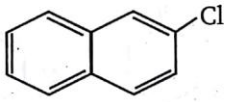
1 GENERAL ORGANIC CHEMISTRY

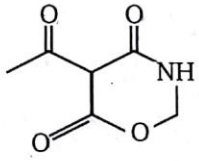
LEVEL-1

1. How many 2° Hydrogen atoms are present in the given following compound ?



(a) 2 (b) 5 (c) 7 (d) 8

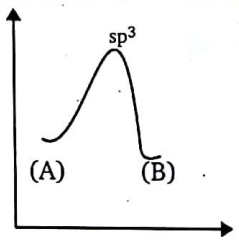
2. Identify which functional group is **Not** present in the given following compound ?

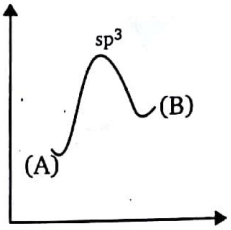


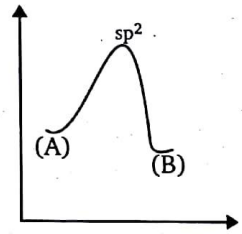
(a) Ketone (b) Ester (c) Amide (d) Ether

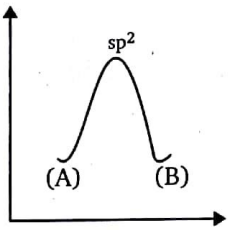
3. Correct energy profile for amine inversion and hybridization of nitrogen in transition state is:

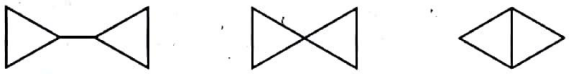
(A) (B)

(a) 

(b) 

(c) 

(d) 

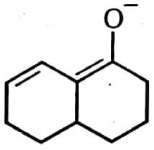
4. 

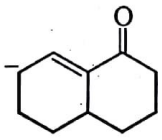
(i) (ii) (iii)

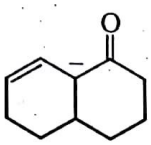
Correct order of the heats of combustion of above compounds is:

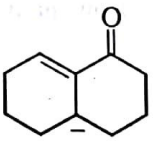
(a) (i) > (ii) > (iii) (b) (i) > (iii) > (ii) (c) (ii) > (i) > (iii) (d) (ii) > (iii) > (i)

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

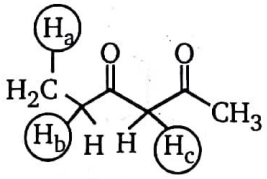
(a) 

(b) 

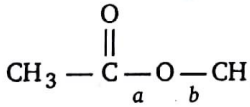
(c) 

(d) 

6. Rank the hydrogen atoms (H_a, H_b, H_c) present in the following molecule in decreasing order of their acidic strength.



(a) $a > b > c$ (b) $b > a > c$ (c) $b > c > a$ (d) $c > b > a$

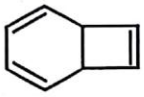
7. 

The correct relation between the bond lengths a and b is:

(a) $a = b$ (b) $b > a$

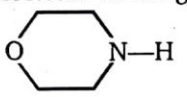
(c) $b < a$ (d) Impossible to predict

8. The number of $sp^2 - sp^2$ sigma bonds in the compound given below is :



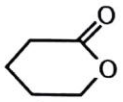
(a) 1 (b) 3 (c) 4 (d) 5

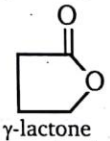
9. The total number of lone pair of electrons in the given molecule is :

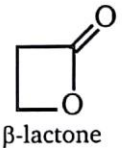


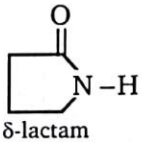
(a) 2 (b) 3 (c) 4 (d) 5

10. Which of the following rings is highly strained ?

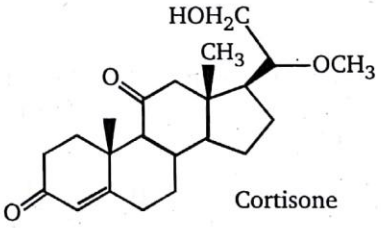
(a)  δ-lactone

(b)  γ-lactone

(c)  β-lactone

(d)  δ-lactam

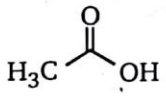
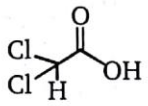
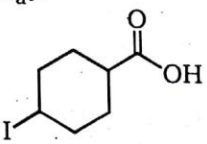
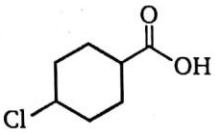
11. The functional groups present in Cortisone are :



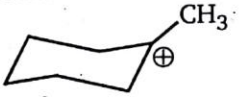
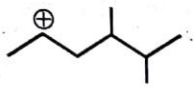
Cortisone

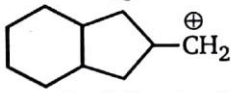
(a) ether, alkene, alcohol (b) alcohol, ketone, alkene, ether
(c) alcohol, ketone, amine (d) ether, amine, ketone

12. Select the acid with the highest K_a (*i.e.*, lowest pK_a).

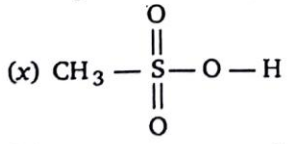
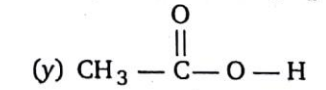
(a)  (b)  (c)  (d) 

13. Most stable carbocation among the following is :

(a)  (b) 

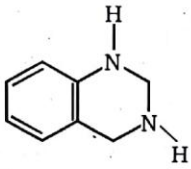
(c)  (d) 

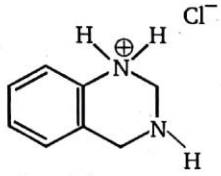
14. Arrange the following in increasing order of their pK_a values.

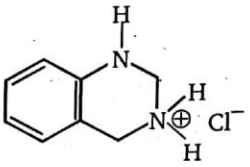
(x)  (y)  (z) $CH_3 - OH$

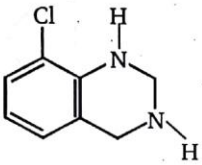
(a) $y < x < z$ (b) $x < y < z$ (c) $y < z < x$ (d) $x < z < y$

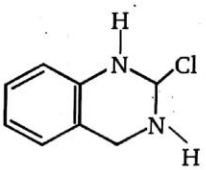
15. Which is the major product of the following reaction ?



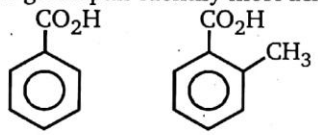
(a) 

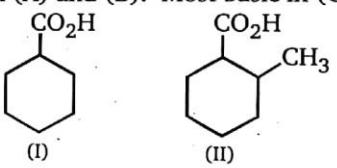
(b) 

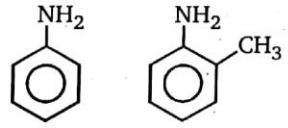
(c) 

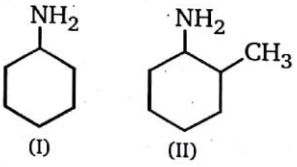
(d) 

16. In the given pair identify most acidic compound in (A) and (B). Most basic in (C) and (D).

(A) 
(I) (II)

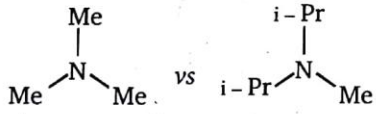
(B) 
(I) (II)

(C) 
(I) (II)

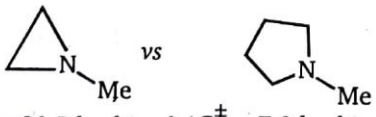
(D) 
(I) (II)

(a) A - I, B - II, C - I, D - II
(b) A - II, B - I, C - I, D - II
(c) A - II, B - II, C - II, D - II
(d) A - I, B - II, C - I, D - I

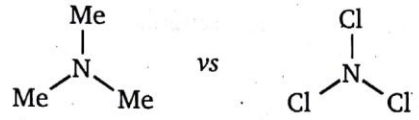
17. Several factors (steric, electronic, orbital interactions etc.) can affect the inversion barrier of an amine. In the given pair which data is correctly placed ?

(a) 

$\Delta G^{\ddagger}$ = 7.9 kcal/mol $\Delta G^{\ddagger}$ = 0.2 kcal/mol

(b) 

$\Delta G^{\ddagger}$ = 20.5 kcal/mol $\Delta G^{\ddagger}$ = 7.0 kcal/mol

(c) 

$\Delta G^{\ddagger}$ = 7.9 kcal/mol $\Delta G^{\ddagger}$ = 22.9 kcal/mol

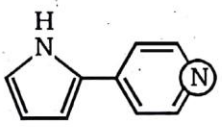
(d) All of these

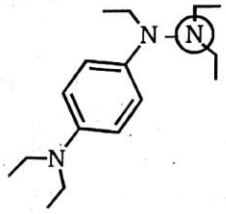
18. Select the response that correctly identifies the number of carbon atoms of each type of hybridization in the compound given below

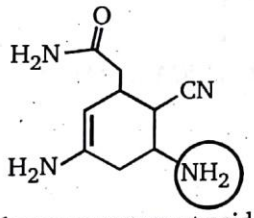
$$H_2C = C = CH - CH = O$$

	sp^3	sp^2	sp		sp^3	sp^2	sp
(a)	2	2	0	(b)	1	3	0
(c)	0	3	1	(d)	1	2	1

19. Circle represents most basic atoms in these molecule. Which of the following is correct representation ?

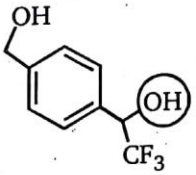
(a) 

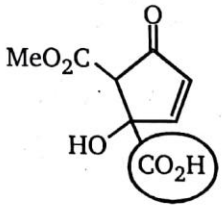
(b) 

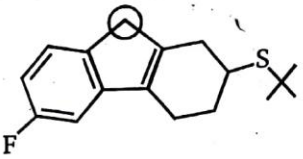
(c) 

(d) All of these

20. Circle represent most acidic hydrogens in these molecules. Which of the following is correct representation ?

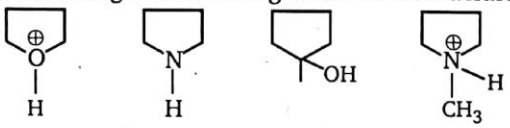
(a) 

(b) 

(c) 

(d) All of these

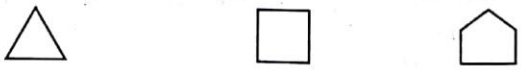
21. Arrange the following in decreasing order of their acidic strengths.



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

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

22.



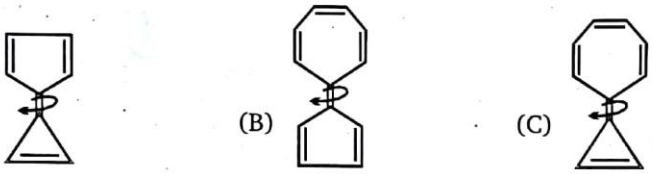
Cyclopropane (I) Cyclobutane (II) Cyclopentane (III)

The correct order of heats of combustion of above compounds is :

(a) I > II > III (b) II > I > III

(c) III > II > I (d) III > I > II

23. (A) (B) (C)



Compare carbon-carbon bond rotation across A, B, and C

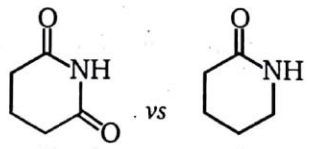
(a) A > B > C (b) A > C > B

(c) B > A > C (d) B > C > A

24. Which of the following acids would have a STRONGER CONJUGATE BASE ?

(A) H_2S (1) *vs* H_2O (2)

(B)



(3) *vs* (4)

(C) $CH_3C \equiv CH$ (5) *vs* $CH_3CH = CH_2$ (6)

(a) 2, 4, 6 (b) 1, 3, 5 (c) 2, 3, 5 (d) 1, 3, 6

25.

$\xrightarrow[-H_2]{KH}$ *A* ; Major products of the reaction is (are):

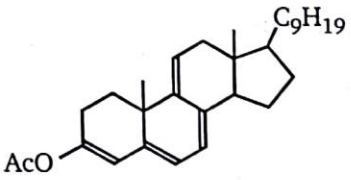
$\downarrow H_2O$

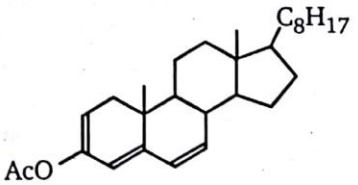
Major Product

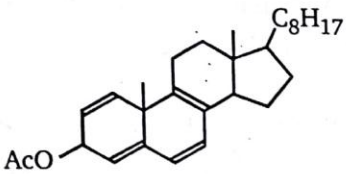
($\overset{*}{C} = C^{14}$)

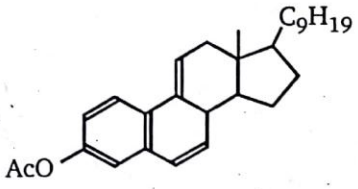
(a)  (b)  (c)  (d) both (b)& (c)

26. Which of the following compound is most stable ?

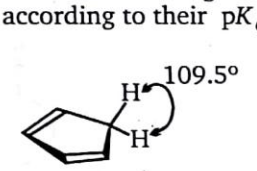
(a) 

(b) 

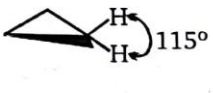
(c) 

(d) 

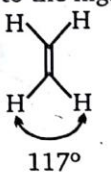
27. Selected bond angles for six hydrocarbons are shown below. Arrange these hydrocarbons according to their pK_a values, from the lowest to the highest.



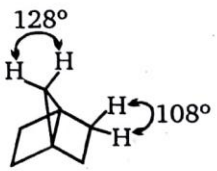
(I)



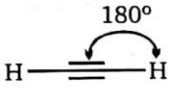
(II)



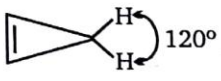
(III)



(IV)



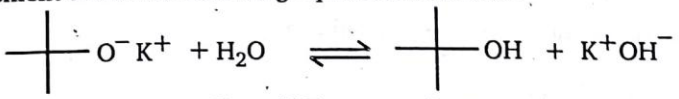
(V)



(VI)

(a) V < I < VI < II < III < IV
(b) IV < I < II < III < V < VI
(c) II < IV < I < VI < V < III
(d) I < V < IV < III < II < VI

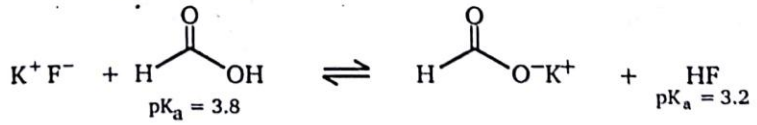
28. Which statement about the following equilibrium is true ?



t-butoxide $pK_a = 15.7$ $pK_a = 18$

(a) The equilibrium favours the products
(b) *t*-Butoxide is the dominant anionic species in the equilibrium
(c) Water is the weaker acid
(d) *t*-Butoxide is stabilized by resonance

29. Consider the following reaction involving two acids shown below : formic acid and HF.



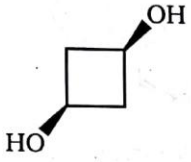
$pK_a = 3.8$ $pK_a = 3.2$

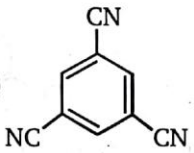
Which of the following statements about this reaction are true ?

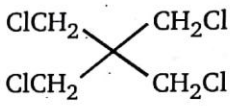
(A) Formic acid is the strongest Bronsted acid in the reaction
(B) HF is the strongest Bronsted acid in the reaction
(C) KF is the strongest Bronsted base in the reaction
(D) KO_2CH is the strongest Bronsted base in the reaction
(E) The equilibrium favours the reactants
(F) The equilibrium favours the products
(G) Formic acid has a weaker conjugate base
(H) HF has a weaker conjugate base

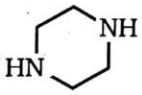
(a) A, D and F (b) B, D, and H (c) A, C, and H (d) B, D, E and H

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

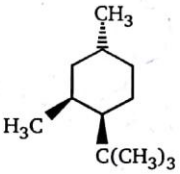
(a) 

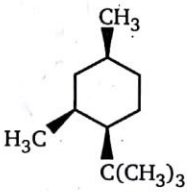
(b) 

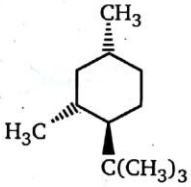
(c) 

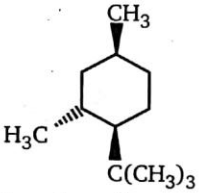
(d) 

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

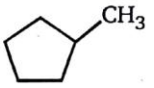
(a) 

(b) 

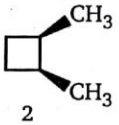
(c) 

(d) 

32. Rank the following substances in order of decreasing heat of combustion (maximum → minimum).

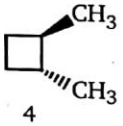


1



2

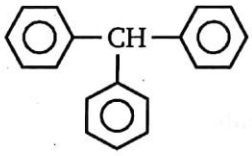

3

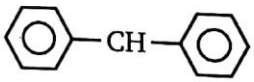


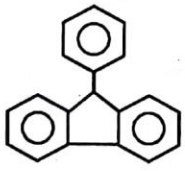
4

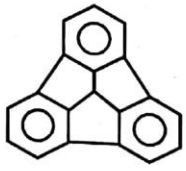
(a) 1 > 2 > 4 > 3 (b) 3 > 4 > 2 > 1
(c) 2 > 4 > 1 > 3 (d) 1 > 3 > 2 > 4

33. Which of the following has lowest pK_a value ?

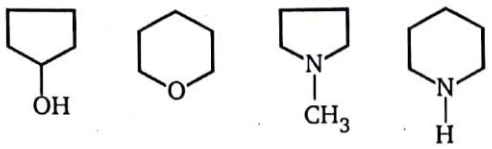
(a) 

(b) 

(c) 

(d) 

34. Arrange the following (w, x, y, z) in decreasing order of their boiling points:

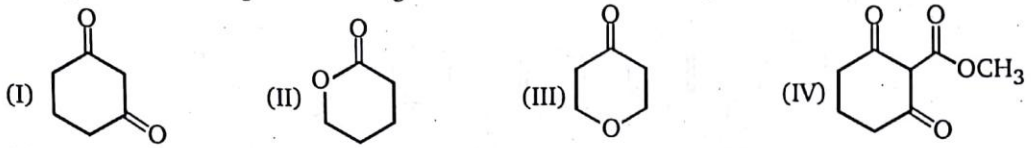


(w) (x) (y) (z)

(a) $w > x > z > y$ (b) $w > x > y > z$

(c) $w > z > y > x$ (d) $w > z > x > y$

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

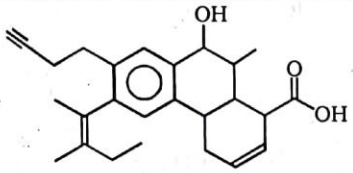


(I) (II) (III) (IV)

(a) III < I < IV < II (b) II < I < IV < III

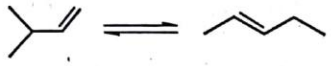
(c) I < III < IV < II (d) II < III < I < IV

36. How many degrees of unsaturation are there the following compound ?



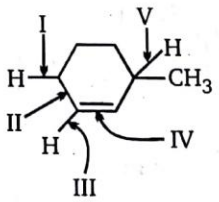
(a) 6 (b) 7 (c) 10 (d) 11

37. The heat of hydrogenation for 3-methylbutene and 2-pentene are –30 kcal/mol and –28 kcal/mol respectively. The heats of combustion of 2-methylbutane and pentane are – 784 kcal/mol and –782 kcal/mol respectively. All the values are given under standard conditions. Taking into account that combustion of both alkanes give the same products, what is ΔH (in kcal/mol) for the following reaction under same conditions ?



