleftrightarrow H - \overset{\overset{O}{\|}}{C} - \overset{\ominus}{C}H - CH = CH_2 \longleftrightarrow H - \overset{\overset{\ominus}{O}}{\underset{|}{C}} = CH - CH = CH_2$

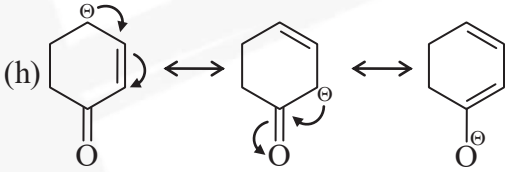
(c) 

(d) 

(e) 

(f) 

(g) 

(h) 

(i) $CH_3 - CH = CH - CH = CH - \overset{\oplus}{C}H - CH_3$

$\updownarrow$

$CH_3 - CH = CH - \overset{\oplus}{C}H - CH = CH - CH_3$

$\updownarrow$

$CH_3 - \overset{\oplus}{C}H - CH = CH - CH = CH - CH_3$

(j) $CH_3 - CH = CH - CH = CH - \overset{\oplus}{C}H_2$

$\updownarrow$

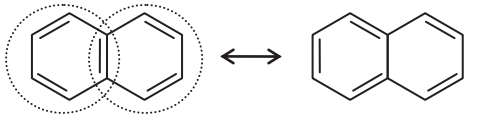
$CH_3 - CH = CH - \overset{\oplus}{C}H - CH = CH_2$

$\updownarrow$

$CH_3 - \overset{\oplus}{C}H - CH = CH - CH = CH_2$

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

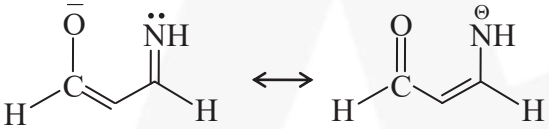
Incomplete octet (less stable) — Complete octet (more stable)

(b) 

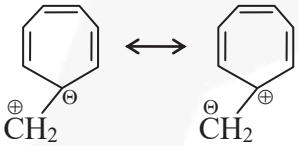
Two benzene structure (more stable) — One benzene ring (less stable)

(c) 

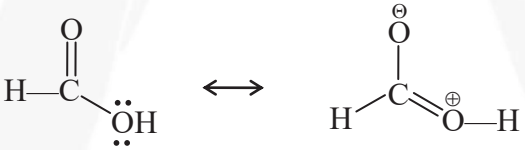
Negative charge on more E.N. atom is more stable — Negative charge on less E.N. atom is less stable

(d) 

Negative charge on more E.N. atom 'O' — Negative charge on less E.N. atom 'N'

(e) 

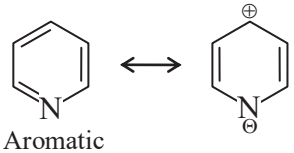
Aromatic ring

20. (a) 

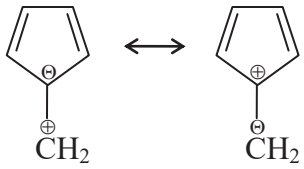
Neutral more stable — charged

(b) 

Aromatic negative charge on 'O' more stable — Non-aromatic negative charge on 'C' less stable

(c) 

Aromatic more stable

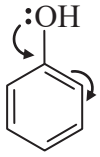
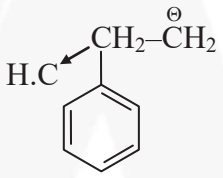
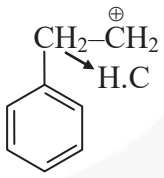
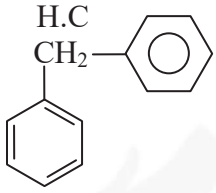
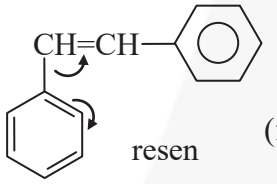
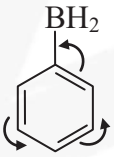
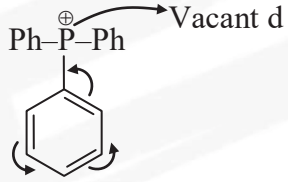
(d) 

Aromatic more stable Anti Aroamtic

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

'Charged structure' 'Neutral'

(f) More EN contain –ve charge and less EN contain +ve charge.

21. (a) 
(b) 
(c) 
(d) 
(e) 
resen
(f) 
(g) 

22. (a) $CH_2=\overset{\oplus}{N}=\overset{\ominus}{\underset{\cdot\cdot}{N}}$ Complete octet

(b) $\overset{\ominus}{C}H_2-N=\overset{\oplus}{N}$ Negative charged on 'C' atom

(c) $\overset{\oplus}{C}H_2-\underset{\cdot\cdot}{\overset{\ominus}{N}}=N$ Positive charged on 'C'

(d) $\overset{\ominus}{C}H_2-\overset{\oplus}{N}\equiv\ddot{N}$ Negative charged on 'C' complete octet

(a > d > c > b)

23. (a) $CH_3=\overset{\ominus}{C}H-C\equiv N: \longleftrightarrow CH_3-CH=C=\ddot{N}:$

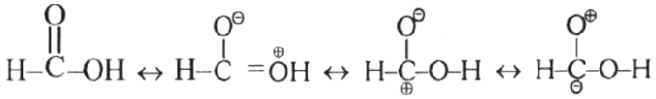
Negative charge on 'C' charge on 'N' (more stable)

(b) $CH_3-\overset{O}{\overset{\|}{C}}-\overset{\ominus}{C}H-\overset{O}{\overset{\|}{C}}-CH_3 \longleftrightarrow CH_3-\overset{\overset{\ominus}{O}}{\overset{|}{C}}=CH-\overset{O}{\overset{\|}{C}}-CH_3$

Negative charge on 'C' (cross conjugation) Negative charge on 'O' extended conjugation (more stable)

(c) $CH_3-CH_2-\overset{NH_2}{\overset{|}{\underset{\oplus}{C}}}-NH_2 \longleftrightarrow CH_3-CH_2-\overset{NH_2}{\overset{|}{C}}=\overset{\oplus}{N}H_2$

Incomplete octet Complete octet (more stable)

24. 

I II III IV

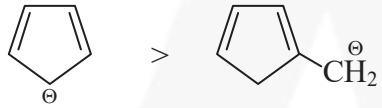
Neutral positive charge on 'C'

(less stable)

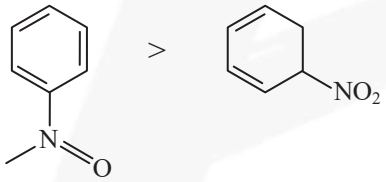
(i > ii > iii > iv)

25. (a) 

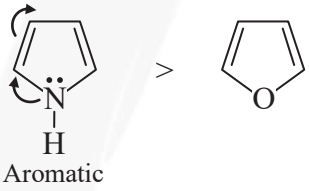
Aromatic compound (more stable) > Extended conjugation

(b) 

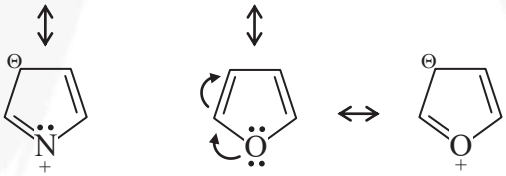
Aromatic compound > Resonance

(c) 

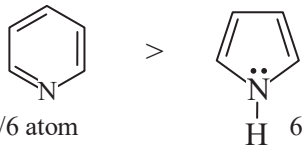
Aromatic compound > Resonance

(d) 

Aromatic >



Positive charge on 'N' (more stable) Positive charge on 'O' (less stable)

27. (i) 

6 e⁻/6 atom Aromatic 6 membered > 6 e⁻/5 atom Aromatic 5 membered

(ii) $CH_2 = CH - \ddot{O} - CH = CH_2$

$CH_2 = CH - \ddot{N}H - CH = CH_2$

LP donation tendency N > O

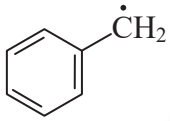
(iii) $CH_2 = CH - \overset{\ominus}{N}H \longleftrightarrow \overset{\ominus}{C}H_2 - CH = \overset{\oplus}{N}H$ < $HN = CH - \overset{\ominus}{N}H \longleftrightarrow HN = CH - \overset{\ominus}{N}H$

