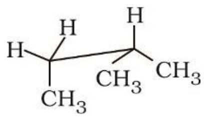
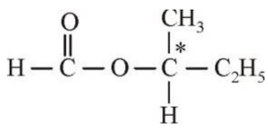
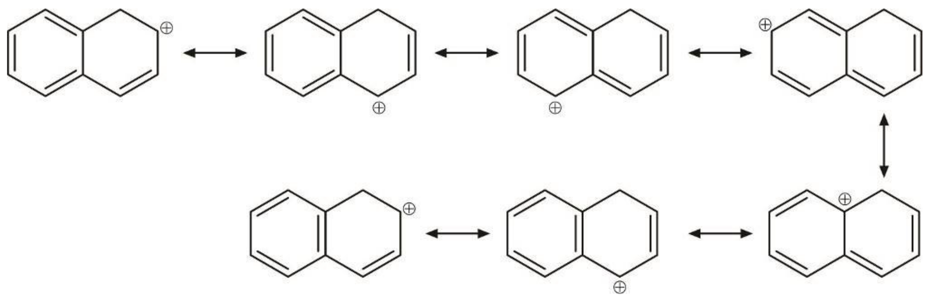
Miscellaneous Exercise Question Bank

1.(B) 

2.(ABCD) All are electron deficient having vacant orbital.

3.(B) 

4.(A) 

5.(A) $FeBr_3 \rightarrow$ has empty d-orbital, behaves as electrophile.

6.(A) Bond strength depends upon stability of free radical formed.

7.(C) $4n\pi\, e^-$

$\rightarrow$ Complete conjugation

$\rightarrow$ Anti aromatic

$\rightarrow$ Unstable

8.(C) Heat of combustion $\propto \dfrac{1}{\text{stability}}$, Ethyl cyclopropane is less stable due to angle strain and highest so has heat of combustion.

9.(D) (A) $\rightarrow$ 1-chloro-2, 4-dinitrobenzene

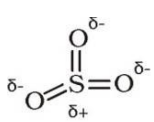
(B) $\rightarrow$ 2-chloro-1-methyl-4-nitrobenzene

(C) $\rightarrow$ 2-chloro-4-methylanisole

10.(A) B has empty p-orbital, BCl_3 behaves as electrophile.

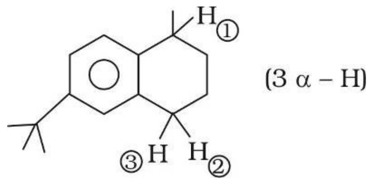
11.(A) (II) Fully eclipsed (most unstable) , (III) Eclipsed. (IV) Anti (Most stable)

12.(D) All are aromatic. So have significant resonance energy

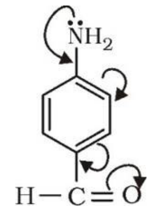
13.(B) 

O is more electronegative than sulphur. There is partial positive charge on sulphur and behaves as electrophile.

14.(B) Hydrogen at carbon atoms next to benzene ring are alpha hydrogen atoms.

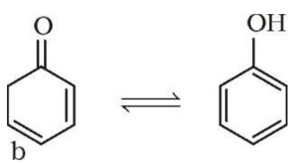


15.(C) CHO at para position decrease electron density in ring and produce partial positive charge at its ortho and para position.
To stabilize that, lone pair of nitrogen involve in π bonding to a large extend. There is increased double bond character and hence stronger C–N bond.

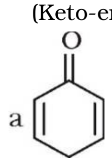


16.(D) 3-methylbutane is C_5H_{12} hence not isomer of C_5H_{10}.

17.(B)



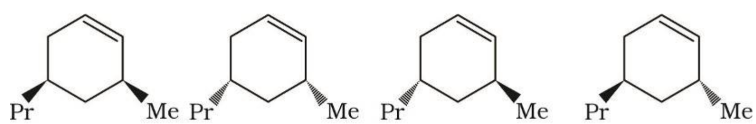
(Keto-enol) More conjugation so bond order is in between 1 and 2.



Less conjugation, so bond order (a) is more near to 2.
More bond order of 'a' bond hence less bond length.

18.(A) $\underset{\text{(More +M)}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-O-CH_3} > CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-OH > CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-Cl$

19.(B)



I II III IV

20.(BD) $R-\ddot{\underset{\cdot\cdot}{O}}-R$ have lone pair on oxygen atom, behave as Lewis base as well as Bronsted base.

21.(A) Bridgehead carbon atom can't be planar.