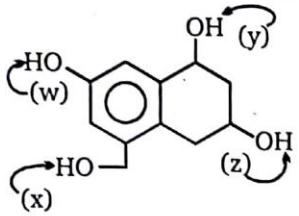
(a) 0 (b) – 4 (c) – 2 (d) 2

38. Which of the following σ-bonds participate in hyperconjugation ?



(a) I and II (b) I and V (c) II and V (d) III and IV

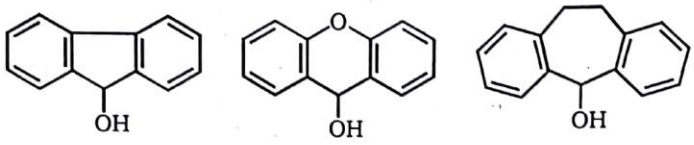
39.



Decreasing order of acidic strength of different (–OH) groups is :

(a) $w > x > y > z$ (b) $w > z > x > y$ (c) $z > w > x > y$ (d) $z > x > w > y$

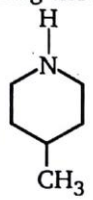
40. Arrange the following alcohols in decreasing order of the ease of ionization under acidic conditions.

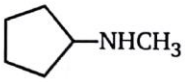


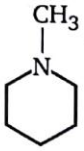
(I) (II) (III)

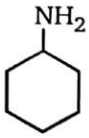
(a) I > III > II (b) I > II > III (c) II > III > I (d) II > I > III

41. Among the isomeric amines select the one with the lowest boiling point.

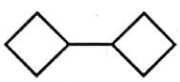
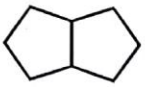
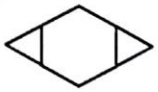
(a) 

(b) 

(c) 

(d) 

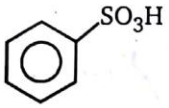
42. Which one of the compounds shown below, is not an isomer of the others ?

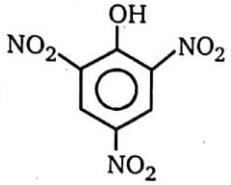
(a)  (b)  (c)  (d) 

43. Arrange the anions (*p*) $\overline{C}H_3$, (*q*) $\overline{N}H_2$, (*r*) OH^-, (*s*) F^-, in decreasing order of their basic strength.

(a) $p > q > r > s$ (b) $q > p > r > s$ (c) $r > q > p > s$ (d) $r > p > q > s$

44. One among the following compounds will not give effervescence with sodium carbonate:

(a) $C_6H_5CO_2H$ (b) 

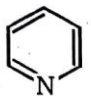
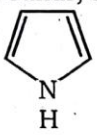
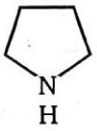
(c) C_6H_5OH (d) 

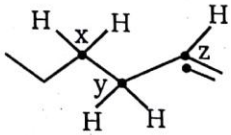
45. The carboxylic acid which has maximum solubility in water is:

(a) phthalic acid (b) succinic acid

(c) malonic acid (d) salicylic acid

46. Among the following compounds, the most basic compound is :

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

47. 

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

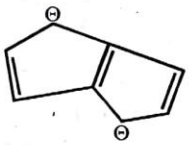
(a) $y > x > z$ (b) $z > x > y$ (c) $z > y > x$ (d) $y > z > x$

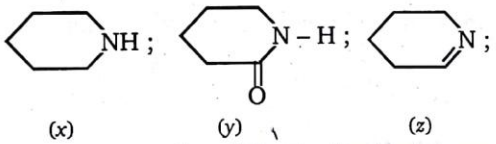
48. 23 g of sodium will react with methyl alcohol to give :

(a) one mole of oxygen (b) 22.4 dm^3 of hydrogen gas at NTP

(c) 1 mole of H_2 (d) 11.2 L of hydrogen gas at NTP

49. Which of the following is most polar?

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

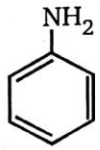
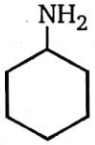
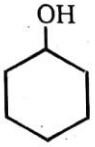
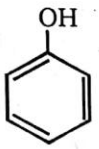
50. 

(x) (y) (z)

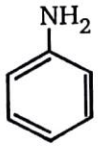
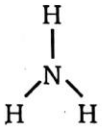
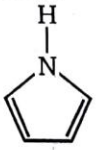
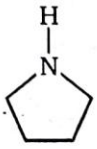
The correct order of decreasing basic strengths of x, y and z is :

(a) $x > y > z$ (b) $x > z > y$ (c) $y > x > z$ (d) $y > z > x$

51. Which of the following is the strongest Bronsted acid ?

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

52. Which of the following is the strongest Bronsted base ?

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

53. Which of the following is polar aprotic solvent ?

(a) DMSO (b) Crown ether (c) DMG (d) All of these

54. Some pairs of acids are given below. Select the pair in which second acid is stronger than first

(a) CH_3CO_2H and CH_2FCO_2H

(b) CH_2FCO_2H and CH_2ClCO_2H

(c) CH_2ClCO_2H and CH_2BrCO_2H

(d) $CH_3CH_2CHFCO_2H$ and $CH_3CHFCH_2CO_2H$

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

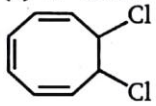
Compare the bond lengths a and b:

(a) $a = b$ (b) $a > b$ (c) $b > a$ (d) $a >>> b$

56. Which (isomeric) amine has lowest boiling point ?

(a) 1° amine (b) 2° amine

(c) 3° amine (d) cannot predict

57.  $\xrightarrow{2SbCl_5}$ P ; P will be :

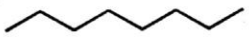
(a) 

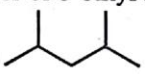
(b) 

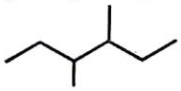
(c) 

(d) mixture of (a) and (b)

58. Which of the following substances is not an isomer of 3-ethyl 2-methyl pentane ?

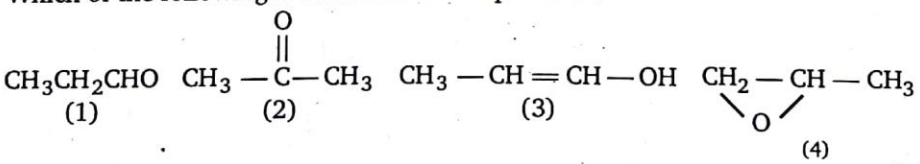
(a) 

(b) 

(c) 

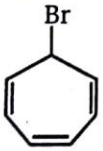
(d) All are isomers

59. Which of the following is an isomer of compound 1 ?



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

(a) 2 (b) 4 (c) 2 and 3 (d) all are isomers

60.  $\xrightarrow{AgNO_3}$ (A) ;

Which statement is incorrect in respect of the above reaction ?

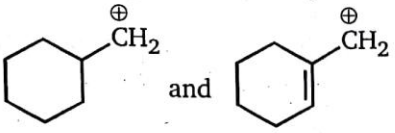
(a) Product is aromatic (b) Product has high dipole moment

(c) Product has less resonance energy (d) Product is soluble in polar solvent

61. Some pairs of ions are given below. In which pair, first ion is more stable than second?

(a) $CH_3-\overset{\oplus}{C}H-CH_3$ and $CH_3-\overset{\oplus}{C}H-OCH_3$

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

(c)  and

(d) $CH_3-\underset{\displaystyle CH_2-\overset{\oplus}{C}-CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{CH}}}}-CH_3$ and $CH_3-\underset{\displaystyle CH_3-\overset{\oplus}{C}-CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{N}}}}-CH_3$

62. Among the given pairs in which pair, first compound has higher boiling point than second ?

(a) $CH_3-CH_2OCH_3$ and $CH_3-\underset{\displaystyle OH}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{CH}}}}-CH_3$

(b) $CH_3-CH_2-CH_2-CH_3$ and $CH_3-CH_2-\underset{\displaystyle CH_2-CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{CH}}}}$

(c) $CH_3-CH_2-CH_2-CH_2-CH_3$ and $CH_3-\underset{\displaystyle CH_2-CH_2-OH}{\overset{\displaystyle CH_2-CH_3}{\underset{|}{\overset{|}{CH}}}}$

(d) $CH_3-CH_2-CH_2-CH_3$ and $CH_3-CH_2-CH_2-Cl$

63. Which of the following alcohols is the least soluble in water ?

(a) Ethanol (b) 1-Propanol

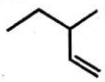
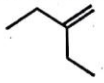
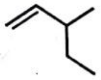
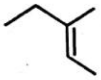
(c) 1-Butanol (d) 1-Pentanol

64. Which of the following alcohols is expected to have a lowest pK_a value ?

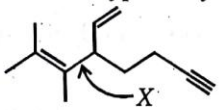
(a) Ethanol (b) 1-propanol

(c) 2, 2, 2-trifluorethanol (d) 2-chloroethanol

65. Which of the following alkenes is the most stable ?

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

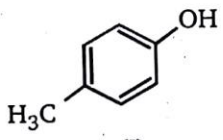
66. Bond *X* is made by the overlap of which type of hybridized orbitals ?



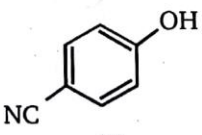
(a) *sp* and sp^3 (b) *sp* and sp^2

(c) sp^2 and sp^3 (d) none of these

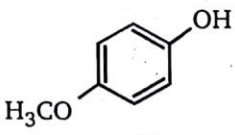
67. Increasing order of acidic strength of given compounds is :



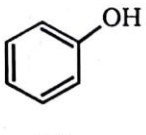
(I)



(II)

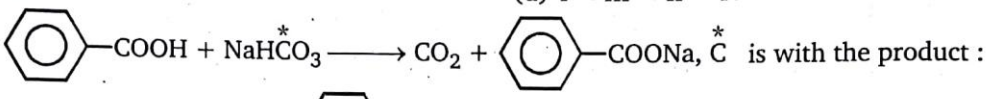


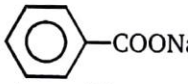
(III)



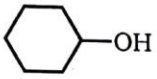
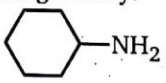
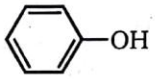
(IV)

(a) III < I < IV < II
(b) II < I < IV < III
(c) I < III < IV < II
(d) I < III < II < IV

68.  is with the product :

(a) CO_2 (b)  (c) both (d) none of these

69. Rank in the order of increasing acidity.

(I)  (II)  (III) 

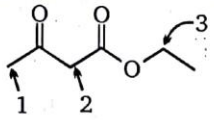
(a) III < I < II
(b) I < III < II
(c) III < II < I
(d) II < I < III

70. Which compound has the highest value of pK_a?

(a) $Cl-CH_2-CH_2-COOH$
(b) CH_3-CH_2-COOH

(c) $CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-COOH$
(d) $CH_3-\overset{\displaystyle Cl}{\overset{|}{\underset{\displaystyle Cl}{\underset{|}{C}}}}-COOH$

71. Consider the hydrogen atoms attached to three different carbon atoms (labeled 1, 2 & 3). Rank the attached hydrogen atoms in order from most acidic to least acidic.



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

72. Decreasing order of acidic strengths of following compounds is :

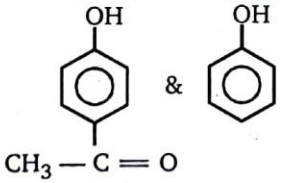
(x)  (y)  (z) 

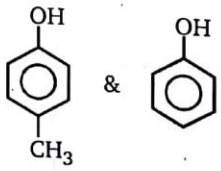
(a) $x > y > z$ (b) $y > x > z$ (c) $z > y > x$ (d) $z > x > y$

73. Among the given pairs, in which pair second compound is more acidic than first ?

(a) $BrCH_2NO_2$ and CH_3CH_3

(b) $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}CH_2CN$ and $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3$

(c) 

(d) 

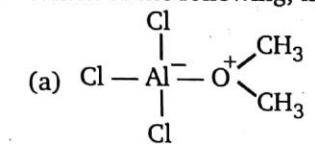
74. Which of the underlined atoms in the molecules shown below have *sp*-hybridization ?

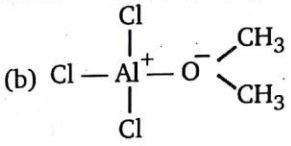
(u) $\underline{C}H_2CHCH_3$ (v) $CH_2\underline{C}CHCl$ (w) $CH_3\underline{C}H_2^+$ (x) $H-C\equiv\underline{C}-H$

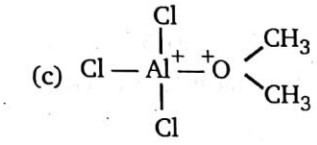
(y) $CH_3\underline{C}N$ (z) $(CH_3)_2\underline{C}\underline{N}NH_2$

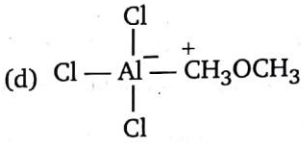
(a) x and z (b) x, y, and z (c) u, w and x (d) v, x and y

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

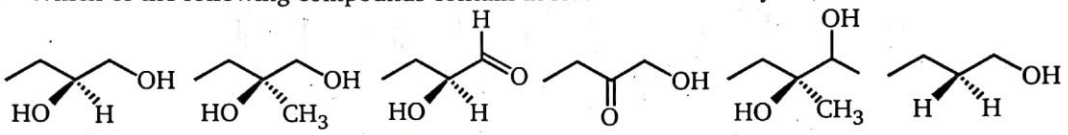
(a) 

(b) 

(c) 

(d) 

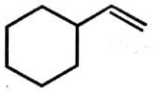
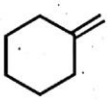
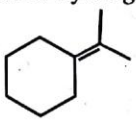
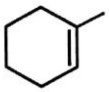
76. Which of the following compounds contain at least one secondary alcohol ?



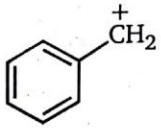
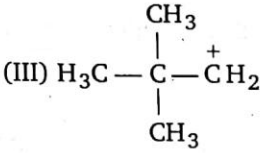
(I) (II) (III) (IV) (V) (VI)

(a) I, II, IV, VI (b) I, III (c) I, II, III, V (d) I, III, V

77. Which of the following has the most negative heat of hydrogenation ?

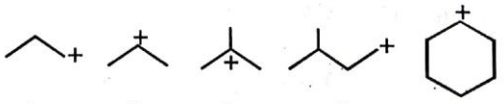
(a)  (b)  (c)  (d) 

78. Which of the following options is the correct order of relative stabilities of cations I, II and III as written below (most stable first) ?

(I)  (II) $H_2C=CH-CH_2-\overset{+}{C}H-CH_3$ (III) 

(a) I > II > III (b) II > III > I (c) III > I > II (d) I > III > II

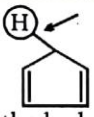
79. What is the decreasing order of stability (most stable → least stable) of the following carbocations ?



1 2 3 4 5

(a) 3 > 2 > 1 > 4 > 5 (b) 3 > 2 > 5 > 4 > 1

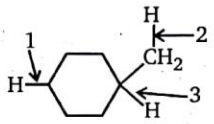
(c) 1 ≈ 4 > 2 ≈ 5 > 3 (d) 3 > 1 ≈ 4 > 2 ≈ 5

80. 

the hydrogen indicated by arrow will be easily removed as :

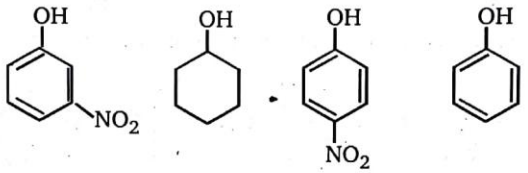
(a) H^+ (b) H^{Θ} (c) $H^{\bullet}$ (d) H^{-2}

81. Rank the bond dissociation energies of the bonds indicated with the arrows. (from smallest to largest).



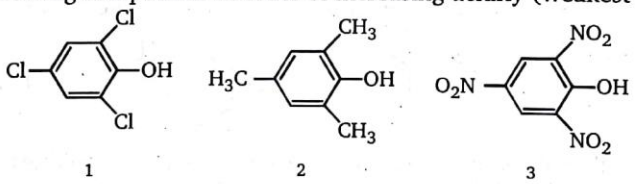
(a) 1 < 2 < 3 (b) 3 < 2 < 1 (c) 2 < 3 < 1 (d) 3 < 1 < 2

82. Rank the following compounds in order of decreasing acid strength (most acidic → least acidic) .



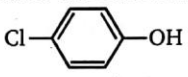
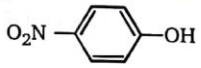
(a) 2 > 4 > 1 > 3 (b) 1 > 3 > 4 > 2 (c) 3 > 1 > 2 > 4 (d) 3 > 1 > 4 > 2

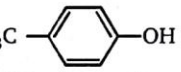
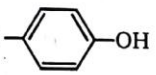
83. Rank the following compounds in order of increasing acidity (weakest acid first).



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

84. Which of the following phenols has the largest pK_a value (*i.e.*, is least acidic) ?

(a)  (b) 

(c)  (d) 

85. Among the given sets, which represents the resonating structures ?

(a) $H-C\equiv \overset{+}{N}-\ddot{\underset{\cdot\cdot}{O}}:^{-}$ and $H-\ddot{\underset{\cdot\cdot}{O}}-C\equiv N:$

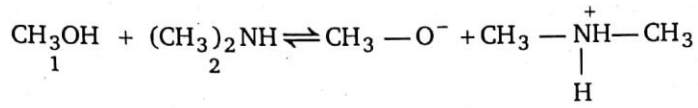
(b) $H-\overset{+}{\ddot{\underset{\cdot\cdot}{O}}}=C=\ddot{N}:^{-}$ and $H-\ddot{\underset{\cdot\cdot}{O}}-C\equiv N:$

(c) $H-C\equiv \overset{+}{N}-\ddot{\underset{\cdot\cdot}{O}}:^{-}$ and $H-\overset{\overset{:O:}{\|}}{C}-\ddot{N}:$ (d) $H-\ddot{\underset{\cdot\cdot}{O}}-C\equiv N:^{-}$ and $H-\ddot{N}=C=\ddot{O}:$

86. Identify each species in the following equilibrium according to the code :

SA = stronger acid ; SB = stronger base ; WA = weaker acid ; WB = weaker base.

The pK_a of $(CH_3)_2NH$ is 36 ; the pK_a of CH_3OH is 15.2.