Negative charge on 'C' Negative charge on 'N'

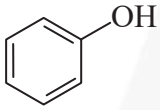
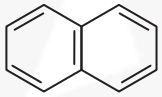
(iv) $CH_2 = CH - \ddot{F}:$ > $CH_2 = CH - \ddot{B}r:$

2P 2P 2P 4P

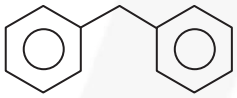
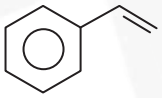
So, electron donatives is for

(v)  > $CH_2 = CH - \dot{C}H_2$

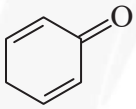
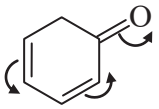
Extended conjugation
(Aromatic ring)

(vi)  < 

1 Aromatic ring 2 Aromatic ring
→ benzene

(vii)  > 

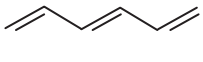
Benzene Benzene 1 Benzene
36 kal 36 kal

(viii)  < 

Cross conjugation Extended conjugation

(ix) $CH_2 = CH - \ddot{O}H$ < $CH_2 = CH - CH = CH - \ddot{O}H$

less conjugated sys long conjugation

(x)  < 

Cross Extended conjugation

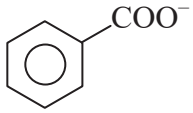
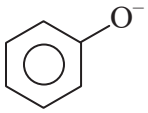
(xi) $CH_3 - \overset{O}{\overset{\|}{C}} - \ddot{O}H$ < $CH_3 - \overset{O}{\overset{\|}{C}} - \overset{\ominus}{\ddot{O}}$ Na

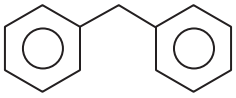
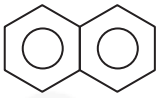
equal R.S

$CH_3 - \overset{O^{\ominus}}{\overset{|}{C}} = \overset{\oplus}{O} - H$ $CH_3 - \overset{O^{\ominus}}{\overset{|}{C}} = O$ Na

Resonance

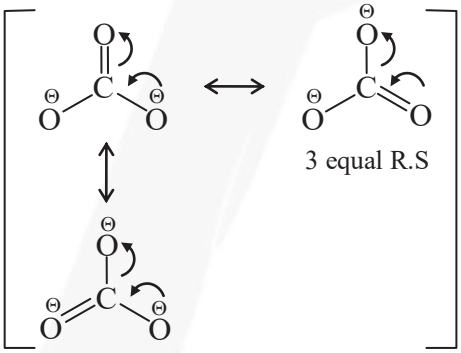
(xii) $CH_2 = CH - \overset{\ominus}{O}$ < $CH_2 = CH - OH$
charged neutral

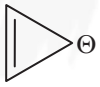
(xiii)  > 
Equal R.S

(xiv)  > 
36 kal 36 kal
Two individual benzene ring
naphthalene
62 kcl

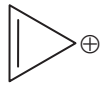
(xv)  > $CH_2 = CH - CH = CH - CH = CH_2$
Aromatic Resonance

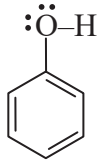
28. (a) CO_3^{2-} > 
2 equal structure

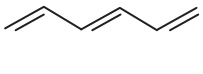

3 equal R.S

(b)  < $CH_2 = CH - \overset{\ominus}{C}H_2$
A. Aromatic Resonance

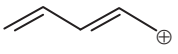
(c)  < $CH_2 = CH - CH = CH_2$
A. Aromatic Resonance

(d)  > $CH_2 = CH - \overset{\ominus}{C}H_2$
Aromatic Resonance

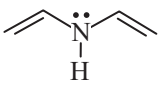
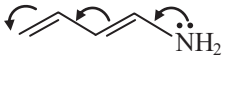
(e)  < 

29. (A)  < 

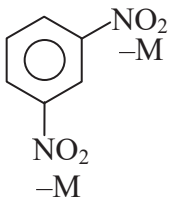
Resonance — Aromatic compound

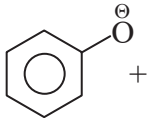
(B)  > 

Resonance — A. Aromatic

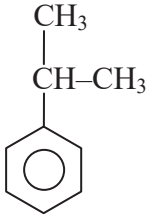
(C)  < 

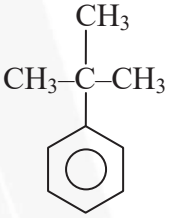
Cross conjugation — Extended resonance

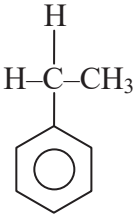
30.  Low e^- density in the ring

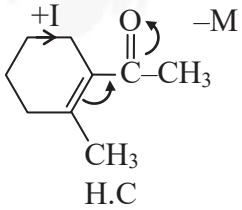
31.  + M, + I

32. (i)  3 α H, H.C, more e^- density

(ii)  1 α H, H.C

(iii)  0 α H

(iv)  2 α H

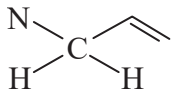
33. 

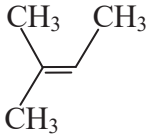
H.C

34. $CH_3 - CH = CH - C - CH_3$ (H.C; O; +I)

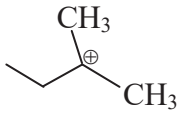
Mesomeric

35. (i), (ii), (iii)

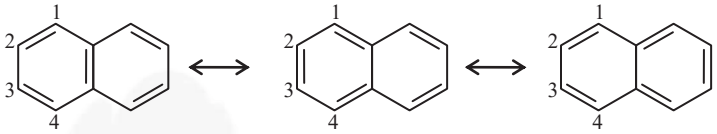
36. (A) 

(B) 

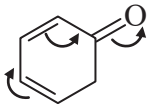
9 α 11

(C) 

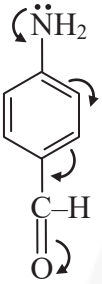
8 α 11

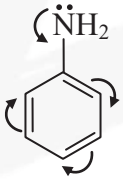
37. 3 R.S of Napthalene 

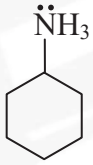
2-1 bond two time double but one time single

38. 

extended conjugated C–O bond length

39. (i) 

(ii) 

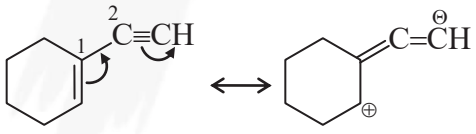
(iii) 

(iv) $CH_2 = NH$ pure = bond

(iii > ii > i > iv)

More resonance

More = bond character

40. 

Resonance

41. Longest bond length $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} = CH_2$

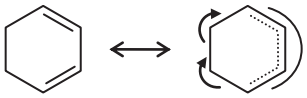
6 α 11

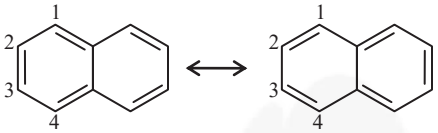
42. $CH_2 = C = CH_2$ (pure double bond)

43. (A) Benzene  (close conjugated)

Two equal R.S all C–C bonds are equal

(B) 1, 3-buta.di-ene $C = \overset{\curvearrowright}{C} - C = \overset{\curvearrowright}{C} \longleftrightarrow \overset{\oplus}{C} - C = C - \overset{\ominus}{C}$ not same length

(C)  C–C & C=C are not same length

(D)  all C–C & C=C are same length

Aromatic compound

44. $CH_3 - CH_3 >$  $> CH_2 = CH_2 > CH \equiv CH$

1.39 A 1.39 A

45. $CH_3 - \ddot{O} - CH = CH - N(=O)-O$ (+M, –M)

(I) more resonance

$CH_2 = CH - N(=O)-O$

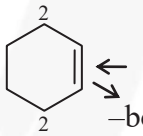
(II)

$CH_2 = CH - \ddot{Cl} \longleftrightarrow \overset{\ominus}{C}H_2 - CH = \overset{\oplus}{Cl}$

(III)

$CH_2 = CH_2$ pure double bond

46. **(A,C,D)**

47. (a)  –bond

$CH_2 = CH_2$

Pure = bond

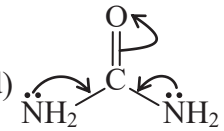
4 α H

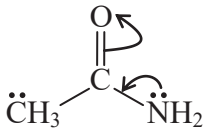
H.C

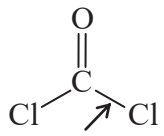
Bond angle with $\propto$ $\boxed{\alpha H}$

