CHAPTER

1

General Organic Chemistry

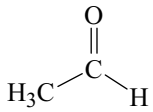
Question Bank

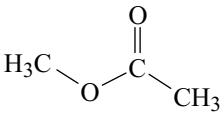
LEVEL 1

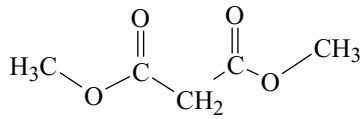
Arrange the items in Questions 1–38 in **DECREASING ORDER** (i.e., greatest, most etc. first) with respect to the indicated property.

Use the following code to indicate your answers.

1. The acidity of the protons H in each of the following is

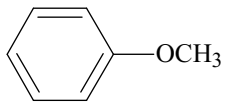
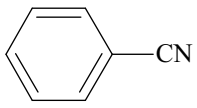
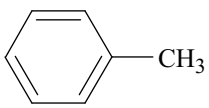
(i) 

(ii) 

(iii) 

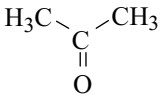
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

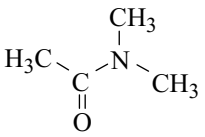
2. Rate of reaction of HNO_3/H_2SO_4 with each of the following is

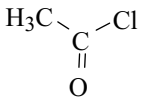
(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

3. Reactivity towards hydrolysis using aqueous acid of the following is

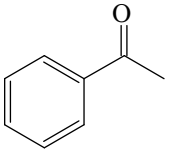
(i) 

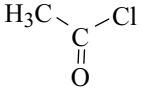
(ii) 

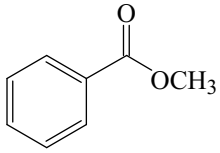
(iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

4. Reactivity of the following towards reaction with $LiAlH_4$ is

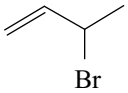
(i) 

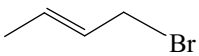
(ii) 

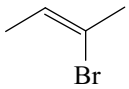
(iii) 

(a) ii > i > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i> ii

5. The relative yield of the following alkenyl bromides from the reaction of 1,3-butadiene with HBr (dark, N_2 atmosphere) at –15°C is

(i) 

(ii) 

(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

6. The amount of conjugate addition obtained in the reaction of the following with 3-butenone is

(i) CH_3Li (ii) CH_3MgBr (iii) $CH_3O_2C-\bar{C}H-CO_2CH_3$

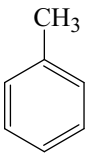
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

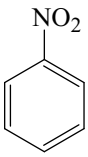
7. The relative reactivity towards Br_2 in $CHCl_3$ of the following is

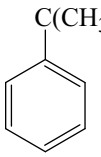
(i) $CH_2=CH-CO_2CH_3$ (ii) $CH_2=CH-CH_3$ (iii) $CH_2=CH-O-CH_3$

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

8. The % of the para product produced in the reaction of $Br_2/FeBr_3$ with each of the following is

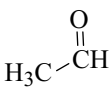
(i) 

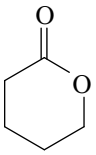
(ii) 

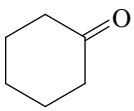
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

9. The number of enolizable protons in each of the following is

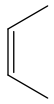
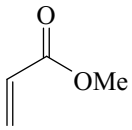
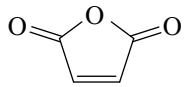
(i) 

(ii) 

(iii) 

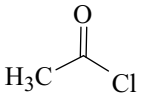
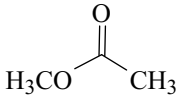
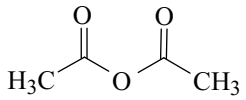
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

10. The relative reactivity towards 1,3-cyclopentadiene of each of the following is

(i) 
(ii) 
(iii) 

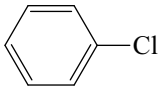
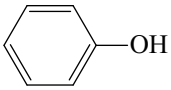
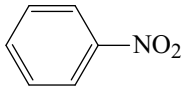
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

11. The relative rate of hydrolysis using dilute aq. NaOH of the following is

(i) 
(ii) 
(iii) 

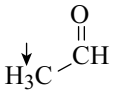
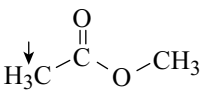
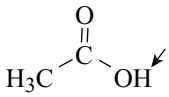
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

12. The relative rate of reaction of isopropyl chloride/$AlCl_3$ with each of the following is

(i) 
(ii) 
(iii) 

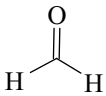
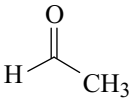
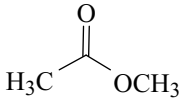
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

13. The relative acidity of the indicated H in each of the following is

(i) 
(ii) 
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

14. The relative reactivity towards reaction with MeMgBr of the following is

(i) 
(ii) 
(iii) 

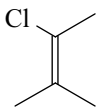
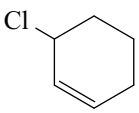
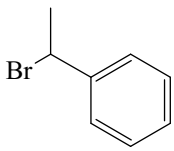
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

15. The relative nucleophilicity in polar, protic solvents of the following is

(i) $CH_3CH_2S^-$ (ii) $CH_3CH_2O^-$ (iii) $CH_3CO_2^-$

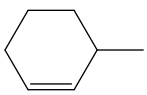
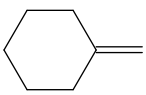
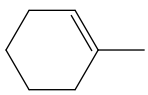
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

16. The relative rate of reaction with aq. EtOH/$AgNO_3$ of the following is

(i) 
(ii) 
(iii) 

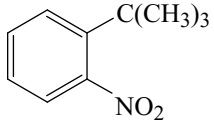
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

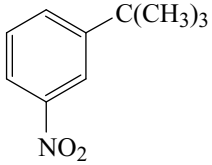
17. The relative yield of the following products produced by the reaction of conc. H_2SO_4 with 1-methylcyclohexanol is

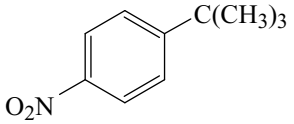
(i) 
(ii) 
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) iii > ii > i (d) iii > i > ii

18. The relative yield of the following products produced in the nitration reaction of t-butylbenzene is

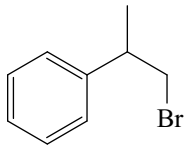
(i) 

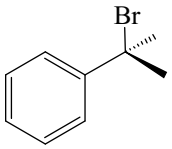
(ii) 

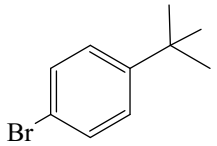
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

19. The relative yield of the following products produced by the reaction of isopropyl benzene with Br_2/UV light is

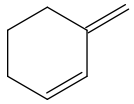
(i) 

(ii) 

(iii) 

(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > i > ii

20. The relative reactivity towards dimethyl cis-butendioate (also called dimethyl maleate) of the following is

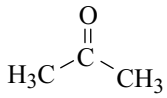
(i) 

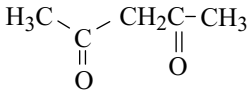
(ii) 

(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

21. The acidity of the protons H in each of the following is

(i) 

(ii) 

(iii) CH_3COOH

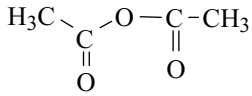
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

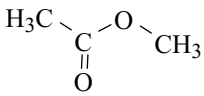
22. The relative nucleophilicity in polar protic solvents of each of the following is

(i) CH_3OH (ii) CH_3SH (iii) CH_3NH_2

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

23. Reactivity towards NH_3 of each of the following is

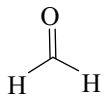
(i) 

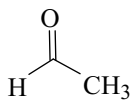
(ii) 

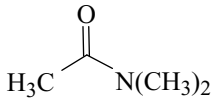
(iii) CH_3COCl

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

24. Reactivity of the following towards reaction with $NaBH_4$ is

(i) 

(ii) 

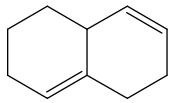
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

25. The relative reactivity towards 1-buten-3-one of each of the following is

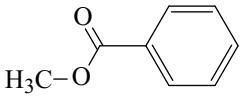
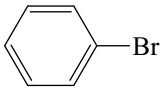
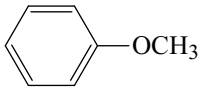
(i) 

(ii) 

(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

26. Rate of reaction of $CH_3COCl/AlCl_3$ with each of the following is

(i)  (ii)  (iii) 

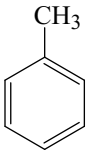
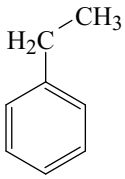
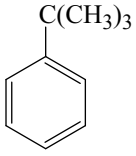
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

27. The relative stability of the following radicals is

(i) $CH_3CH = CH - \dot{C}H_2$ (ii) $\dot{C}H = CHCH_3$ (iii) $CH_3\dot{C}HCH_3$

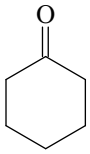
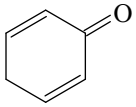
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

28. The ortho/para product ratio produced in the reaction of $Br_2/FeBr_3$ with each of the following is

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

29. The amount of the enol form present at equilibrium for each of the following is

(i) $(CH_3)_3CCOH$ (ii)  (iii) 

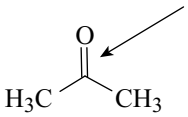
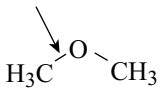
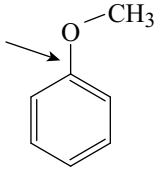
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

30. The relative yield of the following alkenes produced by the reaction of trans-1-chloro-2-methylcyclohexane with KOH/heat is

(i) 1-methylcyclohexene (ii) methylenecyclohexane
(iii) 3-methylcyclohexene

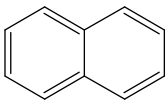
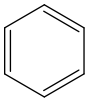
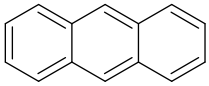
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

31. Identify correct C–O bond length order

(i)  (ii)  (iii) 

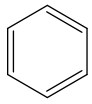
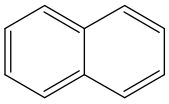
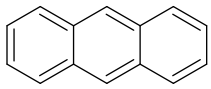
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

32. The resonance energy of each of the following is

(i)  (ii)  (iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

33. Identify order of per ring resonance energies of each of the following

(i)  (ii)  (iii) 

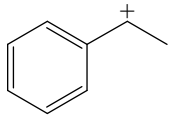
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

34. Identify the correct boiling point order of each of the following

(i) CH_3CH_3 (ii) $CH_3CH_2CH_2CH_3$ (iii) $(CH_3)_3CH$

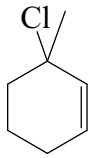
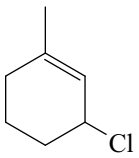
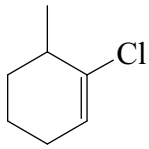
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

35. The relative stability of the following carbocations is

(i)  (ii)  (iii) 

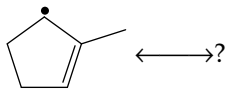
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

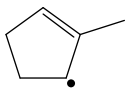
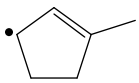
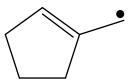
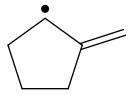
36. The relative yield of the following products from the reaction of HCl with 1-methyl-1, 3-cyclohexadiene at 50°C is

(i)  (ii)  (iii) 

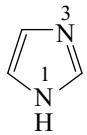
(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > ii > i

37. Which of the following systems are resonance contributors of the radical shown below? (select all that apply)



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

38. Imidazole has a pKa = 7 with respect to its conjugate acid. Which N is protonated in this conjugate acid and why?

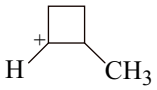
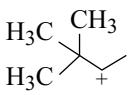
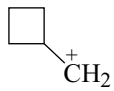
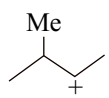
imidazole 

(a) N1 because imidazole is an aromatic heterocycle where $n = 1$ as per Huckel's rule.
(b) N1 is protonated because it is sp^3 hybridised.
(c) N3 is protonated because it is sp^2 hybridised.
(d) N1 is protonated because the lone pair is part of the aromatic pi system.

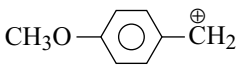
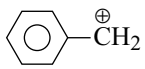
39. Cyclopentadiene has a pKa = 15, whereas cyclopentane has a pKa > 50. This is because
(a) Cyclopentadiene is particularly unstable.
(b) Cyclopentane contains no lone pairs.
(c) Cyclopentadiene is a 4π anti-aromatic compound.
(d) Cyclopentadiene is a 4π non-aromatic compound and after deprotonation it is aromatic.

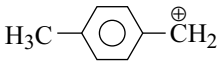
40. The α-hydrogens of esters typically have a pKa = 25, whereas for ketones pKa = 20. This is because:
(a) There is no resonance stabilisation of the enolates of esters.
(b) The inductive effect of the oxygen in the ester destabilises the ester enolate.
(c) The electron donating alkoxy group in esters destabilises the enolate.
(d) The electron donating alkoxy group in esters stabilises the enolate.

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

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

42. Relative stabilities of the following carbocations will be in the order

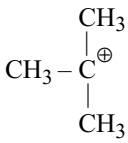
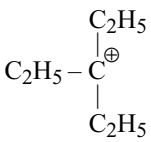
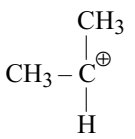
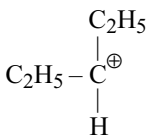
(i)  (ii) 

(iii)  (iv) 

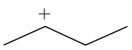
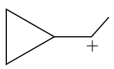
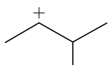
(a) i < ii < iii < iv (b) iv < iii < ii < i
(c) iv < ii < iii < i (d) ii < iv < iii < i

43. Which of the following forms most stable carbocation upon removal of OH^-?
(a) $(CH_3)_3C - CH_2OH$ (b) $CH_3CH_2CH_2CH_2OH$
(c) $C_6H_5CH_2OH$ (d) $C_6H_5CH_2CH_2OH$

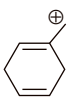
44. Which of the following carbonium ion is most stable?

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

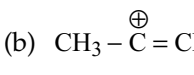
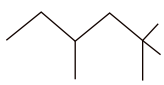
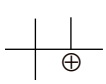
45. Which of the following carbocations would not likely rearrange to a more stable carbocation?

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

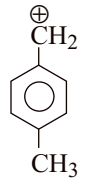
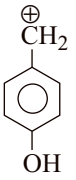
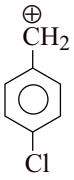
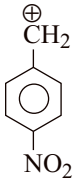
46. Which carbocation is the most stabilised?

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

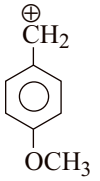
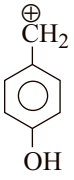
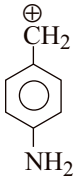
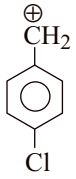
47. Which of the following carbocation do rearrange?

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

48. Which carbocation is the most stable?

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

49. Arrange stability of the given carbocations in decreasing order

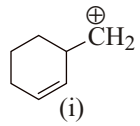
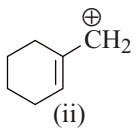
(i)  (ii)  (iii)  (iv) 

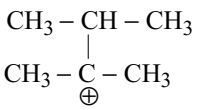
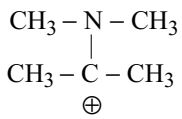
(a) iii > ii > i > iv (b) i > ii > iii > iv
(c) iii > i > ii > iv (d) ii > iii > i > iv

50. In each of the following pairs of ions, which ion is more stable?

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

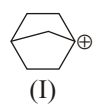
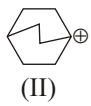
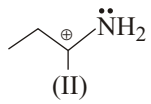
(b) $CH_3-\overset{\oplus}{C}H_2$ (i) and $CH_2=\overset{\oplus}{C}H$ (ii)

(c)  (i) and  (ii)

(d)  (i) and  (ii)

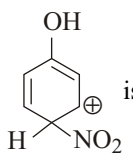
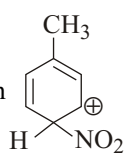
(a) a–i, b–i, c–ii, d–ii (b) a–ii, b–ii, c–ii, d–ii
(c) a–i, b–i, c–i, d–i (d) a–ii, b–ii, c–i, d–i

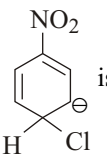
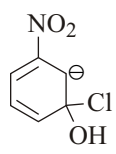
51. Which of the following two carbonium ions is more stable? Explain why.

(a)  (I)  (II) (b)  (I)  (II)

(a) a–ii, b–ii (b) a–i, b–i (c) a–i, b–ii (d) a–ii, b–i

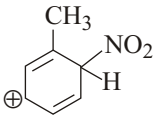
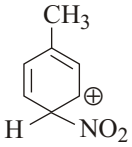
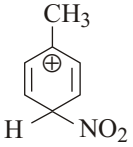
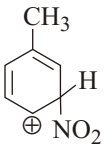
52. Consider the following statements:

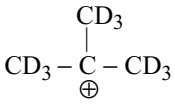
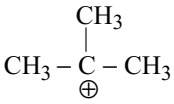
(i)  is more stable than 

(ii)  is more stable than 

(a) i and ii both are correct (b) i and reverse of ii are correct
(c) ii and reverse of i are correct (d) i and ii both are incorrect

53. Which is the most stable arenium carbocation?

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

54.  

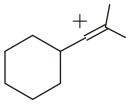
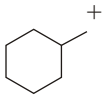
I II

Which of the following statements is correct?

(a) i is more stable than ii (b) ii is more stable than i

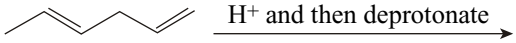
(c) Both are equally stable (d) Stability criterion cannot be applied in this case

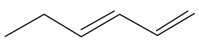
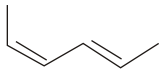
55. List the following carbocations in order of decreasing stability (starting with the most stable)

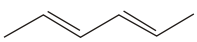
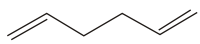
(i)  (ii)  (iii)  (iv) 

(a) ii, iii, i, iv (b) iii, iv, ii, i (c) iii, iv, i, ii (d) i, ii, iv, iii

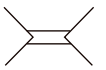
56. Under thermodynamic control, which of the following products would predominate?

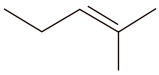
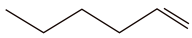


(a)  (b) 

(c)  (d) 

57. Rank the following in order of stability (lowest to highest)

(i)  (ii) 

(iii)  (iv) 

(a) iv < ii < iii < i (b) iv < iii < ii < i

(c) i < iii < ii < iv (d) iv < ii = iii < i

58. Rank, from the most stabilised to the least stabilised, the following free radicals according to their stabilisation energies.

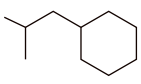
(i) $CH_3\dot{C}H_2$ (ii) $\dot{C}H_2CH_3$

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

(a) iv > iii > ii > i (b) i > iv > iii > ii

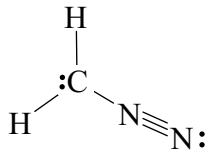
(c) iii > iv > i > ii (d) iii > iv > ii > i

59. How many tertiary hydrogen(s) are (is) there in the following structure?



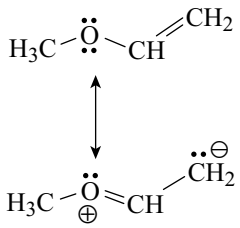
(a) 1 (b) 2 (c) 3 (d) 6

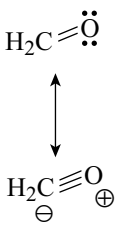
60. For the following incomplete Lewis structure, what are the correct formal charges for the carbon and the nitrogen attached to the carbon?

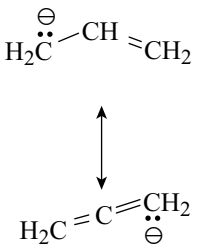


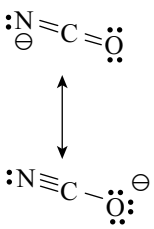
(a) C:0, N:0 (b) C:–1, N:0 (c) C:–1, N:+1 (d) C:+1, N:–1

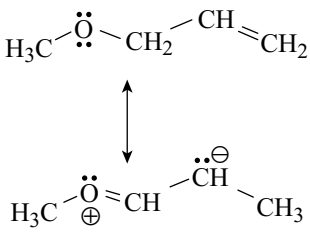
61. Which of the following are pairs of resonance structures?

(i) 

(ii) 

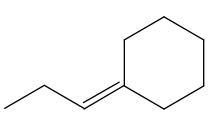
(iii) 

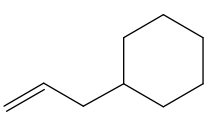
(iv) 

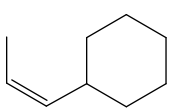
(v) 

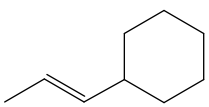
(a) i, ii, iii (b) i, iv (c) ii, iv, v (d) i, iii, iv

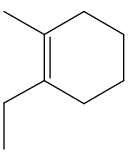
62. Arrange the following alkenes in order of their stability (most to the least).

(i) 

(ii) 

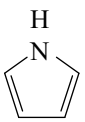
(iii) 

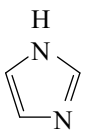
(iv) 

(v) 

(a) v > ii > iii > iv > i
(b) v > ii > iv > iii > i
(c) v > ii > iii > i > iv
(d) v > i > iv > iii > ii

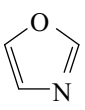
63. Which of the following compounds are aromatic compounds?

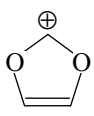
(i) 

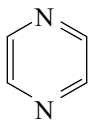
(ii) 

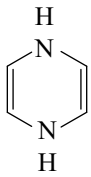
(iii) 

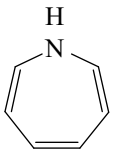
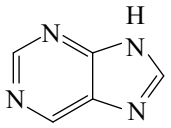
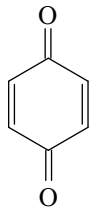
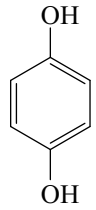
(iv) 

(v) 

(vi) 

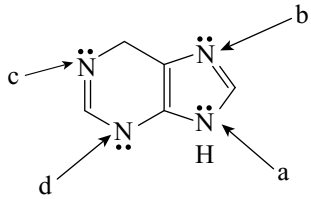
(vii) 

(viii) 

(ix)  (x)  (xi)  (xii) 

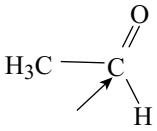
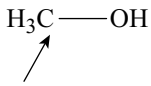
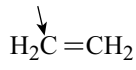
(a) i, ii, iii, iv, v, vi, viii, x, xii
(b) i, ii, iii, vi, viii, x, xi, xii
(c) i, ii, iii, iv, v, vi, vii, x, xii
(d) i, ii, iii, v, vii, viii, ix, x, xii

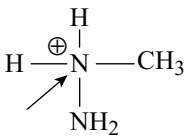
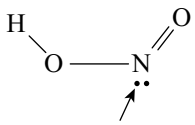
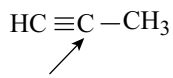
64. For the following compounds, which nitrogen is the least tendency to be protonated?

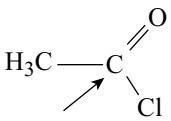
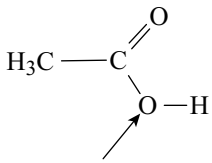


(a) Nitrogen indicated by arrow "b"
(b) Nitrogen indicated by arrow "a"
(c) Nitrogen indicated by arrow "c"
(d) Nitrogen indicated by arrow "d"

65. Using the VSEPR model, predict which atoms pointed by an arrow have SP^2 hybridisation. (Note: not all the lone pair electrons are displayed)

(i)  (ii)  (iii) 

(iv)  (v)  (vi) 

(vii)  (viii) 

(a) i, ii, iv, viii
(b) i, iii, v, vii
(c) ii, iii, v, vii
(d) ii, iv, v, viii

66. Arrange the following compounds in order of their acidity. (most to least)

(i) CH_3CH_2OH (ii) CFH_2CO_2H (iii) CF_2HCO_2H
(iv) CF_3COOH (v) CH_3CO_2H

(a) iv > iii > ii > v > i
(b) iv > iii > ii > i > v
(c) v > ii > iii > iv > i
(d) v > iii > iv > ii > i

67. Rank the following intermediates according to the stability (most stable first). Explain your choices.

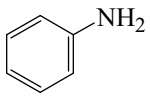
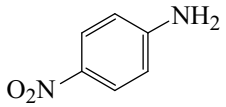
(a) $CH_3CH_2CH_2\overset{\oplus}{C}H_2$, $CH_3\overset{\oplus}{C}HCH_2CH_3$, $(CH_3)_2\overset{\oplus}{C}CH_2CH_3$, $(CH_3)_3\overset{\oplus}{C}$

(b) $CH_3CH_2CH_2\dot{C}H_2$, $CH_3\dot{C}HCH_2CH_3$, $(CH_3)_2\dot{C}CH_2CH_3$, $(CH_3)_3\dot{C}$

(c) $CH_3CH_2CH_2\overset{\ominus}{C}H_2$, $CH_3\overset{\ominus}{C}HCH_2CH_3$, $(CH_3)_2\overset{\ominus}{C}CH_2CH_3$

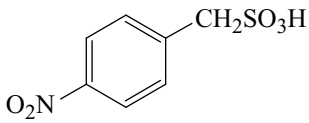
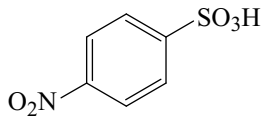
(d) CH_2:, CH_2CH:, C_6H_5CH:, $(C_6H_5)_2C$:

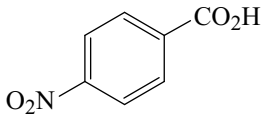
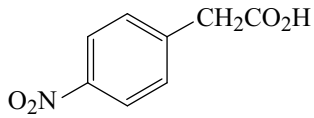
68. Which of the following base has the most acidic conjugate acid?