	1	2		1	2		1	2		1	2
(a)	WA	WB	(b)	WB	WA	(c)	SA	SB	(d)	SB	SA
(e)	WA	WA									

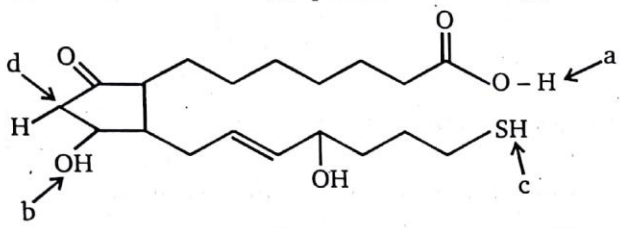
87. The hydrogen bonding is strongest in which one of the following set ?

(a) F — H - - - F (b) O — H - - - S (c) S — H - - - F (d) F — H - - - O

88. Intermolecular hydrogen bonding is strongest in :

(a) methylamine (b) phenol (c) formaldehyde (d) methanol

89.

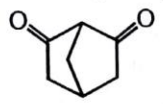


Identify most acidic hydrogen in given compound.

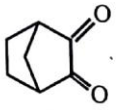
(a) *a* (b) *b* (c) *c* (d) *d*

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

(a)



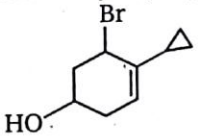
(b)



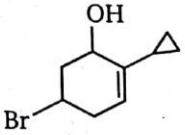
(c) $CH_2(CO_2Et)_2$ (d) $CH_3COCH_2COOC_2H_5$

91. 5-Bromo-2-cyclopropyl cyclohex-2-enol have correct structure is:

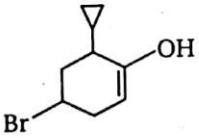
(a)



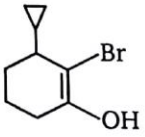
(b)



(c)



(d)

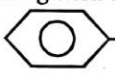


92. Rearrange the following in the increasing order of acidic strength.

(i) benzoic acid (ii) *p*-methoxybenzoic acid (iii) *o*-methyoxybenzoic acid

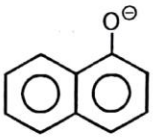
(a) i < ii < iii (b) iii < i < ii (c) ii < i < iii (d) iii < ii < i

93. In the following acid-base reaction, in which can backward reaction if favoured?

(a) $EtO^{\ominus}$ +  $\rightleftharpoons$

(b) KH + EtOH $\rightleftharpoons$

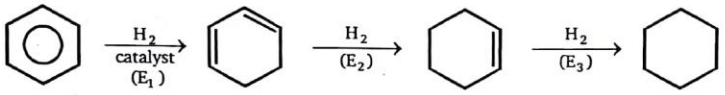
(c) $Me_3CO^{\ominus} + H_2O \rightleftharpoons$

(d)  $+ CH_3OH \rightleftharpoons$

94. Which compound posses highest dipole moment ?

(a) naphthalene (b) phenanthrene

(c) anthracene (d) azulene

95. 

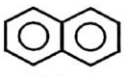
(E = activation energy)

Relation between activation energies of above reactions is :

(a) $E_2 > E_1 > E_3$ (b) $E_3 > E_1 > E_2$ (c) $E_3 > E_2 > E_1$ (d) $E_1 > E_2 > E_3$

96. Rank the following solvents in decreasing order of ability to dissolve given compound.

Solvent
Et_2O
H_2O
EtOH

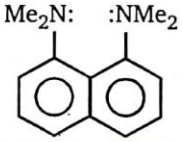


Solute

(a) $Et_2O > H_2O > EtOH$ (b) $H_2O > EtOH > Et_2O$

(c) $H_2O > Et_2O > EtOH$ (d) $Et_2O > EtOH > H_2O$

97.



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

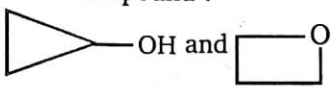
Its basic strength is 10^{10} more than 1-dimethyl amino naphthalene.

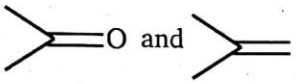
Reason for high basic strength is :

(a) resonance (b) steric inhibitation of resonance

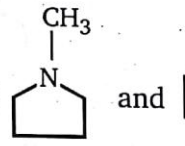
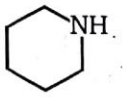
(c) ortho effect (d) hyperconjugation

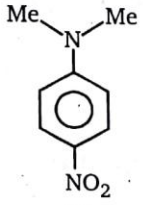
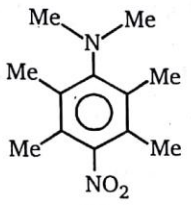
98. In the given pair of compounds, in which pair second compound has higher boiling point than first compound ?

(a)  OH and

(b) 

(c) $HO-CH_2-CH_2-OH$ and $CH_3-CH_2-CH_2-OH$

(d)  and 

99.  ,  ; Dipole moments of given compound will be :

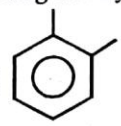
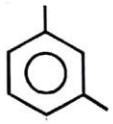
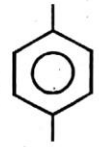
(A) (B)

(a) (A) = 6.87D, (B) = 4.11D
(b) (A) = 4.11 D , (B) = 6.87 D
(c) (A) = 4.11 D , (B) = 4.11 D
(d) (A) = 6.87 D, (B) = 6.87 D

100. Order of decreasing basic strengths of halides is :

(a) $F^- > Cl^- > I^- > Br^-$
(b) $F^- > Cl^- > Br^- > I^-$
(c) $I^- > Br^- > Cl^- > F^-$
(d) $I^- > Cl^- > Br^- > F^-$

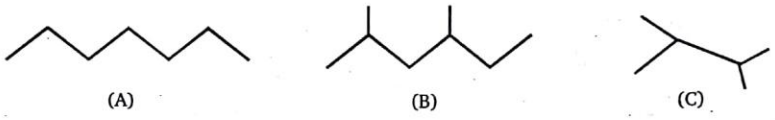
101. Among the xylenes, which is thermodynamically most stable ?

(a) 
(b) 
(c) 
(d) All are equally stable

102. Heat of combustion of two isomer *x* and *y* are 17 kJ/mol and 12 kJ/mol respectively. From this information it may be concluded that :

(a) isomer *x* is 5 kJ /mol more stable
(b) isomer *y* is 5 kJ/mol less stable
(c) isomer *y* has 5 kJ/mol more potential energy
(d) isomer *x* is 5 kJ/mol less stable

103. Rank the following substances in decreasing order of heat of combustion (most exothermic ⟶ least exothermic)



(A) (B) (C)

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

104.

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

Choose the statement that best describes given compounds.

(a) 1, 3, 4 represent same compound (b) 1 and 3 are isomer of 2 and 4

(c) 1, 4 are isomer of 2 and 3

(d) All the structure represent the same compound

105. Decreasing order of acid strengths is :

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

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

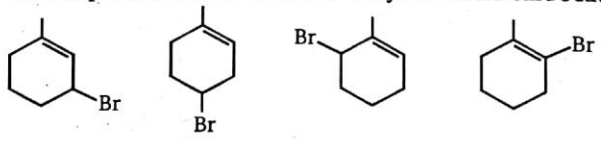
106. Rank the following in decreasing order of basic strength is :

(A) $CH_3-CH_2-C\equiv C^-$ (B) $CH_3-CH_2-S^-$

(C) $CH_3-CH_2-CO_2^-$ (D) $CH_3-CH_2-O^-$

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

107. Among the given compound choose the two that yield same carbocation on ionization.



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

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

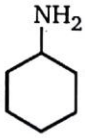
108.

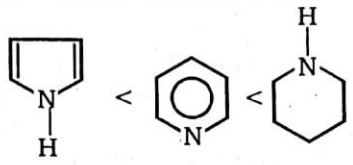
Oxalic acid	pK_1
Malonic acid	pK_2
Heptanedioic acid	pK_3

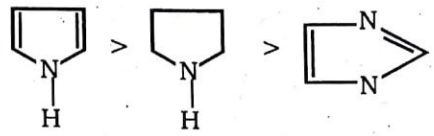
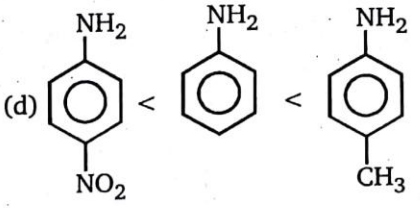
where pK_1, pK_2, pK_3 are first ionization constants. Incorrect order is :

(a) $pK_1 > pK_2 > pK_3$ (b) $pK_1 < pK_2 < pK_3$ (c) $pK_3 > pK_2 > pK_1$ (d) $pK_3 > pK_1 > pK_2$

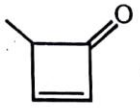
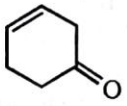
109. In sets a – d, only one of the set is incorrect regarding basic strength. Select it :

(a) $Ph-NH-Ph_1 < Ph-NH_2 <$  (strong base)

(b)  < <

(c)  (d) 

110. Dipole moment of which ketone is maximum ?

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

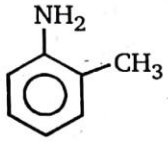
111. Correct order of basic strengths of given amines is :

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

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

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

(d) All are correct

112. Order of basic strength $Ph-\underset{(A)}{NH_2}$, $Ph-\underset{(B)}{NH}-Me$, $Ph-\underset{\underset{Me}{|}}{N}-Me$, 

(C) (D)

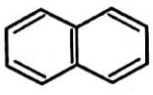
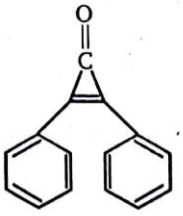
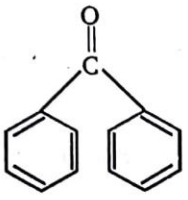
(a) A > B > C > D (b) B > A > C > D (c) C > B > A > D (d) C > B > D > A

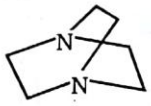
113. Carbon-carbon double bond length will be maximum in which of the following compounds ?

(a) $CH_3-CH=CH_2$ (b) $CH_3-CH=CH-CH_3$

(c) $CH_3-\underset{\underset{CH_3}{|}}{C}=\underset{\underset{CH_3}{|}}{C}-CH_3$ (d) $CH_2=CH_2$

114. Which has maximum dipole moment ?

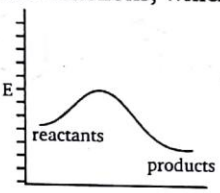
(a)  (b)  (c)  (d) 

115. (i) Et_3N (ii)  (iii) 

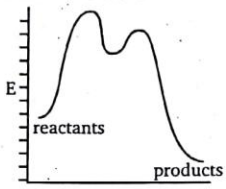
Compare the basic strengths of compounds given:

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

116. For the following two reactions, which statement is true ?



Reaction A



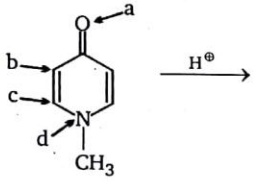
Reaction B

(a) Reaction *A* is faster and less exergonic than *B*

(b) Reaction *B* is faster and more exergonic than *A*

(c) Reaction *A* is faster and less endergonic than *B*

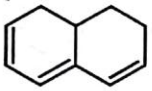
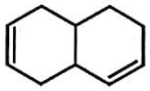
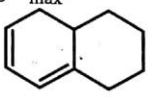
(d) Reaction *B* is faster and more endergonic than *A*

117. 

Identify the site, where attack of H^+ is most favourable.

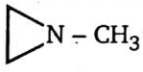
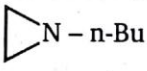
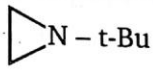
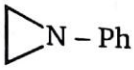
(a) *a* (b) *b* (c) *c* (d) *d*

118. Rank the following alkenes on order of increasing λ_{max}.

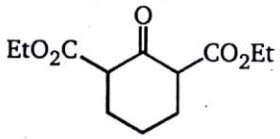
(1)  (2)  (3) 

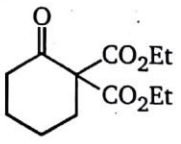
(a) 1 < 2 < 3 (b) 1 < 3 < 2 (c) 2 < 1 < 3 (d) 2 < 3 < 1

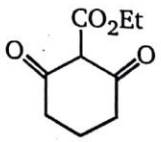
119. Which of the following cyclic amine has lowest $\Delta G^{\#}$ for inversion ?

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

120. Rank in the order of increasing acidic strength:

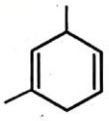
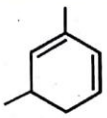
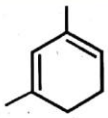
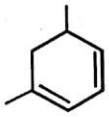

(A)


(B)


(C)

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

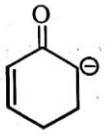
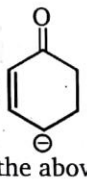
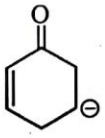
121. Which one of the following dienes would you expect to be the most stable ?

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

122. Which metal catalyzed reaction would release the maximum amount of heat per CH_2 unit ?

(a) cyclopropane + H_2 → propane (b) cyclobutane + H_2 → butane

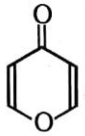
(c) cyclopentane + H_2 → pentane (d) cyclohexane + H_2 → hexane

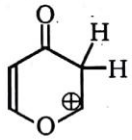
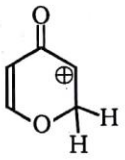
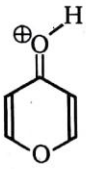
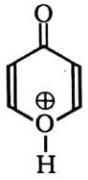
123. (A)  (B)  (C) 

Compare basic strengths of the above compounds:

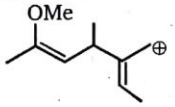
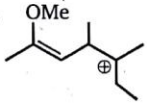
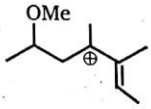
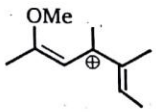
(a) A > B > C (b) B > A > C (c) C > A > B (d) C > B > A

124. On reaction with acid, 4-pyrone gives a very stable cationic product. Which of the following structures shows the protonation site in that product ?

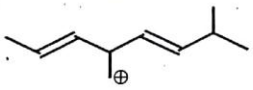
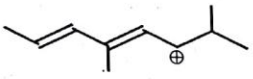
 4-Pyrone

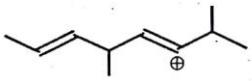
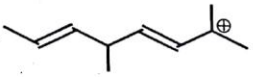
(a)  (b)  (c)  (d) 

125. Which of the following is the most stabilized carbocation ?

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

126. Which carbocation is the most stable ?

(a)  (b) 

(c)  (d) 

127. Consider a positively charged C_2H_3 species in which the positively charged carbon is *sp*-hybridized, the uncharged carbon is sp^2-hybridized and an empty *p*-orbital is perpendicular to the π system. What it the best description of this cation ?

(a) vinyl (b) allenyl (c) alkyl (d) allyl

128. Which of the following reactions is not exothermic ?

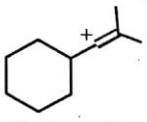
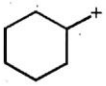
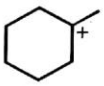
(a) $CH_3-Cl + CH_3-CH_3 \longrightarrow CH_4 + CH_3-CH_2-Cl$

(b) $CH_3-Cl + (CH_3)_3C-H \longrightarrow CH_4 + (CH_3)_3C-Cl$

(c) $CH_3-Cl + CH_2=CH-CH_3 \longrightarrow CH_4 + CH_2=CH-CH_2-Cl$

(d) $CH_3-Cl + CH_2=CH_2 \longrightarrow CH_4 + CH_2=CHCl$

129. List the following carbocations in order of decreasing stabilization energies.

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

(a) II, III, I, IV (b) III, IV, II, I (c) III, IV, I, II (d) I, II, IV, III

130. For the following two acid-base reactions, which statement is true ?

(I) $CH_3CH_2^- + \underset{pK_a=35}{CH_3NH_2} \rightleftharpoons \underset{pK_a=50}{CH_3CH_3} + CH_3NH^-$

(II) $F^- + \underset{pK_a=15.7}{H_2O} \rightleftharpoons \underset{pK_a=3.2}{HF} + HO^-$

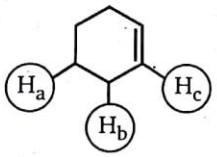
(a) I is favoured to the right, II is favoured to the left

(b) I is favoured to the left, II is favoured to the right

(c) I is favoured to the right, II is favoured to the right

(d) I is favoured to the left, II is favoured to the left

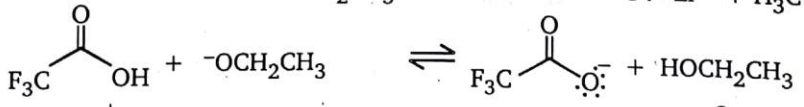
131. Rank the hydrogen atoms (H_a, H_b, H_c) in the following molecules according to their acidic strengths:



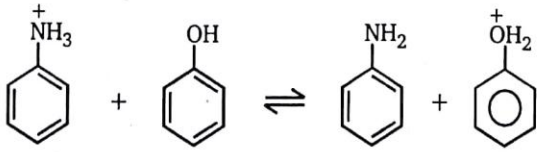
(a) $a > b > c$ (b) $b > a > c$ (c) $b > c > a$ (d) $a > c > b$

132. In which of the following reactions, backward reaction is favoured ?

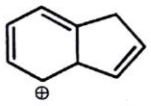
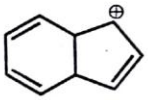
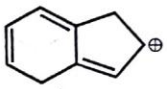
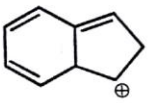
(a) $H-C\equiv C-H + Li^+ {}^-CH_2CH_3 \rightleftharpoons H-C\equiv C:^{\ominus}Li^+ + H_3C-CH_3$

(b) 

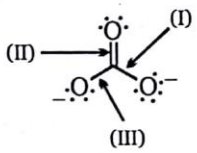
(c) $CH_3CH_2\overset{+}{S}H_2 + CH_3CH_2OH \rightleftharpoons CH_3CH_2SH + CH_3CH_2\overset{\oplus}{\underset{H}{O}}-H$

(d) 

133. Which carbocation is the most stabilized ?

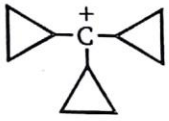
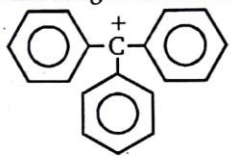
(a)  (b)  (c)  (d) 

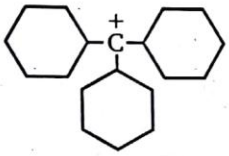
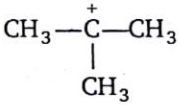
134. Taking into account of hybridization and resonance effects, rank the following bonds in order of decreasing bond length.