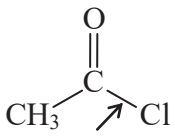
(b) $CH_3 - C \equiv CH$ $\quad CH \equiv CH$

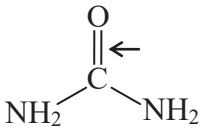
(c) $CH_2 = CH - C(=CH_2) - CH = CH_2 < CH_2 = CH - C(=CH_2) - CH = CH_2$

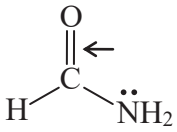
(d) 
3.R.S cross


2.R.S

(e) 



(f) 



48. Bond S

(a) $CH_3 - CH_2 - \overset{\uparrow}{Br} < CH_3 - CH_2 - \overset{\uparrow}{Cl}$

In group top to bottom C–X bond length ↑ so bond strength ↓

(b) $CH_3 - \overset{\curvearrowleft}{CH} = CH - \overset{\uparrow}{Br}$ (Double bond character) $>$ $CH_3 - CH - \overset{\rightarrow}{CH}$ (Br)

(c) $CH_3 - \overset{\uparrow}{C}(=O) - Cl$ (d.b.c) $>$ $CH_3 - CH_2 - \overset{\uparrow}{Cl}$

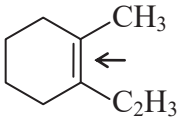
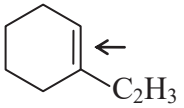
(d) $CH_2 = CH - \overset{\uparrow}{CH} = CH_2$ (d.b.c) $>$ $CH_2 = CH - \overset{\uparrow}{CH_2} - CH_3$ (H.C)

Due to resonance

$CH_2 = CH - \overset{\uparrow}{CH} = CH_2 \quad < \quad CH_2 = CH - \overset{\uparrow}{NO_2}$

(e) $\overset{\oplus}{C}H_2 - CH = CH - \overset{\ominus}{C}H_2$ (less stable) $\qquad$ $\overset{\oplus}{C}H_2 - CH = N(O^{\ominus})(=O)$ (more stable)

Due negative charge on 'C'

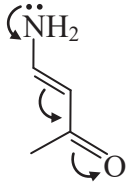
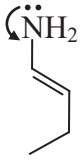
(f)  $<$ 

9 α H $\qquad$ 6 α H $\qquad$ H.C

49. * Remove hydrogen and make radical

* Stability $\propto \frac{1}{\text{Bond dissociation energy}}$

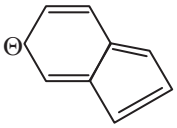
1 > 4 > 3 > 2

50. (A)  (B)  (C)  C > B > A

more stable so more d.b.c

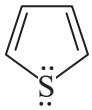
51. Due to SIR in A Ist compound not participate in resonance.

EXERCISE # II

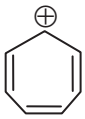
1. (a) 

$4n + 2 = 10\ \pi e^-$ Aromatic n = 2

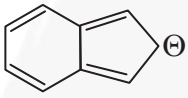
All pheripheri e^- count

(b) 

Total = $6\pi e^-$

(ii) 

$6\pi e^-$

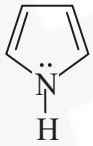


$10\pi e^-$

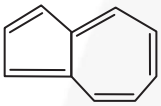
(iii) 

$6\pi e^-$

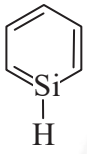
$2\pi e^-$



$6\pi e^-$

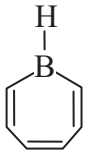
(iv) 

$10\pi e^-$ Aromatic

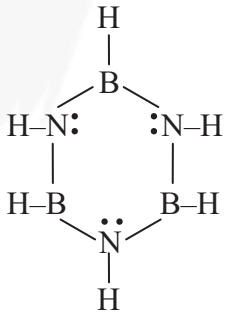


$6\pi e^-$

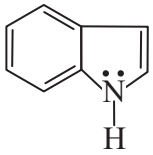
$6\pi e^-$ Aromatic



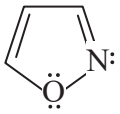
$6\pi e^-$ Aromatic

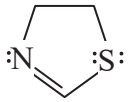
(c) 

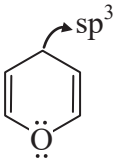
Inorganic benzene $6\pi e^-$ Aromatic

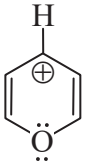
(f) 

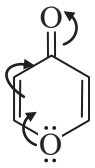
$10\pi e^-$ Aromatic

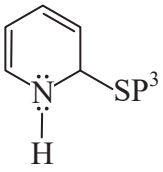
2. (a)  $6\pi e^-$ Aromatic Isoxazolc

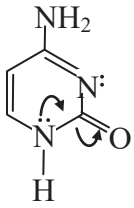
(b)  $6\pi e^-$ Aromatic

(c)  Non-Aromatic pyran

(d)  Aromatic pyryliun ion $6\pi e^-$

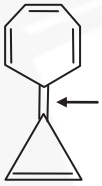
(e)  $6\pi e^-$ Aromatic

(f)  Non-Aromatic

(g)  $6\pi e^-$ Aromatic cystosine

3. (i) 

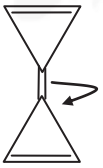
(ii) 

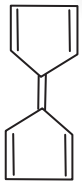
(iii)  ← Not break due to A. N

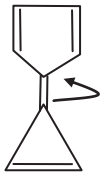
(iv)  Aromatic most stable

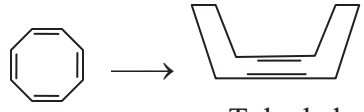
(v)  Aromatic large size ring

$\therefore$ ii > i > iii

4. (i)  Anti Aromatic so not break

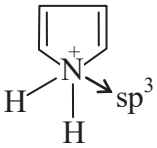
(ii)  Anti Aromatic not break

(iii)  Aromatic so minimum rotation energy barrier is required

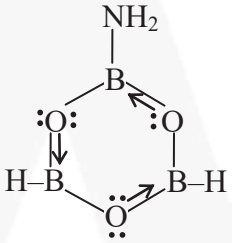
5. 

non-Aromatic

Tub-shab non-planar system

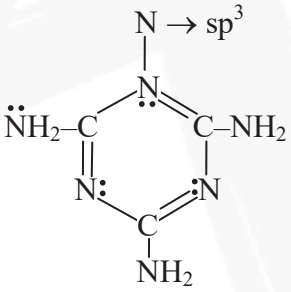
6. 

7. (a) $B_3H_3O_3$ (Boroxine)



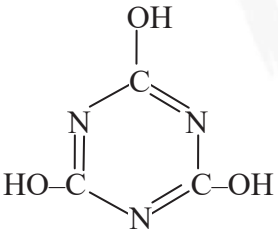
Aromatic

(b) $C_3N_3(NH_2)_3$ (Melamine) (Trimer of cynamide)



Aromatic

(c) Trimer of isocyanic acid $(HN = C = O)_3$



Aromatic

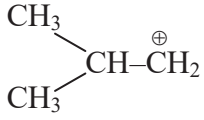
8. (A) $CH_3 - \overset{\oplus}{C}H_2$

3 α H

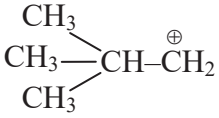
H.C

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

2 α H H.C

(C) 

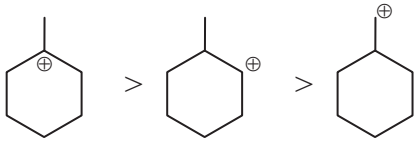
1 α H

(D) 

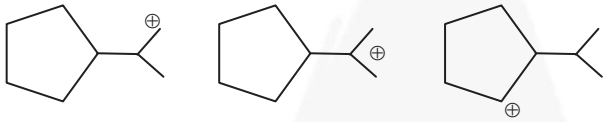
0 α H

9. (i) (C) $CH_3-\overset{CH_3}{\underset{CH_3}{\overset{|}{\underset{|}{C\oplus}}}} > CH_3-\overset{\oplus}{C}H-CH_3 > CH_3-\overset{\oplus}{C}H_2$