(i) NH_3 (ii) $CH_3CH_2NH_2$ (iii)  (iv) 

pKb	4.74	3.19	9.37	13.0
	(a) i	(b) ii	(c) iii	(d) iv

69. What is the structure of p-nitrobenzenesulfonic acid?

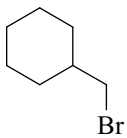
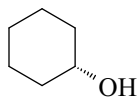
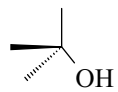
(a)  (b) 

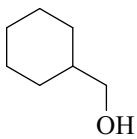
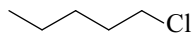
(c)  (d) 

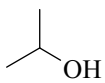
70. Which of the following compound has the highest boiling point?

(a) CH_3OCH_3 (b) CH_3COCH_3 (c) CH_3CH_2OH (d) CH_3CO_2H

71. Which are secondary alkyl alcohols among the following?

(i)  (ii)  (iii) 

(iv)  (v)  (vi) 

(vii)  (viii) CH_3OH (ix) CH_3CH_2I

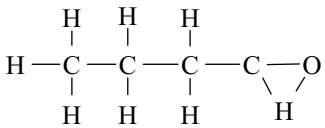
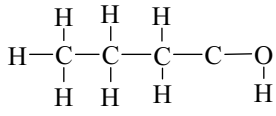
(a) vii (b) ii, iv, vi (c) i, vi, x (d) ii, vii

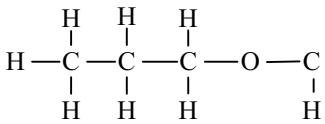
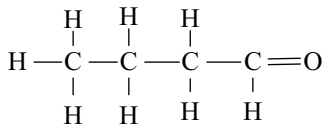
72. Which is the electronic configuration that describes Na^+?

(a) $1S^2, 2S^2, 2P^6$ (b) $1S^2, 2S^2, 2P^6, 3S^2, 3P^6$

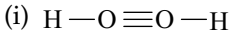
(c) $1S^2, 2S^2$ (d) $1S^2, 2S^2, 2P^6, 3S^2$

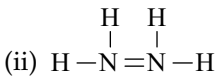
73. What is the Lewis structure of $CH_3 - CH_2 - CH_2 - CHO$?

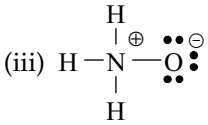
(a)  (b) 

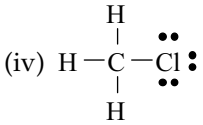
(c)  (d) 

74. Which Lewis structure(s) is(are) correct?

(i) 

(ii) 

(iii) 

(iv) 

(a) i, ii (b) ii, iv (c) iii, iv (d) i, iii

75. Which molecules are non-polar?

(i) NH_3 (ii) CO_2 (iii) H_2O

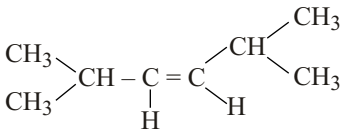
(iv) CF_4 (v) Br_2 (vi) BF_3

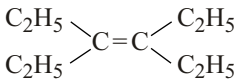
(vii) CH_2Cl_2 (viii) H_2O_2

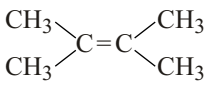
(a) ii, iv, v, vi (b) i, iv, vi, viii

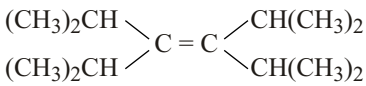
(c) iii, iv, v, vi (d) i, iii, vii, viii

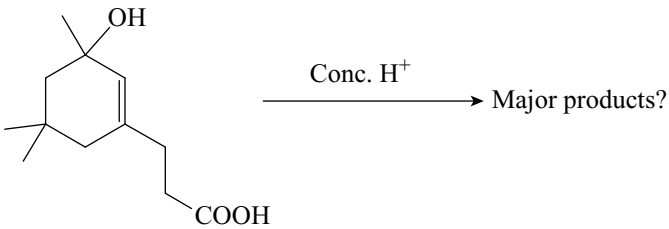
76. Which of the following is the most stable alkene?

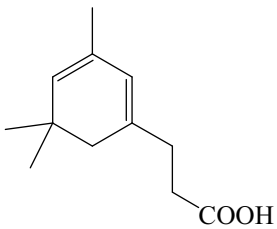
(a) 

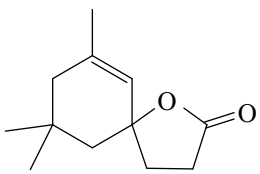
(b) 

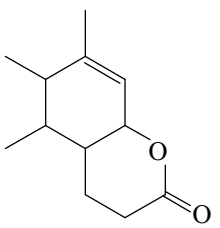
(c) 

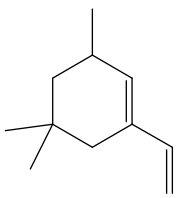
(d) 

77. 

(a) 

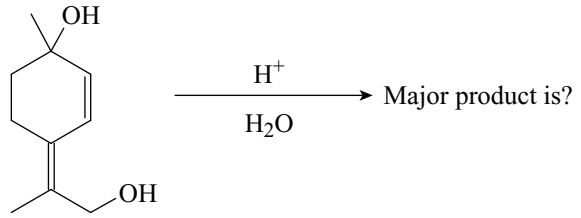
(b) 

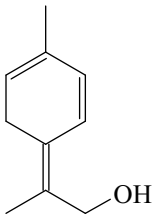
(c) 

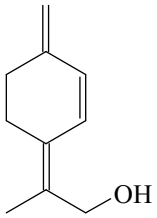
(d) 

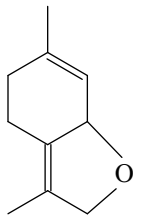
78. Hyperconjugation is best described as:
(a) delocalisation of p electrons into a nearby empty orbital
(b) delocalisation of σ electrons into a nearby empty orbital
(c) the effect of alkyl groups donating a small amount of electron density inductively into a carbocation
(d) the migration of a carbon or hydrogen from one carbocation to another

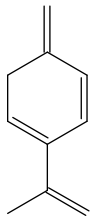
79.



(a) 

(b) 

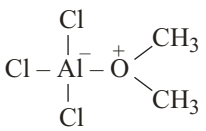
(c) 

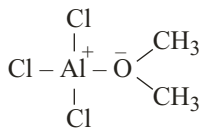
(d) 

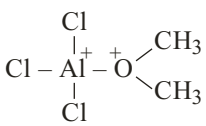
80. Which of the following statements best explains why 1-propyne can be deprotonated by the ethyl anion ($CH_3CH_2^-$)?
(a) The acetylide anion is a stronger base than the ethyl anion.
(b) Ethane has a lower pK_a than acetylene.
(c) The lone-pair orbitals in acetylide anions have more s character than those in alkyl anions.
(d) The acetylide anion is a weaker base than an alkyl anion.

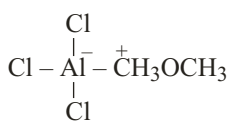
81. Which of the following statements is NOT true for ethylene ($CH_2 = CH_2$) molecule?
(a) Both carbons are sp^2 hybridised.
(b) C = C bond length is shorter than the C–C bond length in ethane.
(c) The two C = C bonds are equally strong. (one is pi and the other is sigma.)
(d) The entire molecule has a planar geometry.

82. Which of the following is the product of the reaction between $AlCl_3$ and CH_3OCH_3?

(a) 

(b) 

(c) 

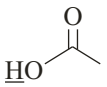
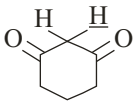
(d) 

83. The acidity for the following compounds increases in the order

(i) $CH_3CH_2CH_2CO_2H$ (ii) $CH_3CH_2\underset{\displaystyle Cl}{\underset{|}{C}}HCO_2H$ (iii) $CH_3CH_2CH_2CH_2OH$

(a) i < ii < iii (b) ii < iii < i (c) iii < i < ii (d) ii < i < iii

84. The relative acidity of the underlined H in each of the following is in the order

(i)  (ii)  (iii) $CH_3–C\equiv C–\underline{H}$

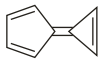
(a) i > ii > iii (b) i > iii > ii (c) ii > i > iii (d) ii > iii > i

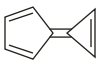
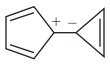
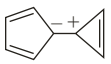
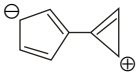
85. Which of the underlined atoms in the molecules shown below have sp hybridisation?

(a) $\underline{C}H_2CHCH_3$ (b) $CH_2\underline{C}CHCl$ (c) $CH_3\underline{C}H_2^+$

(d) $H\underline{C}\equiv\underline{C}CH_3$ (e) $CH_3\underline{C}N$ (f) $(CH_3)_2\underline{C}\underline{N}NH_2$

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

86. A compound  shows a large dipole moment. Which of the following resonance structures can be used to adequately explain this observation?

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

(a) i (b) iii and iv (c) ii and iii (d) iv only

87. The nitrogen in trimethylamine is

(a) sp^2 hybridised (b) sp^3 hybridised

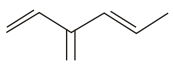
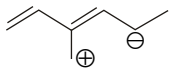
(c) sp hybridised (d) sp^3d^2 hybridised

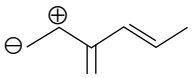
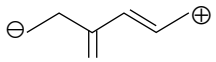
88. The acidity of the protons H:

(i) $CH_3CH_2\overset{\overset{O}{\|}}{C}\underline{H}_3$ (ii) $CH_3CH_2O\overset{\overset{O}{\|}}{C}\underline{H}_3$ (iii) $CH_3CH_2O\overset{\overset{O}{\|}}{C}\underline{H}_2\overset{\overset{O}{\|}}{C}OCH_2CH_3$

(a) i > ii > iii (b) i > iii > ii (c) ii > i > iii (d) iii > i > ii

89. Which of the following is not a valid resonance structure of the others?

(a)  (b) 

(c)  (d) 

90. Which is(are) the correct orbital hybridisation (s) for the C and N atoms in the following structures?

(i) CH_3CH_3 (ii) $CH_2=CH_2$ (iii) NH_3 (iv) $HC\equiv CH$

sp^3 sp sp^2 sp^2

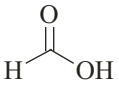
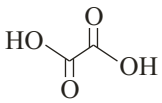
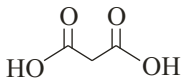
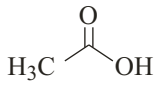
(a) i (b) ii, iii (c) iii, iv (d) i, iii

91. Which allylic carbocation is the most stable carbocation?

(a) $CH_3-CH=CH-\overset{\oplus}{C}H_2$ (b) $CH_3-CH=CH-\overset{\oplus}{C}H-CH_3$

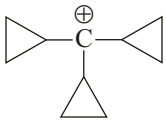
(c) $CH_3-CH=CH-\underset{\displaystyle CH_3}{\overset{\displaystyle\oplus}{\underset{|}{C}}}-CH_3$ (d) All have same stability

92. Rank the following molecules in order of decreasing acidity (increasing pK_a)

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

(a) ii > iii > i > iv
(b) iii > ii > i > iv
(c) i > iv > ii > iii
(d) iv > iii > i > ii

93. Which among the following carbocations is most stable?

(a)  (b) $C_6H_5-\overset{\oplus}{C}H_2$ (c)  (d) $CH_3-\overset{\oplus}{C}H-CH_3$

94. Which of the following statements about resonance structures is false?

(a) Individual resonance structures are imaginary, not real.
(b) Resonance forms differ only in the placement of their π- or non-bonding electrons or unpaired electron.
(c) Different resonance structures of a substance do not have to be equivalent.
(d) In valid resonance structures, all atoms from the second row of the periodic table must have an octet of electrons.

LEVEL 2

Single and Multiple-choice Type

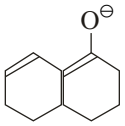
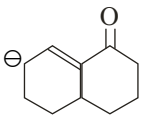
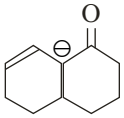
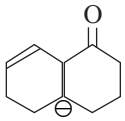
1. The strength of the following bases decreases in the order

(i) $CH_3O^{\ominus}$ (ii) $CH_3^{\ominus}$ (iii) $NH_2^{\ominus}$ (iv) $CH_3\overset{\overset{O}{\|}}{C}-O^{\ominus}$

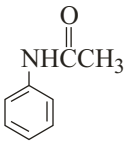
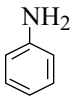
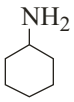
(a) i > iv > iii > ii (b) iii > iv > i > ii

(c) ii > iii > i > iv (d) iv > i > ii > iii

2. Which of the following is not a resonance structure of the others?

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

3. Rank of the following three compounds in decreasing order of basicity is

(i)  (ii)  (iii) 

(a) iii > i > ii (b) iii > ii > i (c) ii > i > iii (d) ii > iii > i

4. Compare the hybridisation of the central carbon atoms in carbon dioxide (CO_2) and allene ($H_2C = C = CH_2$). Which statement is correct?

(a) The hybridisation types of these two carbons cannot be compared because of large electronegativity difference between carbon and oxygen in CO_2 that does not exist in allene.

(b) The hybridisation of carbon in CO_2 cannot be determined, because the lone electron pairs on oxygen do not allow for angle measurements that are necessary to determine the hybridisation involved.

(c) In CO_2 the carbon is sp^2 hybridised, but in allene the central carbon is sp hybridised.

(d) In CO_2 the carbon is sp hybridised but in allene the central carbon is sp hybridised.

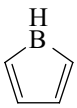
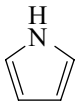
5. The strength of the following bases decreases in the order

(i) $Br^{\ominus}$ (ii) $F^{\ominus}$ (iii) $NH_2^{\ominus}$ (iv) $CH_3^{\ominus}$

(a) iv > iii > ii > i (b) iii > iv > i > ii

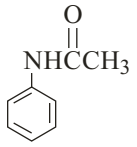
(c) ii > i > iii > iv (d) iv > i > ii > iii

6. Choose the following species that would be predicted to be aromatic according to Hückel's rule.

(i)  (ii)  (iii) 

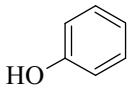
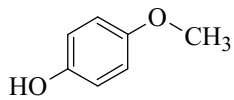
(a) i (b) ii (c) iii (d) i and ii

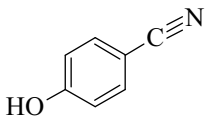
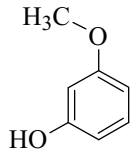
7. Rank of the following three compounds in decreasing order of basicity is

(i)  (ii)  (iii) 

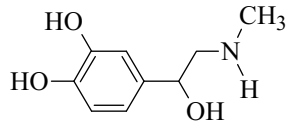
(a) iii > i > ii (b) iii > ii > i (c) ii > i > iii (d) ii > iii > i

8. Which of the following phenol would be the most acidic?

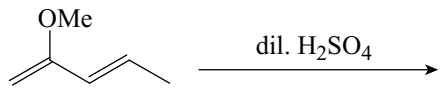
(a)  (b) 

(c)  (d) 

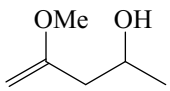
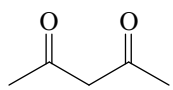
9. Choose the correct formula for epinephrine.

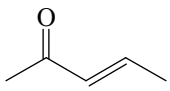
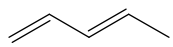


(a) $C_{10}H_{13}NO_3$ (b) $C_9H_{12}NO_3$ (c) $C_{10}H_{14}NO_3$ (d) $C_9H_{13}NO_3$

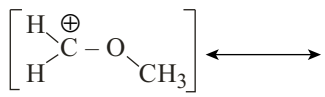
10. 

Major product is?

(a)  (b) 

(c)  (d) 

11. Which is an acceptable resonance structure for the following drawing?



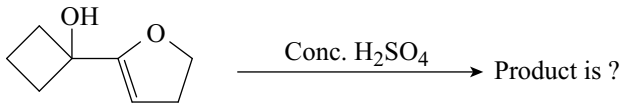
(a) $CH_3\overset{\oplus}{C}H - OH$ (b) $CH_2 = \overset{\oplus}{O} - CH_3$

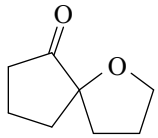
(c) $CH_2CH_2\overset{\oplus}{O}$ (d) $CH_3CH{=}\overset{\oplus}{O}H$

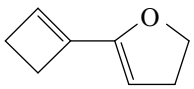
12. In allene ($H_2C = C = CH_2$), the terminal carbons are sp^2 hybridised. Each of the two terminal H_2C groups are situated in such a manner that the two "terminal" planes are 90° from each other. Other compounds with double bonds on successive carbons may also exist. They are called cumulenes. What is the relationship between the two terminal H_2C groups in a cumulene containing three consecutive double bonds ($H_2C = C = C = CH_2$)?

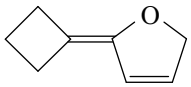
(a) They are in perpendicular planes.
(b) They are in two planes 60° from each other.
(c) They are in the same plane.
(d) They are in two planes 120° from each other.

13.



(a) 

(b) 

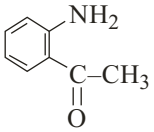
(c) 

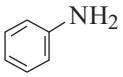
(d) None of these

14. Alkyne hydrogens are more acidic than alkene or alkane hydrogens because
(a) The alkyne carbon has higher 's' character.
(b) The anion formed is more stable.
(c) The electrons in the sp orbital are closer to the nucleus.
(d) All of the above.

15. Which of the following is expected to be the least basic?

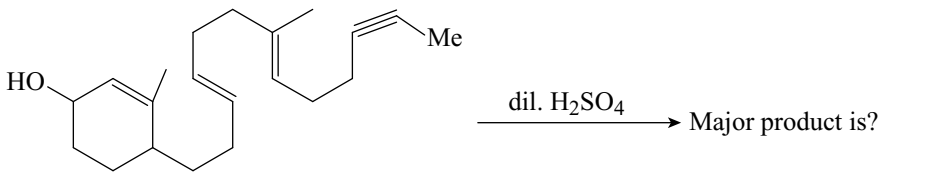
(a) $CH_3CH_2CH_2NH_2$

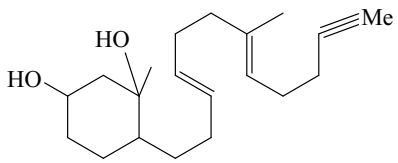
(b) 

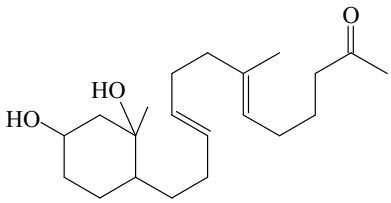
(c) 

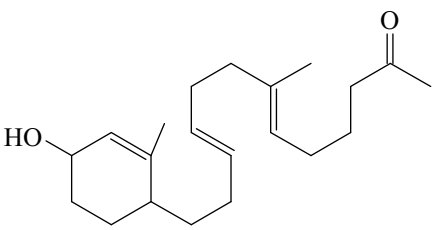
(d) $(CH_3)_3N$

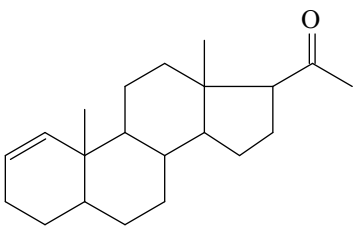
16.



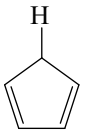
(a) 

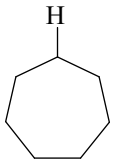
(b) 

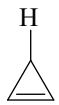
(c) 

(d) 

17. The acidity of the protons H in each of the following is

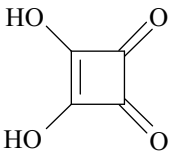
(i) 

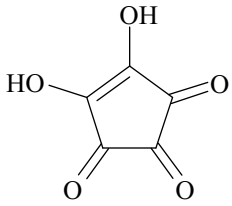
(ii) 

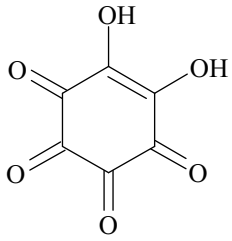
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

18. The acidity of the protons H in each of the following is

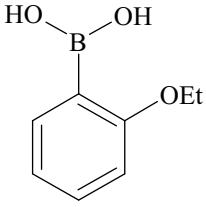
(i) 

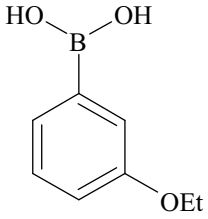
(ii) 

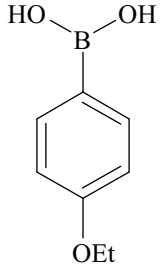
(iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

19. Identify correct acidic strength order in the following compounds

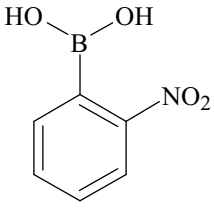
(i) 

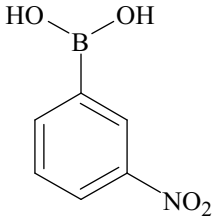
(ii) 

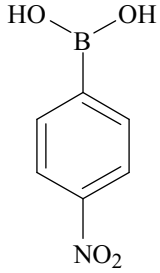
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) ii > i > iii (d) iii > i > ii

20. Identify correct acidic strength order in the following compounds

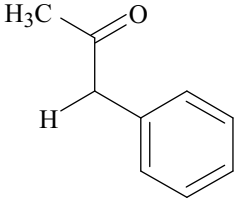
(i) 

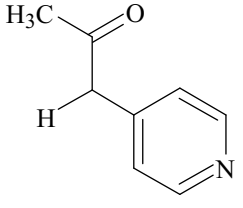
(ii) 

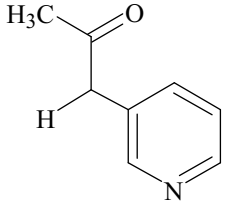
(iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

21. Identify correct acidic strength order in the following compounds

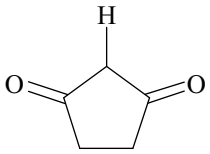
(i) 

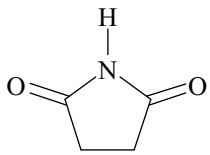
(ii) 

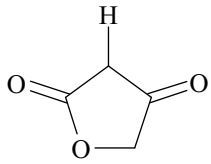
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

22. Identify correct acidic strength order in the following compounds

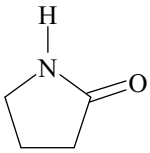
(i) 

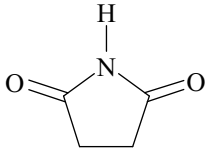
(ii) 

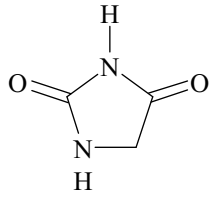
(iii) 

(a) ii > i > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

23. Identify correct acidic strength order in the following compounds

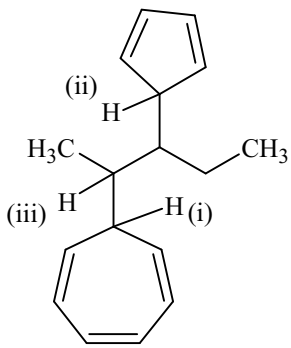
(i) 