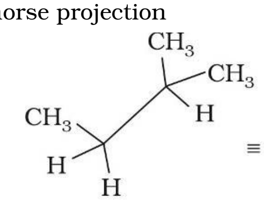
22.(D) No α–Hydrogen at carbon next to carbonyl group.

23.(A) They are keto–enol form, not resonating structure.

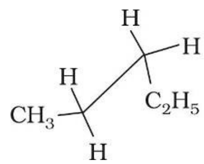
24.(C) Due to resonance all the bond lengths are same.

25.(C) Saw horse projection

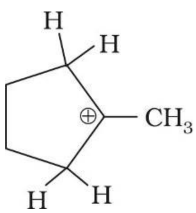
(1)



$\equiv CH_3-CH_2-\underset{\underset{\displaystyle CH_3}{|}}{CH}-CH_3$

(2)  $\equiv CH_3-CH_2-CH_2-C_2H_5$

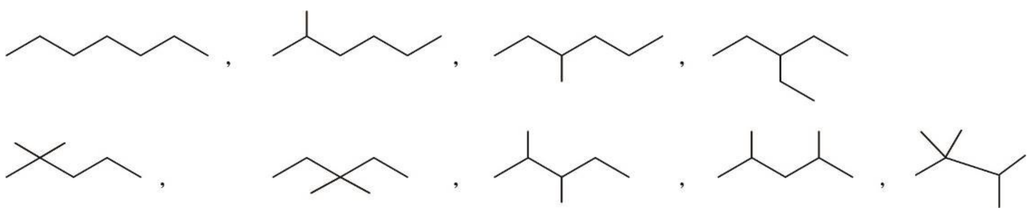
Chain isomer

26.(D)  $\rightarrow 7\alpha - H$

Hyper conjugation effect of D is less than that of H.

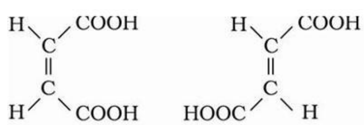
27.(A) Conformers are obtained through rotation around a single bond.

28.(A) For cycloalkenes, begin numbering at the double bond and proceed through the bond in the direction to generate the lowest number at the first point of difference. Thus a double bond should always be carbons 1 and 2.

29.(D) 

30.(CD) $CH_3-\underset{\mid \atop Ph}{CH}-\overset{O \atop \|}{C}-H \rightleftharpoons CH_3-\underset{\mid \atop Ph}{C}=\overset{OH \atop \mid}{C}-H$

31.(D) Arrhenius acid is proton donor while Arrhenius base is hydroxide donor. Bronsted acid is proton donor and Bronsted base is proton acceptor. Lewis acid is electron pair acceptor while Lewis base is electron pair donor.

32.(B) 

(Maleic acid) (Fumaric acid) (Geometrical isomers)

33.(A) a > b ; Due to resonance bond order is in between 1 and 2 for a. Whereas in b bond order is 2. (No resonance)

Bond order $\propto \dfrac{1}{\text{bond length}}$

34.(C) Octet of carbon is not complete in (I) and (II), in (III) octet of each atom is complete hence most stable.

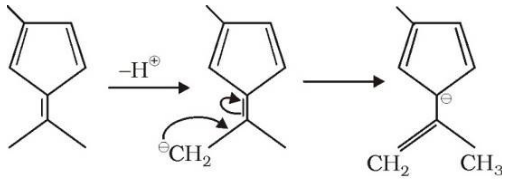
35.(B) Degree of unsaturation is 4 (3 double bond, 1 ring).

36.(A) –ve charge and lone pair are at adjacent position making it least stable.

37.(C) Number of carbon are different in both structure.

38.(B) Second pair is keto - enol pair.

In resonating structure number of lone pair or electron pair should remain same.

39.(B) 

Stable product

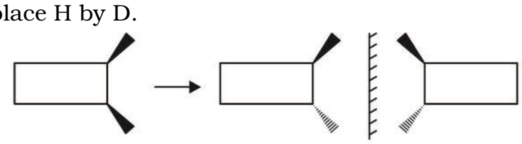
Compound after deprotonation is aromatic hence stable.

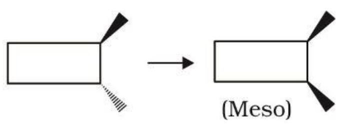
40.(A) Cis and trans form of cyclooctane.