9 α H 6 α H 3 α H

(ii)  > >

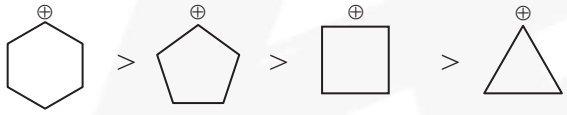
7αH 3αH 1αH

(iii) 

1αH 7αH 3αH

$\boxed{b > c > a}$

(iv) Angle strain α S-characatic on ring positive charge is unstable at most E.N. ring

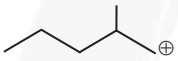
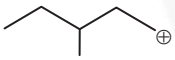
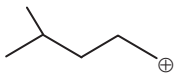


(v) (a) $CF_3-\overset{\oplus}{C}H_2$ (b) $CCl_3-\overset{\oplus}{C}H_2$ (c) $CBr_3-\overset{\oplus}{C}H_2$

– I – I – I

– I order – F > – Cl > Br

$\boxed{c > b > a}$

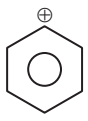
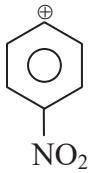
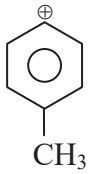
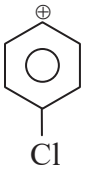
(vi) (a)  (b)  (c) 

1 α H +I 2 α H +I 2 α H

$\boxed{b > c > a}$ + I effect it distance dependent

(vii) (a) $HC\equiv\overset{\oplus}{C}$ (sp) (b) $CH_2=\overset{\oplus}{C}H$ (sp^2) (c) $CH_3-\overset{\oplus}{C}H_2$ (sp^3 H.C)

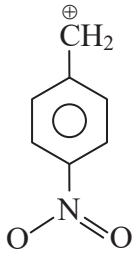
$\boxed{c > b > a}$

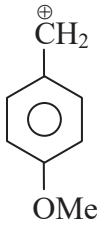
(viii) (a)  (b)  (c)  (d) 

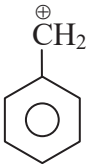
NO_2 CH_3 Cl

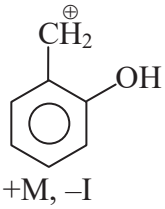
– I + I – I

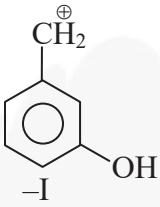
$\boxed{c > a > d > b}$

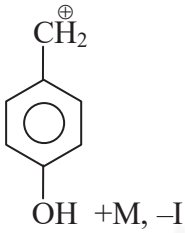
(ix) (a)  – M, – I

(b)  + M, – I

(c)  b > c > a

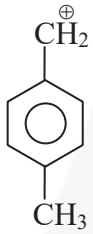
(x) (a)  +M, –I

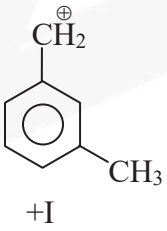
(b)  –I

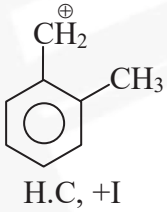
(c)  +M, –I

In a and b +H is same but CH_3 having more +I in C

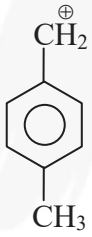
$\boxed{c > a > b}$

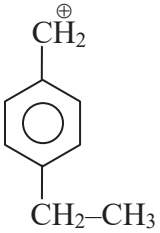
(xi) (a)  H.C, +I

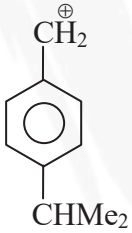
(b)  +I

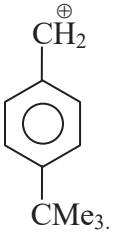
(c)  H.C, +I

$\boxed{c > a > b}$

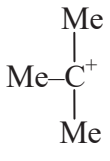
(xii) (a)  H.C = 3 α H

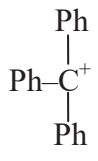
(b)  2 α H

(c)  1 α H

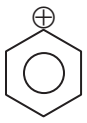
(d)  O

$\boxed{a > b > c > d}$

(xiii) (a)  9 α H

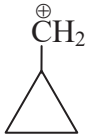
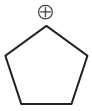
(b)  Resonance

(c)  3 α H

(d)  Highly unstable

(xiv)
- In case of d and e resonace is present but in d having more α H.
- Check other by α H

$\boxed{d > e > b > a > c}$

(xv) (a)  σ-resonance (b)  1 α H (c)  4 α H

(xvi) (a)  Anti Aromatic highly unstable (b)  Aromatic (c)  Resonance

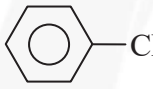
$\boxed{b > c > a}$

10. (i) $CH_3 - \ddot{O} - \overset{\oplus}{C}H_2$ (+M) > $CH_3 - \overset{\oplus}{C}H_2$ (H.C)

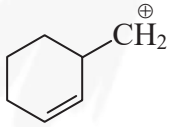
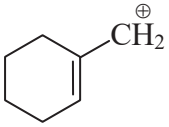
(ii) $Me - \underset{Me}{\overset{\oplus}{C}H}$ (6 α H) > $CH_3 - CH_2 - \overset{\oplus}{C}H_2$ (2 α H)

(iii) $CH_2 = CH - \overset{\oplus}{C}H_2$ (Resonance) > $CH_3 - CH_2 - \overset{\oplus}{C}H_2$ (2 α H H.C)

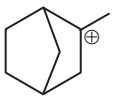
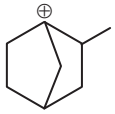
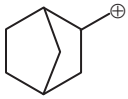
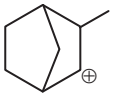
(iv) $CH_2 = \overset{\oplus}{C}H$ (sp^2) < $CH_3 - \overset{\oplus}{C}H_2$ (3 α H)

11. (a) (I)  more resonance > (II) $CH_2 = CH - \overset{\oplus}{C}H_2$ Resonance

(b) $CH_3 - \overset{\oplus}{C}H_2 > CH_2 = \overset{\oplus}{C}H$

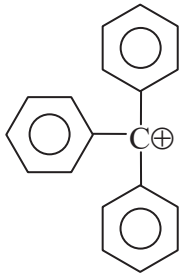
(c)  (H.C) <  (Resonance)

(d) (I) $\begin{matrix} CH_3-CH-CH_3 \\ | \\ CH_3-\overset{\oplus}{C}-CH_3 \end{matrix}$ (6 α H) < $\begin{matrix} CH_3-N-CH_3 \\ | \\ CH_3-\overset{\oplus}{C}-CH_3 \end{matrix}$ (6 α H + (+M of N))

12. (I)  6 α H (II)  Bridge head Highly unstable (III)  1 α H (IV)  2 α H

$\boxed{i > iv > iii > ii}$

13. (carbocation)

(A) 

Resonance

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

9 α H

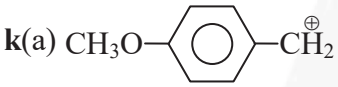
(C) $(CH_3)_2\overset{\oplus}{C}H$

6 α H

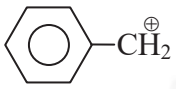
(D) $CH_2 = CH - \overset{\oplus}{C}H_2$

Resonance

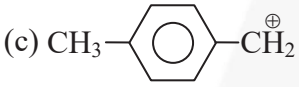
$\boxed{A > D > B > C}$

14. **k**(a) 

+M

(b) 

Resonance

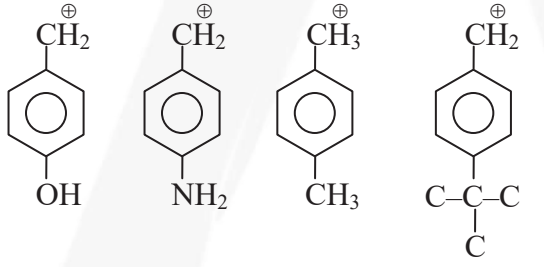
(c) 

H.C

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

3 α H

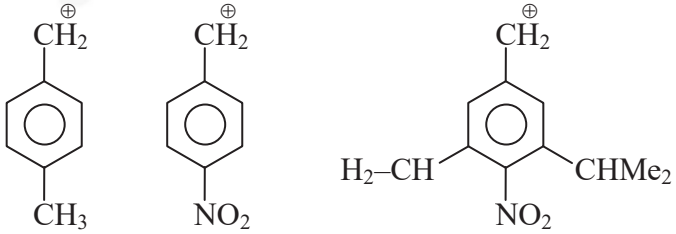
$\boxed{a > c > b > d}$

15. 