(ii) 

(iii) 

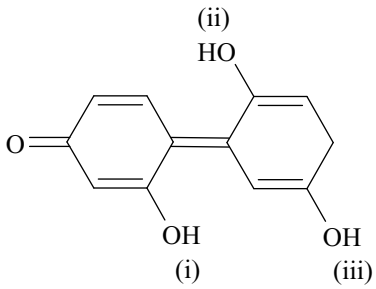
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

24. Identify correct acidic strength order in the following compounds



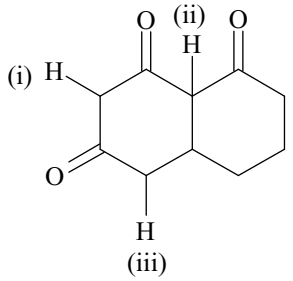
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

25. Identify correct acidic strength order in the following compounds



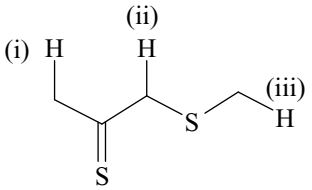
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

26. Identify correct acidic strength order in the following compounds



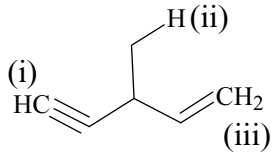
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

27. Identify correct acidic strength order in the following compounds



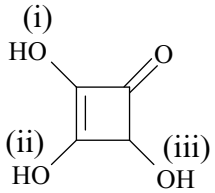
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

28. Identify correct acidic strength order in the following compounds



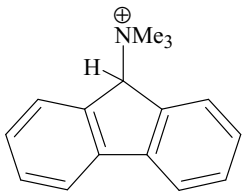
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

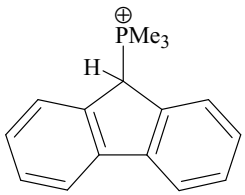
29. Identify correct acidic strength order in the following compounds

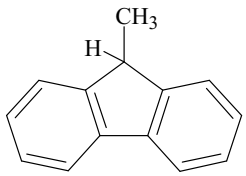


(a) ii > i > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

30. The acidity of the protons H in each of the following is

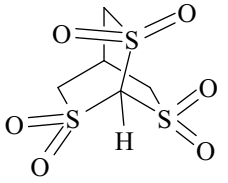
(i) 

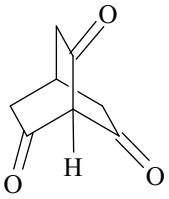
(ii) 

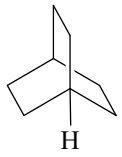
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) ii > i > iii (d) iii > i > ii

31. The acidity of the protons H in each of the following is

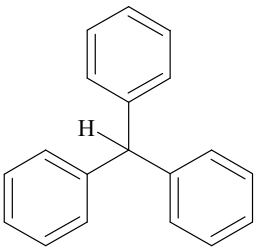
(i) 

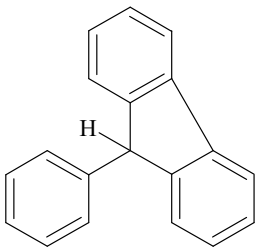
(ii) 

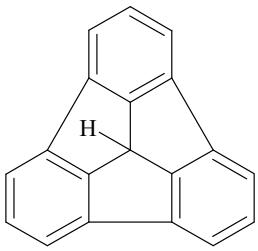
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

32. Identify correct acidic strength order in the following compounds

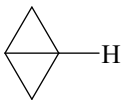
(i) 

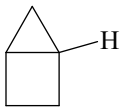
(ii) 

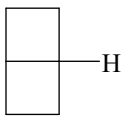
(iii) 

(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

33. Identify correct acidic strength order in the following compounds

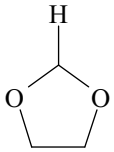
(i) 

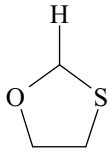
(ii) 

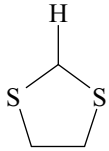
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

34. Identify correct acidic strength order in the following compounds

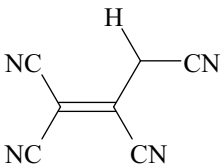
(i) 

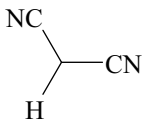
(ii) 

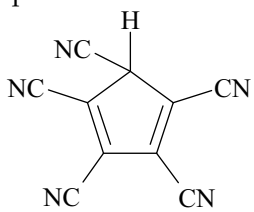
(iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

35. Identify correct acidic strength order in the following compounds

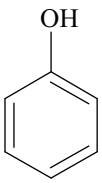
(i) 

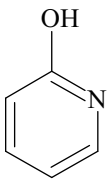
(ii) 

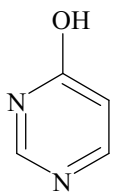
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

36. Identify correct acidic strength order in the following compounds

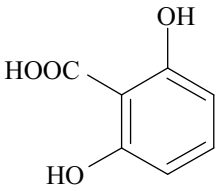
(i) 

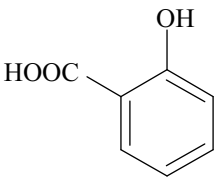
(ii) 

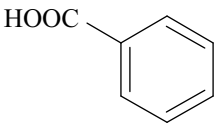
(iii) 

(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

37. Identify correct acidic strength order in the following compounds

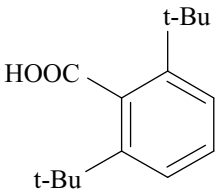
(i) 

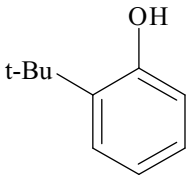
(ii) 

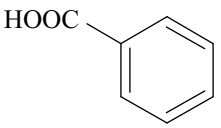
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

38. Identify correct acidic strength order in the following compounds

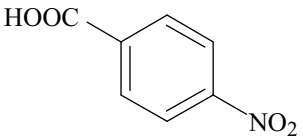
(i) 

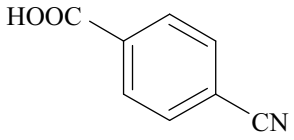
(ii) 

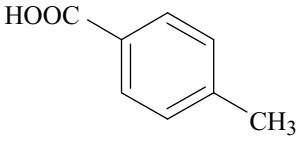
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

39. Identify correct acidic strength order in the following compounds

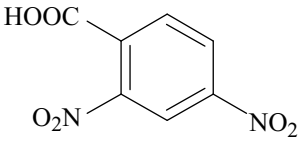
(i) 

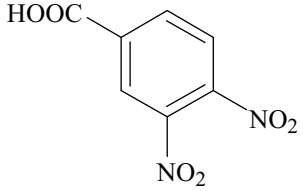
(ii) 

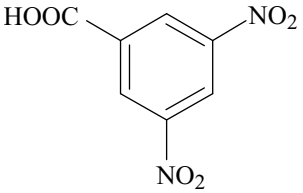
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

40. Identify correct acidic strength order in the following compounds

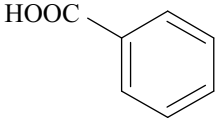
(i) 

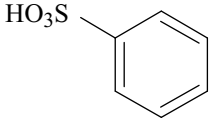
(ii) 

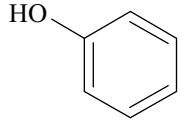
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

41. Identify correct acidic strength order in the following compounds

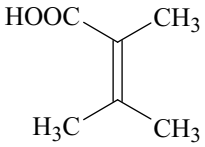
(i) 

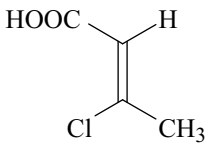
(ii) 

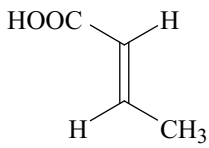
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

42. Identify correct acidic strength order in the following compounds

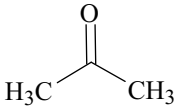
(i) 

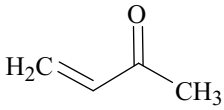
(ii) 

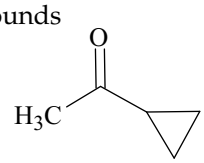
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

43. Identify correct dipole moment order in the following compounds

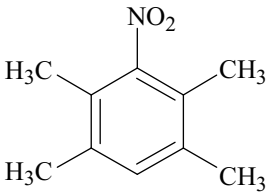
(i) 

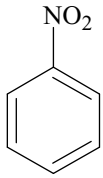
(ii) 

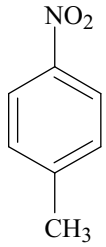
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > ii > i

44. Identify correct dipole moment order in the following compounds

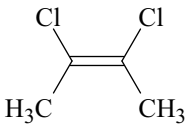
(i) 

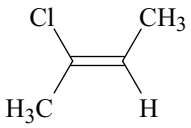
(ii) 

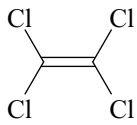
(iii) 

(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

45. Identify correct dipole moment order in the following compounds

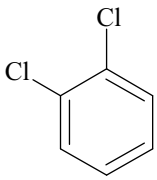
(i) 

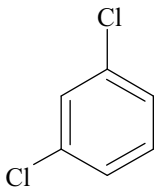
(ii) 

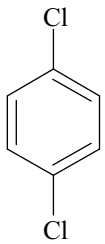
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

46. Identify correct dipole moment order in the following compounds

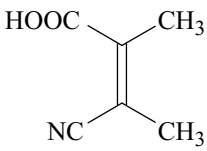
(i) 

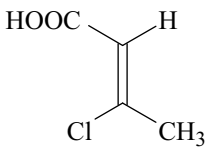
(ii) 

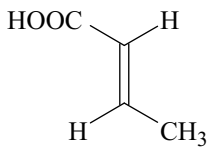
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

47. Identify correct acidic strength order in the following compounds

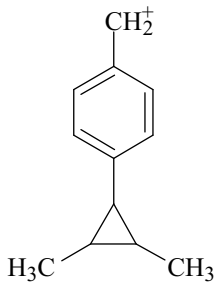
(i) 

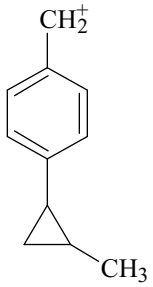
(ii) 

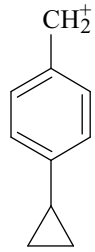
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

48. Identify correct stability order in the following compounds

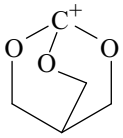
(i) 

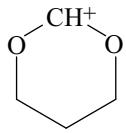
(ii) 

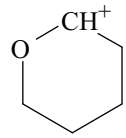
(iii) 

(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

49. Identify correct stability order in the following compounds

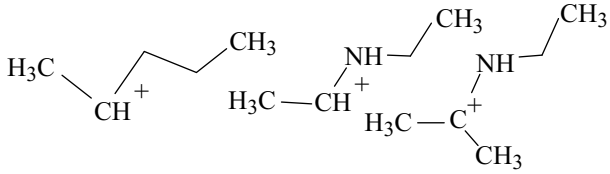
(i) 

(ii) 

(iii) 

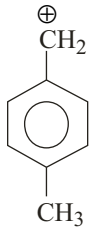
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

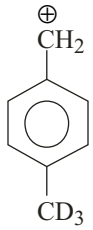
50. Identify correct stability order in the following compounds

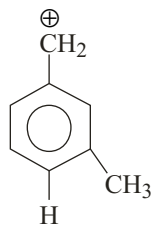


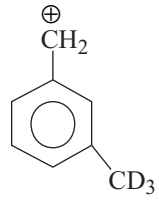
(a) i > ii > iii (b) ii > iii > i (c) iii > ii > i (d) iii > i > ii

51. Correct order of stability of the following carbocation is

(i) 

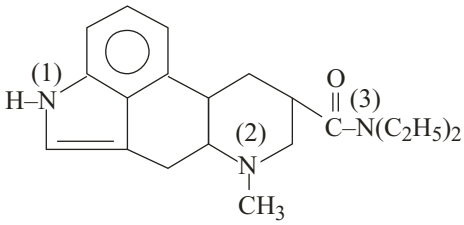
(ii) 

(iii) 

(iv) 

(a) i > ii > iii > iv (b) i > ii > iv > iii
(c) ii > i > iv > iii (d) i > iv > ii > iii

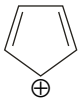
52. Which nitrogen in LSD is most basic?

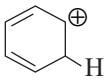


(a) 1 (b) 2
(c) 3 (d) All are equally basic

53. Which one of the following ion is aromatic?

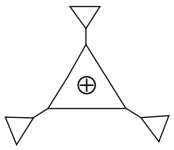
(a) 

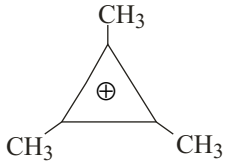
(b) 

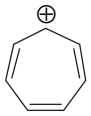
(c) 

(d) 

54. Arrange the following carbocations in decreasing order of their stability?

(i) 

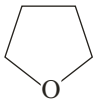
(ii) 

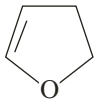
(iii) 

(iv) 

(a) i, ii, iii, iv (b) i, ii, iv, iii (c) i, iii, ii, iv (d) iv, iii, ii, i

55. Arrange the following in decreasing order of their solubility in water or extent of hydrogen bonding with H_2O

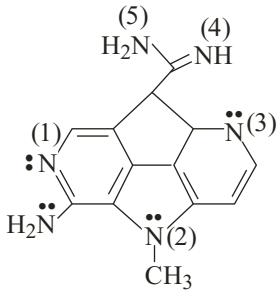
(i) 

(ii) 

(iii) 

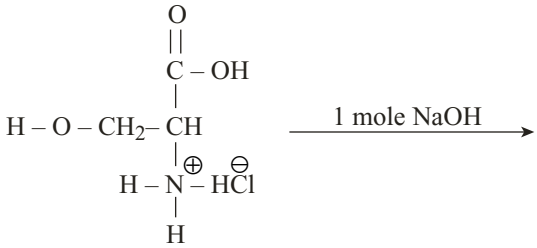
(a) i, ii, iii (b) iii, ii, i (c) ii, iii, i (d) iii, i, ii

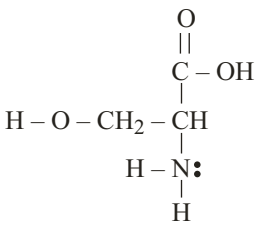
56. The decreasing order of basic strength is

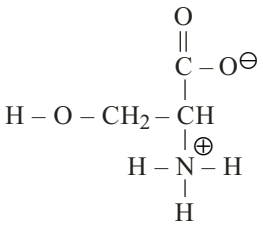


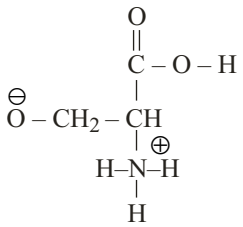
(a) i > v > iii > iv > ii (b) iv > i > v > iii > ii
(c) v > iv > i > ii > iii (d) iv > v > iii > i > ii

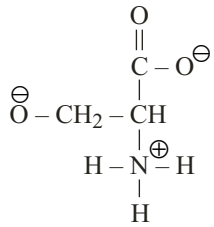
57. What is the major product obtained from the following reaction?



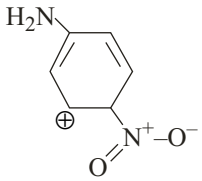
(a) 

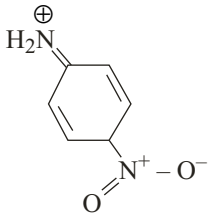
(b) 

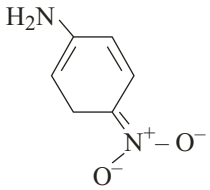
(c) 

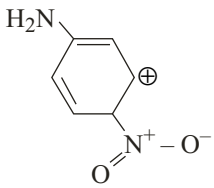
(d) 

58. All the following are the resonance structure of one another except

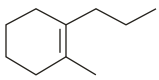
(a) 

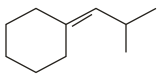
(b) 

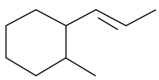
(c) 

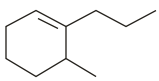
(d) 

59. Which of the following shows minimum heat of combustion?

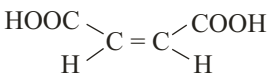
(a) 

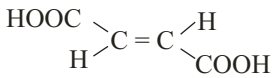
(b) 

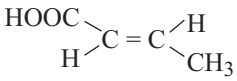
(c) 

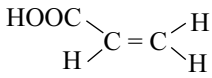
(d) 

60. Arrange the following in the decreasing order of their acidic strength

(i) 

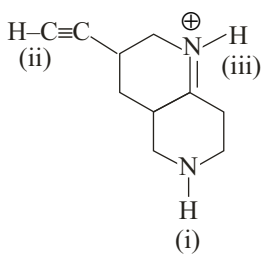
(ii) 

(iii) 

(iv) 

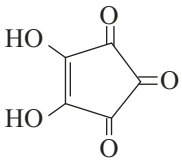
(a) i > ii > iii > iv
(b) iv > iii > ii > i
(c) ii > i > iv > iii
(d) i > ii > iv > iii

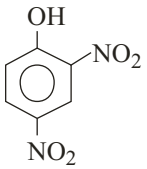
61. Arrange the following hydrogens in the order of their acidic behaviour

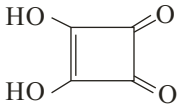


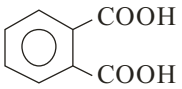
(a) i > iii > ii
(b) ii > iii > i
(c) i > ii > iii
(d) iii > ii > i

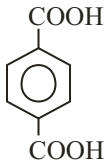
62. Which of the following acid gives evolution of CO_2 with $NaHCO_3$?

(i) 

(ii) 

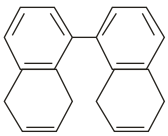
(iii) 

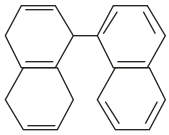
(iv) 

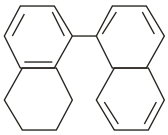
(v) 

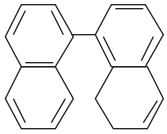
(a) i, iii, iv, v (b) iii, iv, v (c) i, ii, iii iv, v (d) i, iii, iv

63. Maximum resonance energy is known for

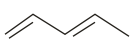
(a) 

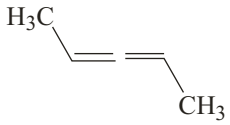
(b) 

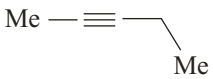
(c) 

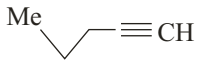
(d) 

64. Arrange the following in the order of their heat of hydrogenation, when all of them are converted to n-pentane

(i) 

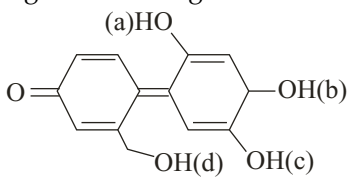
(ii) 

(iii) 

(iv) 

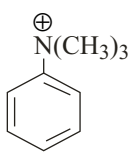
(a) ii > iii > i > iv (b) i > iv > ii > iii
(c) iv > ii > i > iii (d) ii > iv > iii > i

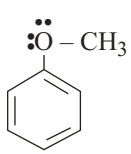
65. Most acidic hydrogen among the following is

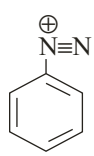


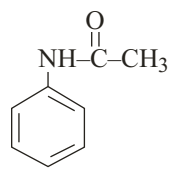
(a) a (b) b (c) c (d) d

66. In which of the following molecule the mesomeric effect does not operate?

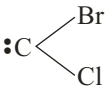
(a) 

(b) 

(c) 

(d) 

67. Which is not carbene out of the following?

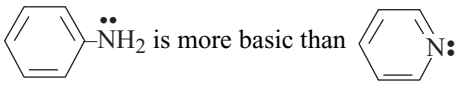
(a) $:CH_2$ (b) $:CCl_2$ (c)  (d) $:CCl_3$

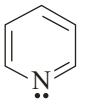
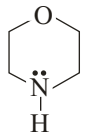
68. Out of the following reagents, pure electrophiles are

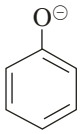
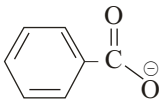
(P) R_3N (Q) $:CCl_2$ (R) $CH_3^{\oplus}$ (S) H_2O (T) $H_3O^{\oplus}$ (U) $Na^{\oplus}$

(a) Q, R, T, U (b) Q, R (c) Q, R, S, T (d) Q, R, S, T, U

69. Select the correct statement

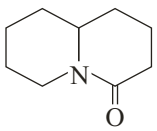
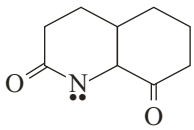
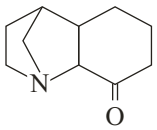
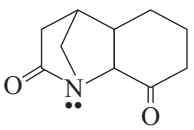
(a)  is more basic than

(b)  is more basic than 

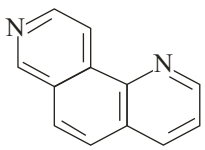
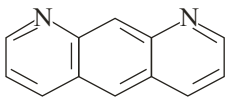
(c)  is more basic than 

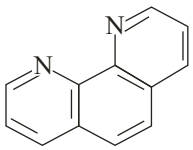
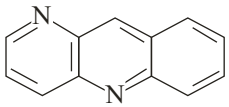
(d) All of them

70. Which of the following is most basic?

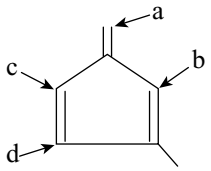
(a)  (b)  (c)  (d) 

71. Which of the following is most basic?

(a)  (b) 

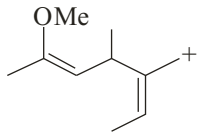
(c)  (d) 

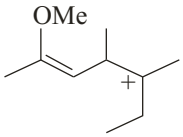
72. Which is the least likely protonation site in the conjugated alkene shown below?

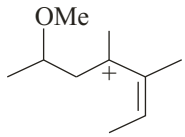


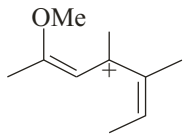
(a) a (b) b (c) c (d) d

73. Which of the following is the most stabilised carbocation?

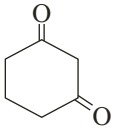
(a) 

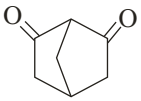
(b) 

(c) 

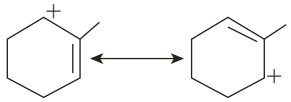
(d) 

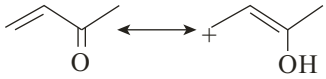
74. Which one of the following compounds would you expect to be the strongest carbon acid?

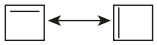
(a) 

(b) $CH_2(COOEt)_2$ (c) CH_3COCH_2COOEt (d) 

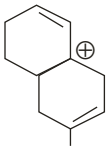
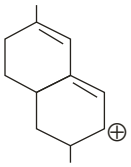
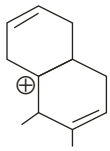
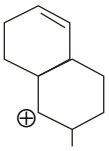
75. Which of the following is a pair of resonance structure?