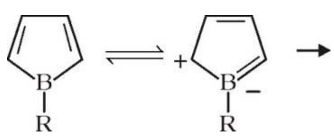
41.(B) $\underset{(1)}{CH_2} = \underset{(2)}{CH} - \underset{(3)}{CH_2} - \underset{(4)}{CH_3}$

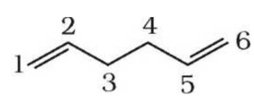
4 different hydrogen are there and can be replaced and 4 different isomers are formed.

$\rightarrow$ $CH_2 = CH - CH = CH_2$, only two different hydrogen and will produce only two isomers when we replace H by D.

42.(C) (x)  2 diastereomer of (x)

(y)  1 diastereomer of (y)

43.(D) 

44.(C) 

$\rightarrow$ $4n\pi\ e^-$, complete conjugation. Hence anti aromatic.

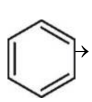
45.(C) Annulenes are completely conjugated monocyclic hydrocarbon. They have the general formula C_nH_n (when n is an even number) or C_nH_{n+1} (when n is an odd number). Annulenes are named as [n] annulene, where n is the number of carbon atoms in their ring. Annulenes may be aromatic (benzene), non-aromatic ([10] annulene) or anti-aromatic ([12] annulene). Like cyclooctatetraene, large annulenes such as [12] annulene and [16]-annulene have $4n\pi$ system and do not show anti aromatically because they have the flexibility to adopt non-planar conformations.

46.(D) Geometrical isomers are stereoisomers having different physical properties.

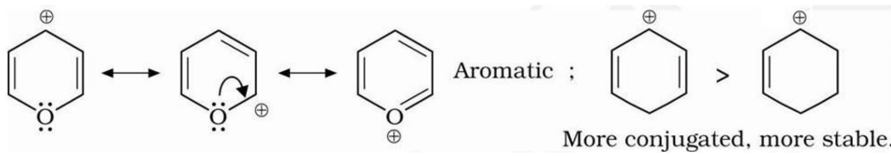
47.(B) $C_1 - C_2$ contain more double bond character than $C_2 - C_3$.

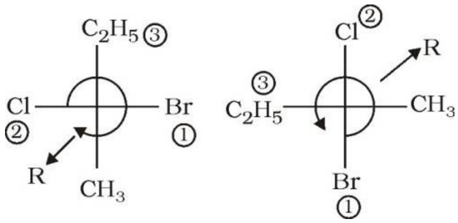
48.(D) 1, 1-dimethyl cyclopentane can't exhibit geometrical isomerism due to absence of stereogenic bond.

49.(C) Two isomer will always have same molecular formula.

50.(D)  $\rightarrow$ 3 π bonds

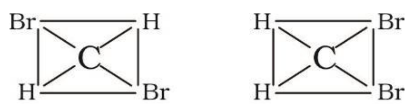
$\rightarrow$ 6 π electrons

51.(A) 

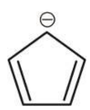
52.(D) 

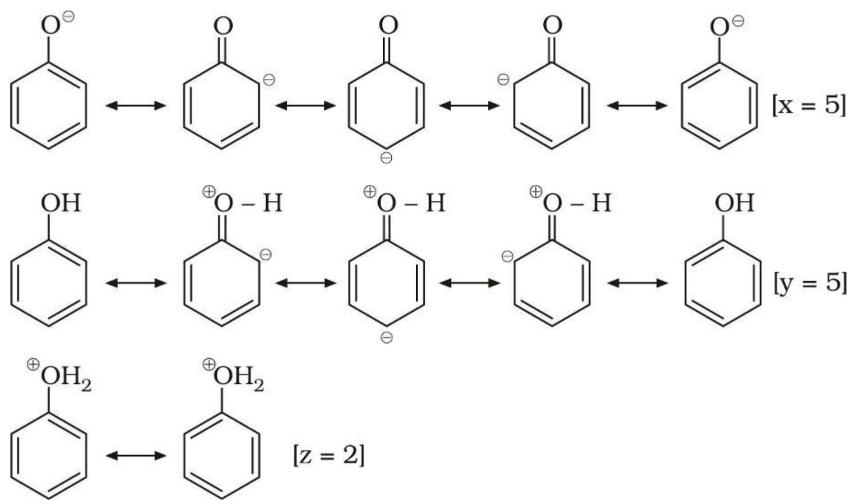
(R and R-both are identical)

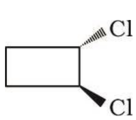
53.(C) CH_2Br_2 if not tetrahedral than it will have cis and trans form. But such forms are not known for CH_2Br_2.