+M, –I +M, –I H.C O α H, +I

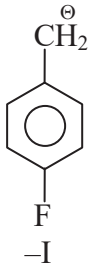
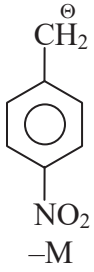
Donation tendency of N > O

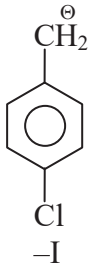
$\boxed{ii > i > iii > iv}$

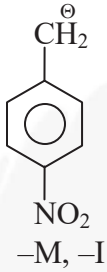
16. 

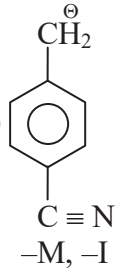
H.C –M SIR not in resonance

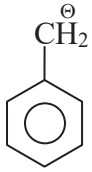
$\boxed{i > iii > ii}$

17. (i) (a)  –I < (b)  –M

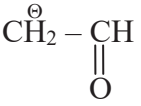
(ii) (a)  –I

(b)  –M, –I

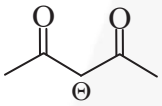
(c)  –M, –I

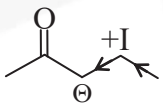
(d) 

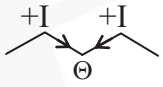
b > c > a > d

(iii) (a)  > (b) 

Resonance +I

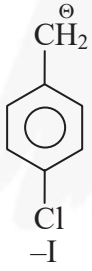
(iv) (a)  more resonance

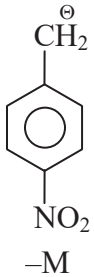
(b)  Resonance, +I

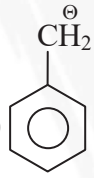
(c) 

+I, ↓, stability of anion.

a > b > c

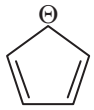
(v) (a)  –I

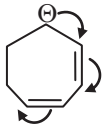
(b)  –M

(c) 

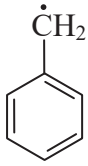
b > a > c

(vi) (a)  Ant. A

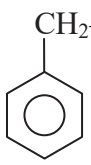
(b)  Aromatic

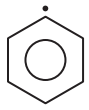
(c)  Resonance

b > c > a

(vii) (a)  Resonance

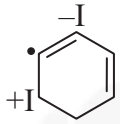
$\boxed{a > b > c}$

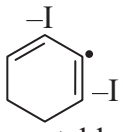
(b)  +I

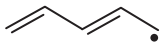
(c)  Highly unstable

(viii) (a)  Resonance

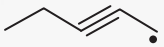
$\boxed{a > b > c}$

(b)  +I

(c)  Less stable

(ix) (a)  Resonance

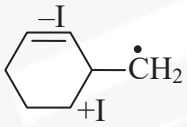
$\boxed{a > b}$

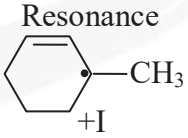
(b)  –I ≡ having more –I

(x) (a) $CH_2 = \dot{C}H$ sp^2

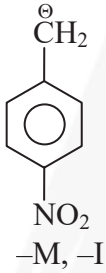
$\boxed{d > b > c > a}$

(b) $CH_2 = CH - \dot{C}H_2$ Resonance

(c) 

(d) 

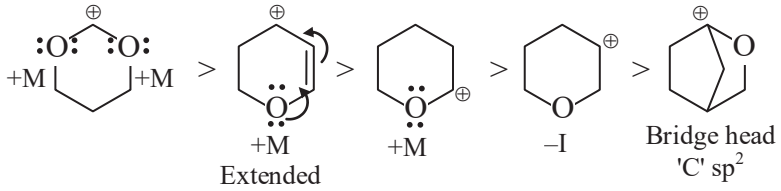
18. $HC{\equiv}C^{\ominus}$ (negative charge is more stable on sp hybridised 'C')

19.  –M, –I group ↑ stability of carbon ion

20.  Aromatic

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

Reso + 6 α H Resonance 3 α H

22. (a) 

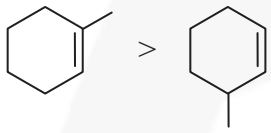
(b) $CH_2^{\ominus}-\overset{O}{\overset{\|}{C}}-H > CH_2^{\ominus}-\overset{O}{\overset{\|}{C}}-CH_3 > CH_2^{\ominus}-\overset{O}{\overset{\|}{C}}-OH > CH_2^{\ominus}-\overset{O}{\overset{\|}{C}}-NCH_3$

(+I) (+M) (+M)

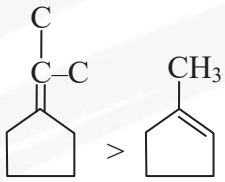
23. (iv) $Ph-\overset{\bullet}{\underset{CH_3}{\underset{|}{C}}}-CH=CH_2$ i&iv

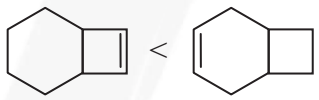
24. $\overset{\curvearrowleft}{CH_2}=CH-\overset{\curvearrowleft}{CH}=CH-CH_3 > CH_3-CH=C=CH-CH_3$

Resonance

25. (a)  >

7 α H 3 α H

(b) 

(c) 

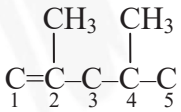
2 α H 4 α H

26. (a) 1-Heptene

C=C–C–C–C–C–C

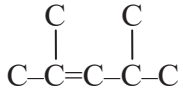
7.C, 2 α H

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



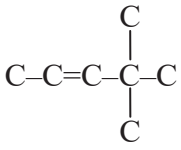
7.C, 5 α H

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



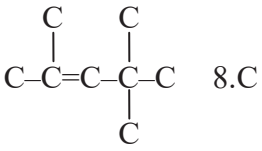
7.C, 7 α H

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



7.C, 3 α H

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

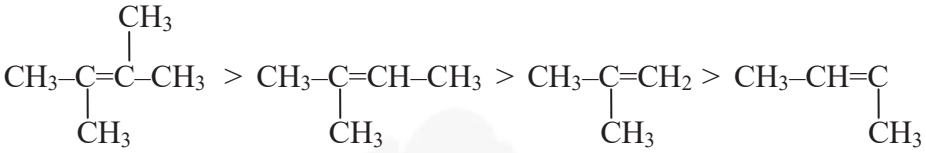


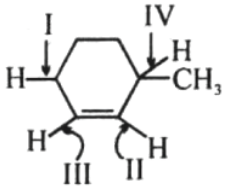
8.C

HOC α number of 'C'

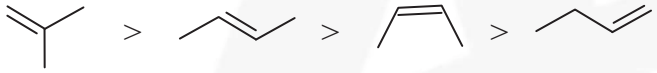
$\alpha \frac{1}{\text{Stability}}$

e > a > d > b > c

27. 

28. 

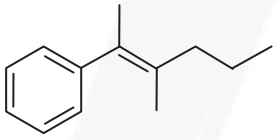
i & iv

29. 

Isobuten 2° anion

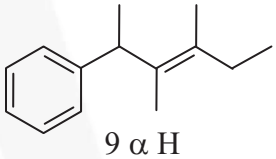
1° anion

30. **Ans. (D > C > B > A)**

(i) (a) 

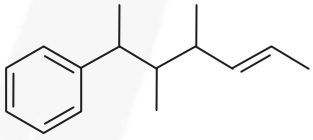
8 α H

Reso + H.C

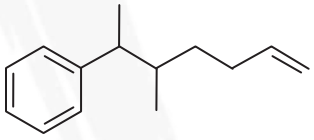
(b) 

9 α H

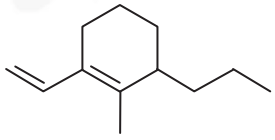
H.C

(c) 

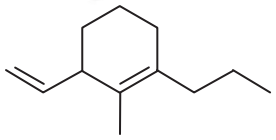
4 α H

(d) 

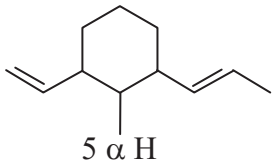
2 α H

(ii) (a) 

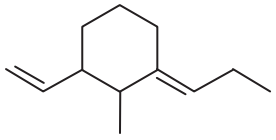
Reso + H.C

(b) 