(a) 

(b) 

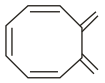
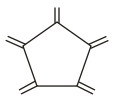
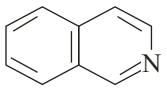
(c) 
(d) 

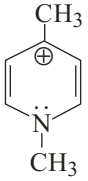
76. Rank the following carbocations in increasing order of stability

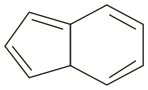
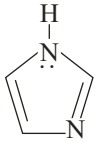
(i) 
(ii) 
(iii) 
(iv) 

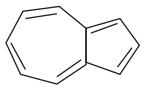
(a) iv < iii < i < ii (b) iv < i < iii < ii (c) iii < ii < i < iv (d) i < iii < ii < iv

77. In which of the following option correctly follow aromaticity?

(i) 
(ii) 
(iii) 

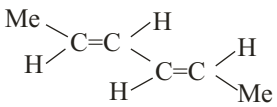
(iv) 

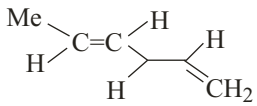
(v) 
(vi) 

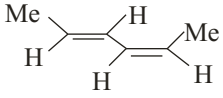
(vii) 

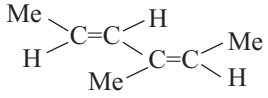
(a) i, iii, iv, vii (b) iii, iv vi, vii (c) i, iii, iv, vii (d) i, iv, vi, vii

78. Which of the following is the correct order for decreasing order of heat of hydrogenation (magnitude)?

(i) 

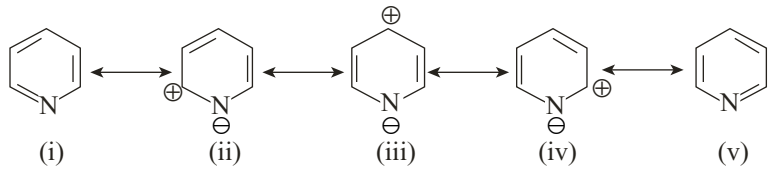
(ii) 

(iii) 

(iv) 

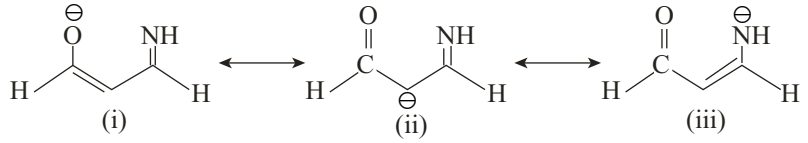
(a) i > ii > iii > iv (b) ii > i > iii > iv (c) iv > iii > i > ii (d) ii > iii > i > iv

79. Among the following canonical structures of pyridine, the correct order of stability is



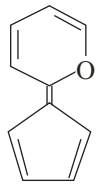
(a) (i = v) > (ii = iv) > iii
(b) (ii = iv) > (i = v) > iii
(c) (i = v) > iii > (ii = iv)
(d) iii > (ii = iv) > (i = v)

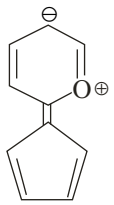
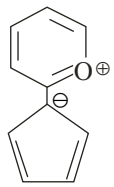
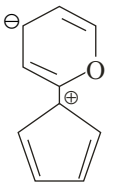
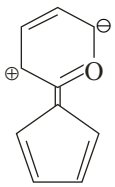
80. The correct order of stability among the following canonical structures is



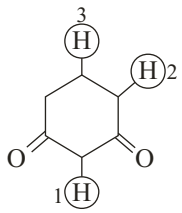
(a) i > ii > iii
(b) i > iii > ii
(c) ii > i > iii
(d) iii > i > ii

81. The most stable canonical structure of the given molecule is



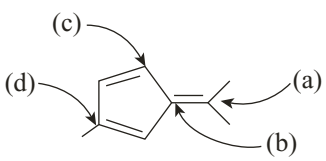
(a) 
(b) 
(c) 
(d) 

82. Which of the following order is correct for the acidity of indicated H-atoms?



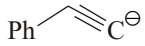
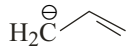
(a) Ⓗ1 > Ⓗ2 > Ⓗ3
(b) Ⓗ3 > Ⓗ2 > Ⓗ1
(c) Ⓗ2 > Ⓗ1 > Ⓗ3
(d) Ⓗ1 > Ⓗ3 > Ⓗ2

83. Which is the least likely protonation site in the conjugated alkene shown below?

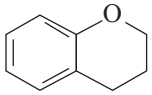
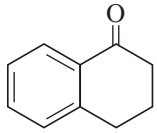
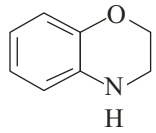
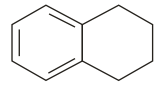


(a) a
(b) b
(c) c
(d) d

84. Which of the following carbanion is most stable?

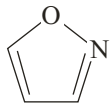
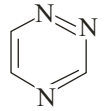
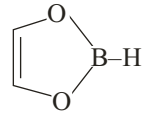
(a)  (b)  (c)  (d) 

85. Identify correct order of electron cloud in benzene ring for the following compounds

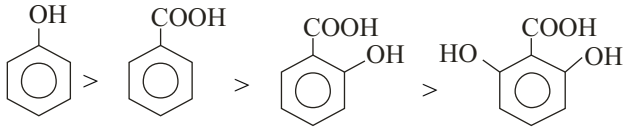
(i)  (ii)  (iii)  (iv) 

(a) iv > i > iii > ii (b) iii > i > iv > ii (c) i > iii > iv > ii (d) iii > ii > i > iv

86. Which of the following is antiaromatic?

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

87. The correct order of pK_a is

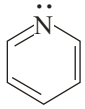
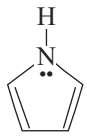
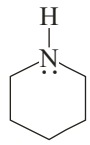
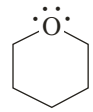
(a) 

(b) $HClO_4 > H_2SO_4 > HNO_3 > HNO_2$

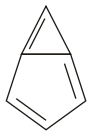
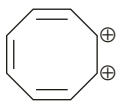
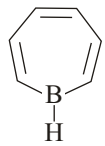
(c) HOCl > HOF > HOBr > HOI

(d) $H_2O_2 > ROH > H_2O$ (R = Et group)

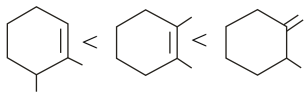
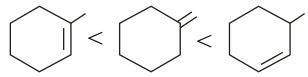
88. Which of the following is the strongest base?

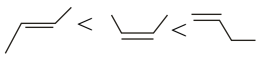
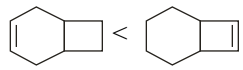
(a)  (b)  (c)  (d) 

89. Among the following compounds which nonaromatic?

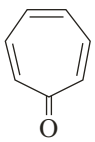
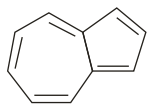
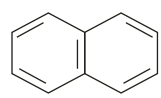
(a)  (b)  (c)  (d) 

90. Identify correct order of heat of hydrogenation

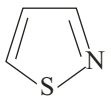
(a)  (b) 

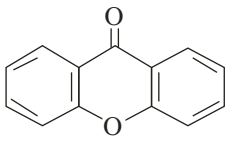
(c)  (d) 

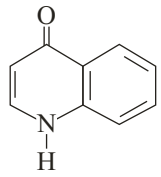
91. Dipole moment of which compound(s) is/are not zero?

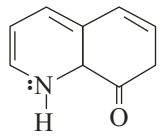
(a)  (b)  (c)  (d) 

92. Which of the following is/are aromatic?

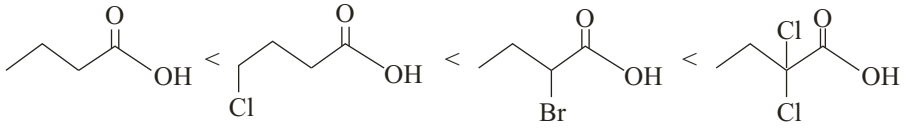
(a) 

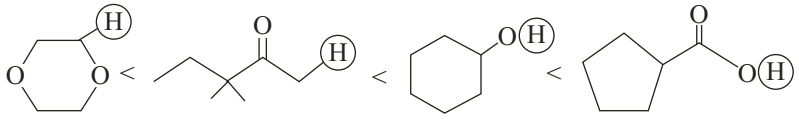
(b) 

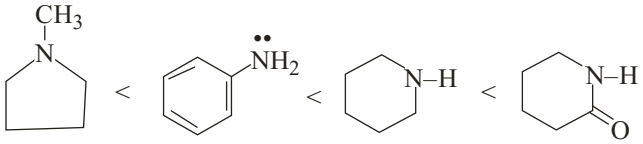
(c) 

(d) 

93. Which of following represent the correct order of acidity?

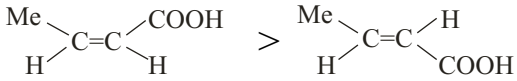
(a) 

(b) 

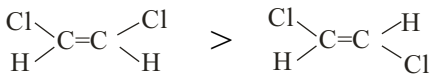
(c) 

(d) Ph–O–CH_3 < Ph–CH_2–OH < Ph–OH < Ph – C(=O) – OH

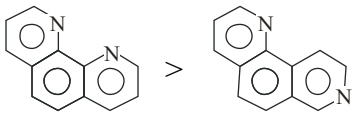
94. Which of the following is correct?

(a) 

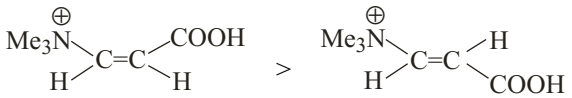
(acidic strength)

(b) 

(dipole moment)

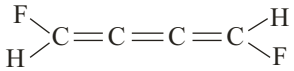
(c) 

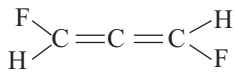
(basicity)

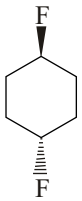
(d) 

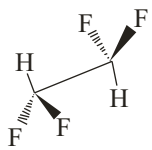
(acidic strength)

95. Which of the following molecules have dipole moment?

(a) 

(b) 

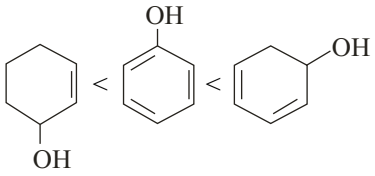
(c) 

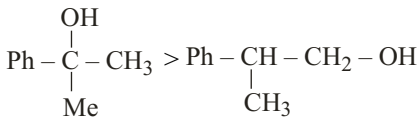
(d) 

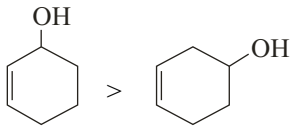
96. $CH_3 - CH_2 - NH_2 \xrightarrow[HCl]{NaNO_2} [P]$; Products of the reaction are:

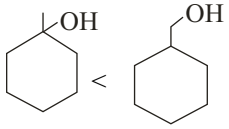
(a) CH_3–CH_2–OH (b) Et–Cl (c)  (d) Et–ONO

97. Identify correct order of rate of dehydration

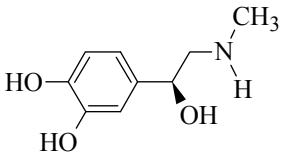
(a) 

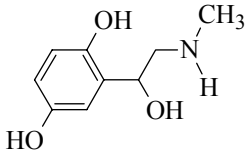
(b) 

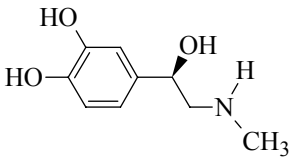
(c) 

(d) 

98. Choose the constitutional isomer(s) of epinephrine (among following structures)

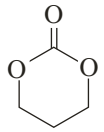
(i) 

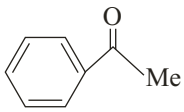
(ii) 

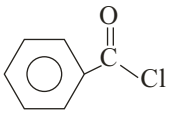
(iii) 

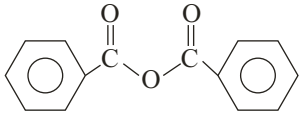
(a) i (b) ii (c) iii (d) i & ii

99. 2-phenyl-2-propanol can be prepared by treating which of these compounds with MeMgBr followed by hydrolysis?

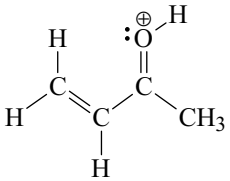
(a) 

(b) 

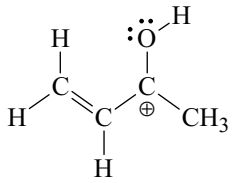
(c) 

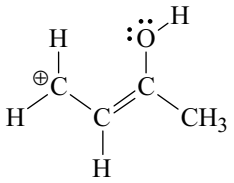
(d) 

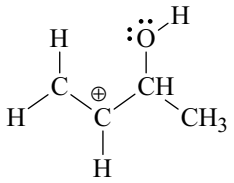
100. Choose those that are resonance structures of protonated methyl vinyl ketone.



protonated methyl vinyl ketone

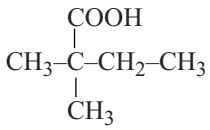
(i) 

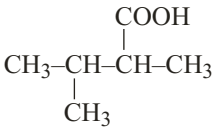
(ii) 

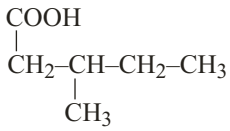
(iii) 

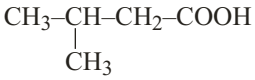
(a) i (b) ii (c) iii (d) i and ii

101. Which of the following acid will give isopentane on decarboxylation with soda lime?

(a) 

(b) 

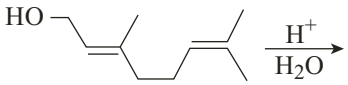
(c) 

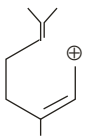
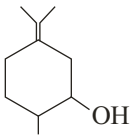
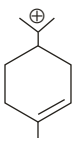
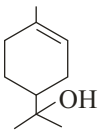
(d) 

102. Which of the following alkane can not be synthesised by Wurtz reaction in good yield?

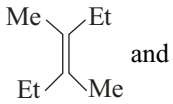
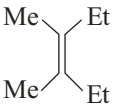
(a) $(CH_3)_2$–CH–CH_2–CH–$(CH_3)_2$ (b) $(CH_3)_2$CH–CH_2–CH_2–CH–$(CH_3)_2$

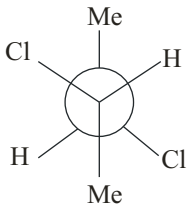
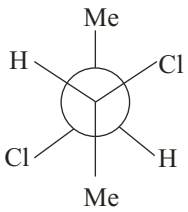
(c) CH_3–CH_2–C$(CH_3)_2$–CH_2–CH_3 (d) CH_3–CH_2–CH_2–CH_3

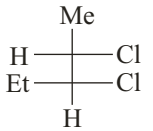
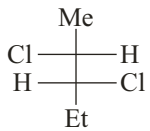
103.  product and intermediate form is/are:

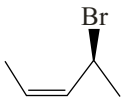
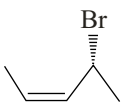
(a)  (b)  (c)  (d) 

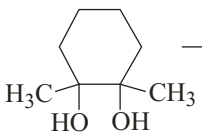
104. Among the following pair(s) of compounds identify enantiomeric pairs

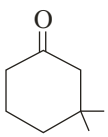
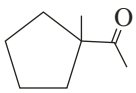
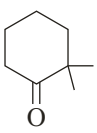
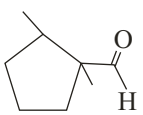
(a)  and 

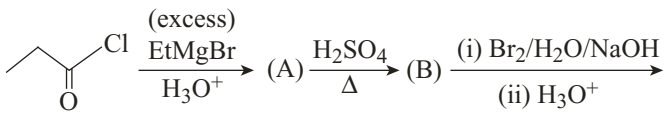
(b)  and 

(c)  and 

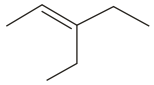
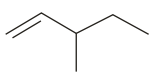
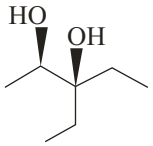
(d)  and 

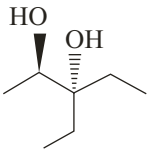
105.  possible products obtained is/are

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

106. 

; Products B and C are

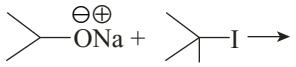
(a)  (b)  (c) 

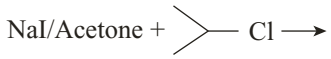
(d) 

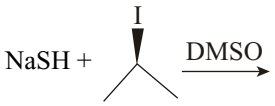
107. Which statement is/are correct in the following?
(a) Allyl bromide gives S_{N^1} reaction but vinyl chloride does not.
(b) Primary alkyl halides can give S_{N^1} or S_{N^2} reaction. This depends on the structure of the substrate and nature of solvent.
(c) CH_3–CH=CH–CH_2Cl reacts with KCN to give mixture of two isomeric products.
(d) CH_3–CH_2–O–CH_2Br is less reactive than tert. butyl bromide for S_{N^1} reaction.

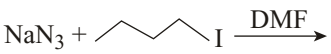
108. Test for identification of But-2-ene and benzene is
(a) Tollen's Reagent test (b) 1% Alkaline $KMnO_4$
(c) Iodoform test (d) $Br_2 + H_2O$ test

109. Identify the reaction that follows S_{N^2} path

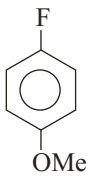
(a) 

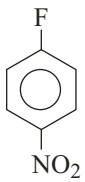
(b) 

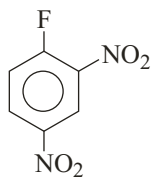
(c) 

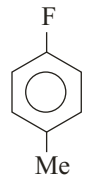
(d) 

110. Among the following compounds, which liberates F^- on reaction with MeO^-?

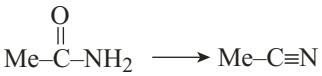
(a) 

(b) 

(c) 

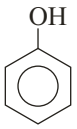
(d) 

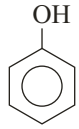
111. Identify reagents used for the following conversions



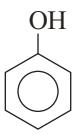
(a) P_2O_5/Δ (b) $NaCl/\Delta$ (c) $POCl_3/\Delta$ (d) Al_2O_3/Δ

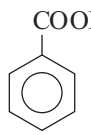
112. Among the following reactions, which form salicylic acid (after acidification)?

(a) 

$+ CHCl_3 + NaOH \longrightarrow$ (b) 

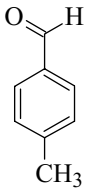
$+ CCl_4 + NaOH \longrightarrow$

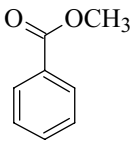
(c) 

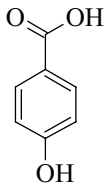
$+ CO_2 + NaOH \longrightarrow$ (d) 

$+ NaOH \longrightarrow$

113. Choose the order for increasing boiling point of the following compounds.

(i) 

(ii) 

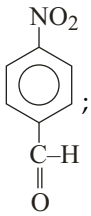
(iii) 

(a) (i) (ii) (iii) increasing boiling point

(b) (ii) (i) (iii) increasing boiling point

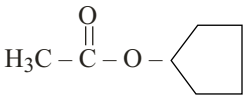
(c) (i) (iii) (ii) increasing boiling point

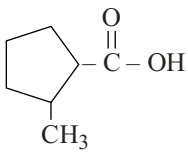
(d) (ii) (iii) (i) increasing boiling point

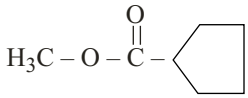
114.  ; identify reagent which reduces both groups

(a) $NaBH_4$
(b) LAH
(c) Zn–Hg/HCl
(d) NH_2–NH_2/OH^-/Δ

115. For the given compounds, correct statement is/are

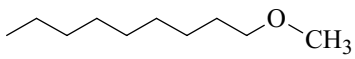
(i) 

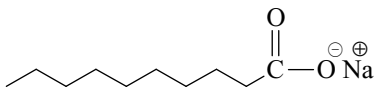
(ii) 

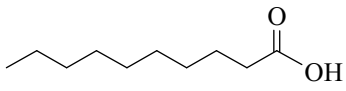
(iii) 

(a) i and ii are positional isomers
(b) ii and iii are functional group isomers
(c) i and iii are metamers
(d) i and iii are positional isomers

116. Choose the order that has the following compounds correctly arranged with respect to increasing solubility in water.

(i) 

(ii) 

(iii) 

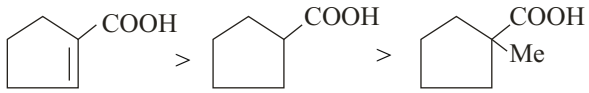
(a) (ii) (i) (iii) increasing solubility

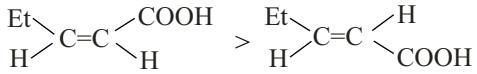
(b) (i) (ii) (iii) increasing solubility

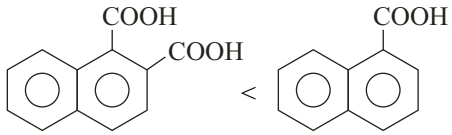
(c) (i) (iii) (ii) increasing solubility

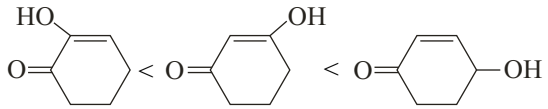
(d) (ii) (iii) (i) increasing solubility

117. Which of following order is/are correct for acidic strength?

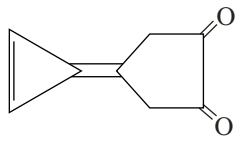
(a) 

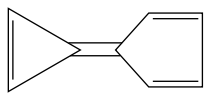
(b) 

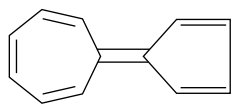
(c) 

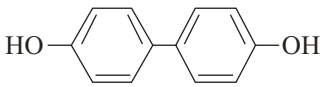
(d) 

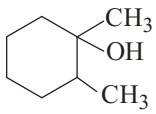
118. Which has non-zero dipole moment?

(a) 

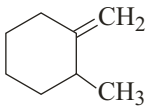
(b) 

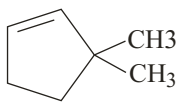
(c) 

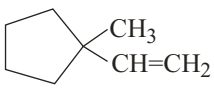
(d) 

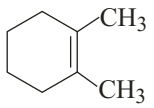
119. Compound (A) $\xrightarrow{\text{dil. } H_2SO_4}$ 

Compound (A) can be

(a) 

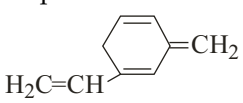
(b) 

(c) 

(d) 

120. Which of the following gives glyoxal as one of the product on ozonolysis?

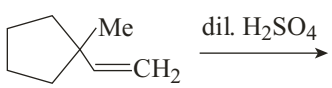
(a) 

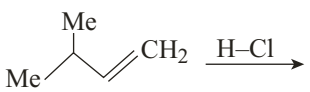
(b) 

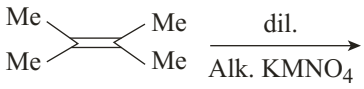
(c) $H_2C{=}CH{-}CH{=}CH_2$

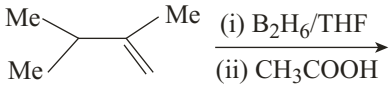
(d) Benzene

121. In which of the following reactions the rearrangment of carbocation is involved?

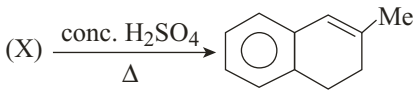
(a) 

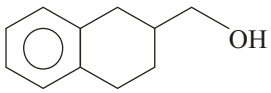
(b) 

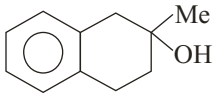
(c) 

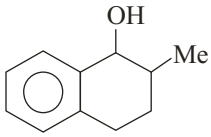
(d) 

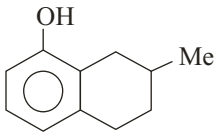
122. In the given reaction, the possible structure of compound (X) is



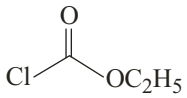
(a) 

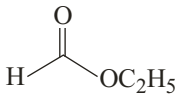
(b) 

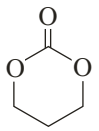
(c) 

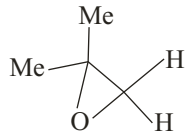
(d) 

123. Which of the following compounds will give or tertiary alcohol as a resultant product when they are treated with either 1 mole of MeMgBr or with excess MeMgBr followed by H_2O?