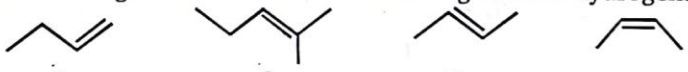
(a) I > II = III (b) II > III > I (c) I > III > II (d) II = III = I

135. Which one among the following carbocations has the longest half-life ?

(a)  (b) 

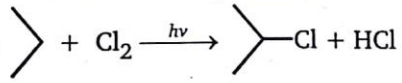
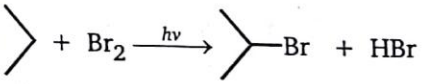
(c)  (d) 

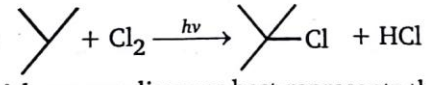
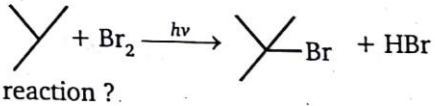
136. Rank the following alkenes in order of decreasing heats of hydrogenation (largest first)



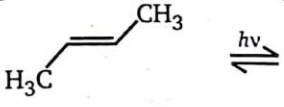
(a) 2 > 3 > 4 > 1 (b) 2 > 4 > 3 > 1 (c) 1 > 3 > 4 > 2 (d) 1 > 4 > 3 > 2

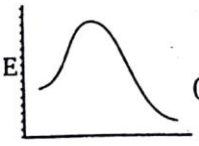
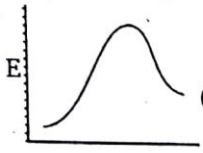
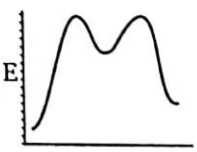
137. Which of the following reactions is most exothermic ?

(a)  (b) 

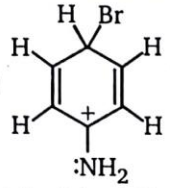
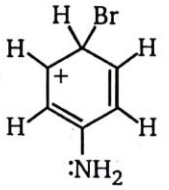
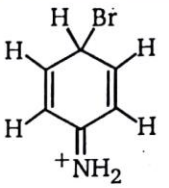
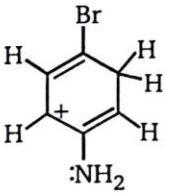
(c)  (d) 

138. Which energy diagram best represents the given reaction ?

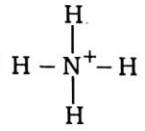
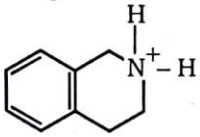
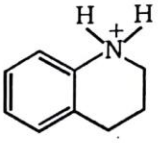
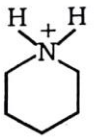


(a)  (b)  (c)  (d) 

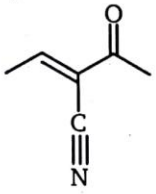
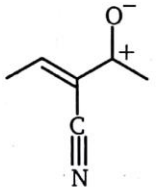
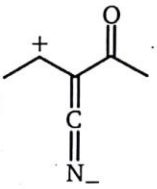
139. Which one of the following is most stable ?

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

140. Which of the following is strongest acid ?

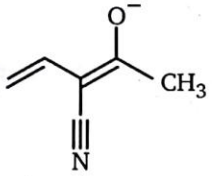
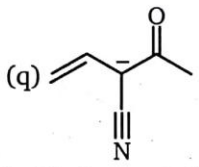
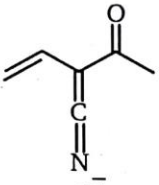
(a)  (b)  (c)  (d) 

141. Compare relative stability of the following resonating structure.

(i)  (ii)  (iii) 

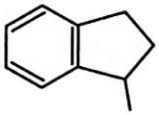
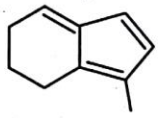
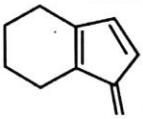
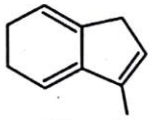
(a) (i) > (ii) > (iii) (b) (ii) > (i) > (iii) (c) (i) > (iii) > (ii) (d) (ii) > (iii) > (i)

142. Compare relative stability of the following resonating structure.

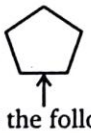
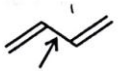
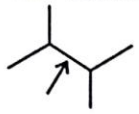
(p)  (q)  (r) 

(a) p > q > r (b) q > p > r (c) q > r > p (d) p > r > q

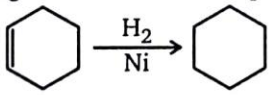
143. Which of the following isomeric hydrocarbons is most acidic ?

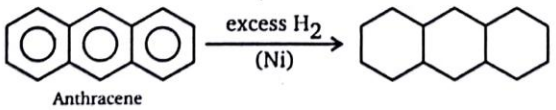
(a)  (b)  (c)  (d) 

144. Which of the following has the lowest barrier to rotation about the indicated bond ?

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

145. Use the following data to answer the question below.

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



Anthracene

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

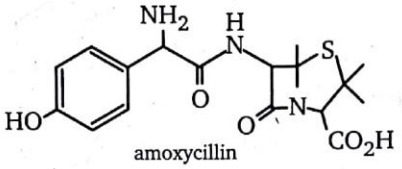
Calculate the resonance energy of anthracene:

(a) 84 kcal/mol (b) 100 kcal/mol (c) 110 kcal/mol (d) 116 kcal/mol

146. How many double bond equivalents does a compound of molecular formula $C_6H_{12}O_6$ possess?

(a) 0 (b) 1 (c) 2 (d) 3

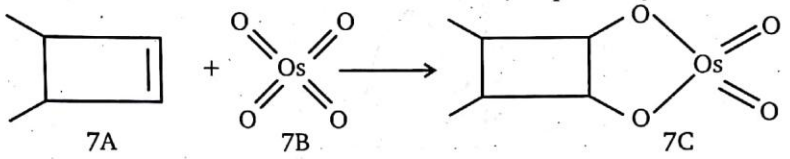
147. How many double bond equivalents does amoxycillin (shown below) possess ?



amoxycillin

(a) 5 (b) 6 (c) 7 (d) 9

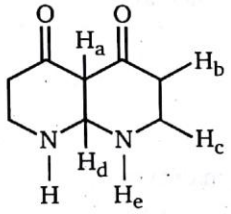
148. What is the oxidation state of osmium in 7B and 7C, respectively ?



7A 7B 7C

(a) 6, 8 (b) 8, 6 (c) 6, 6 (d) 8, 8

149.

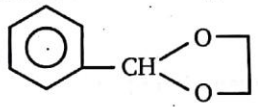


Identify most acidic hydrogen present in the above compound:

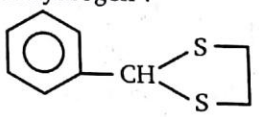
(a) *a* (b) *b* (c) *c* (d) *d*

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

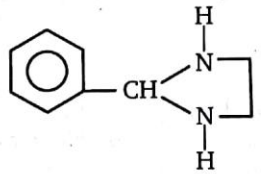
(a)



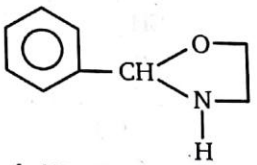
(b)



(c)



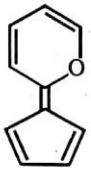
(d)



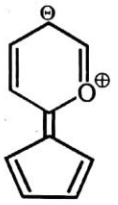
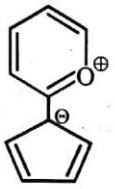
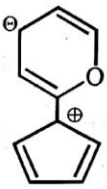
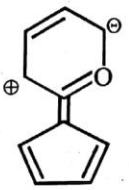
151. Acetic acid, (CH_3COOH), has a pK_a of 4.8. Ethanol, (CH_3CH_2OH), has a pK_a of 16.0. What are the major species present, when acetic acid and ethanol are added to water and the pH is adjusted to 7.0 ?

(a) CH_3CO_2H and CH_3CO_2OH (b) $CH_3CH_2O^-$ and CH_3CH_2OH

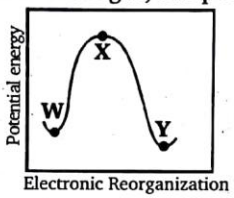
(c) CH_3CO_2H and $CH_3CH_2O^-$ (d) $CH_3CO_2^-$ and CH_3CH_2OH

152. 

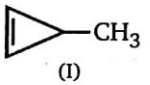
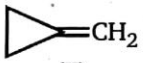
The most stable canonical structure of given molecule is:

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

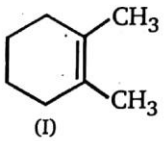
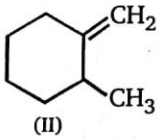
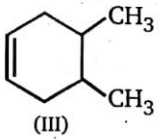
153. In the potential energy diagram to the right, the point X represents :



(a) a transition state (b) a reaction intermediate
(c) a resonance hybrid (d) a reactant

154.  (I)  (II)  (III)

Which of the following orders is correct for heat of hydrogenation of these compounds ?
(a) I > III > II (b) III > II > I (c) III > I > II (d) II > I > III

155.  (I)  (II)  (III)

Which of the following orders is correct for heat of hydrogenation of these compounds ?
(a) I > II > III (b) III > II > I (c) II > III > I (d) III > I > II

156. $CH_2=O \longleftrightarrow {}^{\oplus}CH_2-O^{\ominus} \longleftrightarrow {}^{\ominus}CH_2-O^{\oplus}$

(I) (II) (III)

Which of these structures is practically not a valid canonical structure for formaldehyde ?
(a) I (b) II (c) III (d) None of these

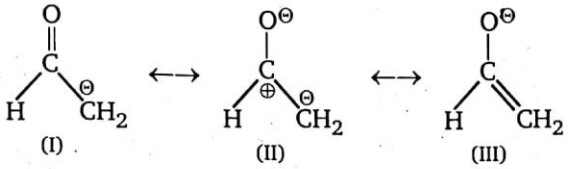
157. $CH_2=CH-CH=CH-{}^{\oplus}NH_3$; (I)

${}^{\oplus}CH_2-CH=CH-{}^{\ominus}CH-{}^{\oplus}NH_3$ (II)

${}^{\oplus}CH_2-CH=CH-CH=NH_3$ (III)

Which of these structures is not a valid canonical structure ?

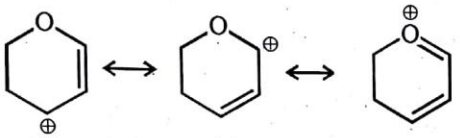
(a) I (b) II (c) III (d) none of these

158. 

(I) (II) (III)

The correct order of stability for the given canonical structures is :

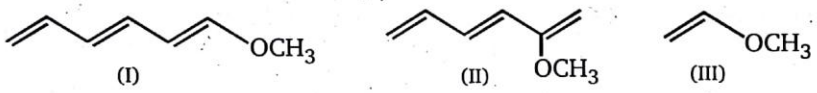
(a) I > III > II (b) III > I > II (c) II > III > I (d) II > I > III

159. 

(I) (II) (III)

The most stable canonical structure among the given structure is :

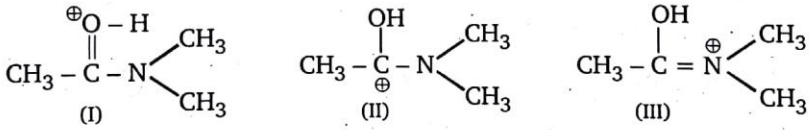
(a) I (b) II (c) III (d) all are equally stable

160. 

(I) (II) (III)

For the given compounds the correct order of resonance energy is :

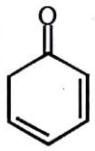
(a) III > I > II (b) II > I > III (c) I > II > III (d) III > II > I

161. 

(I) (II) (III)

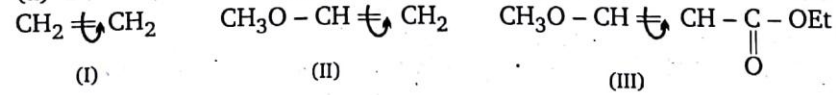
The correct stability order of the given canonical structures is :

(a) I > II > III (b) III > I > II (c) I > III > II (d) II > III > I

162. 

In the above compound, how many sites are available for the attack of CH_3O^- ?

(a) 1 (b) 2 (c) 3 (d) 4

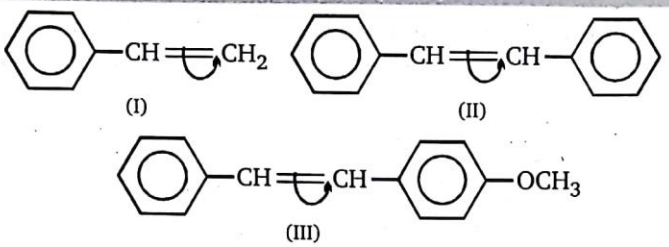
163. 

(I) (II) (III)

Which of the following orders of rotation barrier about the C = C bond, as indicated, is correct ?

(a) I > II > III (b) III > II > I (c) III > I > II (d) II > I > III

164.

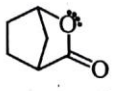
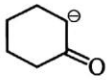
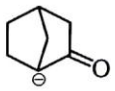
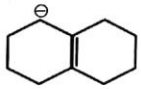


(I) (II) (III)

Which of the following orders of rotation barrier about the C = C bond, as indicated, is correct?

(a) I > II > III (b) III > II > I (c) III > I > II (d) II > I > III

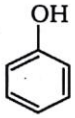
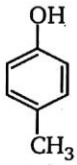
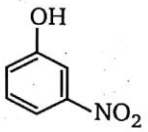
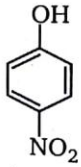
165. Which of the following compound is not resonance stabilized ?

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

166. Homologous compound have same:

(a) General formula (b) Emperical formula
(c) Structural formula (d) Molecular formula

167. Most acidic is:

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

168. Which of the following substituents will decrease the acidic strength of phenol?

(a) $-NO_2$ (b) $-CN$ (c) $-CH_3$ (d) $-CHO$

169. Which of the following structures possesses a cross-conjugated system?

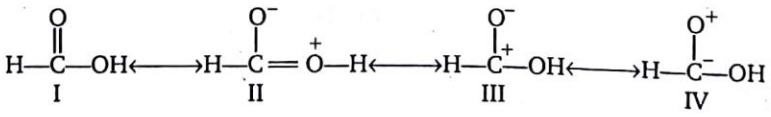
(a) $CH_2=CH-CH=CH-CH_2$

(b) $CH_2=CH-\underset{\displaystyle CH_2CH_3}{\underset{|}{C}}=CH_2$

(c) $CH_2=CH-\underset{\displaystyle CH=CH_2}{\underset{|}{CH}}-CH=CH_2$

(d) $CH_2=CH-\underset{\displaystyle CH=CH_2}{\underset{|}{C}}=CH_2$

170. Examine the following resonating structures of formic acid for their individual stability and then answer the question given below.



I II III IV

Which of the following arrangements gives the correct order of decreasing stability of the above-mentioned resonance contributors?

(a) II > I > III > IV (b) I > II > III > IV (c) IV > III > I > II (d) IV > III > I > II

171. Which of the following is not resonating structure of each other?

(a) $CH_3 - N = C = S$ and $CH_3 - S - C \equiv N$

(b) $CH_3 - \overset{+}{C} = O$ and $CH_3 - C \equiv \overset{+}{O}$

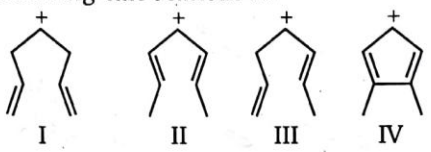
(c) $CH_3 - \overset{O}{\overset{\|}{C}} - OH$ and $CH_3 - \overset{O^-}{\overset{|}{C}} = \overset{+}{O} - H$

(d) $CH_2 = CH - C \equiv N$ and $\overset{+}{C}H_2 - CH = C = N^-$

172. In the molecule $CH_3C \equiv CCH = CH_2$, the maximum number of carbon atoms arranged linearly is:

(a) 2 (b) 3 (c) 4 (d) 5

173. The stability order of the following carbocations is:



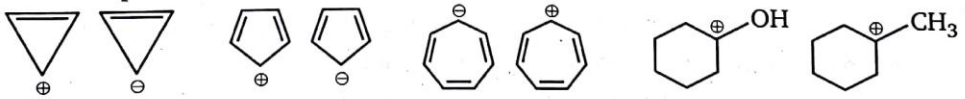
I II III IV

(a) II > IV > III > I (b) IV > II > III > I (c) II > III > I > IV (d) I > III > II > IV

174. Total number of α-hydrogen in given compound is:

(a) 4 (b) 5 (c) 6 (d) 7

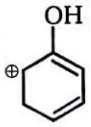
175. In which pair second ion is more stable than first?

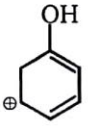


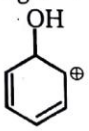
(i) (ii) (iii) (iv)

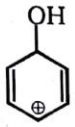
(a) (i) and (ii) (b) (ii) and (iii) (c) (ii) and (iv) (d) (iii) and (iv)

176. Which one is the most stable cation in the following ?

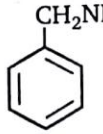
(a) 

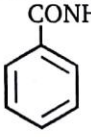
(b) 

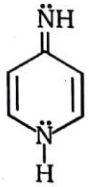
(c) 

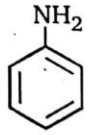
(d) 

177. The most reactive amine towards dilute hydrochloric acid is _____.

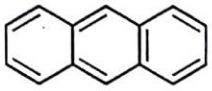
(a) 

(b) 

(c) 

(d) 

178. How many resonance structures are there for anthracene ?



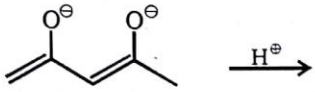
(a) 6 (b) 5 (c) 4 (d) 2

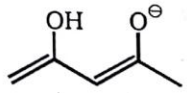
179. Which base is strong enough to convert $(CH_3)_3COH$ into $(CH_3)_3CONa$ in a reaction that goes to completion ?