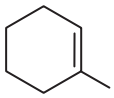
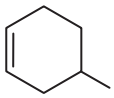
8 α H H.C

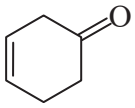
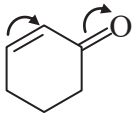
(c) 

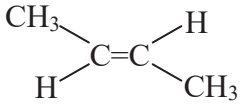
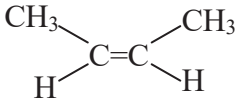
5 α H

(d) 

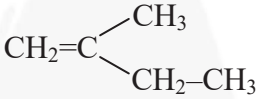
6 α H

(iii) (a)  < 

(iv) (a)  >  Resonance more stable

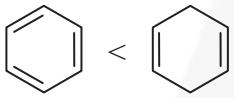
(v) (a)  < 

more stable Ci>

(vi)  > 

1 α H more stable 5 α H

31. HOH

(i) 

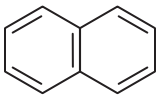
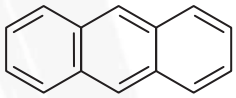
stable due to resonance

(ii) $\boxed{a > b > c > d > e}$

See α H

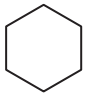
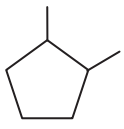
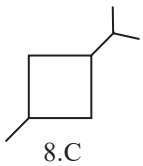
(iii) (a)  (b)  less (c)  more stable

$\boxed{b > c > a}$

(iv) (a)  36 Ka R.E (b)  63 Ka R.E (c)  K (HOH per benzene ring)

$\boxed{c > b > a}$

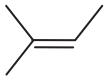
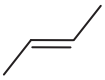
32. H.O.C. α number of 'C' atom α $\frac{1}{\text{stable}\,\&\,1}$

(i) (a)  6.C (b)  7.C (c)  8.C

$\boxed{c > b > a}$

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

(iii) (a)  (b)  more stable

(iv) (a)  >  > 

33. (a)  > 

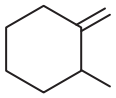
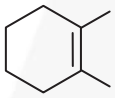
Resonance stability

(b)  > 

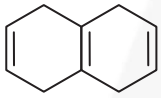
3 = bond

(c) $CH_3–CH = CH–CH_3 < CH_3–CH_2–CH= CH_2$

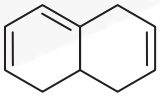
6 α H 2 α H

(d)  > 

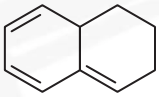
3 α H 10 α H

34. (a) 

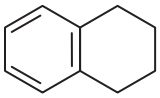
stability order

(b) 

resonance

(c) 

extend resonance

(d) 

Benzene aromatic ring

$\boxed{d > c > b > a}$ H.O.C order $\boxed{a > b > c > d}$

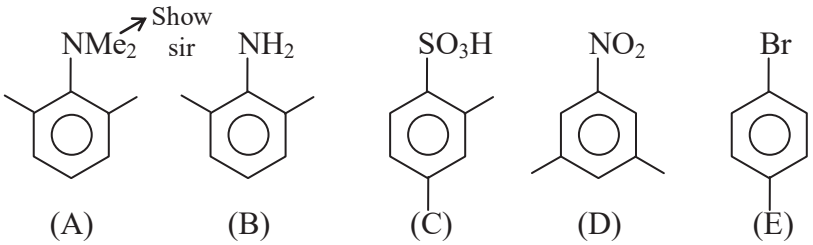
35. (57)

1-butene C=C–C–C 30 kcal

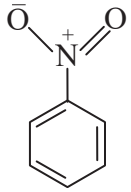
C=C–C=C 1,3-butation resonance

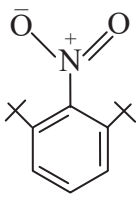
If two '=' bond mol in resonance than Holt = 2 × 30 = 60 kal

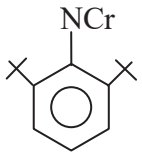
But due to resonance holt is slightly less than 60 kcal

36. 

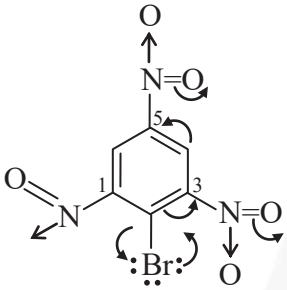
(A) (B) (C) (D) (E)

37. (i)  resonance

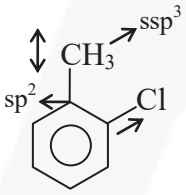
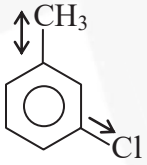
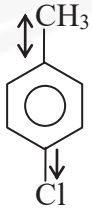
(ii)  SIR

 not is resonance

(B) C–N (1) < C–N (2)

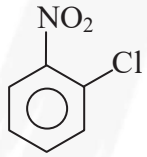
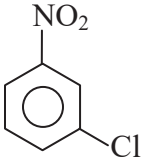
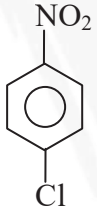
38.  less resonance

When the l.P of Br participates in resonance long conjugation C–S–N and short with C–3 & Cl–N & C–3–N so bond length of C–1–N & C–3–N are of same length and longer than C.S–N

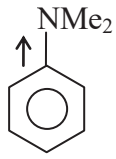
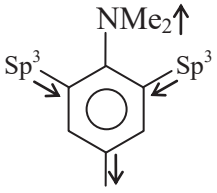
39. (i) (a)  (b)  (c)  $r \neq 0$

Direction of dipoles $\oplus \longrightarrow \Theta$

$\boxed{a < b < c}$ (dipole moment angle ↑ dipole moment ↓)

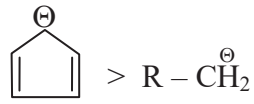
(ii) (a)  (b)  (c) 

Angle ↑ dipole moment ↓ $\boxed{a < b < c}$

(iii) (a)  (b)  a > b

40. Due to, bridge bound carbon can never be sp^2 by brad's rule no real structure possible.

EXERCISE # III

1.  > $R-\overset{\ominus}{C}H_2$

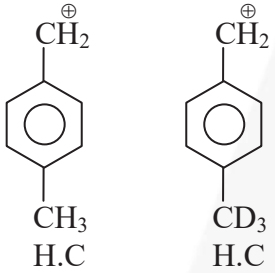
Aromatic

2. (i) $CH_3-\ddot{O}-CH_3$ (ii) CH_3-CH_2-OH

NO–H–bonding Due to H–bonding intermolecular

3. $\overset{(I)}{CH_3}-\overset{(II)}{CH}=\overset{(III)}{CH}-\overset{(IV)}{C}\equiv N$

sp (more electronegative)

4. 

CH_3 H.C CD_3 H.C

Strength of C–D/H bond

C – D > C – H

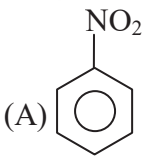
$-CH_3$ has more +H effect than $-CD_3$

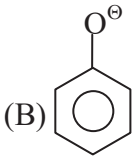
5. Acetate ion $CH_3-\overset{O}{\overset{\|}{C}}-O^- \longleftrightarrow CH_3-\overset{O^-}{\overset{|}{C}}=O^- \quad CH_3-\overset{O^{\delta-}}{\overset{|}{C}}-O^{\delta}$

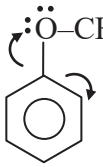
equal R.S R.H

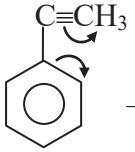
Formate ion $H-\overset{O}{\overset{\|}{C}}-O^- \longleftrightarrow H-\overset{O^-}{\overset{|}{C}}=O \quad H-\overset{O^{\delta-}}{\overset{|}{C}}-O^{\delta}$

R.H C–O equal

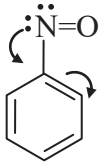
6.  (A) –M/–R, –I

 (B) +M, +I

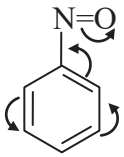
 (C) +M, –I

 (D) –M, –I

7. (A) $-\ddot{N}=O$ P, Q, S

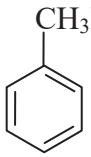


+M/–I



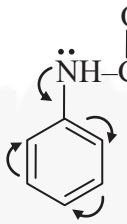
–M/–I

(B) $-CH_3$



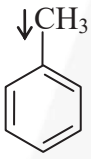
(R)