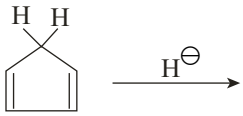
(a) 

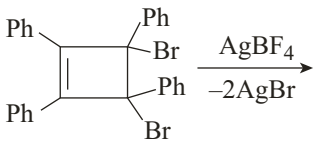
(b) 

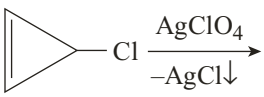
(c) 

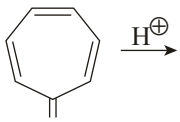
(d) 

124. Which of the following reactions give an aromatic product?

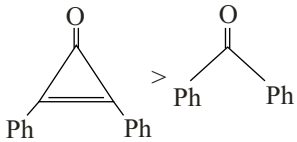
(a) 

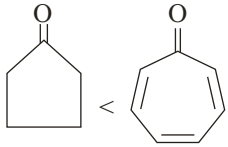
(b) 

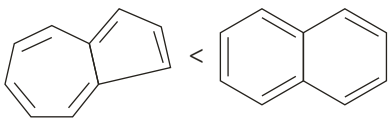
(c) 

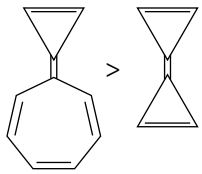
(d) 

125. Identify the correct order of dipole moment

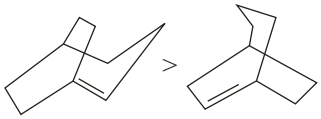
(a) 

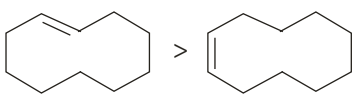
(b) 

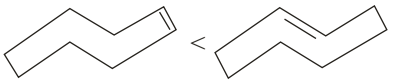
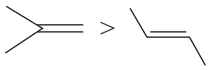
(c) 

(d) 

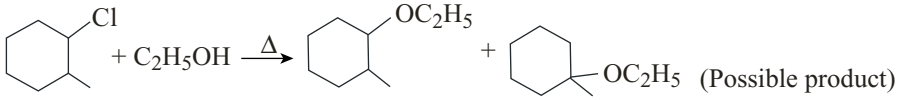
126. Identify the correct order of heat of hydrogenation

(a) 

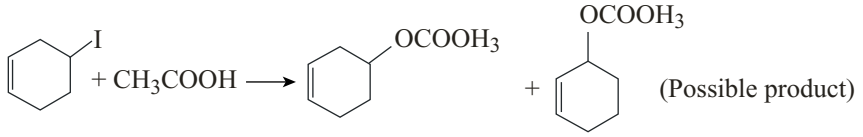
(b) 

(c)  (d) 

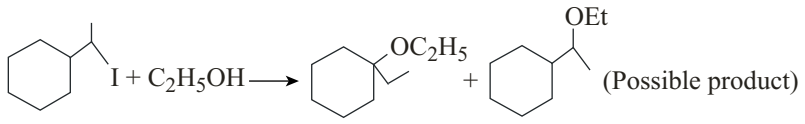
127. Which of the following reactions give the correct product?

(a) 

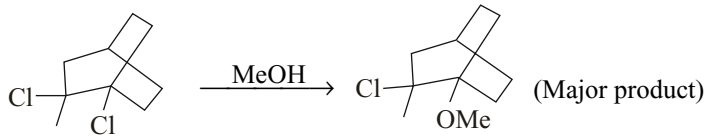
(Possible product)

(b) 

(Possible product)

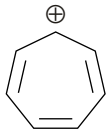
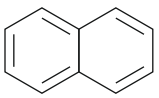
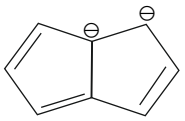
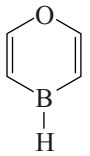
(c) 

(Possible product)

(d) 

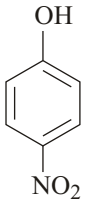
(Major product)

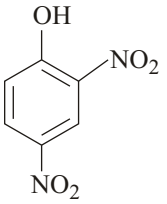
128. From the compound shown below, choose which is aromatic

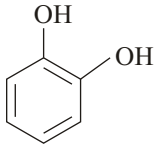
(a)  (b)  (c)  (d) 

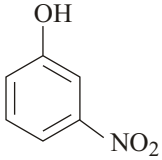
Comprehension Type

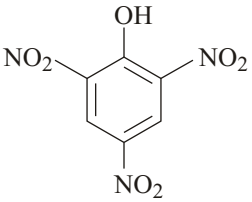
Passage 1

(i) 

(ii) 

(iii) 

(iv) 

(v) 

(vi) 

129. The correct order of Ka value is:

(a) i > iii > iv (b) iv > iii > vi (c) v > vi > iii (d) ii > i > iv

130. Which of the following gives effervescence with $NaHCO_3$?

(a) ii (b) vi (c) iii (d) iv

131. Which of the following pairs of phenol derivative are stronger acid than phenol?

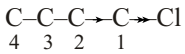
(a) i, ii, iv (b) ii, iv, vi (c) i, ii, vi (d) v, iii, vi

Passage 2

In a covalent single bond between unlike atoms, the electron pair forming the σ bond is never shared absolutely equally between the two atoms; it tends to be attracted a little more towards the more electronegative atom of the two.

This is generally represented as

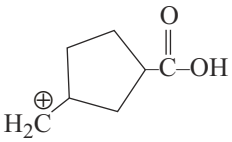
If the carbon atom bonded to chlorine is itself attached to further carbon atoms, the effect can be transmitted further as

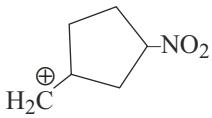


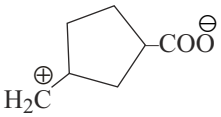
The effect of Cl on C_2 is less than the effect of Cl on C_1; however, the transmission quickly dies away in a saturated chain, usually being too small to be noticeable beyond C_2. These influences on the electron distribution in σ bonds are known as **inductive effects.**

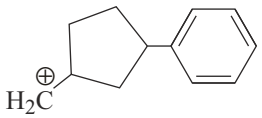
Electron releasing groups w.r.t. the hydrogen atom are known to have +I effect and electron withdrawing groups are known to have –I effect. Electron donating group increases the stability of carbocation and withdrawing group increases the stability of carbanion.

132. Which of the following carbocation is expected to be most unstable?

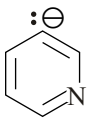
(a) 

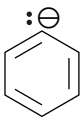
(b) 

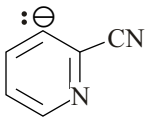
(c) 

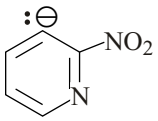
(d) 

133. Correct order of the stability of the given carbanion is

(i) 

(ii) 

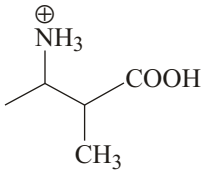
(iii) 

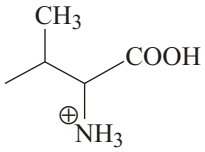
(iv) 

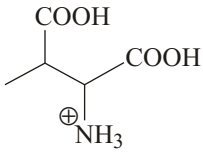
(a) i > ii > iii > iv (b) ii > i > iii > iv

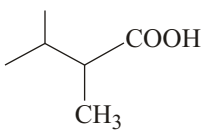
(c) iv > iii > ii > i (d) iv > iii > i > ii

134. Most acidic compound in aqueous medium is

(a) 

(b) 

(c) 

(d) 

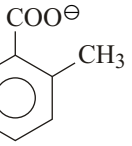
Passage 3

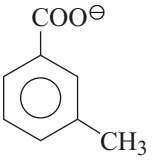
Benzoic acid is more acidic than acetic acid. Acidity of formic acid is more than the benzoic acid. Among monosubstituted benzoic acid derivatives, the ortho derivative is most acidic due to ortho effect. Acidity of any acid can be explained by the stability of conjugate base of the acid.

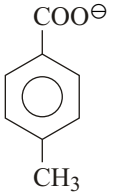
135. Which of the following is most acidic in character?

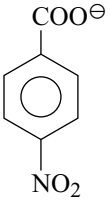
(a) o-nitrobenzoic acid (b) p-nitrobenzoic acid
(c) m-nitrobenzoic acid (d) Benzoic acid

136. Which conjugate base is most stable?

(a) 

(b) 

(c) 

(d) 

137. Arrange acidity of the given compounds increasing order

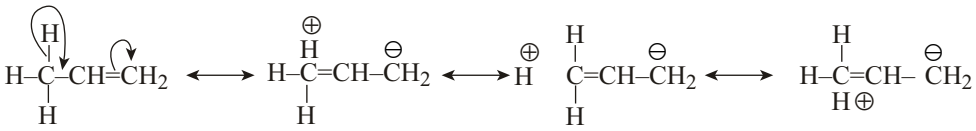
(i) p-nitrophenol (ii) p-fluorophenol (iii) p-chlorophenol

(a) (i), (ii), (iii) (b) (ii), (i), (iii) (c) (ii), (iii), (i) (d) (iii), (ii), (i)

Passage 4

When (C–H) sigma electrons are in conjugation with pi bond, this conjugation is known as σ (C–H) π conjugation, excessive conjugation or hyperconjugation.

(i) Compound should have at least one sp^2-hybrid carbon of either alkene, alkyl carbocation or alkyl free radical.
(ii) α-carbon with respect to sp^2 hybrid carbon should have at least one hydrogen.
(iii) Resonating structures due to hyperconjugation may be written involving "no bond" between the alpha carbon and hydrogen atoms.



In the above resonating structures there is no covalent bond between carbon and hydrogen, and from this point of view, hyperconjugation may be regarded as "no bond resonance". Actually the hydrogen atom is not free from the carbon. These resonating structures only suggest that: (a) there is some ionic character between C–H bond and (b) carbon–carbon double bond acquires some single bond character.

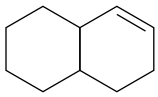
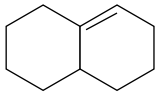
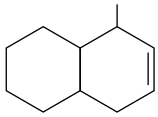
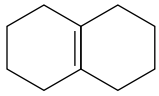
We can explain the stability of alkene, carbocation and carbon free radical on the basis of hyperconjugation.

$$\text{Stability of alkene} \propto \text{number of } \alpha\text{–H} \propto \frac{1}{\text{Heat of hydrogenation}}$$

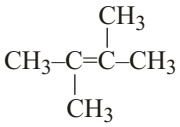
138. Which of the following statements are correct for C_6H_5–CCl_3?

(a) CCl_3 group is electron withdrawing due to the –I effect and reverse hyperconjugation.
(b) CCl_3 group is meta directing due to the –M effect.
(c) CCl_3 group is o, p-directing because it is +R group.
(d) CCl_3 group can exert +M effect.

139. Which of the following has the lowest heat of hydrogenation?

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

140. Carbon–carbon double bond length will be maximum in which of the following compounds?

(a) $CH_3–CH=CH_2$ (b) $CH_3–CH=CH–CH_3$ (c)  (d) $CH_2=CH_2$

Passage 5

For a compound to be classified as aromatic, it must fulfill both of the following criteria.

(i) It must have an uninterrupted cyclic cloud of π electrons above and below the plane of the molecule (often called a π cloud).

For the π cloud to be cyclic, the molecule must be cyclic.

For the π cloud to be uninterrupted, every atom in the ring must have a p orbital.

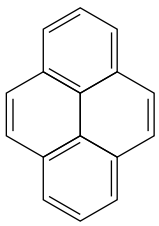
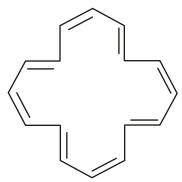
For the π cloud to form, each p orbital must be able to overlap with the p orbitals on either side of it. Therefore, the molecule must be planar.

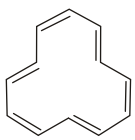
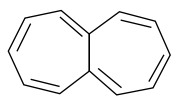
(ii) The π cloud must contain an odd number of pairs of π electrons.

Benzene is an aromatic compound because it is cyclic and planar, every carbon in the ring has a p orbital and the π cloud contains three pairs of π electrons.

The German chemist Erich Huckel was the first to recognise that an aromatic compound must have an odd number of pairs of π electrons. He described this requirement by what has come to be known as Huckel's rule, or the $4n + 2$ rule. The rule states that for a planar, cyclic compound to be aromatic, its uninterrupted π cloud must contain $(4n + 2)$ π electrons, where n is any whole number. According to Huckel's rule, then an aromatic compound must have 2 ($n = 0$), 6($n = 1$), 10 ($n = 2$), 14 ($n = 3$), 18 ($n = 4$), etc. π electrons. Because there are two electrons in a pair, Huckel's rule requires that an aromatic compound must have 1, 3, 5, 7, 9, etc. pairs of π electron. Thus, Huckel's rule is just a mathematical way of saying that an aromatic compound must have an odd number of pairs of π electrons. For an anti-aromatic system a planar, cyclic compound must contain $(4n)$ π electrons.

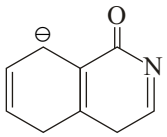
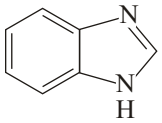
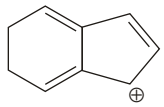
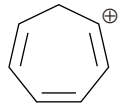
141. Which one of the following compounds is non-aromatic?

(i)  (ii) 

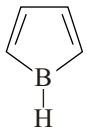
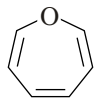
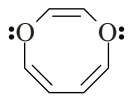
(iii)  (iv) 

(a) only i (b) i and iv (c) ii, iii, iv (d) i and ii

142. Which of the following will show aromatic behaviour?

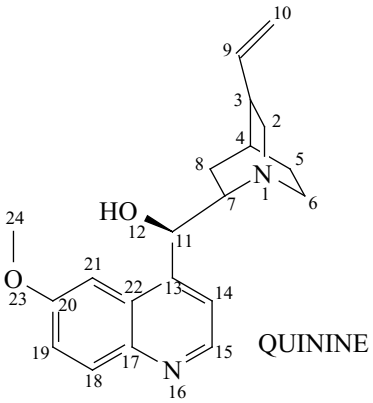
(a)  (b)  (c)  (d) 

143. Which of following is a non-aromatic system?

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

Passage 6

For each of the questions 149–154 about QUININE (shown right), select the answer from those provided.



QUININE

144. What is the oxidation state of C11?
(a) +1 (b) 0 (c) –1 (d) –2

145. Of the following list, which atom(s) is (are) sp3 hydridised?
(a) O12 (b) N16 (c) C21 (d) N1

146. Which of the following carbon atoms are tertiary?
(a) C24 (b) C19 (c) C20 (d) C22

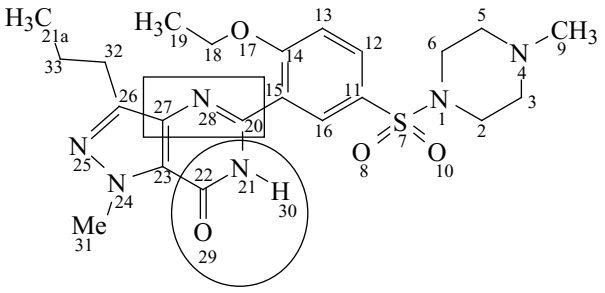
147. Which carbon atom(s) is (are) ortho to a methoxy group?
(a) C5 (b) C6 (c) C7 (d) C21

148. Which of the following functional groups are found in QUININE?
(a) Alcohol (b) Amide (c) Ester (d) Ether

149. How many units of unsaturation are there in QUININE? (units of unsaturation are the same as the index of hydrogen deficiency or IHD)
(a) 7 (b) 8 (c) 9 (d) 10

Passage 7

In the year of its launch, VIAGRA (below) was used by over three million satisfied customers. Each of the questions below refers to the structure of VIAGRA. Now select the answer(s) from the options provided.



150. What are the oxidation states of C3 and N25?
(a) –1, –2 (b) +1, –2 (c) –1, +3
(d) –1, –3 (e) +1, –3

151. What is the functional group in the circle?
(a) amide (b) amine (c) aniline (d) nitrile

152. What is the functional group in the rectangular box?
(a) epoxide (b) amine (c) ester (d) ether

153. How many units of unsaturation are there in VIAGRA?
(a) 7 (b) 8 (c) 11
(d) 12 (e) 13

154. In VIAGRA, what are the hybridisations of O10, N4 and N28, respectively?
(a) sp^3, sp^3, sp^3 (b) sp^2, sp^3, sp^3 (c) sp^3, sp^2, sp^3 (d) sp^2, sp^3, sp^2

155. In VIAGRA, what are the hybridisations of C2, C3 and N24, respectively?
(a) sp^3, sp^3, sp^3 (b) sp^2, sp, sp^3 (c) sp^3, sp^2, sp^3 (d) sp^3, sp^3, sp^2

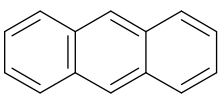
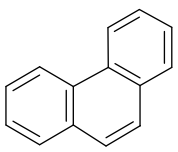
156. How many carbon chiral centres are there in VIAGRA?
(a) 0 (b) 1 (c) 2 (d) 3

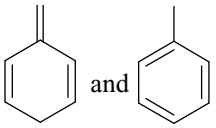
Matrix Type

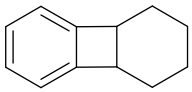
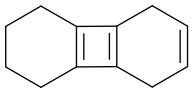
157.

Column I (Groups)	**Column II (Effect)**
(a) $-\overset{\oplus}{N}Me_3$	(p) +I
(b) $-\overset{\oplus}{P}Me_3$	(q) –I
(c) –OMe	(r) +R
(d) $-CH_3$	(s) –R
	(t) +H

158.

Column I			**Column II**
(a)		and 	(p) (i) compound has more heat of hydrogenation than (ii)

(b)  and

(c)  and 

(d)  and 

(q) (i) compound has more resonance energy than (ii) compound

(r) (i) compound is more stable than (ii)

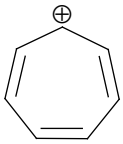
(s) (ii) compound has more heat of hydrogenation than (i)

(t) (ii) compound has more degree of unsaturation than (i)

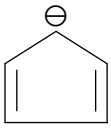
159. Column I **Column II**

(a) 

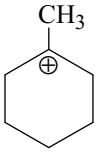
(p) Hyperconjugation

(b) 

(q) All carbon atoms are sp^2-hybridised

(c) 

(r) Aromatic

(d) 

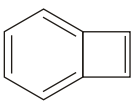
(s) Resonance

(t) Diamagnetic

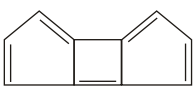
160. Column I **Column II**

(a) 

(p) Aromatic

(b) 

(q) Antiaromatic

(c) 

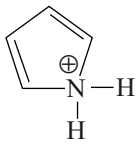
(r) Readily reacts with metal to form stable dianion

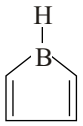
(d) C_8H_8

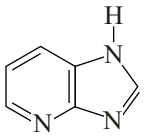
(s) Paramagnetic in nature due to presence of unpaired electrons in molecular orbitals

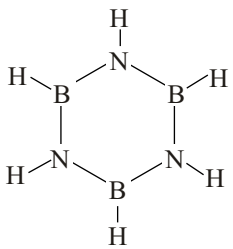
(t) Diamagnetic in nature due to presence of even electrons in molecular orbitals

161. **Column I** **Column II**

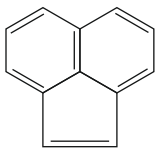
(a)  (p) Aromatic

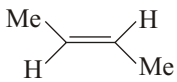
(b)  (q) Antiaromatic

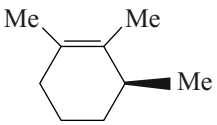
(c)  (r) Nonaromatic

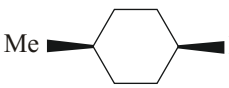
(d)  (s) Degree of unsaturation = 3

162. **Column I (Reaction)** **Column II (Product)**

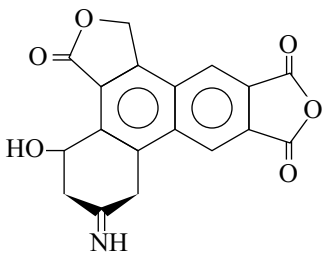
(a)  $+ D_2$ (1 Eq.) $\xrightarrow{Ni}$ product (p) Contains even chiral carbons

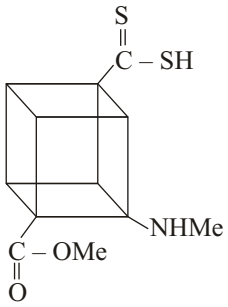
(b)  $+ Br_2 \xrightarrow{CCl_4}$ product (q) Contains odd chiral carbon

(c)  $\xrightarrow[II\ Me_2S]{I\ O_3/CH_2Cl_2}$ product (r) Optically inactive

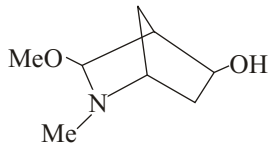
(d)  $\xrightarrow[DMSO]{CH_3S^-Na^+}$ product (s) Contains plane of symmetry

163. **Column I** **Column II**

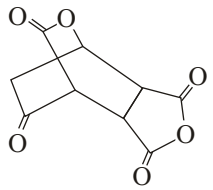
(a)  (p) Total number of functional groups in the compound is even. [excluding >C=C< bond]

(b) 

(q) Total number of functional groups in the compound is odd. [excluding >C=C< bond]

(c) 

(r) Degree of unsaturation in the compound is even

(d) 

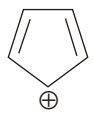
(s) Degree of unsaturation in the compound is odd

(t) Lactone is present as a functional group in the molecule

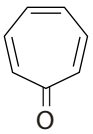
164. Column I **Column II**

(a) 

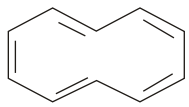
(p) Antiaromatic

(b) 

(q) Aromatic

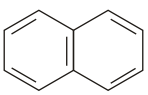
(c) 

(r) Nonaromatic

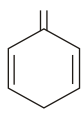
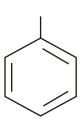
(d) 

(s) Degree of unsaturation (D.O.U) = 6

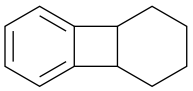
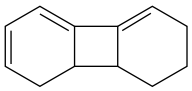
165. Column I (group) **Column II (effect of group)**

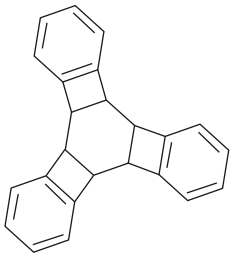
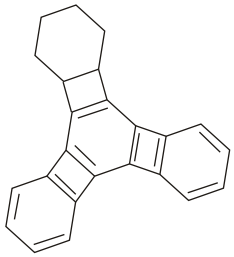
(a)  and 

(p) Ist compound has more heat of hydrogenation than the IInd

(b)  and 

(q) Ist compound has more resonance energy than the IInd

(c)  and 

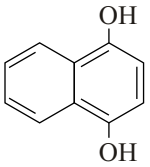
(d)  and 

(r) I[st] compound is more stable than the II[nd]

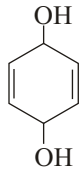
(s) II[nd] compound has more heat of combustion than the I[st]

(t) II[nd] compound has more degree of unsaturation than the I[st]

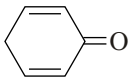
166. Column I (compound) **Column II (relationship)**

(a) 

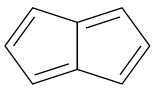
(p) Aromatic

(b) 

(q) Nonaromatic

(c) 

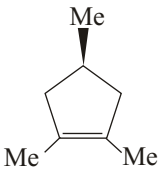
(r) Dipolemoment is nonzero

(d) 

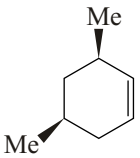
(s) Antiaromatic

(t) Dipolemoment is zero

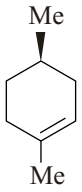
167. Column I **Column II**

(a) 

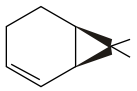
(p) Compound which is optically active

(b) 

(q) Compound which is optically inactive due to the presence of plane of symmetry and gives optically inactive hydrogenation product (major product)

(c) 

(r) Compound which is optically active but gives optically inactive hydrogenation product (major product) with 1 equivalent of H_2 and metal

(d) 

(s) Degree of unsaturation in compound = 2

(t) Compound which give optically active product on ozonolysis

Integer Type

168. From the following compounds/ions:

(a) $\overset{\oplus}{C}H_3$ (b) $\overset{\oplus}{N}H_4$ (c) BF_3 (d) NH_3 (e) $NH_2–NH_2$

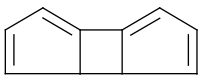
(f) PCl_3 (g) PCl_5 (h) $SbCl_5$ (i) $GaCl_3$ (j) $AlCl_3$

(k) F^- (l) $\overset{\ominus}{C}N$ (m) $CH_3–Cl$ ["C" atom of halide]

Identify value of "X".

Where "X" is the total number of $E^{\oplus}$/electrophiles.

169. From the following compound

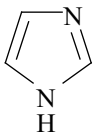
(a) 

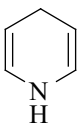
(b) $C_{14}H_{14}$

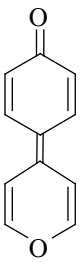
(c) C_8H_8 [COT]

(d) $C_4H_4^{-2}$

(e) $C_4H_4^{+}$

(f) 

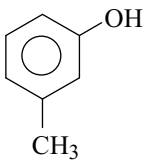
(g) 

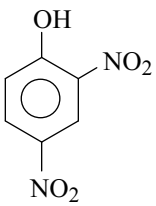
(h) 

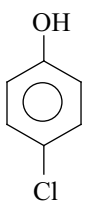
(i) 

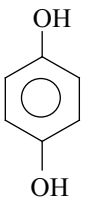
Identify the total number of aromatic compounds.