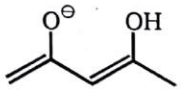
(a) $NaNH_2$ (b) CH_3CH_2Na (c) NaOH (d) CH_3CO_2Na

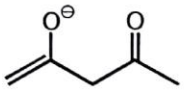
(e) More than one of the above

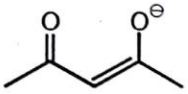
180. Based upon an understanding of product stability, predict the product formed when the following dianion reacts with one equivalent of acid

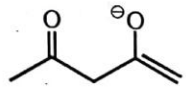


(a) 

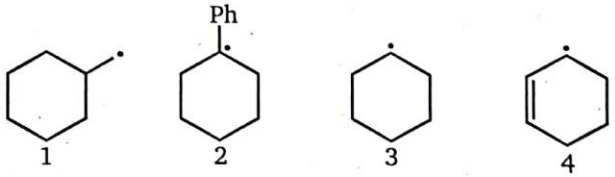
(b) 

(c) 

(d) 

(e) 

181. Rank the following alkyl radicals in order of increasing stability (least < < < most).



(a) $4 < 2 < 1 < 3$ (b) $3 < 1 < 2 < 4$ (c) $1 < 3 < 4 < 2$ (d) $2 < 4 < 3 < 1$

182. Among the given cations, the most stable carbonium ion is ?

(a) sec-butyl (b) tert-butyl (c) *n*-butyl (d) None of these

183. Cyclohexadiene contains ____ vinylic and _____ allylic hydrogen atoms ?

(a) 2 and 2 respectively (b) 4 and 4 respectively

(c) 2 and 4 respectively (d) 4 and 2 respectively

184. The dipole moments of halo compounds are in the order

(a) $CHCl_3 > CCl_4 > CHCl_2 > cis-CHCl=CHCl$

(b) $cis-CHCl=CHCl > CHCl_3 > CH_2Cl > CCl_4$

(c) $cis-CHCl=CHCl > CH_2Cl_2 > CHCl_3 > CCl$

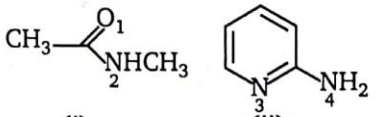
(d) $CHCl_3 > CHCl_2 > cis-CHCl=CHCl > CCl_4$

185. The pka value in H_2O of picric acid, acetic acid and phenol are in the order :

(a) Picric acid 0.4, acetic acid 4.75, phenol 10.0

(b) Acetic acid 0.4, picric acid 4.75, phenol 10.0
(c) Picric acid 0.4 phenol 4.75, acetic acid 10.0
(d) Phenol 0.4, acetic acid 4.75 picric acid 10.0

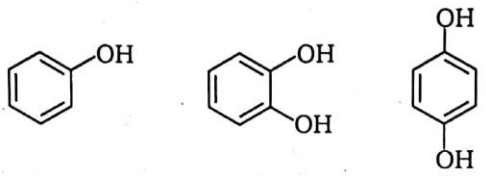
186. The preferred sites of protonation in the following compounds are:



(i) (ii)

(a) 1 and 3 (b) 2 and 4 (c) 1 and 4 (d) 2 and 3

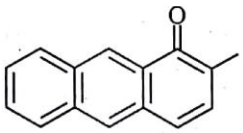
187. Among i-iii



(i) (ii) (iii)

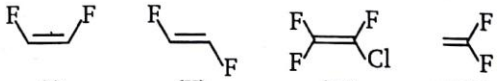
the boiling point follows the order
(a) (ii) < (i) < (iii) (b) (iii) < (ii) < (i) (c) (i) < (ii) < (iii) (d) (ii) < (iii) < (i)

188. The number of C — C sigma bonds in the compound



(a) 16 (b) 14 (b) 18 (d) 11

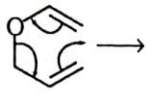
189. The correct order of dipole moment for the following molecules is

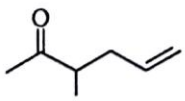
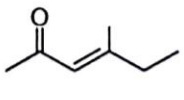
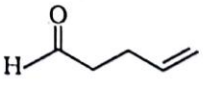
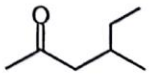


(I) (II) (III) (IV)

(a) IV > I > III > II (b) I > IV > III > II (c) III > I > II > IV (d) II > III > IV > I

190. Curved arrows are used in Organic Chemistry to show the movement of electrons in the mechanism of a reaction. The correct product of the following reaction is



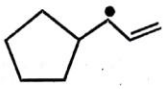
(a)  (b)  (c)  (d) 

ANSWERS — LEVEL 1

1.	(c)	**2.**	(d)	**3.**	(d)	**4.**	(a)	**5.**	(d)	**6.**	(d)	**7.**	(b)	**8.**	(c)
9.	(b)	**10.**	(c)	**11.**	(b)	**12.**	(b)	**13.**	(a)	**14.**	(b)	**15.**	(b)	**16.**	(b)
17.	(d)	**18.**	(c)	**19.**	(d)	**20.**	(d)	**21.**	(c)	**22.**	(c)	**23.**	(c)	**24.**	(a)
25.	(d)	**26.**	(d)	**27.**	(d)	**28.**	(a)	**29.**	(d)	**30.**	(a)	**31.**	(c)	**32.**	(c)
33.	(d)	**34.**	(d)	**35.**	(d)	**36.**	(d)	**37.**	(b)	**38.**	(b)	**39.**	(a)	**40.**	(c)
41.	(c)	**42.**	(d)	**43.**	(a)	**44.**	(c)	**45.**	(c)	**46.**	(d)	**47.**	(b)	**48.**	(d)
49.	(b)	**50.**	(b)	**51.**	(d)	**52.**	(d)	**53.**	(d)	**54.**	(a)	**55.**	(c)	**56.**	(c)
57.	(b)	**58.**	(b)	**59.**	(d)	**60.**	(c)	**61.**	(b)	**62.**	(b)	**63.**	(d)	**64.**	(c)
65.	(d)	**66.**	(c)	**67.**	(a)	**68.**	(a)	**69.**	(d)	**70.**	(b)	**71.**	(a)	**72.**	(d)
73.	(d)	**74.**	(d)	**75.**	(a)	**76.**	(d)	**77.**	(a)	**78.**	(a)	**79.**	(b)	**80.**	(a)
81.	(d)	**82.**	(d)	**83.**	(d)	**84.**	(c)	**85.**	(b)	**86.**	(a)	**87.**	(a)	**88.**	(b)
89.	(a)	**90.**	(d)	**91.**	(b)	**92.**	(c)	**93.**	(d)	**94.**	(d)	**95.**	(d)	**96.**	(d)
97.	(b)	**98.**	(d)	**99.**	(a)	**100.**	(b)	**101.**	(b)	**102.**	(d)	**103.**	(a)	**104.**	(a)
105.	(c)	**106.**	(c)	**107.**	(c)	**108.**	(b)	**109.**	(c)	**110.**	(c)	**111.**	(d)	**112.**	(c)
113.	(c)	**114.**	(c)	**115.**	(c)	**116.**	(a)	**117.**	(a)	**118.**	(d)	**119.**	(c)	**120.**	(c)
121.	(c)	**122.**	(a)	**123.**	(c)	**124.**	(c)	**125.**	(d)	**126.**	(b)	**127.**	(a)	**128.**	(d)
129.	(b)	**130.**	(a)	**131.**	(c)	**132.**	(d)	**133.**	(c)	**134.**	(d)	**135.**	(a)	**136.**	(d)
137.	(c)	**138.**	(d)	**139.**	(c)	**140.**	(c)	**141.**	(a)	**142.**	(d)	**143.**	(b)	**144.**	(c)
145.	(a)	**146.**	(b)	**147.**	(d)	**148.**	(b)	**149.**	(a)	**150.**	(b)	**151.**	(d)	**152.**	(b)
153.	(a)	**154.**	(a)	**155.**	(c)	**156.**	(c)	**157.**	(c)	**158.**	(b)	**159.**	(c)	**160.**	(c)
161.	(b)	**162.**	(c)	**163.**	(a)	**164.**	(a)	**165.**	(c)	**166.**	(a)	**167.**	(d)	**168.**	(c)
169.	(d)	**170.**	(b)	**171.**	(a)	**172.**	(c)	**173.**	(c)	**174.**	(c)	**175.**	(b)	**176.**	(b)
177.	(c)	**178.**	(c)	**179.**	(e)	**180.**	(d)	**181.**	(c)	**182.**	(b)	**183.**	(b)	**184.**	(c)
185.	(a)	**186.**	(a)	**187.**	(a)	**188.**	(b)	**189.**	(b)	**190.**	(c)				

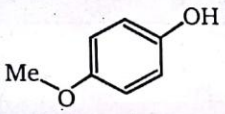
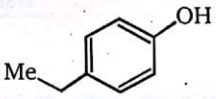
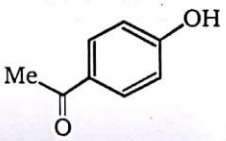
LEVEL-2

1. Rank in order of radical stability (1 = most stable).

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

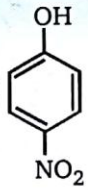
☐ ☐ ☐ ☐

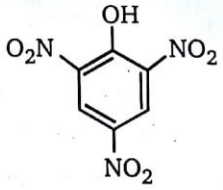
2. Predict the acidity order for the three phenols shown below :
Acidity order : 1 (most) to 3 (least)

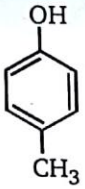
(a)  (b)  (c) 

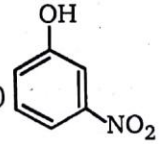
Acidity order : ....

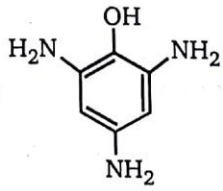
3. Comprehension

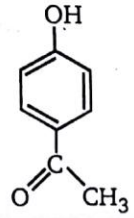
(A) 

(B) 

(C) 

(D) 

(E) 

(F) 

A. Which of the phenol derivatives above is the strongest acid ?

☐ Compound A ☐ Compound B ☐ Compound C
☐ Compound D ☐ Compound E ☐ Compound F

B. Which of the phenol derivatives above is the weakest acid ?

☐ Compound A ☐ Compound B ☐ Compound C
☐ Compound D ☐ Compound E ☐ Compound F

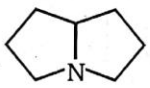
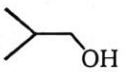
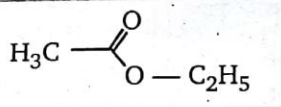
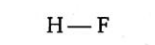
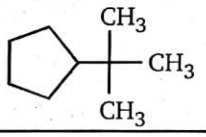
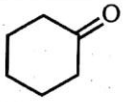
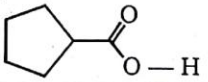
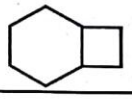
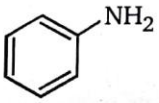
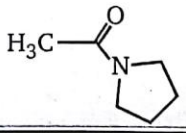
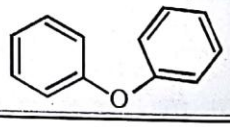
C. Which of the mono-nitrophenol derivatives above is the strongest acid ?

☐ Compound A ☐ Compound D

D. Which of the carbon-substituted phenol derivatives above is the strongest acid ?

☐ Compound C ☐ Compound F

4. The following questions refer to the twelve compounds given below. You may enter as many as six choices in each answer box.

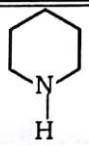
(a)		**(b)**		**(c)**	
(d)		**(e)**		**(f)**	
(g)		**(h)**		**(i)**	
(j)		**(k)**		**(l)**	

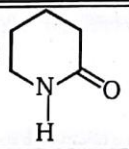
A. Which compound may serve only as H-bond acceptors ? ____

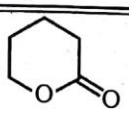
B. Which may serve both as H-bond donors and acceptors? ____

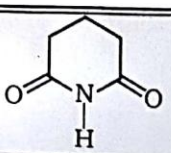
C. Which compounds will not participate in H-bonding ? ____

5. Consider the following compounds and answer A and B.

(I) 

(II) 

(III) 

(IV) 

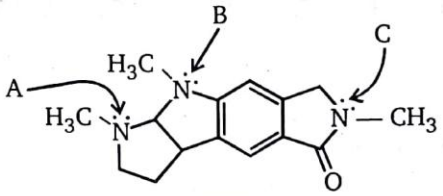
A. Which of the compounds is the strongest Bronsted acid ?

(a) I (b) II (c) III (d) IV

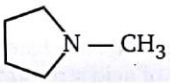
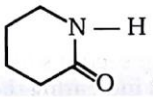
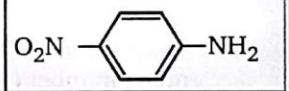
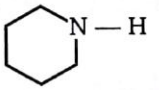
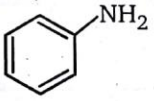
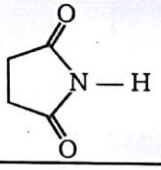
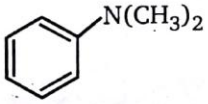
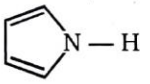
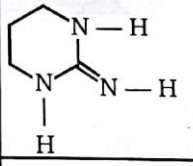
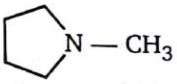
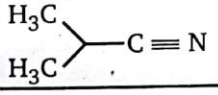
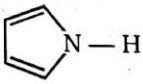
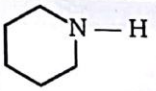
B. Which of the compounds is the strongest Lewis base ?

(a) I (b) II (c) III (d) IV

6. Rank the non-bonding electrons indicated by the arrows in order of increasing energy.

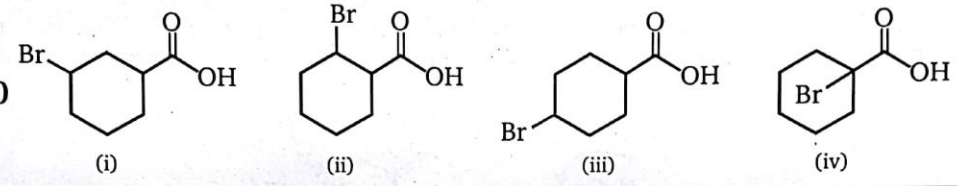


7. In each of the following sections four nitrogen containing compounds are listed. In the box under each formula write a number (1 to 4) indicating the order of base strength.

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

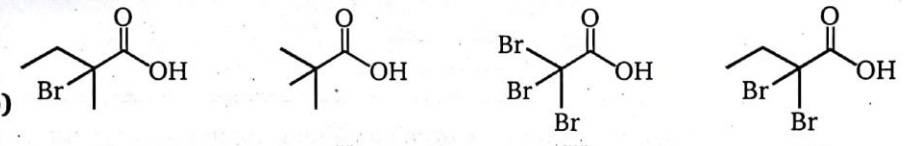
8. For the two sets of acids shown below, rank their acidity most acidic to least acidic.

(a)



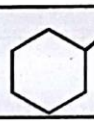
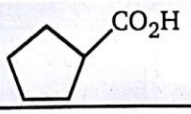
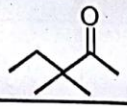
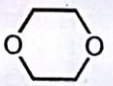
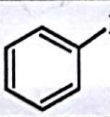
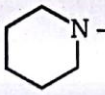
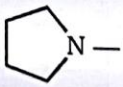
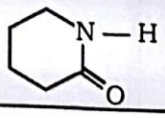
(i) (ii) (iii) (iv)

(b)



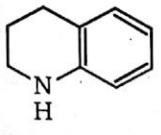
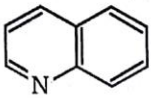
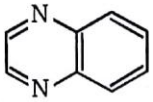
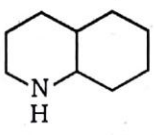
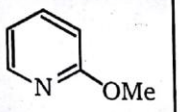
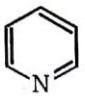
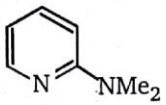
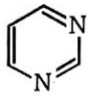
(i) (ii) (iii) (iv)

9. In each of the following sections four compounds are listed. In the box under each formula enter a number (1 to 4) indicating the order of acid strength (1 is strongest & 4 is weakest).

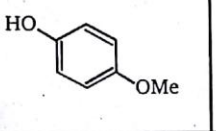
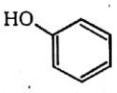
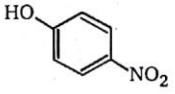
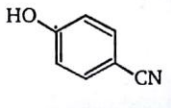
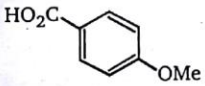
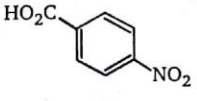
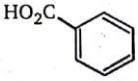
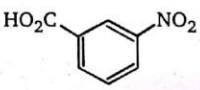
(a)	$CH_3CH_2CH_2CO_2H$	$CH_3CH_2CHBrCO_2H$	$ClCH_2CH_2CH_2CO_2H$	$CH_3CCl_2CO_2H$
(b)	$C_6H_5CH_2OH$	$C_6H_5CO_2H$	$C_6H_5OCH_3$	C_6H_5OH
(c)				
(d)				

10. In the two questions below, you are asked to rank the relative strengths of illustrated acids and bases. Use your knowledge of resonance and inductive to answer this.

A. For the series of bases shown below, rank the set from strongest to weakest.

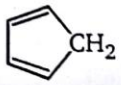
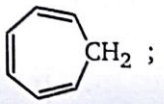
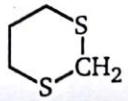
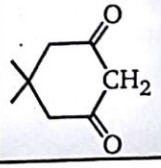
(i)						Strongest
	(a)	**(b)**	**(c)**	**(d)**		Weakest
(ii)						Strongest
	(a)	**(b)**	**(c)**	**(d)**		Weakest

B. For the series of acids shown below, rank the set from strongest to weakest.

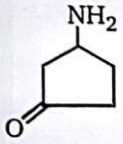
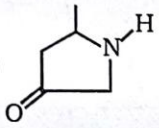
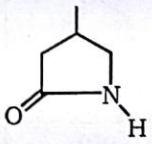
(i)						Strongest
	(a)	**(b)**	**(c)**	**(d)**		Weakest
(ii)						Strongest
	(a)	**(b)**	**(c)**	**(d)**		Weakest

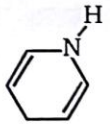
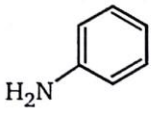
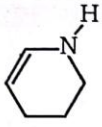
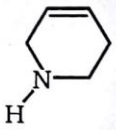
11. In each of the following sections four compounds are listed. (Decreasing order of acidic strength, 1 is strongest & 4 is weakest).

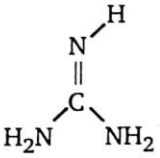
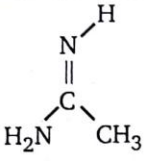
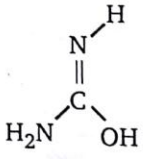
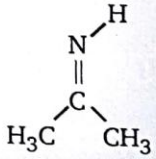
(a)	$CH_2(CO_2C_2H_5)_2$	$CH_3COCH_2CO_2C_2H_5$	$(CH_3CO)_2CH_2$	$RC \equiv CH$
(b)	RCH_2NO_2	RSO_2CH_3	$(C_6H_5)_3CH$	$RCOCH_3$
(c)	$CH_2(C \equiv N)_2$	$CH_2(NO_2)_2$	$HC \equiv N$	$RCH_2CO_2C_2H_5$

(d)		 ;		

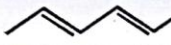
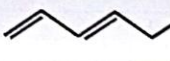
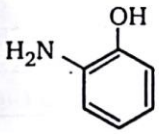
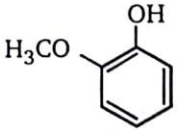
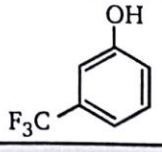
12. Rank in the order of increasing basic strength.

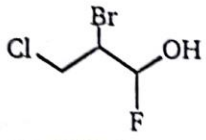
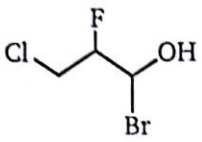
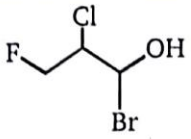
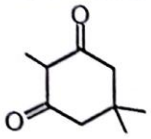
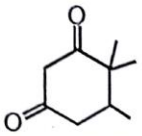
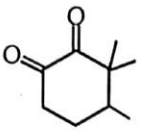
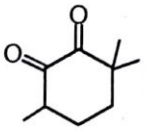
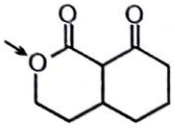
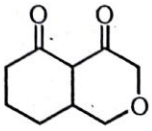
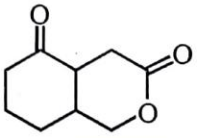
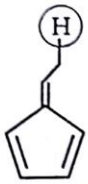
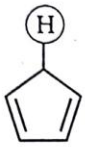
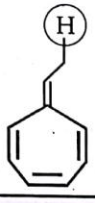
A. (a)  (b)  (c) 

B. (a)  (b)  (c)  (d) 

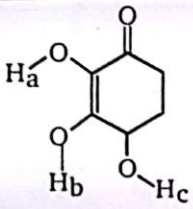
C. (a)  (b)  (c)  (d) 

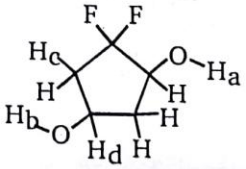
13. Compare acidic strength of the following (Write your answer in box).