(C) $-\ddot{N}H-\overset{O}{\overset{\|}{C}}-CH_3$ P, S



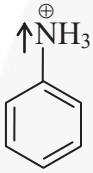
+M/–I

8. (A) → R



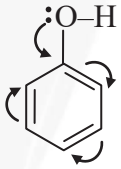
+I

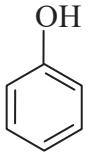
(B) → S



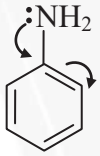
N can't form 5 bond

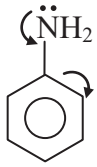
(C) → P,T





–I





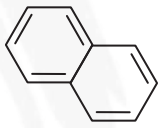
–I

(D) → Q

9. (A)

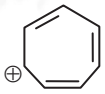
→ Q, S

(B)



→ P, S

(C)



→ P, S

(D)

→ R, S

$4\pi e^-$

10. $-\overset{O}{\overset{\|}{C}}-\ddot{O}-Et$

only one side resonance fast
a > b (bond length)

$-\overset{O}{\overset{\|}{C}}-\ddot{O}-\overset{O}{\overset{\|}{C}}-$

here l.P involved in both side in resonance

11. $CH_3-\overset{\oplus}{C}(=CH_2)-CH_3$ > $C-\overset{\oplus}{C}(=C)$ > $C-\overset{\oplus}{C}$

9 α H 6 α H 3 α

12. 2-butene $H_3C-C=C-CH_3$ 6 α H

ethylene $CH_2=CH_2$ less = bond character

pure '=' bond

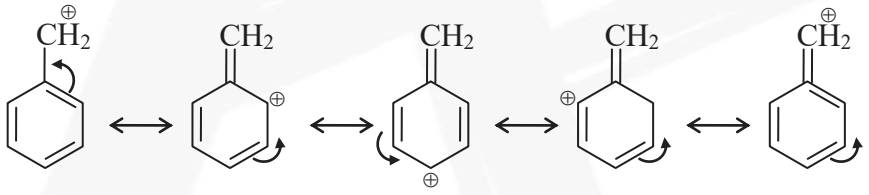
Hyperconjugation effect δ, the '=' bond character

13. $CH_2=CH-\ddot{Cl}: \longleftrightarrow :\bar{C}H_2-CH=\overset{+}{Cl}: \longleftrightarrow \overset{+}{C}H_2-CH=\ddot{Cl}:^-$

'Neutral' complete octet incomplete octel

(I) (II) (III)

$\boxed{I > II > III}$

14. (A) 

S → R.S

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

A > B

15. $\overset{\ominus}{C}H_2-CH(=O)-H \longleftrightarrow CH_2=CH(-\overset{\ominus}{O})$

16. $CH_3-\overset{\ominus}{C}(-CH_3)-CH_3$ 9 α H

H.C

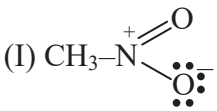
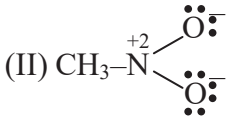
17. 

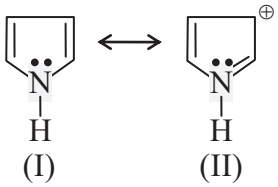
7 α H

18. $CH_2 = \overset{\oplus}{C}H$ < $CH_3 - \overset{\oplus}{C}H_2$

+ve charge on '=' bond

3 α H H.C

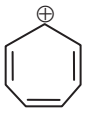
19. (I)  (II) 

20. 

(I) (II)

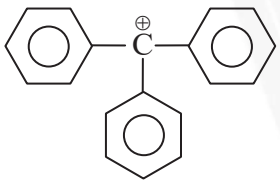
10 e^- on 'N' not value

21. Delocalization of electrons ↑ molecular stability CO_2 pot energy ↓

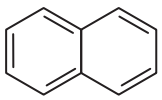
22. (I)  Aromatic most stable compound $6\pi e^-$

(IV) $CH_3 - \overset{+}{C}H - CH_3$

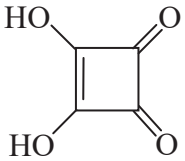
H.C least stable

23. $(C_6H_5)\ C-Br \xrightarrow{\text{heterolysis}}$ 

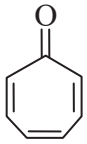
3 ring resonanc with $C^{\oplus}$

24. (a) 

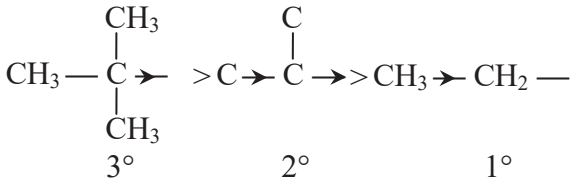
$10\pi e^-$

(b) 

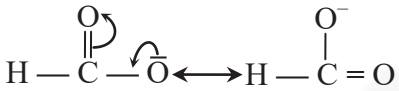
(c) Azulene

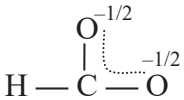
(f) 

EXERCISE # IV (JEE-MAINS)

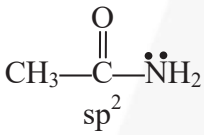
1. 

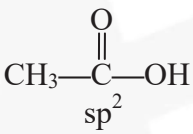
+I effect order

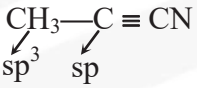
2. 

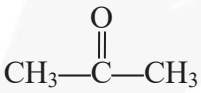
R.H 

two equal R.S.

3. (i) Acetamide 

(ii) Acetic acid 

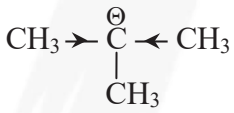
(iii) Acetonitrile 

(iv) Acetene 

4. CH_3 (reactive)

5. $(C_6H_5)_3\dot{C} > (C_6H_5)_2\dot{C}H > (CH_3)\dot{C}$

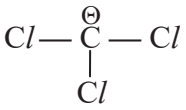
Resonance

6. 

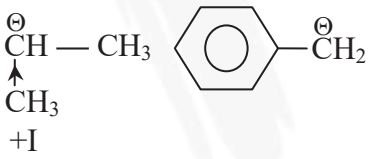
+I

+I effect ↓

Stability of anion

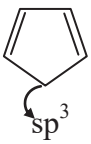


Vacant-d-orbital resonance (equal R.S)



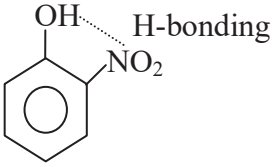
+I

$\bar{C}CC\ell_3 > C_6H_5\overset{\ominus}{C}H_2 > (CH_3)_2\overset{\ominus}{C}H > (CH_3)_3\overset{\ominus}{C}$

7. 

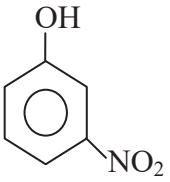
Non-Aromatic

8. Ortho-nitrophenol

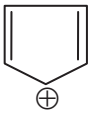


Less acidic due to intramolecular H-bonding

p-nitrophenol

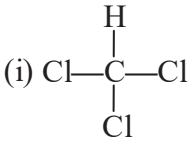


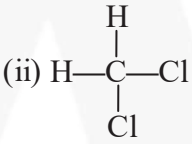
9.

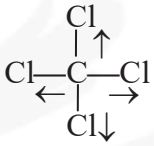


4πe
A.A

4πe
A.A

10. (i) 

(ii) 

(iii) 

μ = 0 most symmetrical

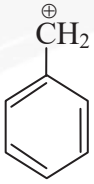
11. (I) $CH_2 = CH - \overset{\oplus}{C}H_2$

resononc

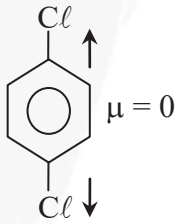
III > I > II

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

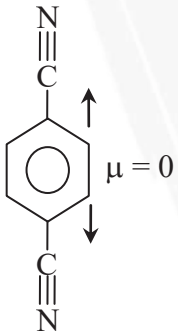
H.C.