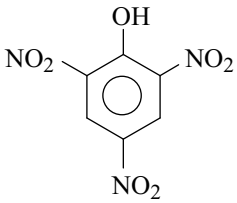
170. The following compounds are phenol derivative

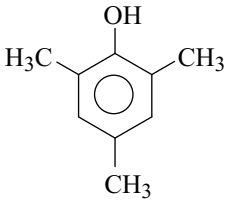
(a) 

(b) 

(c) 

(d) 

(e) 

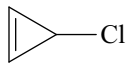
(f) 

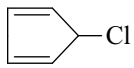
If number of phenol derivative = x.

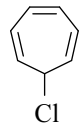
Number of phenol derivative gives +ve test with $NaHCO_3$ = y.

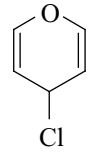
Then, find value of x + y.

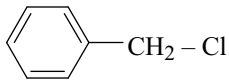
171. How many products will be aromatic ion when $AgNO_3$ reacts with the following compounds?

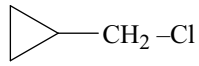
(a) 

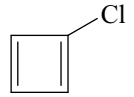
(b) 

(c) 

(d) 

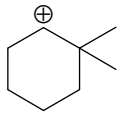
(e) 

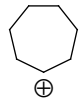
(f) 

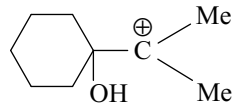
(g) 

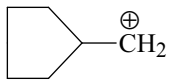
(h) $H-C\equiv C-Cl$

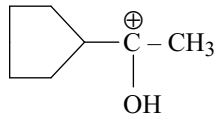
172. How many carbocations undergo rearragements?

(i) 

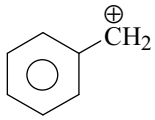
(ii) 

(iii) 

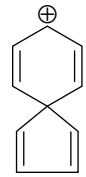
(iv) 

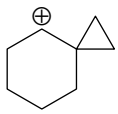
(v) 

(vi) $Me_3C-CH_2-\overset{\oplus}{C}H_2$

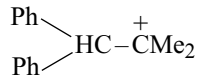
(vii) 

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

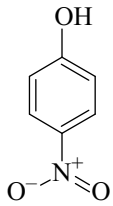
(ix) 

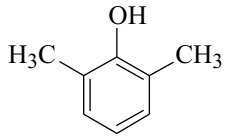
(x) 

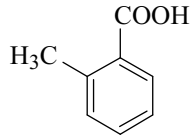
(xi) $CH_2=CH-\overset{+}{C}H_2$

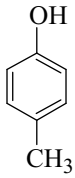
(xii) 

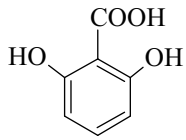
173. How many compounds are soluble in aqueous NaHCO3?

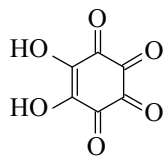
(a) 

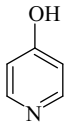
(b) 

(c) 

(d) 

(e) 

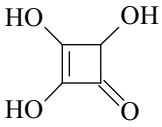
(f) 

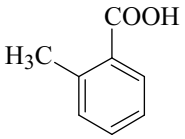
(g) 

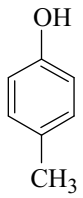
(h) $H-C\equiv C-H$

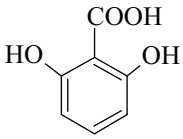
174. How many compounds are soluble in aqueous NaOH?

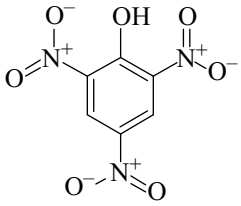
(a) 

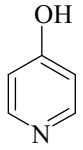
(b) 

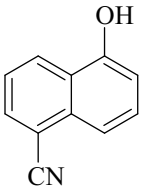
(c) 

(d) 

(e) 

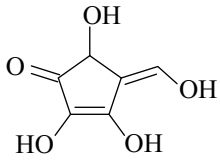
(f) 

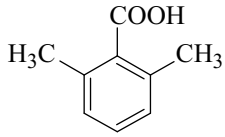
(g) 

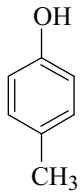
(h) 

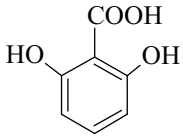
175. How many compounds liberate hydrogen gas on reaction with Na metal?

(a) 

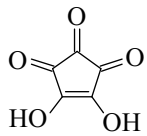
(b) 

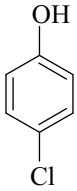
(c) 

(d) 

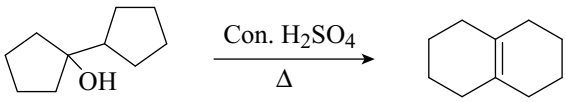
(e) 

(f) CH_4

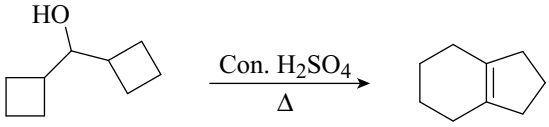
(g) 

(h) 

176. How many transition states are formed during the following reaction?



177. How many transition states are formed during the following reaction?



Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
d	c	d	a	a	d	b	c	d	a	c	d	d	a	a
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
b	c	d	b	b	a	b	d	a	d	a	c	a	d	d
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
b	d	a	b	d	b	a	c	d	c	d	c	c	a	bc
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	ac	b	c	a	a	a	c	b	b	c	a	a	b	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	d	c	b	b	a	c	d	b	d	d	a	d	c	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
c	b	b	c	cd	c	a	c	b	d	b	b	d	d	a
91	92	93	94											
c	a	a	c											

LEVEL 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	d	b	d	a	b	b	c	b	c	b	c	a	abcd	b
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
d	a	b	c	b	b	a	b	b	d	a	d	c	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
a	a	a	b	d	a	a	c	a	a	d	b	d	b	a
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	a	a	b	c	b	b	a	a	a	b	b	c	a	d
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	c	d	d	c	a	d	b	c	c	c	a	d	a	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
a	b	d	a	b	b	a	a	c	b	a	a	c	d	bcd
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
ab	abc	abd	abcd	bcd	abd	bc	b	bcd	d	abc	ac	acd	cd	bc
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
ad	abc	bd	bcd	bc	acd	bc	b	bc	bc	c	ab	abcd	acd	acd

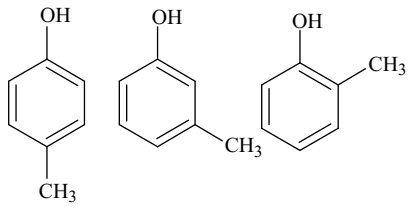
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
ab	abc	acd	abcd	abd	bc	abc	abcd	d	a	a	b	d	c	a
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
d	c	a	d	c	c	b	b	a	ad	cd	d	ad	d	c
151	152	153	154	155	156	157(a)	157(b)	157(c)	157(d)	158(a)	158(b)	158(c)	158(d)	159(a)
a	b	c	d	d	a	q	qs	qr	pt	p	p	qrs	st	qrst
159(b)	159(c)	159(d)	160(a)	160(b)	160(c)	160(d)	161(a)	161(b)	161(c)	161(d)	162(a)	162(b)	162(c)	162(d)
qrst	qrst	p	qrs	qrs	pt	r	rs	qs	p	p	prs	prs	q	rs
163(a)	163(b)	163(c)	163(d)	164(a)	164(b)	164(c)	164(d)	165(a)	165(b)	165(c)	165(d)	166(a)	166(b)	166(c)
pst	qs	qr	qst	q	p	p	rs	rst	p	qrs	qrs	pr	qr	qr
166(d)	167(a)	167(b)	167(c)	167(d)	168	169	170	171	172	173	174	175	176	177
rs	qs	prs	prst	prst	8	5	8	4	8	4	7	6	5	7

WORKBOOK EXERCISES

EXERCISE 1

Correct Acidic Strength of Compounds

1.



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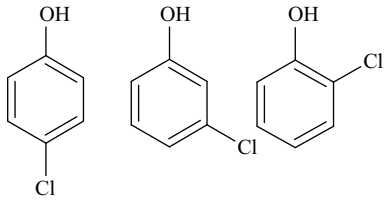

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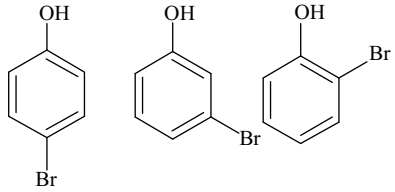

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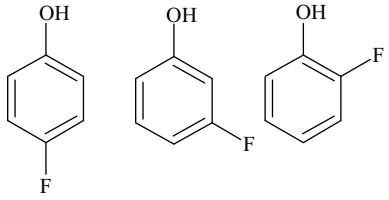

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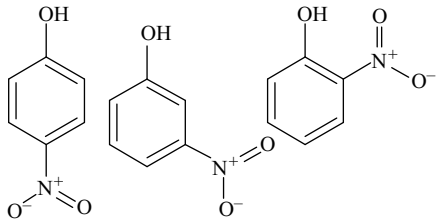

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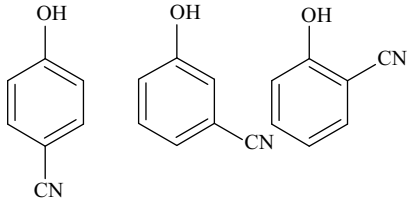

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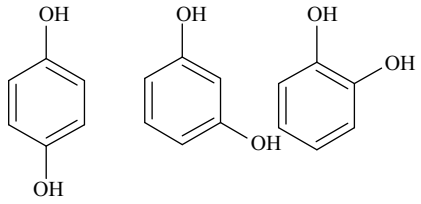

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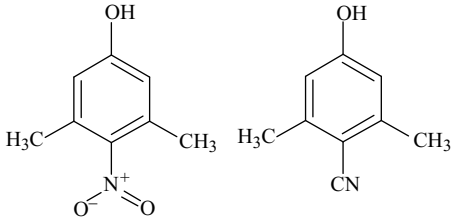

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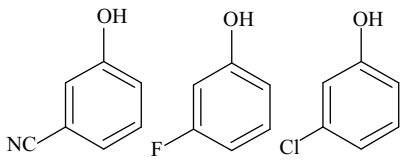

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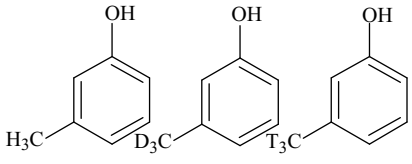

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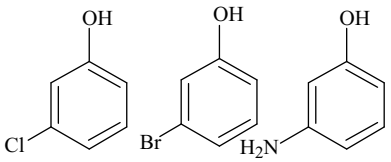

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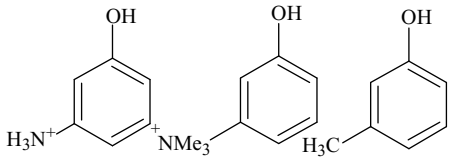

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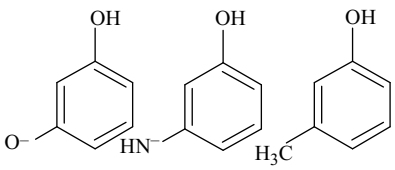

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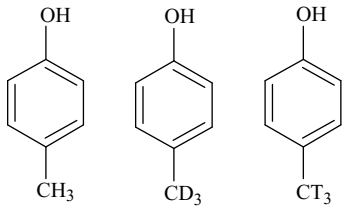

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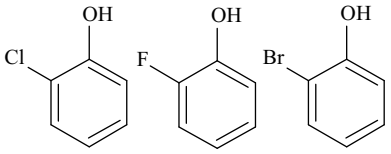

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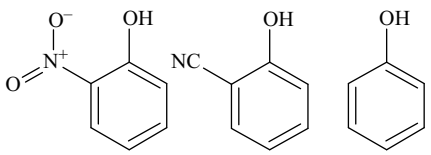

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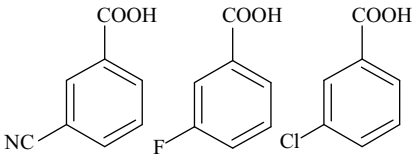

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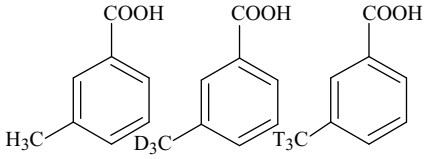

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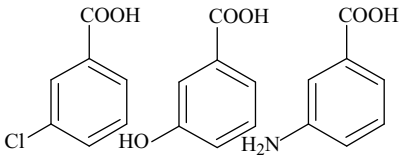

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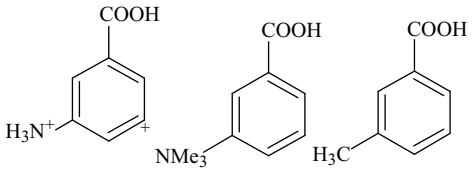

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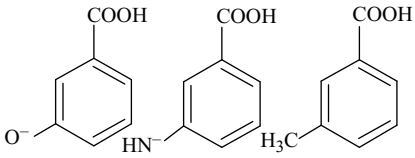

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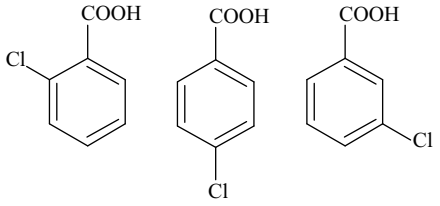

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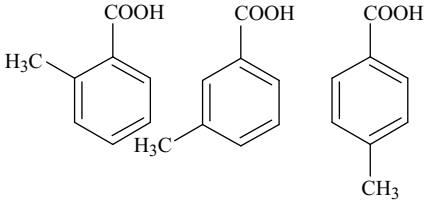

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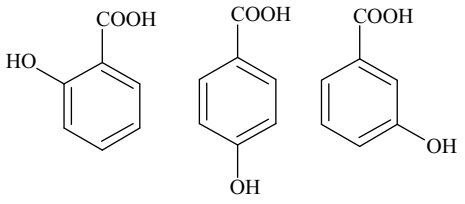

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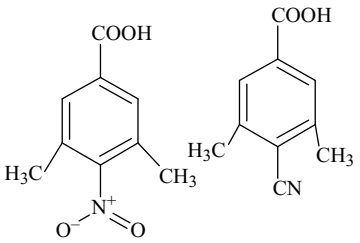

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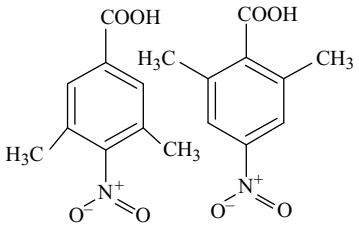

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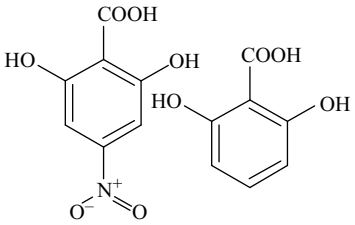

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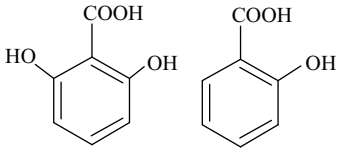

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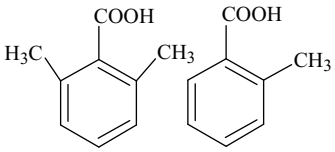

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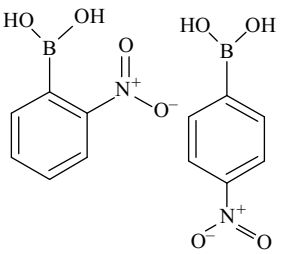

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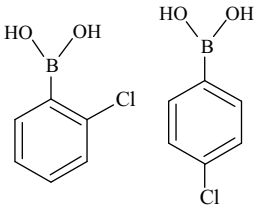

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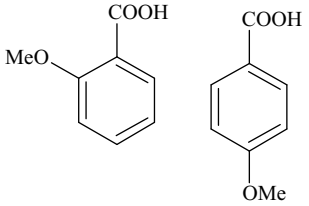

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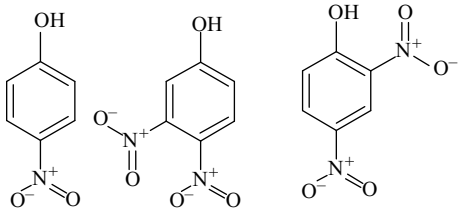

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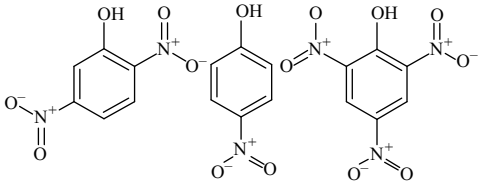

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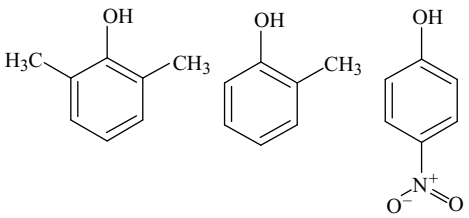

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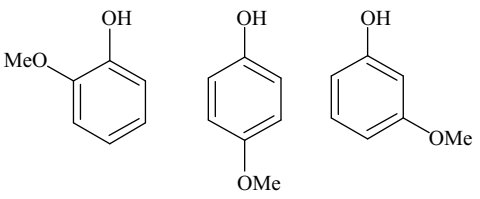

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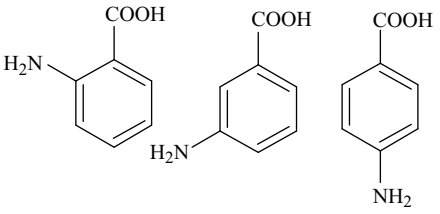

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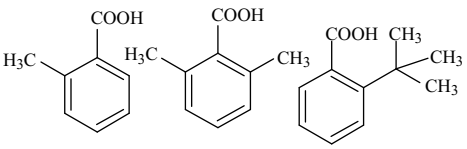

EXERCISE 2

Correct Carbocation Stability Order

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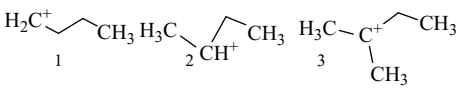

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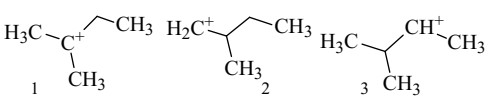

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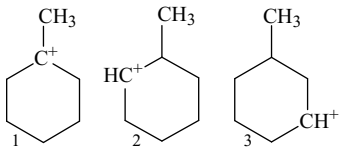

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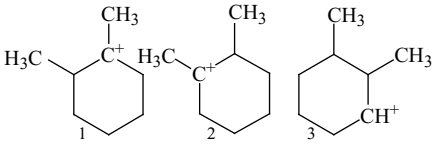

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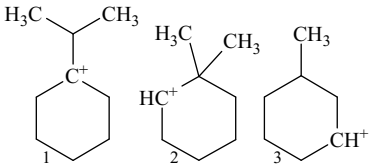

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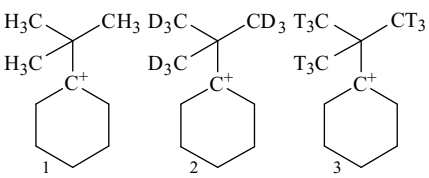

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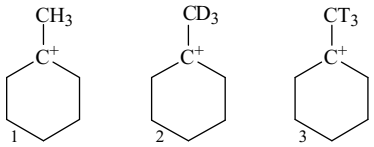

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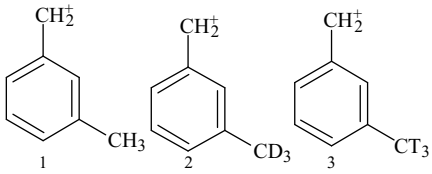

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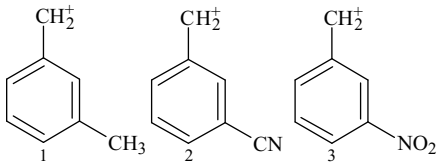

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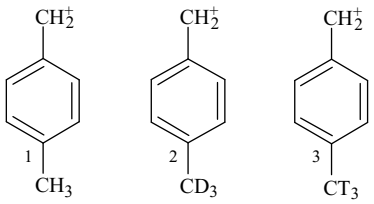

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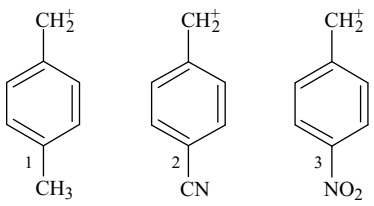

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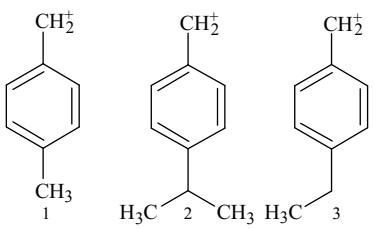

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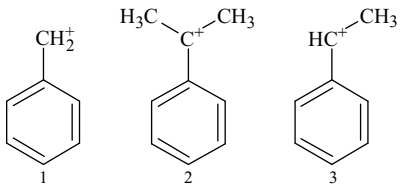

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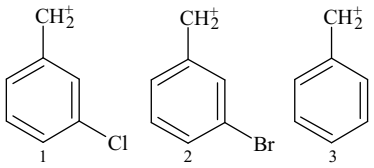

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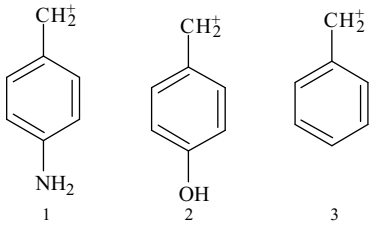

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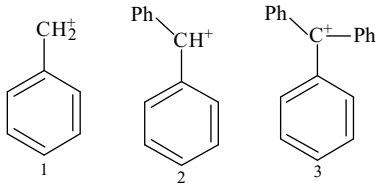

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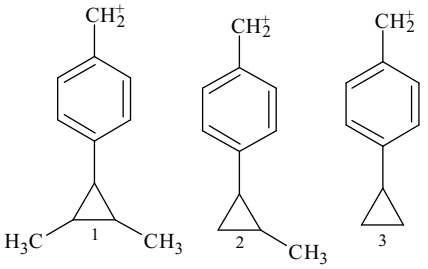

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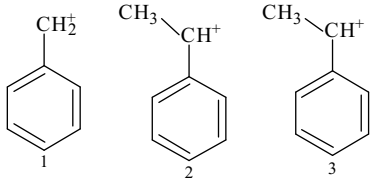

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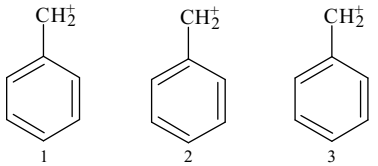

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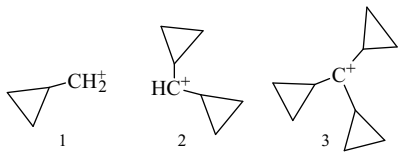

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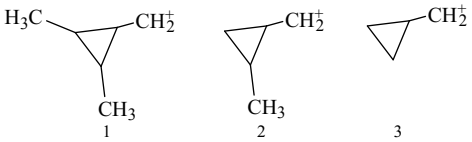

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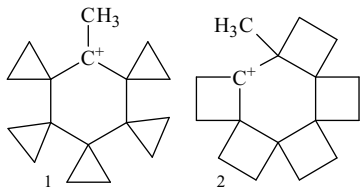

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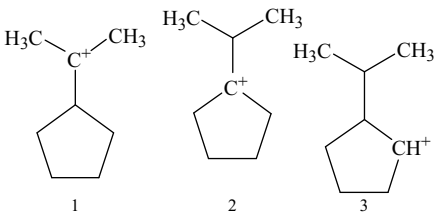

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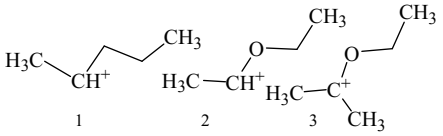

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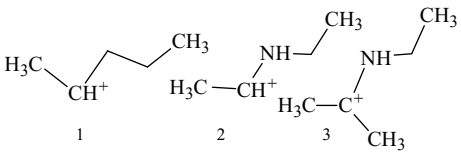

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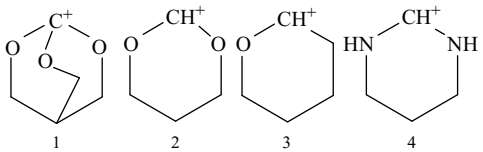

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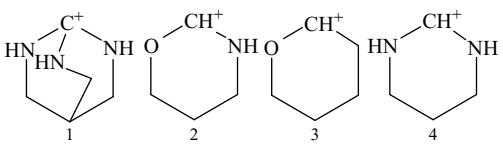

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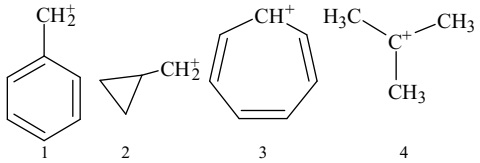

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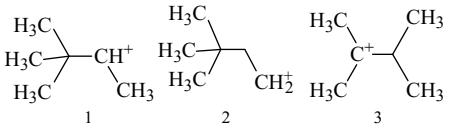

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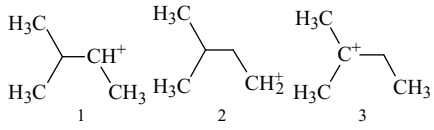

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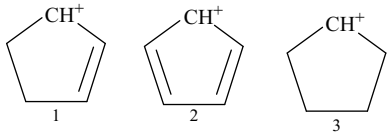

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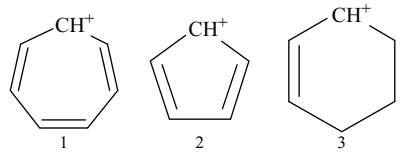

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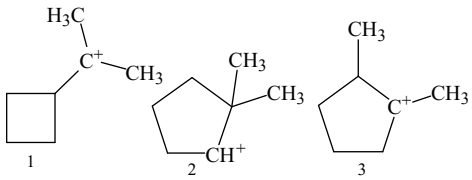

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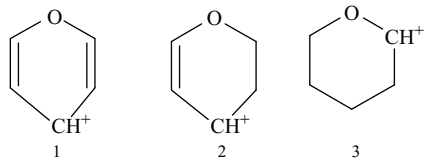

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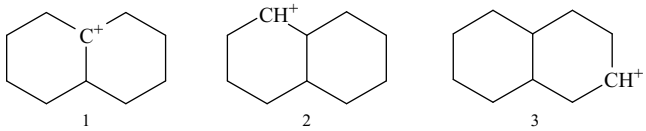
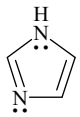
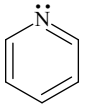
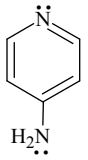


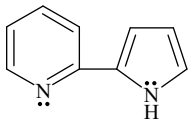
EXERCISE 3

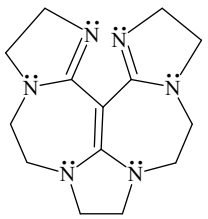
Identify localised and delocalised lp in the following examples

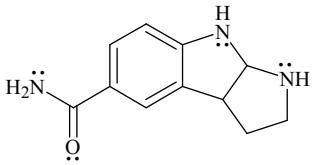
1. 