A.					
	(a)	(b)	(c)		
B.					
	(a)	(b)	(c)		

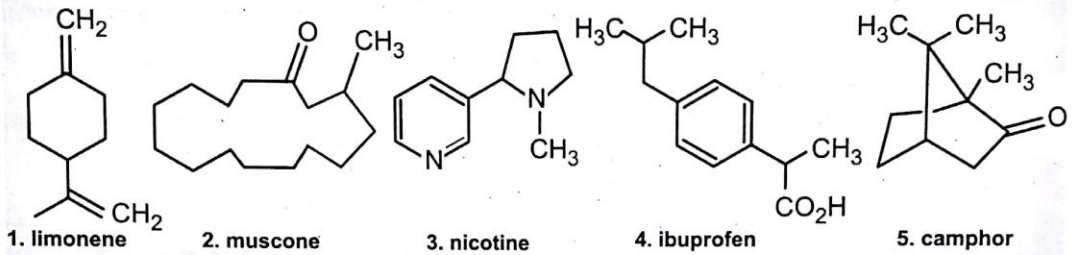
C.					
	(a)	(b)	(c)		
D.					
	(a)	(b)	(c)	(d)	
E.					
	(a)	(b)	(c)		
F.					
	(a)	(b)	(c)		

14. Arrange the hydrogens in increasing order of their acidic strengths.

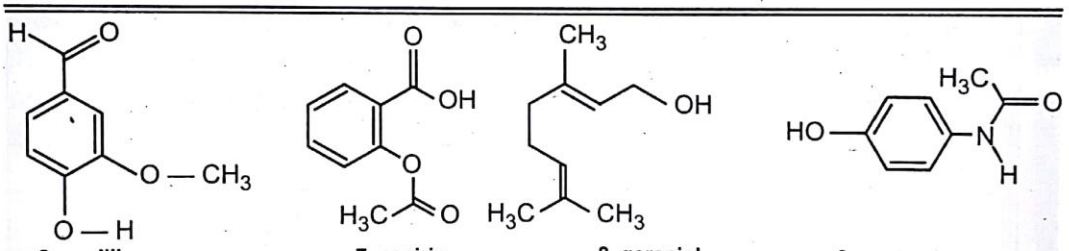
A. 

B. 

15. The compounds whose structures are shown below, incorporate a variety of functional groups. The question on the right ask you to identify which compounds have a specific functional group. For each compound that has the designed group, enter the appropriate number. The aromatic rings should not be counted as double bonds.



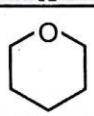
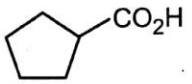
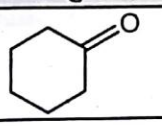
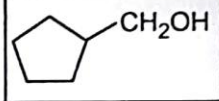
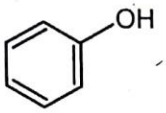
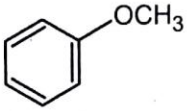
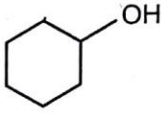
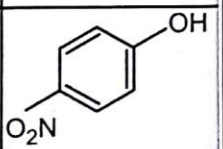
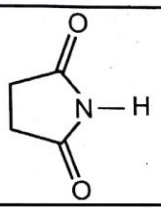
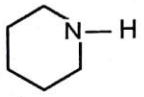
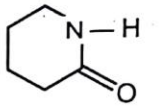
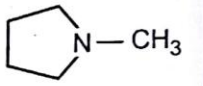
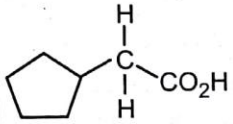
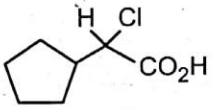
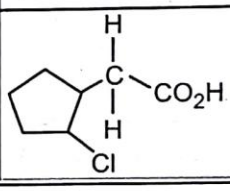
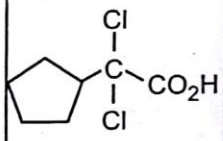
1. limonene 2. muscone 3. nicotine 4. ibuprofen 5. camphor



6. vanillin 7. aspirin 8. geraniol 9. acetaminophenol

A.	Which have carbon-carbon double bonds ?	
B.	Which have a ketone carbonyl group ?	
C.	Which have an aldehyde carbonyl group ?	
D.	Which have aromatic rings ?	
E.	Which have a hydroxy group ?	
F.	Which have ether groups ?	
G.	Which have an ester group ?	
H.	Which have an amide group ?	
I.	Which have a carboxylic acid group ?	

16.

Problem	A	B	C	D
1				
2				
3				
4				

A. Which is the strongest acid in 1?

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

B. Which is weakest acid in 1 ?

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

C. Which is the strongest acid in 2 ?

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

D. Which is weakest acid in 2 ?

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

E. Which is the strongest acid in 3 ?

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

F. Which is weakest acid in 3 ?

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

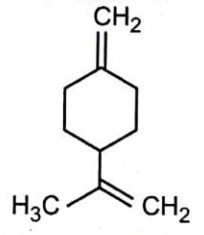
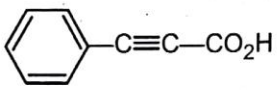
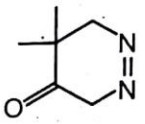
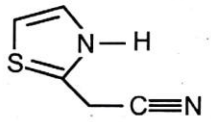
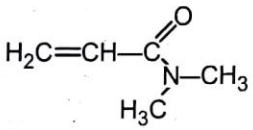
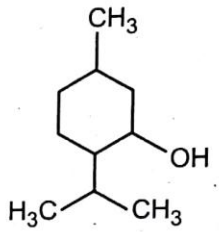
G. Which is the strongest acid in 4 ?

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

H. Which is weakest acid in 4 ?

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

17. For each of the six structural formulae (**A** through **F**), shown below, five questions are posed. The answer to each is a number that should be entered in the appropriate answer box.

		
A	**B**	**C**
		
D	**E**	**F**

A. (i) Number of sp^3 carbons : .....

(ii) Number of sp^2 carbons : .....

(iii) Number of *sp* carbons : .....

(iv) Number of carbon-carbon σ-bonds : .....

(v) Number of π-bonds to carbon : .....

B. Number of sp^3 carbons : .....

Number of sp^2 carbons : .....

Number of *sp* carbons : .....

Number of carbon-carbon σ-bonds : .....

Number of π-bonds to carbon : .....

C. Number of sp^3 carbons : .....

Number of sp^2 carbons : .....

Number of *sp* carbons : .....

Number of carbon-carbon σ-bonds : .....

Number of π-bonds to carbon :.....

D. (i) Number of sp^3 carbons : .....

(ii) Number of sp^2 carbons : .....

(iii) Number of *sp* carbons : .....

(iv) Number of carbon-carbon σ-bonds : .....

(v) Number of π-bonds to carbon : .....

E. Number of sp^3 carbons : .....

Number of sp^2 carbons : .....

Number of *sp* carbons : .....

Number of carbon-carbon σ-bonds : .....

Number of π-bonds to carbon :.....

F. Number of sp^3 carbons : .....

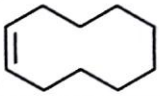
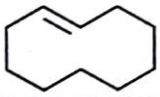
Number of sp^2 carbons : .....

Number of *sp* carbons : .....

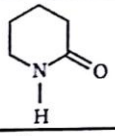
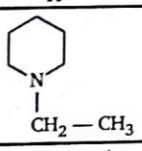
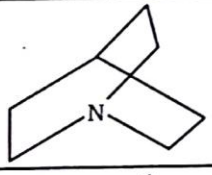
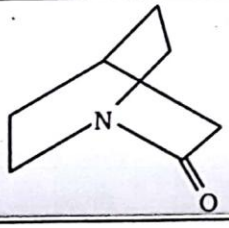
Number of carbon-carbon σ-bonds : .....

Number of π-bonds to carbon :.....

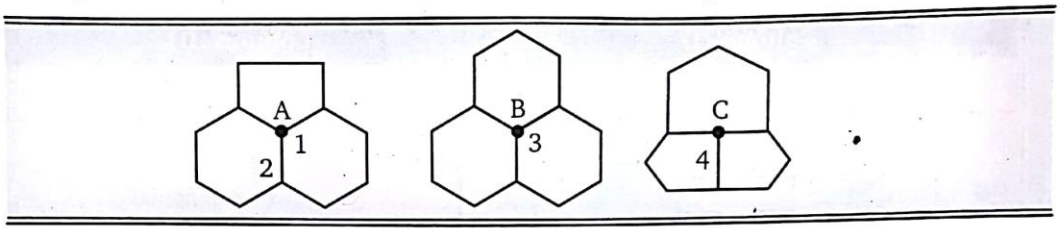
18. Match the column (I) and (II). (Matrix)

Column (I)		Column (II)	
	Molecule		Property
(a)		(p)	*cis*-compound
(b)		(q)	*trans*-compound
(c)		(r)	Highest heat of combustion
(d)		(s)	lowest heat of combustion

19. Match the column (I) and (II).

Column (I)		Column (II)	
	Molecule		pK_a of Conjugate acid
(a)		(p)	0.8
(b)		(q)	5.33
(c)		(r)	10.65
(d)		(s)	10.95

20. The junctures centred on atoms A, B and C on the given structure.



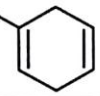
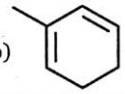
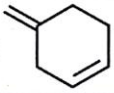
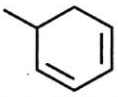
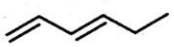
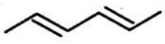
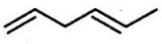
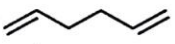
A. Which juncture has the greatest deviation from planarity ?

(a) A (b) B (c) C (d) Cannot be predicted

B. Of the carbon-carbon bonds, (shown above) numbered from 1 to 4, which represent the most favourable site for H_2 addition ?

(a) 1 (b) 2 (c) 3 (d) 4

21. Select the most stable structure in each of the following

Part (A)			
(a) 	(b) 	(c) 	(d) 
Part (B)			
(a) 	(b) 	(c) 	(d) 
Part (C)			
(a) $H_2C=CH-CH=CH-CH_3$		(b) $H_2C=C=CH-CH_2-CH_3$	
(c) $H_3C-CH=C=CH-CH_3$		(d) $H_2C=CH-CH_2-CH=CH_2$	

22. Match the column I and II. (Matrix)

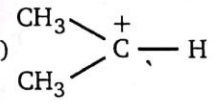
	Column (I)		Column (II)
(a)	$-NO_2$	**(p)**	$-m$ effect
(b)	$-O^-$	**(q)**	$+m$ effect
(c)	$-O-CH_3$	**(r)**	$+I$ effect
(d)	$-C\equiv N$	**(s)**	$-I$ effect

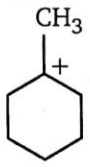
23. Match the column I and II. (Matrix)

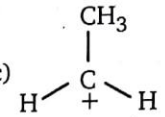
	Column (I)		Column (II)
(a)	$H_3C-CH=CH-CH_3$	**(p)**	Dipole (*cis* > *trans*)
(b)	$H_3C-CH=CH-CN$	**(q)**	Dipole (*trans* > *cis*)
(c)	$H_3C-CH=CH-Cl$	**(r)**	Melting point ((*trans* > *cis*)
(d)	$Cl-CH=CH-Cl$	**(s)**	Boiling point (*cis* > *trans*)

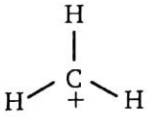
24. Identify the most stable structure in each of the following :

Part (A)

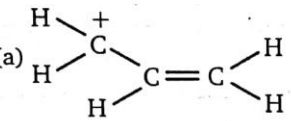
(a) 

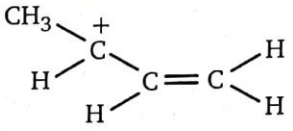
(b) 

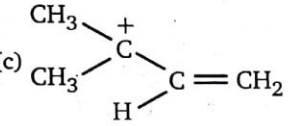
(c) 

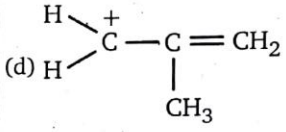
(d) 

Part (B)

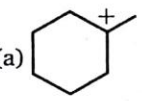
(a) 

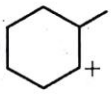
(b) 

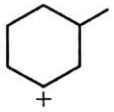
(c) 

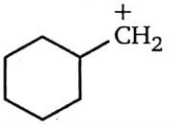
(d) 

Part (C)

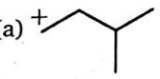
(a) 

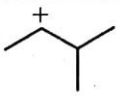
(b) 

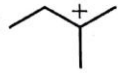
(c) 

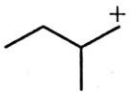
(d) 

Part (D)

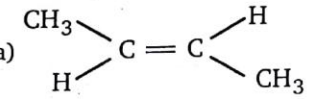
(a) 

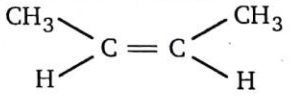
(b) 

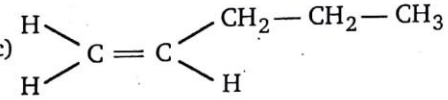
(c) 

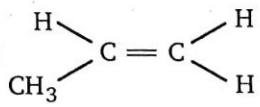
(d) 

Part (E)

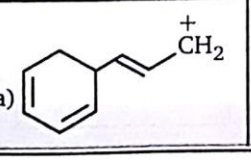
(a) 

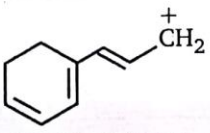
(b) 

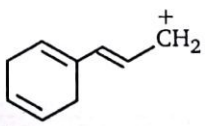
(c) 

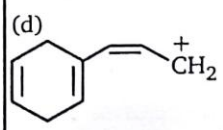
(d) 

Part (F)

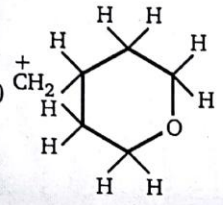
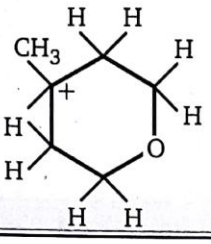
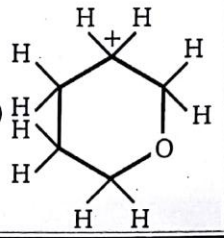
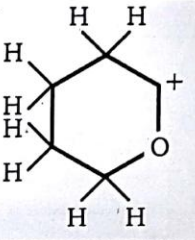
(a) 

(b) 

(c) 

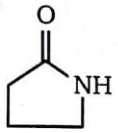
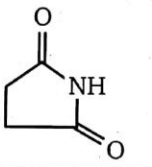
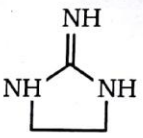
(d) 

Part (G)

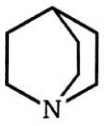
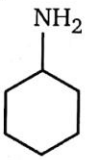
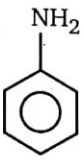
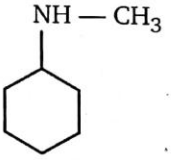
(a) 	(b) 	(c) 	(d) 

25. Identify the most basic compound in the following.

Part (A)

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

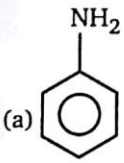
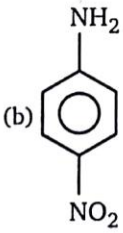
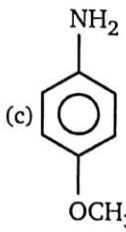
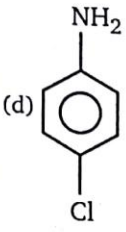
Part (B)

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

Part (C)

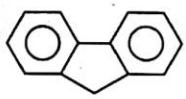
(a) NaOH	(b) $NaOOCCH_3$	(c) $NaOCH_3$	(d) $NaNH_2$

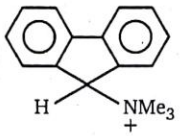
Part (D)

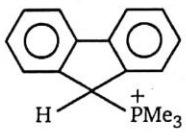
(a) 	(b) 	(c) 	(d) 

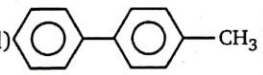
26. Identify the most acidic hydrogen containing compound from the following.

Part (A)

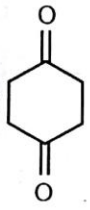
(a) 

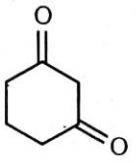
(b) 

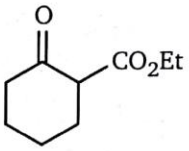
(c) 

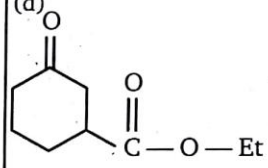
(d) 

Part (B)

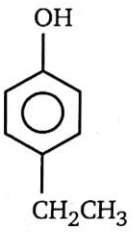
(a) 

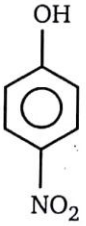
(b) 

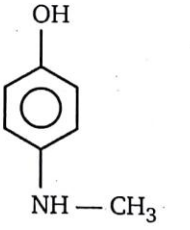
(c) 

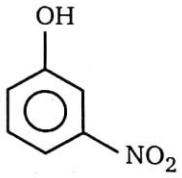
(d) 

Part (C)

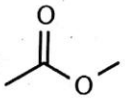
(a) 

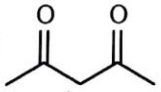
(b) 

(c) 

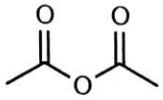
(d) 

Part (D)

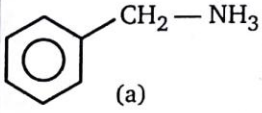
(a) 

(b) 

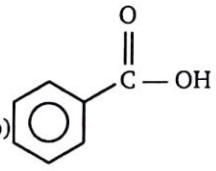
(c) 

(d) 

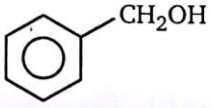
Part (E)



(a)

(b) 

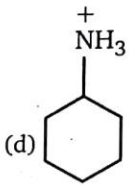
(c) 

(d) 

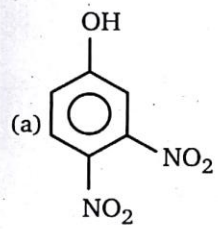
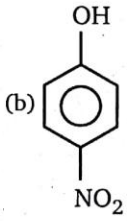
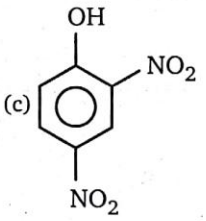
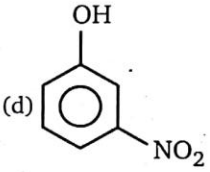
Part (F)

(a) CH_3CH_2OH	(b) $CH_3CH_2NH_2$	(c) $CH_3-C\equiv CH$	(d) $CH_3-CH=CH_2$

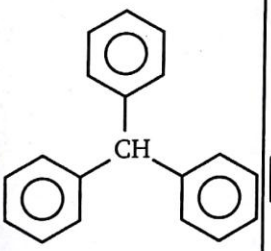
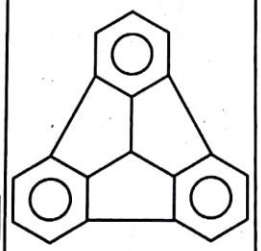
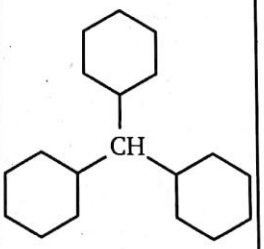
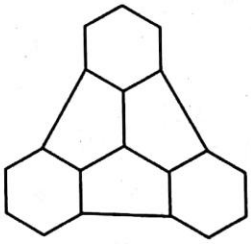
Part (G)

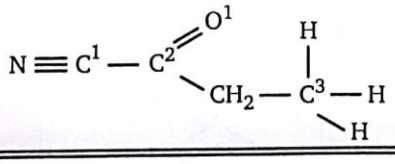
(a) CH_3-CO_2H	(b) $CH_2(NH_3^{\oplus})-CO_2H$	(c) 	(d) 

Part (H)

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

Part (I)

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

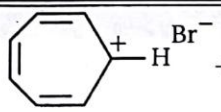
27. 