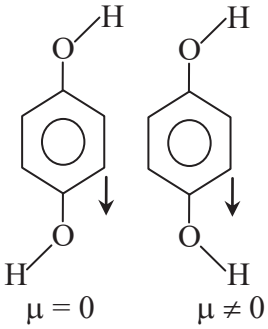
Resonance

12. (1) 

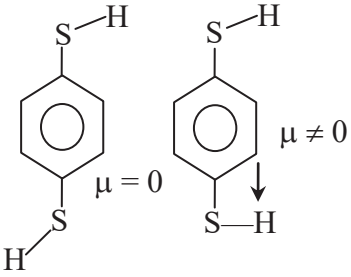
μ = 0

(2) 

μ = 0

(3) 

μ = 0 μ ≠ 0

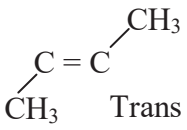
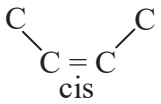
(4) 

μ = 0 μ ≠ 0

13. Non-Aromatic

EXERCISE # V (JEE-ADVANCED)

1. **HOH per mole of H_2**

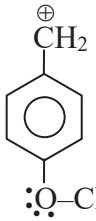
(A) $C = C - C - C$ (B)  Trans (C)  cis

(d) $C = C - C = C$

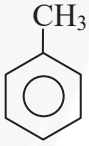
C = C resonance stabilized

$\therefore$ HOH α $\frac{1}{\text{stability}}$

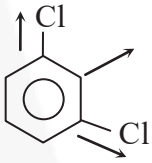
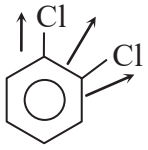
$\boxed{A > C > B > D}$

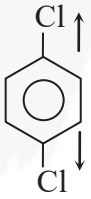
2.  ↑ stability

$\ddot{O}–CH_3$ + M, – I

3. (i) 

9-bond resonance (3 α H)

(ii)  (iii) 

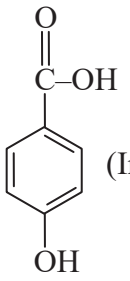
(iv)  $\mu = 0$ $\theta \downarrow$ D.M. $\uparrow$

$\boxed{iii > ii > i > iv}$

4. Because nitrogen can't form five bond.

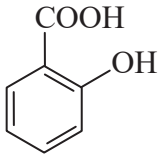
5. $4n\pi e^-$

6. P-hydroxybenzoic acid



(Inter molecular H-bond)

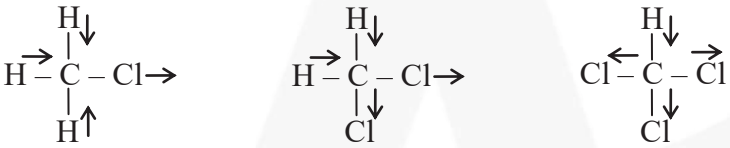
O- hydroxybenzoic acid



(Intra molecular H-bonding)

B.P order inter > intra H-bond

7. (A) CH_3Cl (B) CH_2Cl_2 (C) $CHCl_3$



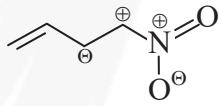
8.

9. $CH_3-\ddot{O}-\overset{\ominus}{C}H-\overset{\oplus}{C}H-CH=CH_2$

Lp and $C^{\ominus}$ repulsion.

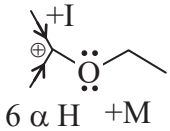
10. Adjacent positive like charges unstable

(A)



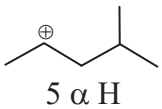
+ve and +ve repulsion.

11. (I)



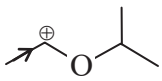
6 α H +M

(II)



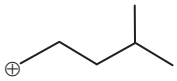
5 α H

(III)



3 α H +M

(IV)



2 α H

+M and $2CH_3$ +I effect

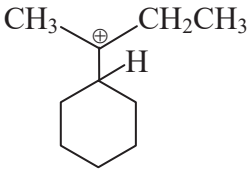
$\boxed{I > III > II > IV}$

12. (I) $CH_2C=\overset{\oplus}{N}=\overset{\ominus}{N}$ complete octet (B) $\overset{\oplus}{C}H_2-N=\overset{\ominus}{N}$ Incomplete octel (C) $\overset{\ominus}{C}H_2-\overset{\oplus}{N}\equiv N$ complete octet (D) $\overset{\ominus}{C}H_2-\overset{\bullet\bullet}{N}=\overset{\oplus}{N}$

–ve charge on 'N'

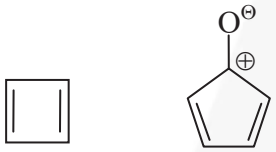
+ve charge on 'C' (For maximum stability)

13.



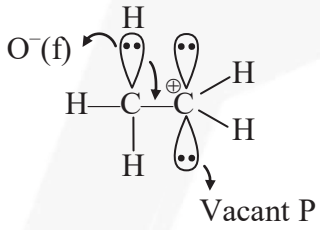
H.C = 6 (6 α H)

14.

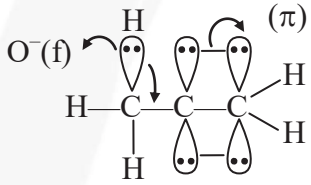


Anti aromatic Anti aromatic

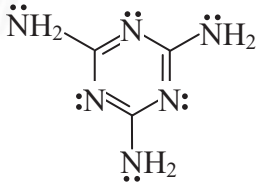
15. (i)



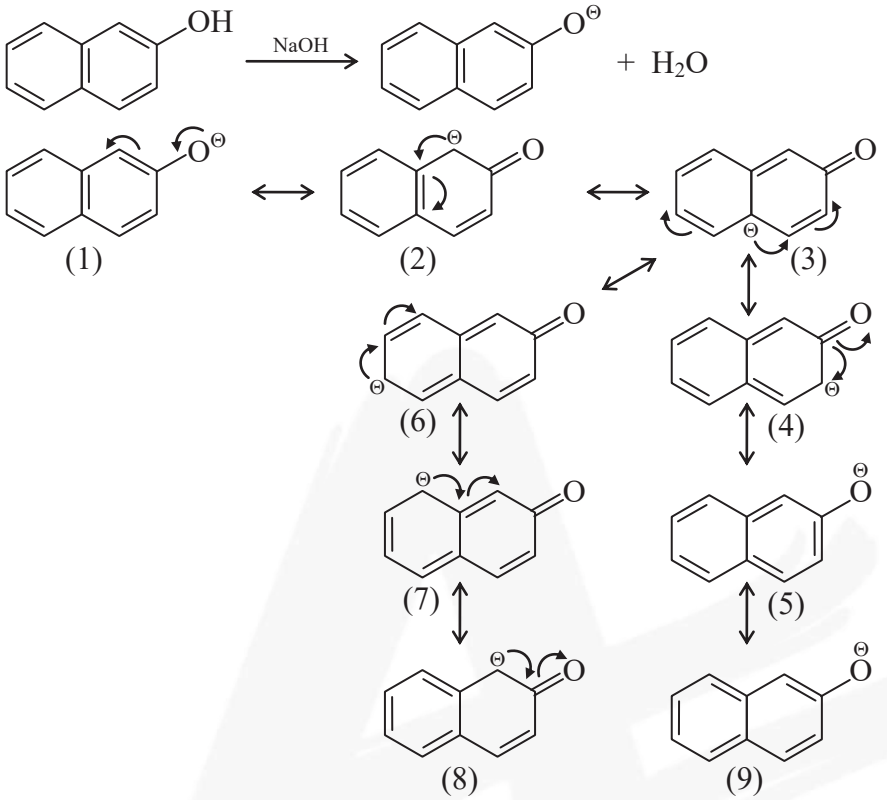
(ii)



16. Melamine



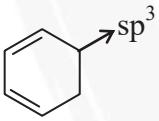
17. 9 R.S



18.  tub-shape (non-planar) non-aromatic

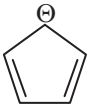
 ⟶ $4\pi e^-$ $4n\pi = 4$ n = 1 Anti-aromatic

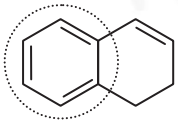
 ⟶ Aromatic

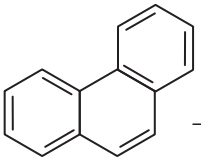
 ⟶ Non-Aromatic

 ⟶ $6\pi e^-$ Aromatic

 ⟶ $4\pi e^-$ Anti Aromatic

 ⟶ $6\pi e^-$ Aromatic

 ⟶ Aromatic compound

 ⟶ Aromatic

$14\pi e^-$