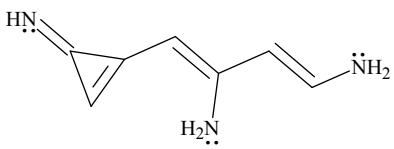
2. 

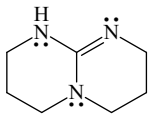
3. 

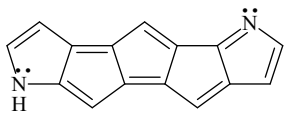
4. 

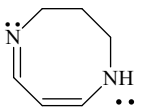
5. 

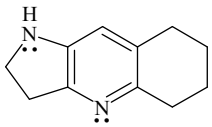
6. 

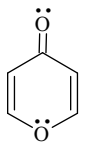
7. 

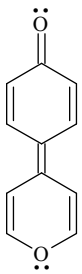
8. 

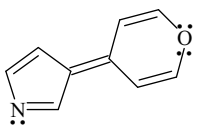
9. 

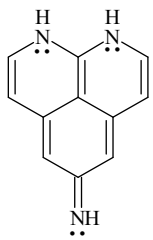
10. 

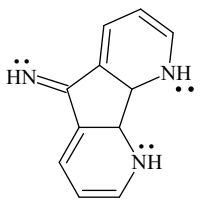
11. 

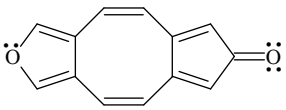
12. 

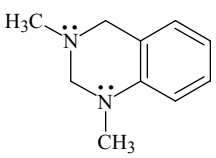
13. 

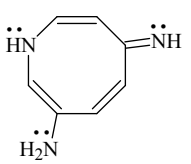
14. 

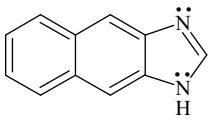
15. 

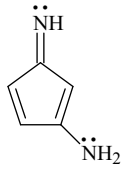
16. 

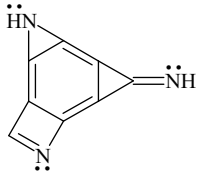
17. 

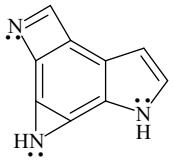
18. 

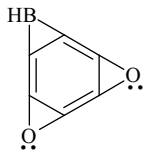
19. 

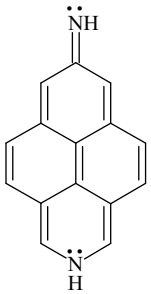
20. 

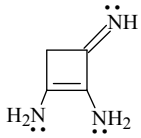
21. 

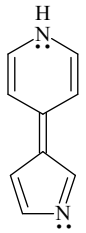
22. 

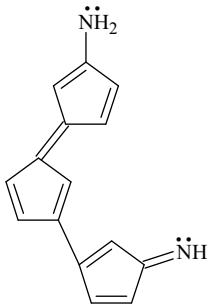
23. 

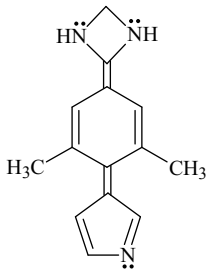
24. 

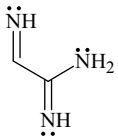
25. 

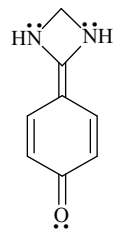
26. 

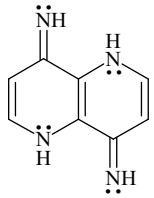
27. 

28. 

29. 

30. 

31. 

32. 

EXERCISE 4

Identify the site of electrophilic attack at benzene ring

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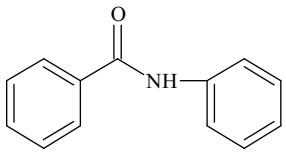

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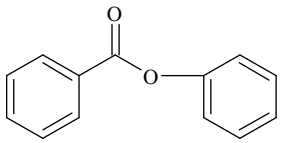

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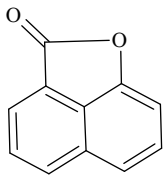

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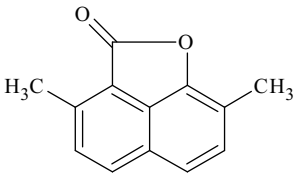

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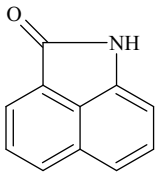

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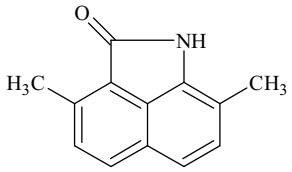

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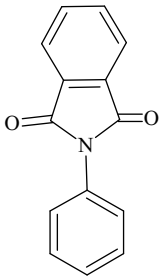

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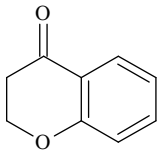

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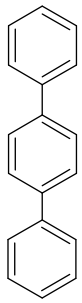

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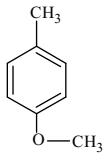

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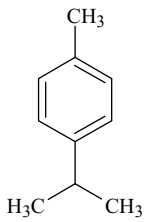

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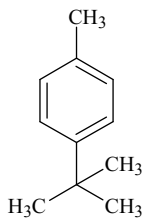

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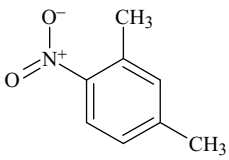

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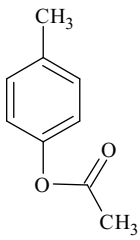

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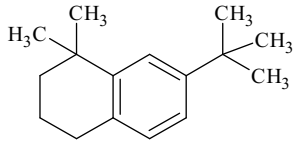

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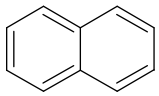

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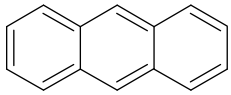

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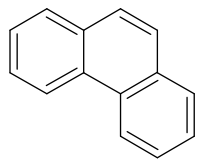

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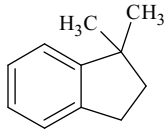

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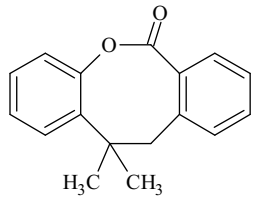

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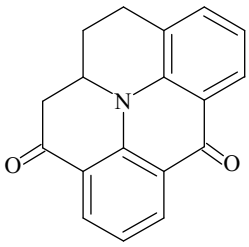

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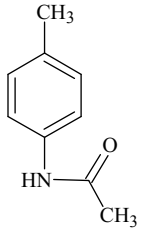

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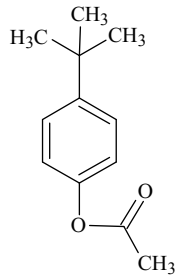

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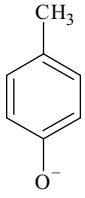

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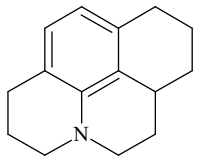

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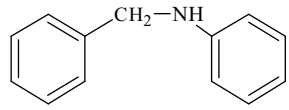

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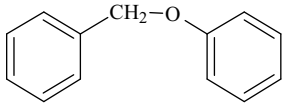

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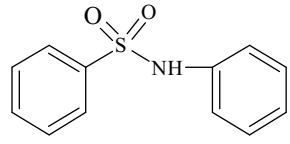

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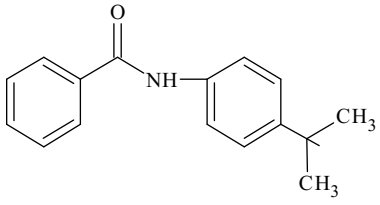

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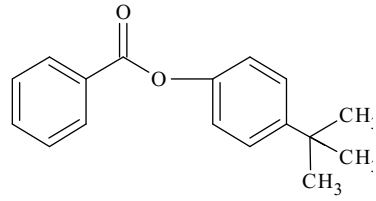

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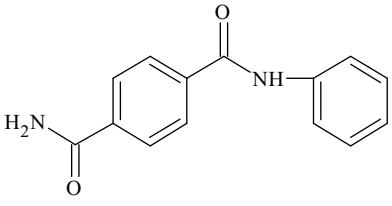

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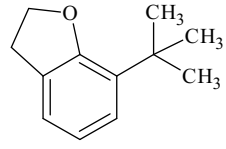

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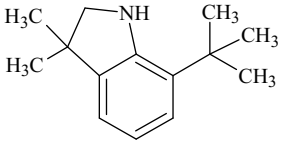
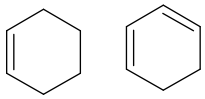
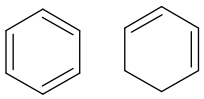
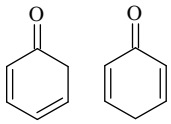


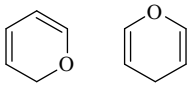
EXERCISE 5

Identify the correct order of resonance energy for the following pairs of compounds

1. 

2. 

3. 

4. 

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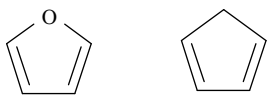
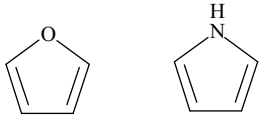
7. 

8. 

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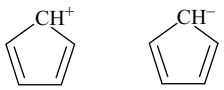
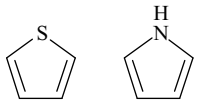
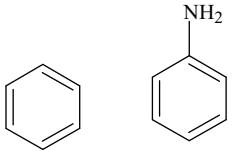
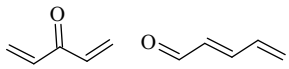
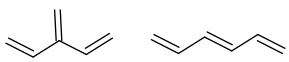
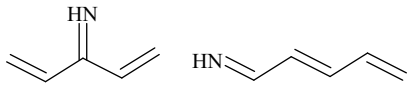
10. 

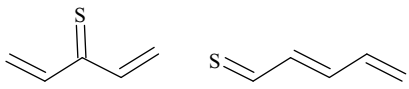
11. 

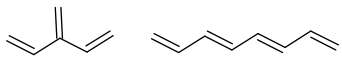
12. 

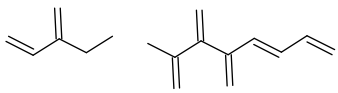
13. 

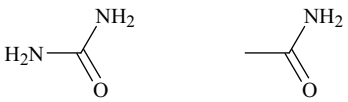
14. 

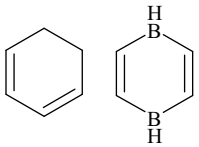
15. 

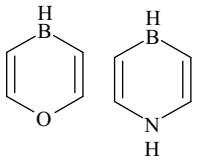
16. 

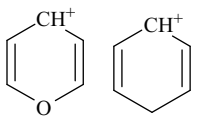
17. 

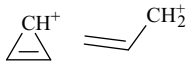
18. 

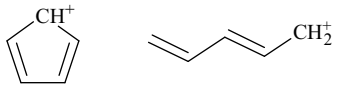
19. 

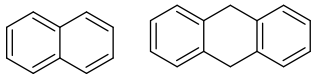
20. 

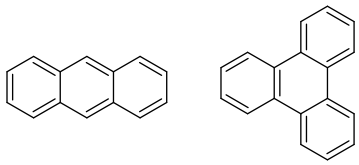
21. 

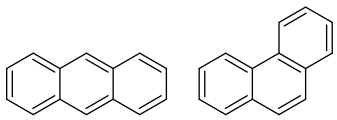
22. 

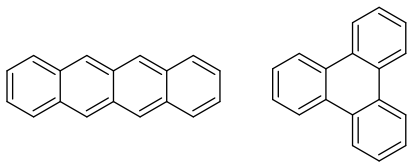
23. 

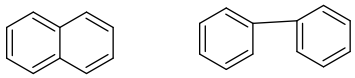
24. 

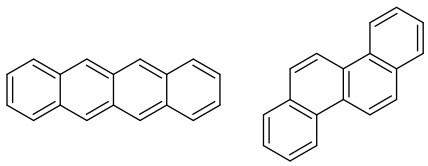
25. 

26. 

27. 

28. 

29. 

30. 

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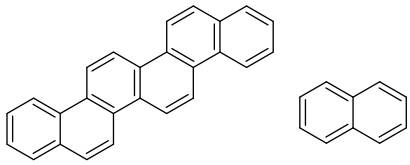
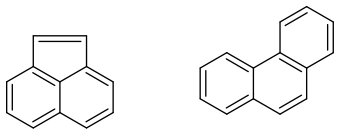
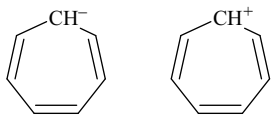
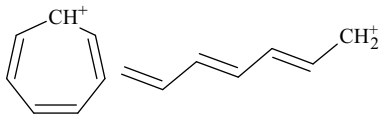
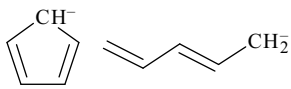
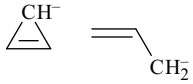
32. 

33. 

34. 

35. 

36. 

37. 

SOLUTION FOR WORKBOOK EXERCISES

EXERCISE 1

Acidic Strength of Compounds

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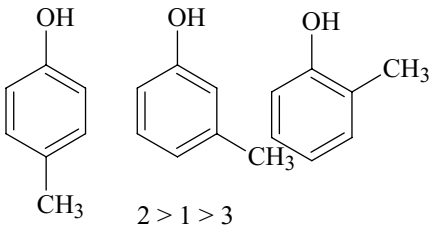

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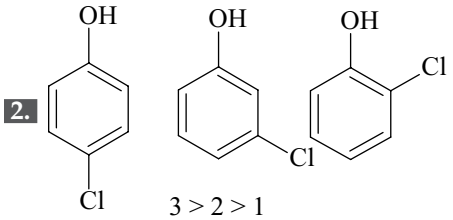

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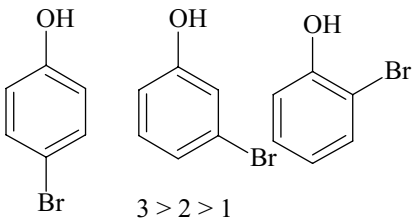

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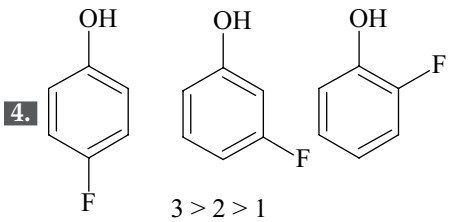

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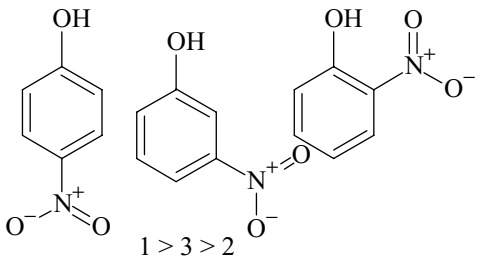

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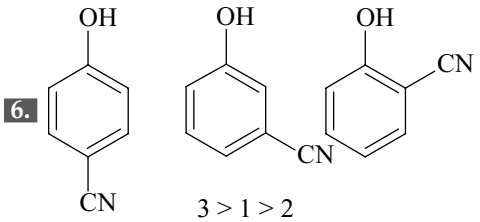

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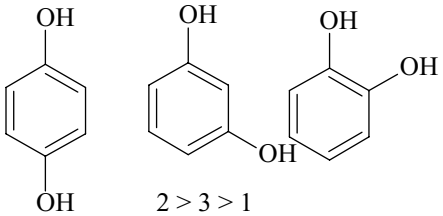

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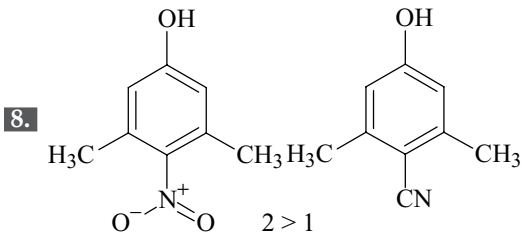
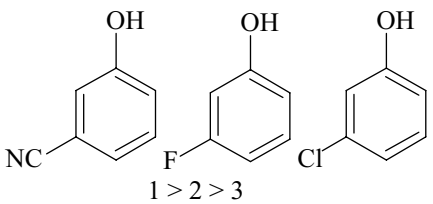


2 > 1

9.



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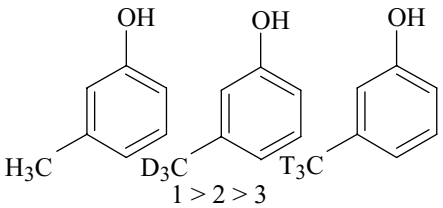

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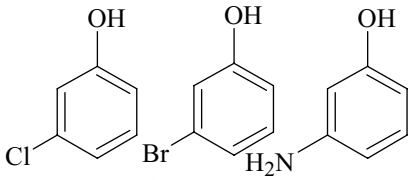

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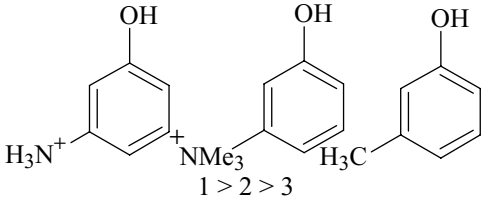

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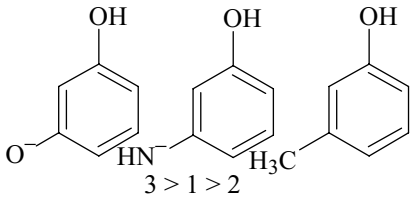

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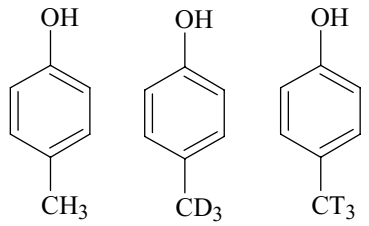

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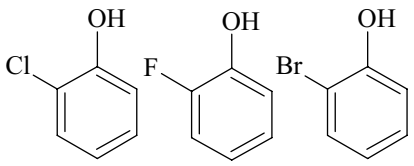

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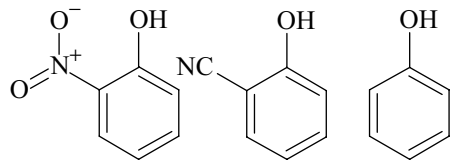

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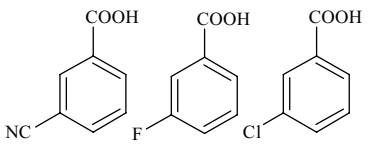

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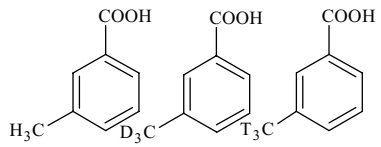

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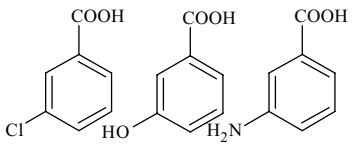

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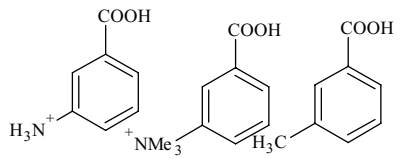

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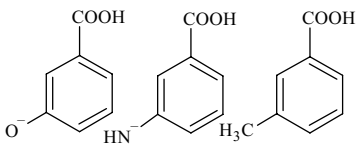

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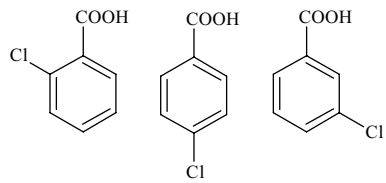

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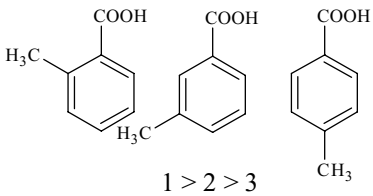

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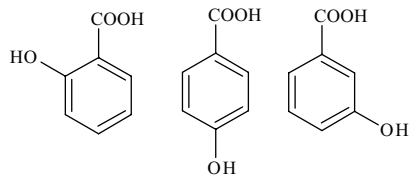

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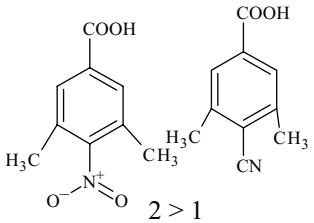

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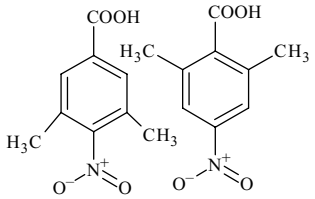

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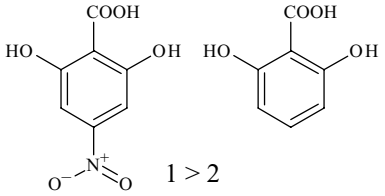

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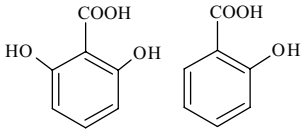

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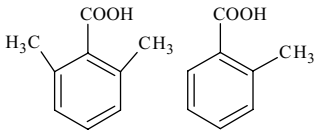

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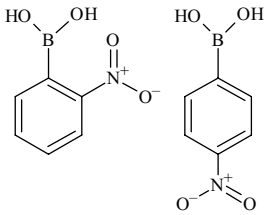

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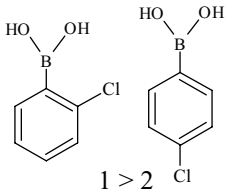

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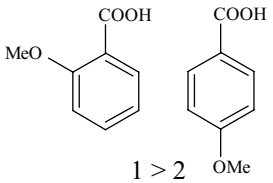

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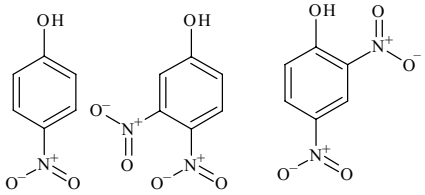

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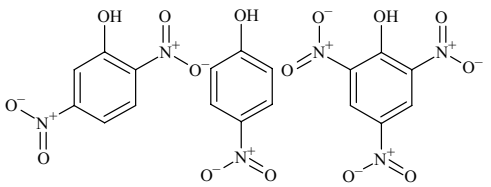

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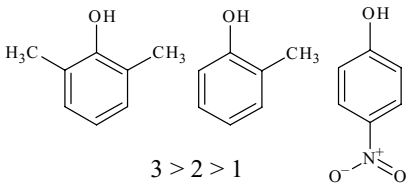

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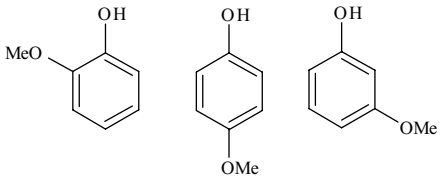

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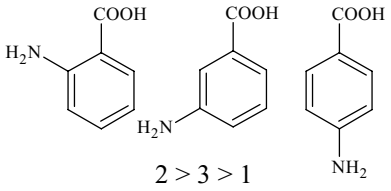

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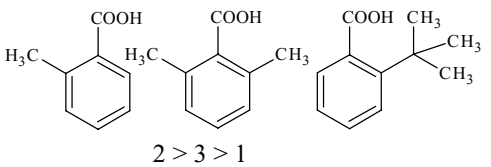
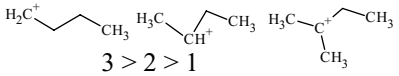


2 > 3 > 1

EXERCISE 2

Carbocation Stability order

1. 