Give the type of hybridization present at each atom.

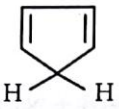
(i) N —..... (ii) C_1 —..... (iii) C_2 —.....

(iv) O_1 —..... (v) CH_2 —..... (vi) C_3 —.....

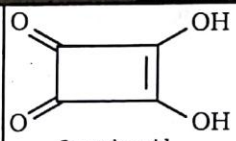
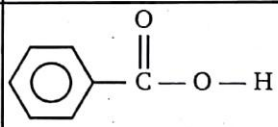
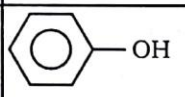
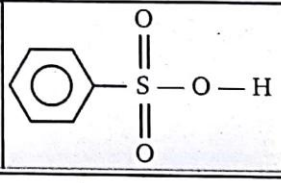
28. Predict the direction of the following equilibrium. Write your answer in the box given below.

(a)  $+Ph_3\overset{\oplus}{C}\,\overset{-}{Br}$ $\rightleftharpoons$  $+ Ph_3CH$ ☐

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

(b)  $+ CH_4$ $\rightleftharpoons$  $+$ $\overset{\oplus}{K}\,\overset{-}{C}H_3$ ☐

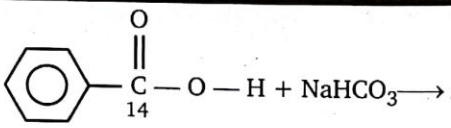
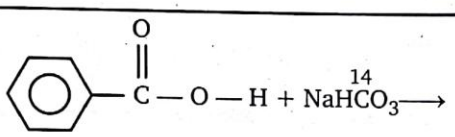
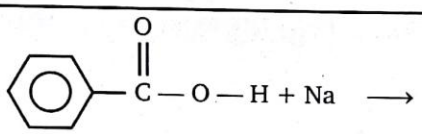
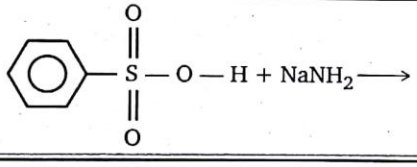
29. **Match the column I and II. (Matrix)**

	Column (I)		Column (II)
(a)	$NaHCO_3$ will react with	**(p)**	 Squaric acid
(b)	Na will react with	**(q)**	
(c)	NaOH will react with	**(r)**	
(d)	$NaNH_2$ will react with	**(s)**	

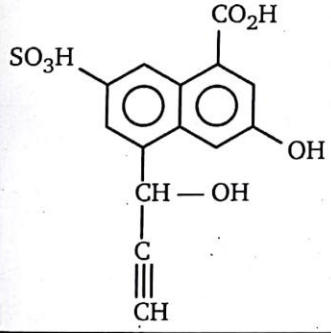
30. **Match the column I and II.**

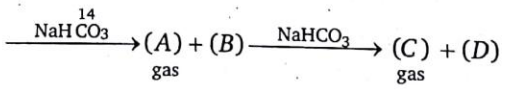
	Column (I)		Column (II)
	Acid		pK_a
(a)	CH_3-CO_2H	**(p)**	5.69
(b)	$(CH_3)_3\overset{\oplus}{N}CH_2CO_2H$	**(q)**	4.27
(c)	$(CH_3)_3\overset{\oplus}{N}(CH_2)_4CO_2H$	**(r)**	1.83
(d)	$\overset{-}{O}_2C-CH_2-CO_2H$	**(s)**	4.80

31. Match the column I and II.

	Column (I)		Column (II)
(a)		**(p)**	NH_3
(b)		**(q)**	$^{14}CO_2$
(c)		**(r)**	CO_2
(d)		**(s)**	H_2

32.

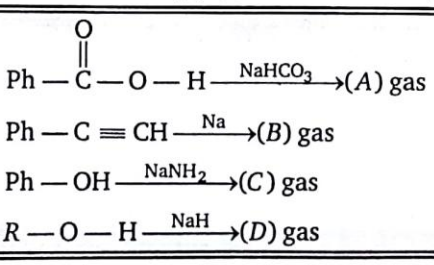




Sum of molecular mass of gas $(A + C)$ is :

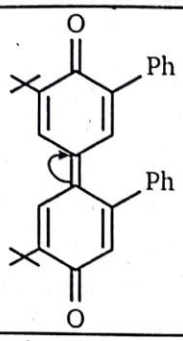
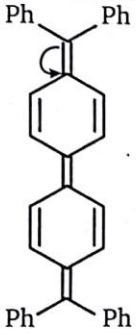
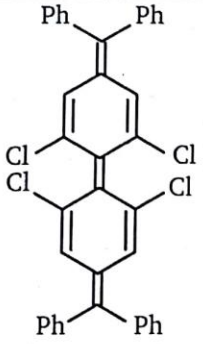
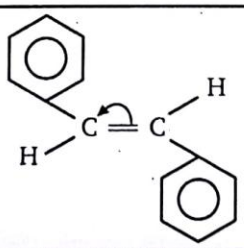
(a) 88 (b) 90 (c) 92 (d) 40

33.

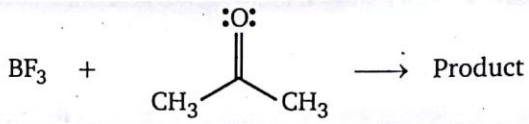


Sum of molecular mass of gas $A + B + C + D$ is :

34. Match the column I and II.

Column (I)		Column (II)	
Molecule		Rotational free energy barrier	
(a)		**(p)**	180 kJ/mol
(b)		**(q)**	88.3 kJ/mol
(c)		**(r)**	21 kJ/mol
(d)		**(s)**	Negative barrier

35. Consider the following reaction of boron trifluoride (BF_3) and acetone :



A. What is the critical HOMO (nucleophile) of this reaction ?

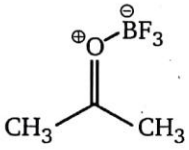
(a) non-bonding orbital on boron
(b) σ-orbital of acetone
(c) π-orbital of acetone
(d) non-bonding electron pair orbital on oxygen

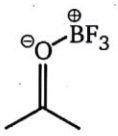
B. What is the critical LUMO (electrophile) of the reaction ?

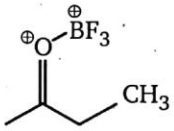
(a) *p*-orbital of BF_3
(b) σ-orbital of BF_3
(c) π* orbital of acetone
(d) non-bonding electron pair orbital on oxygen

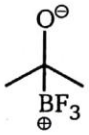
C. Which of the following is the correct product of this reaction ?

(Lone electron pairs are not shown explicitly).

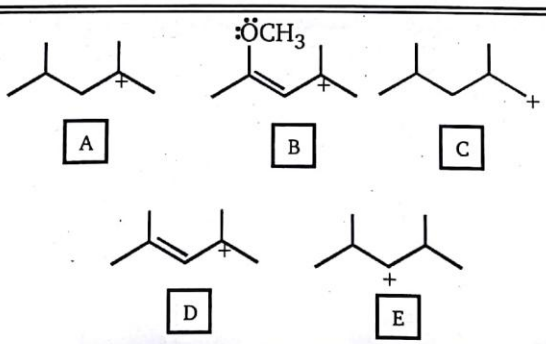
(a) 

(b) 

(c) 

(d) 

36. Rank the following carbocations according to stability (1 = most stable, 5 = least stable).



Put the answer in the boxes.

☐ ☐ ☐ ☐ ☐

37. Among the given molecules, identify aromatic, anti-aromatic and non-aromatic molecules.

(1) 

(2) 

(3) 

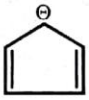
(4) 

(5) 

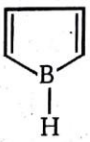
(6) 

(7) 

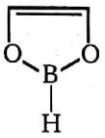
(8) 

(9) 

(10) 

(11) 

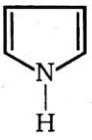
(12) 

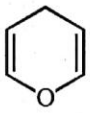
(13) 

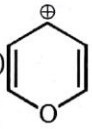
(14) 

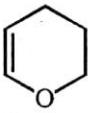
(15) 

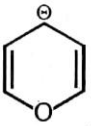
(16) 

(17) 

(18) 

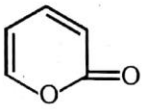
(19) 

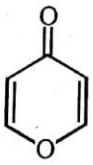
(20) 

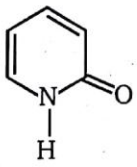
(21) 

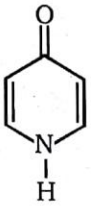
(22) 

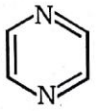
(23) 

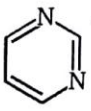
(24) 

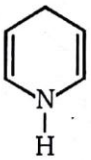
(25) 

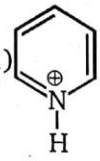
(26) 

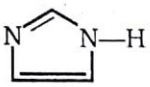
(27) 

(28) 

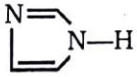
(29) 

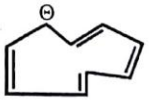
(30) 

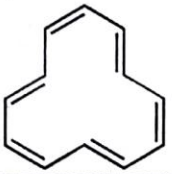
(31) 

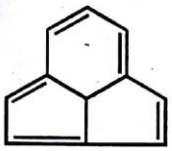
(32) 

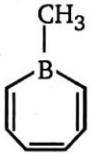
(33) 

(34) 

(35) 

(36) 

(37) 

(38) 

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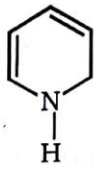
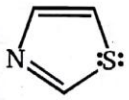
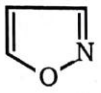
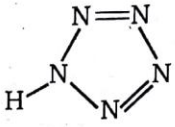
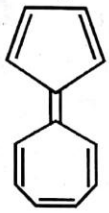
(40) 

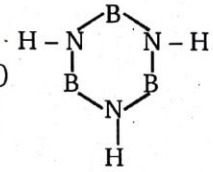
(41) 

(42) 

(43) 

(44) 

(45) 

(46) 

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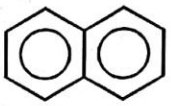
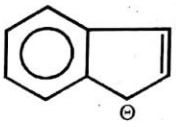
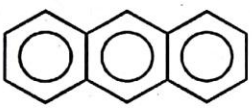
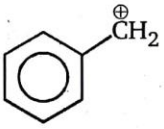
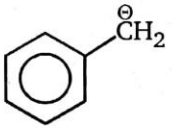
(47) 

(48) 

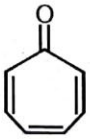
(49) 

(50) 

(51) 

(52) 

(53) 

(54) 

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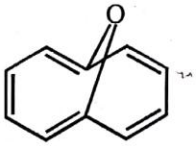
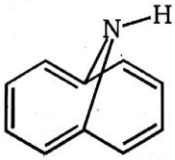
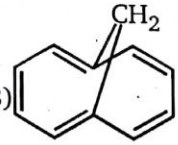
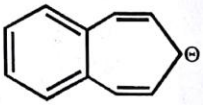
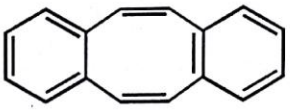
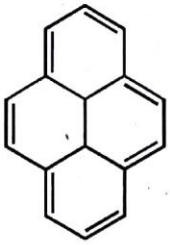
(56) 

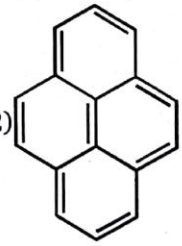
(57) 

(58) 

(59) 

(60) 

(61) 

(62) 

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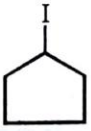
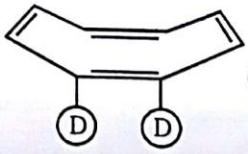
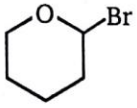
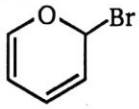
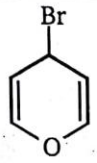
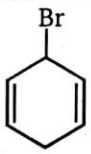
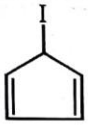
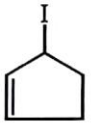
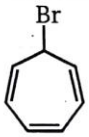
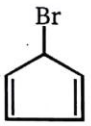
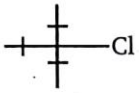
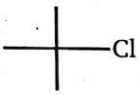
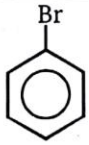
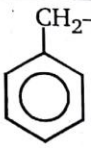
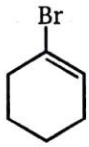
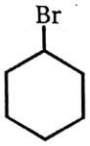
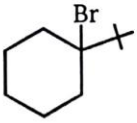
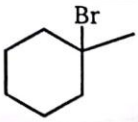
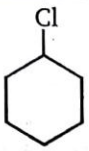
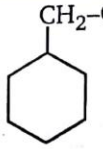
(64) 

(65) 

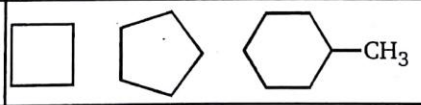
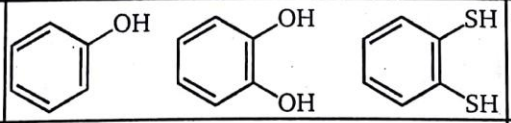
(66) 

38. Among the given pairs, which is more reactive towards $AgNO_3$ (or) toward hydrolysis.

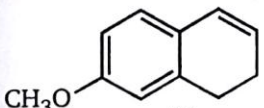
	Compound (A)	Compound (B)	Put the Answer here
1.			
2.			
3.			
4.			
5.			
6.	CH_3-O-CH_2-Cl	$CH_3-CH_2-CH_2-Cl$	
7.			
8.			
9.			

10.			

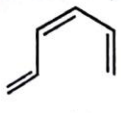
39. Put the answer in boxes given as directed.

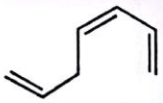
S.No.	Property	Molecules	Correct Answer	Name of force responsible for the property
A.	highest boiling point	NCl_3 $ClNH_2$ NH_4Cl NH_3		
B.	highest boiling point			
C.	most soluble in water			
D.	highest solubility in benzene			

40. Circle any conjugated portions of these molecules.


(A)

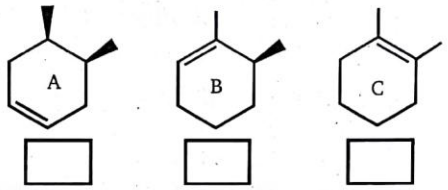
$CH_2 = C = CH - CH = CH_2$
(B)


(C)

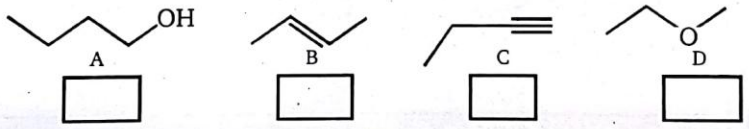

(D)

41. Arrange in the order as directed -

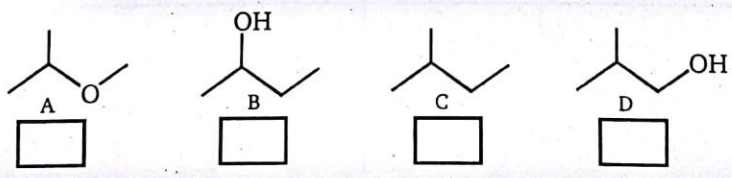
A. The given alkenes in the order of their stability (1- most stable, 3-least stable).



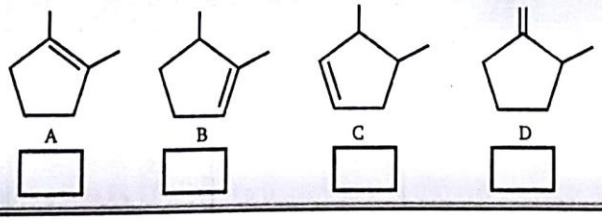
B. Arrange the following in the order of their acidic strength (1-most acidic, 4-least acidic)



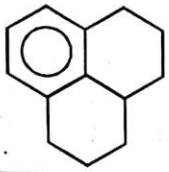
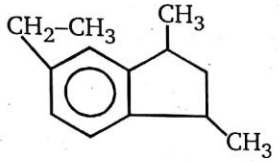
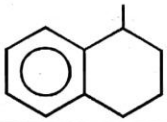
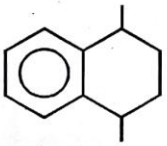
C. Arrange the following molecules in order of expected boiling point. (1=highest bpt ; 4=lowest bpt.)



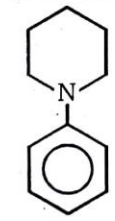
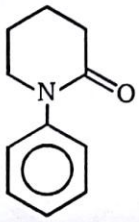
D. Arrange the following alkenes in order of their stability. (1 = most stable ; 5 = least stable).

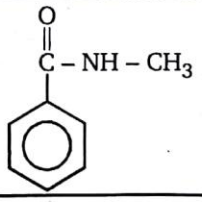
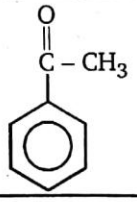
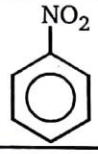
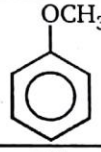
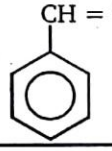
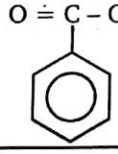
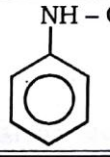


42. Match the column. (Matrix)

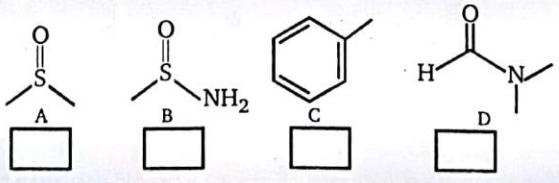
Column (I)		Column (II)	
Compounds		Number of Benzylic hydrogen	
(a)		(p)	2
(b)		(q)	3
(c)		(r)	4
(d)		(s)	5

43. Identify (+M) mesomeric & (–M) group of following.

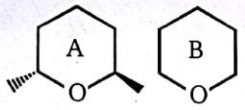
	+M	–M	–I	+I
				
				

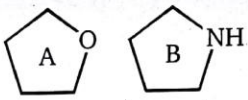
				
				
				
				
				
				
				

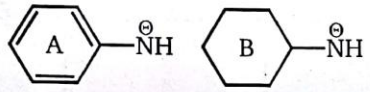
44. Identify the following solvents as polar protic (PP), polar aprotic (PA), non-polar protic (NPP) or non-polar aprotic (NPA).