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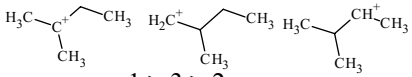
2. 

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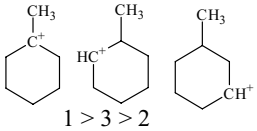
3. 

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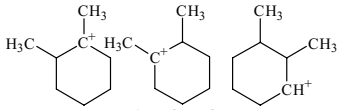
4. 

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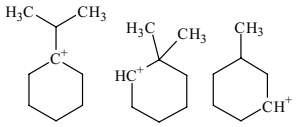
5. 

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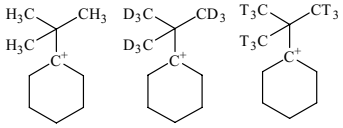
6. 

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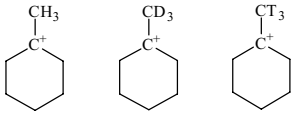
7. 

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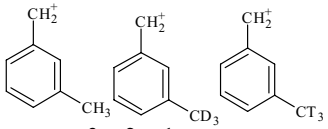
8. 

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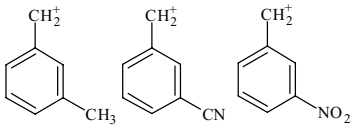
9. 

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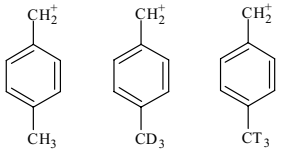
10. 

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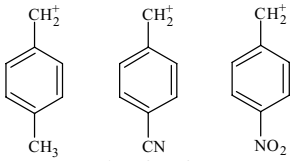
11. 

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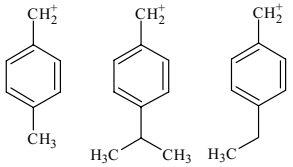
12. 

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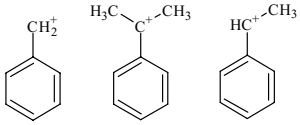
13. 

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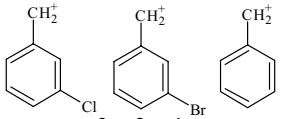
14. 

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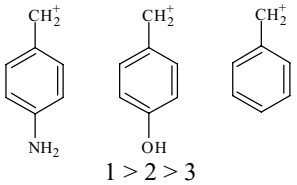
15. 

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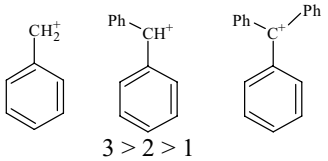
16. 

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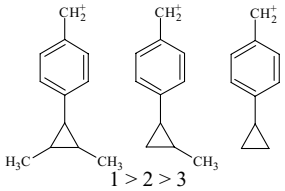
17. 

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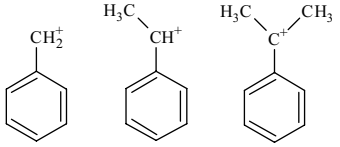
18. 

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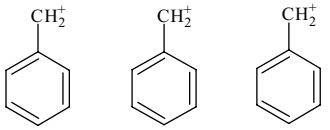
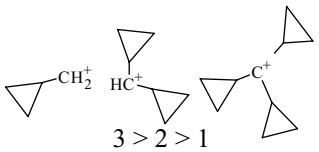


same stability

20.



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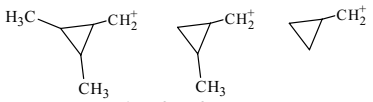

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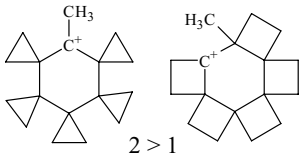

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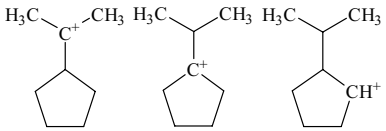

1 > 2 > 3

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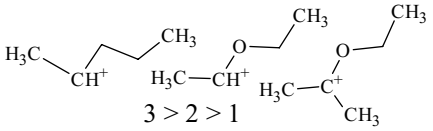

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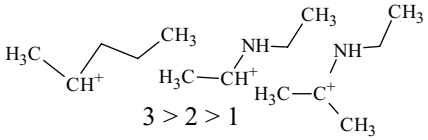

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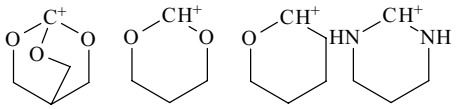

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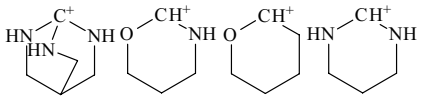

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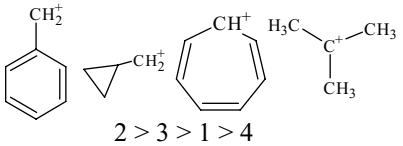
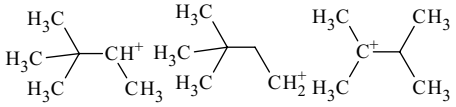


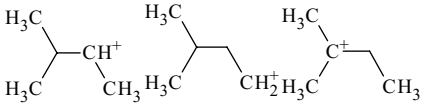
2 > 3 > 1 > 4

29.



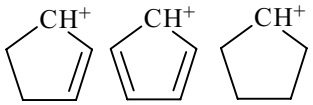
3 > 1 > 2

30.



3 > 1 > 2

31.



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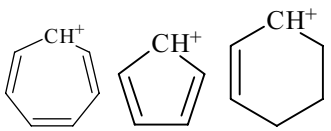
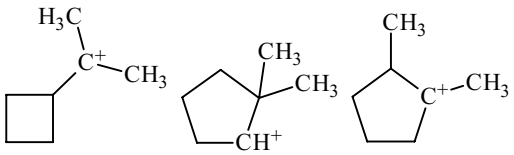


1 > 3 > 2

33.



3 > 2 > 1

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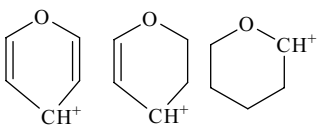
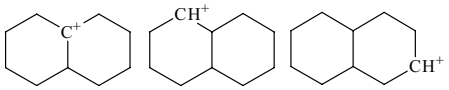


1 > 2 > 3

35.

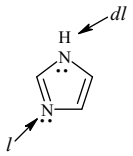


1 > 3 > 2

EXERCISE 3

Identify localised and delocalised 1p in the following examples

1.



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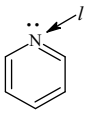

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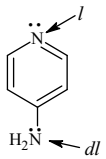

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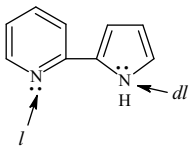

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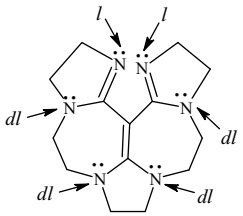

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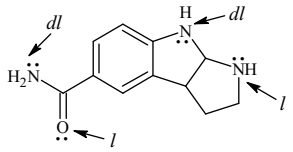

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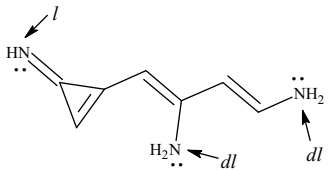

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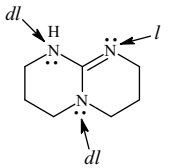

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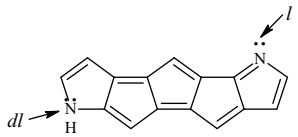

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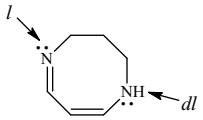

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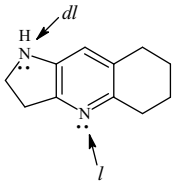

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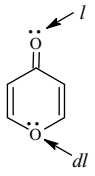

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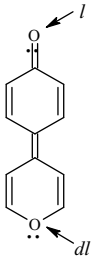

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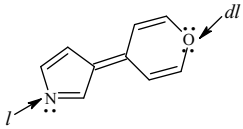

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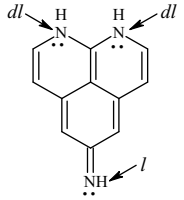

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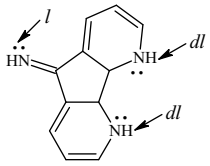

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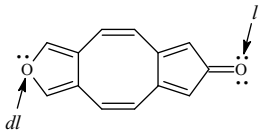

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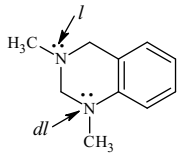

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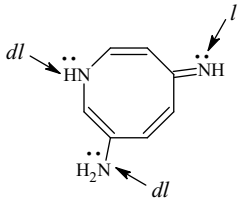

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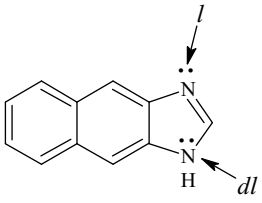

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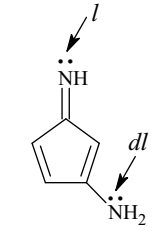

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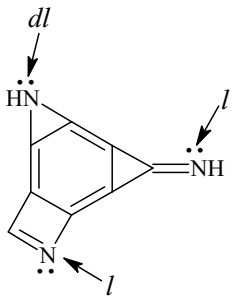

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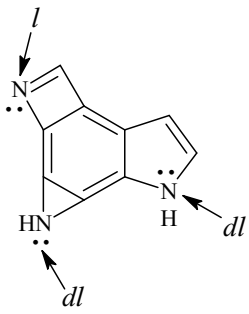

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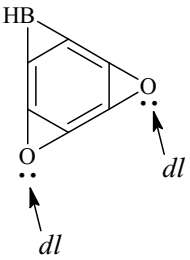

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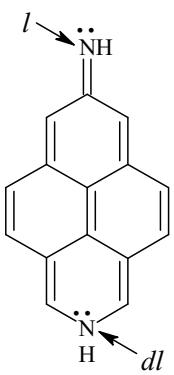

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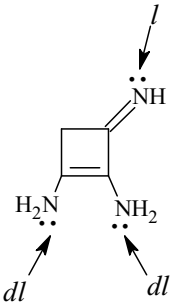

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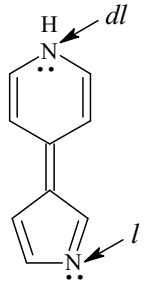

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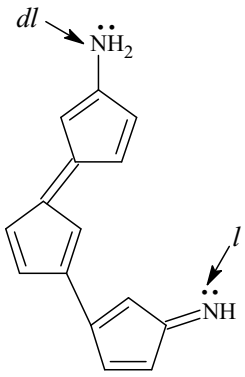

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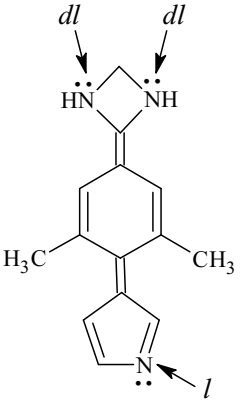

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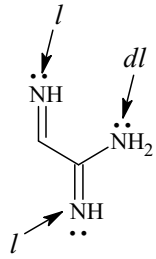

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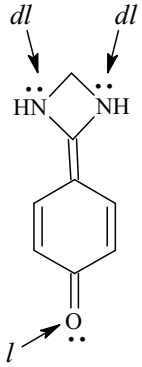

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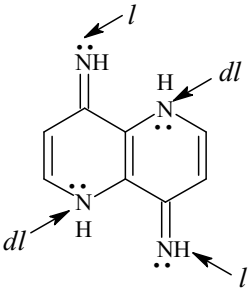

EXERCISE 4

Identify the site of electrophilic attack at benzene ring

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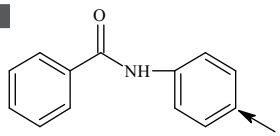
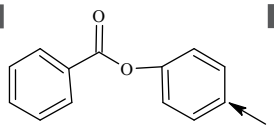


2.



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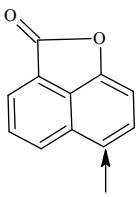

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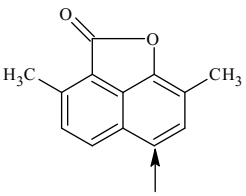

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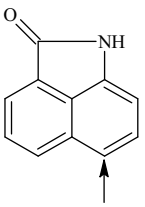

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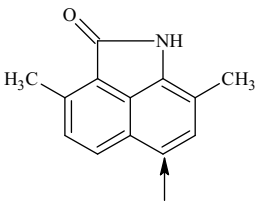

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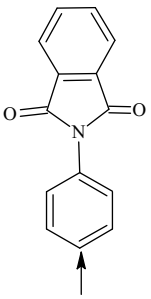

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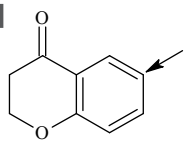

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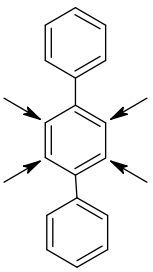

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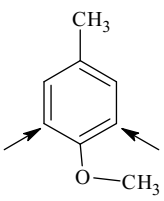

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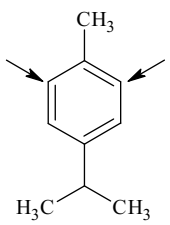

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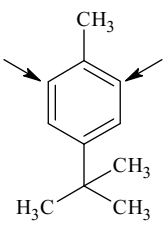
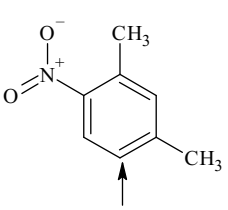


13.



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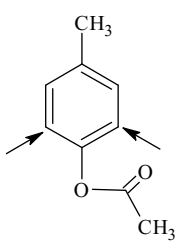
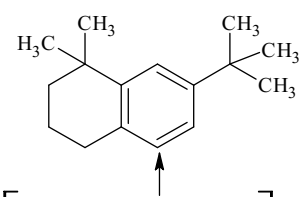
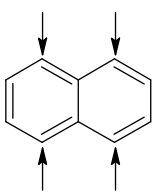


15.

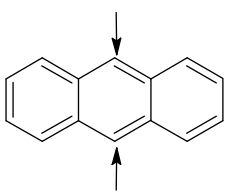


Note : Major attack represents b arrow (→)

16.



17.



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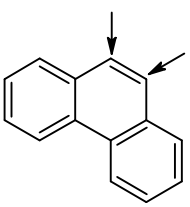

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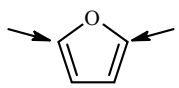

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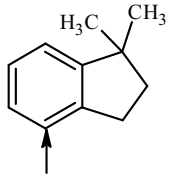

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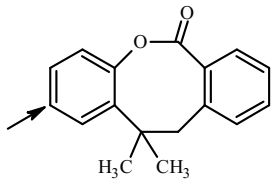

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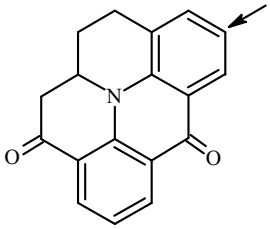

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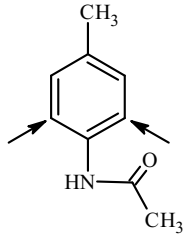

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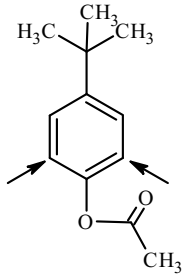

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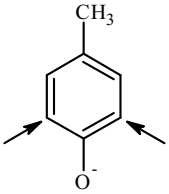

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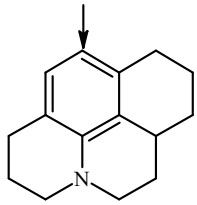

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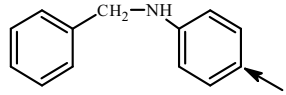

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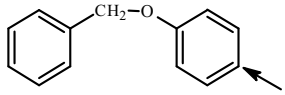

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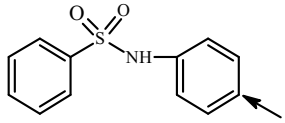

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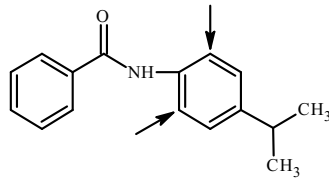

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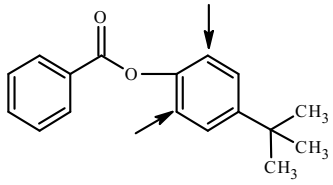

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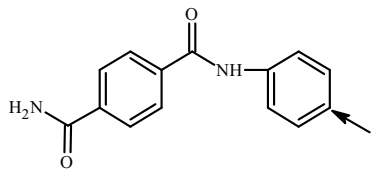

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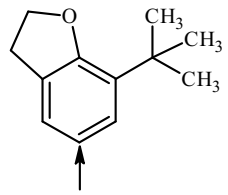

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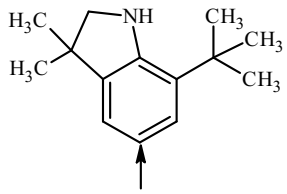
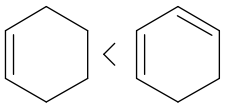
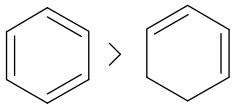
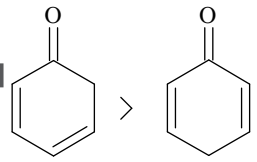


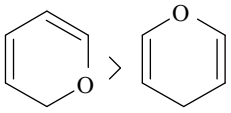
EXERCISE 5

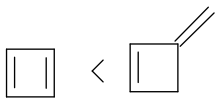
Identify the correct order of resonance energy for the following pairs of compounds

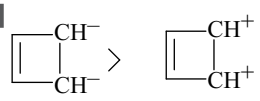
1. 

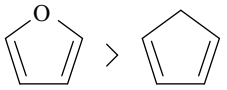
2. 

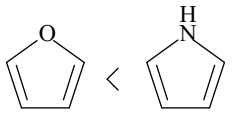
3. 

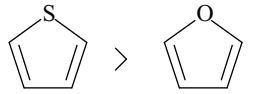
4. 

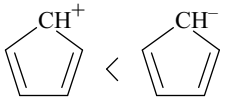
5. 

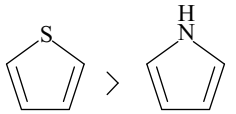
6. 

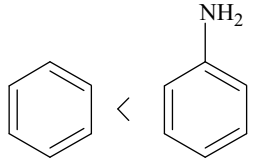
7. 

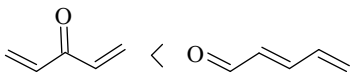
8. 

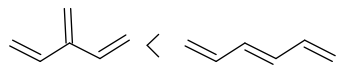
9. 

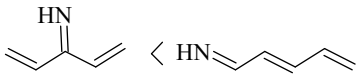
10. 

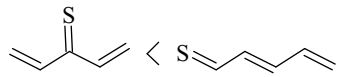
11. 

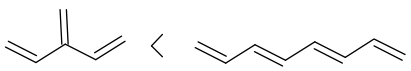
12. 

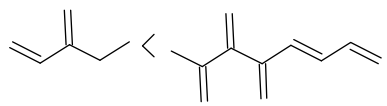
13. 

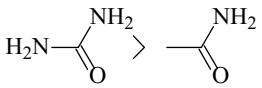
14. 

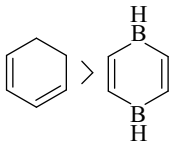
15. 

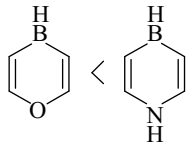
16. 

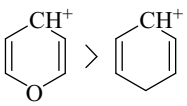
17. 

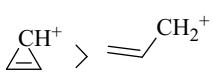
18. 

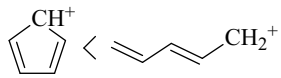
19. 

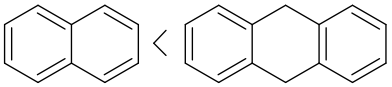
20. 

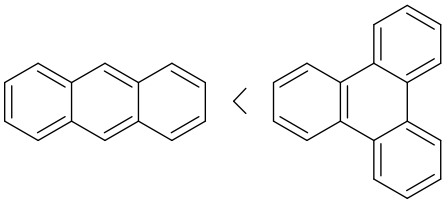
21. 

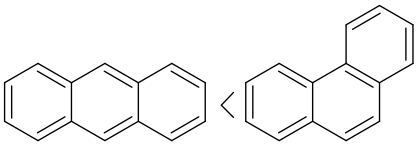
22. 

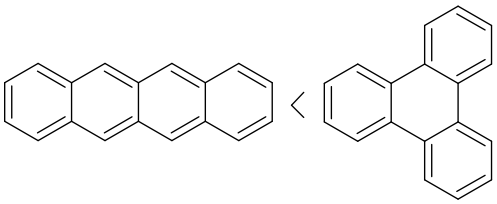
23. 

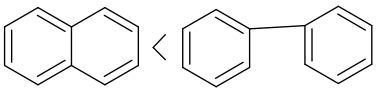
24. 

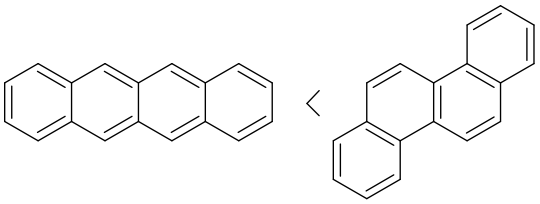
25. 

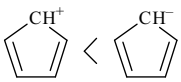
26. 

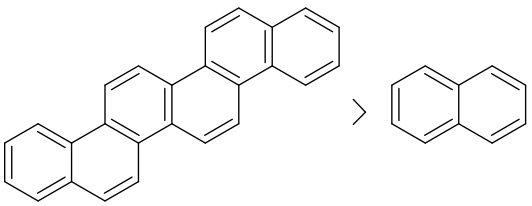
27. 

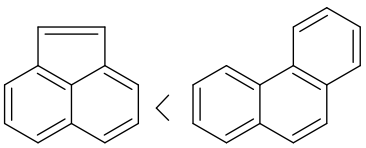
28. 

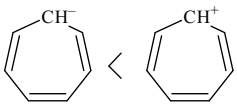
29. 

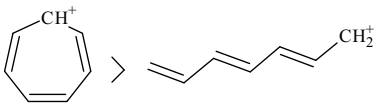
30. 

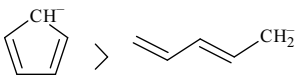
31. 

32. 

33. 

34. 

35. 

36. 

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