45. Identify the stronger nucleophile in each pair.

(i) 

(ii) 

(iii) 

(iv) NH_3 CH_4
A B

46. Encircle the molecule as directed :

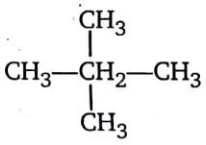
(a) Which has higher boiling point : HBr or HCl

(b) Which has a higher boiling point : CH_3-CH_2-OH or $CH_3-CH=O$

(c) Which is more miscible with methanol (CH_3OH) : $CH_3-CH_2-CH_2-CH_2-CH_3$

or $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$

(d) Which has a higher melting point : CH_4 or $CH_3-CH_2-CH_3$

(e) Which has a higher boiling point : $CH_3-CH_2-CH_2-CH_2-CH_3$ or 

47. Encircle the molecule as directed :

(a) Which is more stable : BH_3 or BF_3

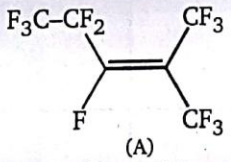
(b) Which is a stronger base : HO^- or H_2O

(c) Which is a stronger base : HO^- or HS^-

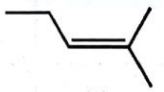
(d) Which is a stronger acid : HCl or HI

(e) Which is a stronger acid : HOCl or HCl

48. Explain why **A** has lower boiling point than **B** ?

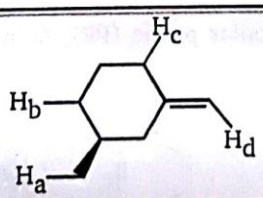


(A)
b.p. = 58°C

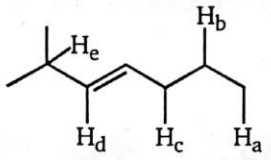


(B)
b.p. = 67°C

49. Arrange the protons shown in the decreasing order of their approximate bond energies.

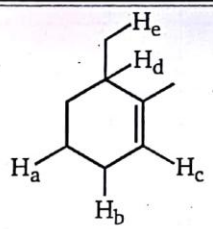


50. Consider the H-atoms in the molecule given below and answer the following.



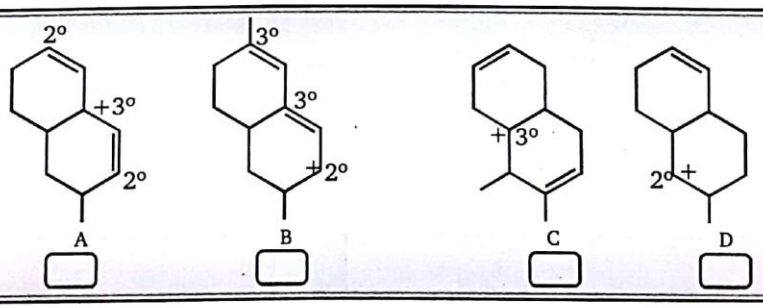
(A) Identify the type (1°, 2° or 3° alkyl, vinyl, allyl etc.) of these H-atoms.
(B) Arrange them in the decreasing order of their case of abstraction (easiest first)

51. Consider the molecule shown below and answer with respect to $H_a \longrightarrow H_e$

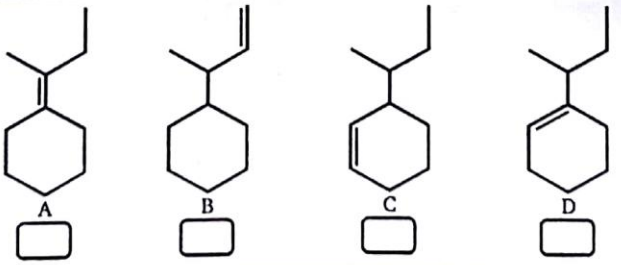


(A) Identify the type of H-atom (1°, 2°, 3° alkyl, vinyl or allyl)
(B) Arrange them in decreasing order of their bond energy.

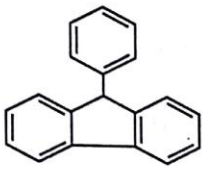
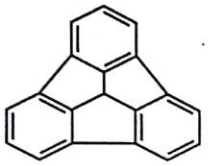
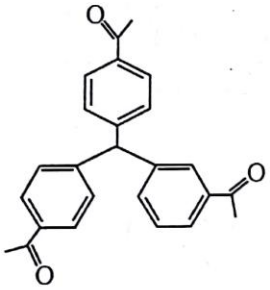
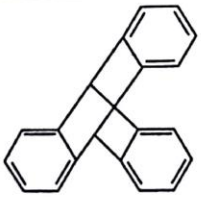
52. Rank the following carbocations in order of stability (1 = most stable).



53. Rank the following alkenes according to energy (1 = lowest energy).

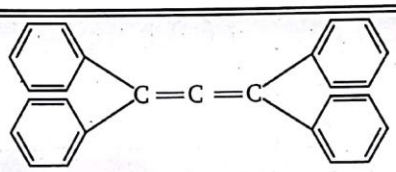


54. Match the column:

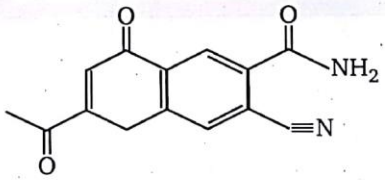
Column (I) (Compounds)		Column (II) (Double bond equivalent value)	
(a)		(p)	11
(b)		(q)	12
(c)		(r)	13
(d)		(s)	14
		(t)	15

SUBJECTIVE PROBLEMS

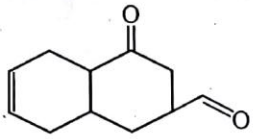
1. How many 2° carbon in the following ?



2. Find out the double bond equivalent (DBE) value of the given following compound:

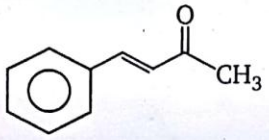


3. Total number of functional groups present in the given following compound :

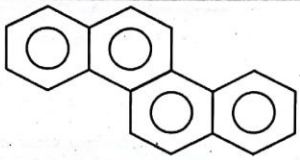


4. Total number of α-hydrogen in the given following compound is:

5. How many carbon atom present in the parent chain in the given following compound?

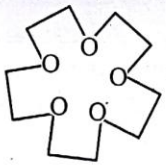


6. Total number of DBE value in :



7. How many isomers of $C_4H_{10}O$ reacts with Na metal to evolve H_2 gas ? (excluding stereoisomer)

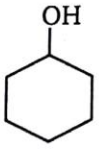
8.

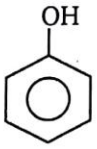


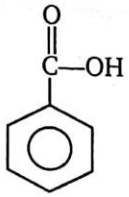
[x]-crown-[y]-ether.

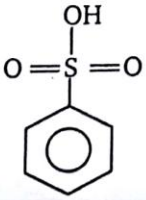
value of $\frac{x+y}{3}$ = ?

9. Which of the given following compound will react with $NaHCO_3$ or soluble in $NaHCO_3$?

(a) 

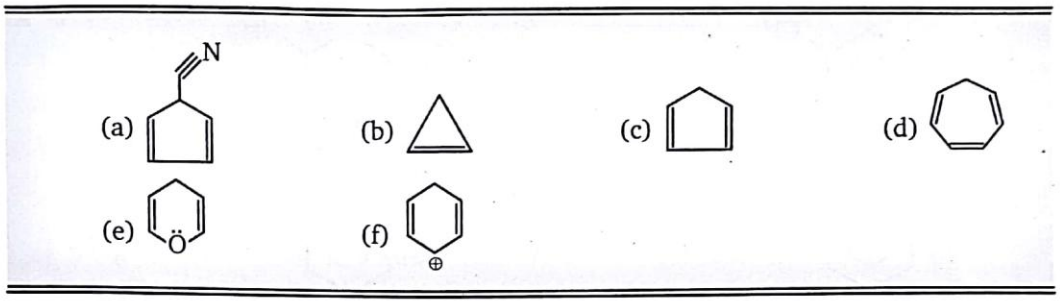
(b) 

(c) 

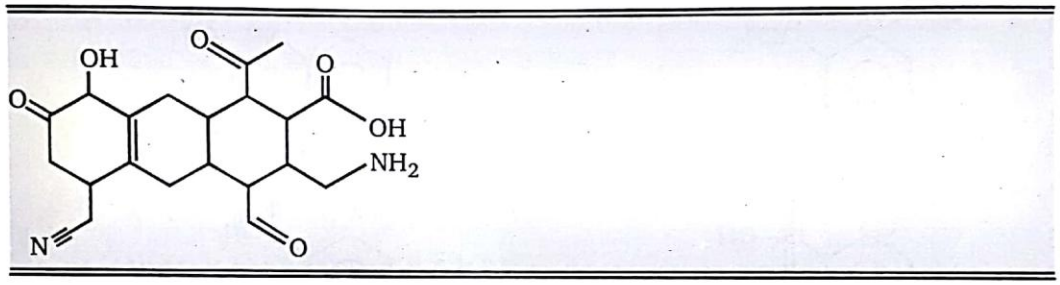
(d) 

(e) $CH_3 - C \equiv CH$

10. How many compound are stable after deprotonation ?

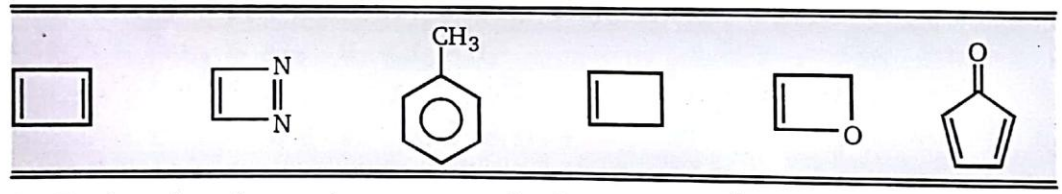


11.

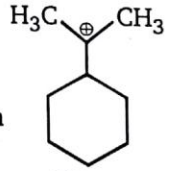


Sum of types of functional group and DBE value for given compound is X so the value of $X-10$ is

12. P = Number of anti-aromatic compound, so the value of x is :



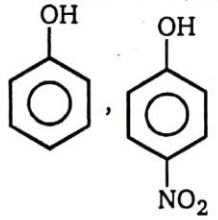
Q = Total number of resonating structures of carbonate ion $[CO_3^{2-}]$



R = Number of α-hydrogen in given carbocation

S = Total number of geometrical isomers of $CH_3-CH=CH-CH=CH_2$

T = Number of compound more acidic then CH_3CH_2OH

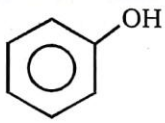


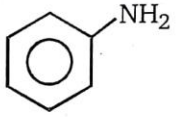
,

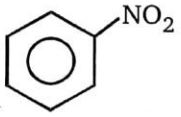
, CH_3COOH , CH_3SO_3H

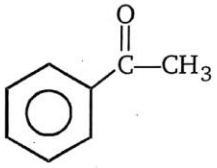
Sum of $(P+Q+R+S+T)-15$ is :

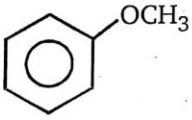
13. x = number of $(+M)$ group attached with phenyl ring, so the value of x is.

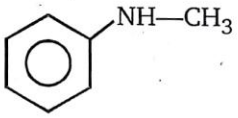
(a) 

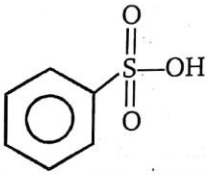
(b) 

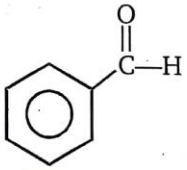
(c) 

(d) 

(e) 

(f) 

(g) 

(h) 

ANSWERS — LEVEL 2

1. a – 4; b – 3; c – 2; d – 1

2. a – 3; b – 2; c – 1

3. A – b; B – e; C – a; D – b

4. A – a, c, f, g, k, l; B – b, d, h, j; C – e, i

5. A –d; B – a

6. C < B < A

7. a – 2, 1, 4, 3; b – 1, 2, 3, 4 ; c – 3, 4, 1, 2; d – 3, 2, 4, 1

8. a – iv > ii > i > iii; b – iii > iv > i > ii

9. a – 4, 2, 3, 1; b – 3, 1, 4, 2; c – 2, 1, 3, 4; d – 2, 3, 4, 1

10. A (i) – d > b > c > a; (ii) – c > a > b > d

B (i) – c > d > b > a; (ii) – b > d > c > a

11. (a) 3 2 1 4; (b) 2 1 4 3; (c) 3 1 2 4; (d) 3 4 1 2

12. A – c < a < b; B – b < a < c < d; C – d < b < c < a

13. A – c < a < b; B – a < b < c; C – c < b < a; D – d < c < a <b; E – c < a < b; F – a > b > c

14. A – $H_c < H_a < H_b$; B – $H_d < H_c < H_b < H_a$

15. A – 1, 3, 4, 6, 7, 8, 9; B – 2, 5; C – 6; D – 3, 4, 6, 7, 9; E – 6, 8, 9; F – 6; G – 7; H – 9; I – 4,7

16. A – b; B – a; C – d; D – b; E – a; F – d; G – d; H – a

17.

	(i)	(ii)	(iii)	(iv)	(v)
A	6	4	0	10	2
B	0	7	2	9	6
C	5	1	0	5	1
D	1	3	1	3	4
E	2	3	0	2	2
F	10	0	0	10	0

18. a – q; b – p, r; c – p, s; d – q

19. a – p; b– r; c – s; d – q

20. A – c; B – d

21. A – b; B – b; C – a

22. a – p, s; b – q, r; c – q, s; d – p, s

23. a – p, r, s; b – q, r; c – q, r; d – p, r, s

24. A – b; B – c; C – a; D – c; E – a; F – b; G – d

25. A – d; B – a; C – d; D – c

26. A – c; B – b; C – b; D – b; E – b; F – a; G – b; H – c; I – b

27. i. – *sp*; ii – *sp*; iii – sp^2 ; iv – sp^2; v – sp^3; vi – sp^3

28. a – forward b – backward

29. a – p. q, s; b – p, q, r, s; c – p, q, r, s; d – p, q, r, s

30. a – s; b – r; c – q; d – p

31. a – r; b – q; c – s; d – p

32. b

33. 65

34. a – q; b – r; c – s; d – p

35. A – d; B – a; C – a

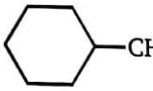
36. A – 3; B – 1; C – 5; D – 2; E – 4

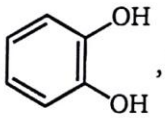
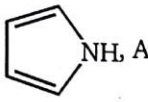
37. Aromatic— 3, 4, 5, 9, 12, 13, 15, 16, 17, 19, 22, 24, 25, 26 ,27, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51 , 53, 54, 56, 57, 58, 61, 62, 63, 66

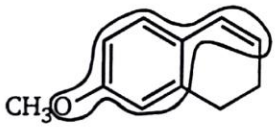
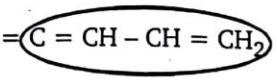
Non-aromatic— 1, 6, 7, 8, 18, 20, 23, 30, 40, 55, 64, 65

Anti-aromatic— 2, 10, 11, 14, 21, 36, 52, 59, 60

38. 1 – B; 2 – A; 3 – B; 4 – A; 5 – A; 6 – A; 7 – B; 8 – B; 9 – A; 10 – A

39. A. NH_4Cl, cation-anion interactoin B.  CH_3, van der Waals' forces

C.  , H-bonding (Also dipole-dipole) D.  NH, Aromatic stacking

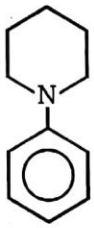
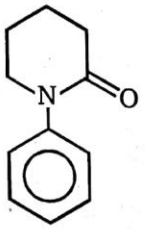
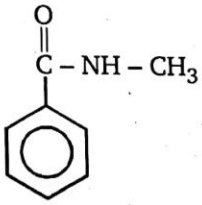
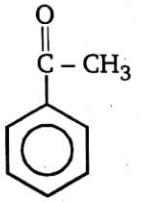
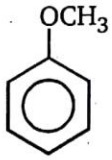
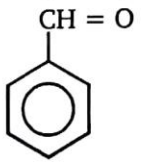
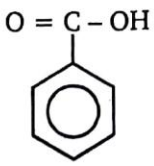
40.  $CH_2 =$   

41. **A.** A – 3, B – 2, C – 1, **B.** A – 1, B – 3, C – 2, D – 4

C. A – 3, B – 1, C – 4, D – 2 **D.** A – 1, B – 2, C – 3, D – 4

42. a – s; b – r; c – q; d – p

43.

		+M	–M	–I	+I
(1)		✓	×	✓	×
(2)		✓	×	✓	×
(3)		×	✓	✓	×
(4)		×	✓	✓	×
(5)		×	✓	✓	×
(6)		✓	×	✓	×
(7)		×	✓	✓	×
(8)		×	✓	✓	×

(9) 

✓ × ✓ ×

44. A – PA; B – PP; C – NPA; D – PA

45. (i) B, (ii) B, (iii) B, (iv) A

46. (a) $\ce{HBr}$; (b) $\ce{CH3-CH2-OH}$; (c) $\ce{CH3-CH2-CH2-CH2-CH3}$;
(d) $\ce{CH3-CH2-CH3}$; (e) $\ce{CH3-CH2-CH2-CH2-CH3}$

47. (a) $\ce{BF3}$; (b) $\ce{HO^-}$; (c) $\ce{HO^-}$; (d) $\ce{HI}$; (e) $\ce{HOCl}$

48. In A, highly electronegative F-atoms are present at the periphery. In liquid term these F-atoms will repel each other due to partial negative charge and thus A will have lower b.pt.

49. $H_d > H_a > H_b > H_c$

50. A– H_a =1° alkyl; H_b = 2° alkyl; H_c =2° allyl; H_d = vinyl; H_e = 3° allyl
B– Easiest to abstract: $H_e > H_c > H_b > H_a > H_d$ Hardest to abstract

51. A– H_a = 2° alkyl; H_b = 2° allyl; H_c = vinyl; H_d = 3° allyl; H_e = 1° alkyl
B– $H_c > H_e > H_a > H_b > H_d$

52. A–2; B–1; C–3; D–4

53. A–1; B–4; C–3; D–2

54. a-r; b-t; c-t; d-s

Subjective Problems

1. 21 **2.** 11 **3.** 3 **4.** 6 **5.** 4 **6.** 13 **7.** 4 **8.** 7

9. 2 (c, d) **10.** 3 (a, c, f) **11.** 7

12. $P = 3, Q = 3, R = 7, S = 2, T = 4 = 19 - 15 = \mathbf{4}$ **13.** 4