Trans Cis

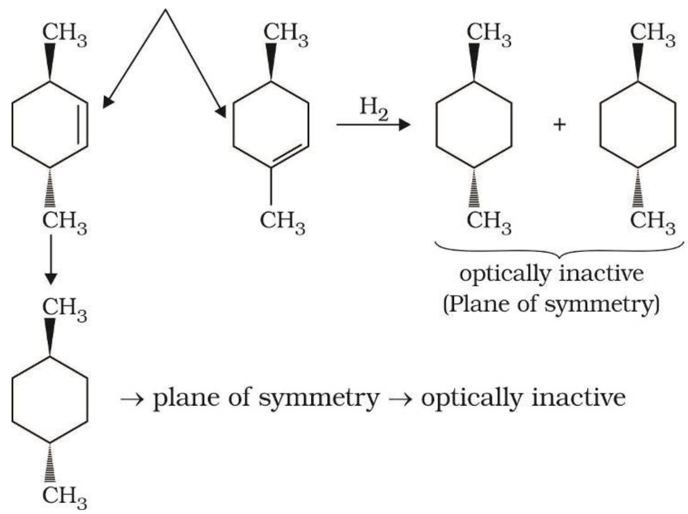
54.(D)  $\rightarrow$ aromatic more stable.

55.(A) 

56.(D) 

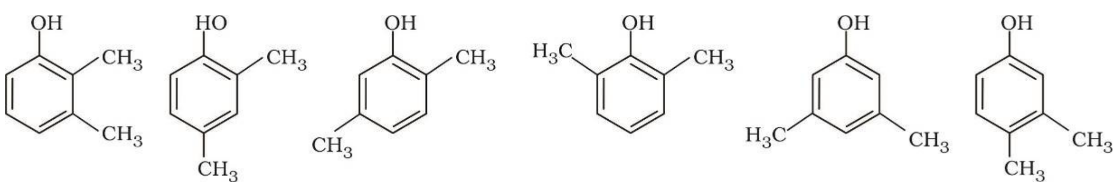
$\rightarrow$ No centre of symmetry.
$\rightarrow$ No plane of symmetry
$\rightarrow$ Hence optically active.

57.(D) No plane of symmetry.

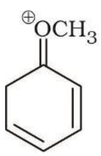


58.(BC) X is optically inactive due to plane of symmetry while y is optically active due to absence of both plane of symmetry and centre of symmetry..

59.(D)



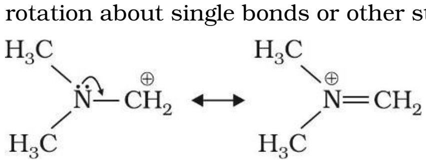
60.(D)



– most stable as each atom has complete octet.

61.(A) In principle, the maximum number of configurational stereoisomers (not constitutional isomers) is $N_{max} = 2^{(n+m)}$ where n is the number of stereo centres (R or S) and m is the number of stereogenic double bonds (E or Z). However the actual number of different stereoisomers may be smaller than the maximum number N_{max} if constitutional symmetry (POS, COS) is present in the molecule (meso compounds). The actual number of practically possible stereoisomers may be reduced by ring strains or other geometrical limitations. Nevertheless, the maximum number may also be exceeded if hindered rotation about single bonds or other steric interactions result in additional stereoisomers.

62.(B)



Maximum back bonding by N because of symmetrical overlapping with C and lower electronegativity.

63.(A) All atoms have complete octet structure.

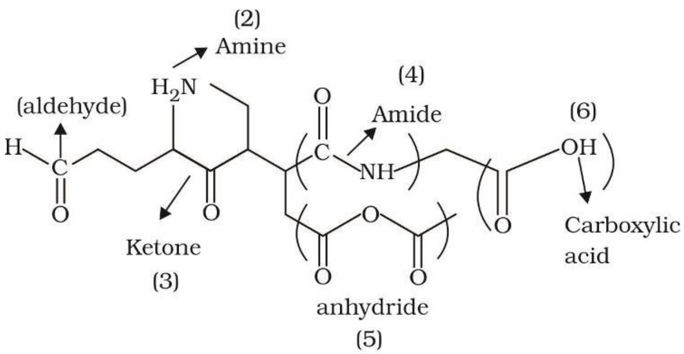
64.(C) Compound is non planar, hence its mirror image will also be optically active. So its mirror image will be optically active. Total-2 stereo isomers.

65.(D) Inductive effect represent displacement of electron pair of σ bond due to difference in electronegativity and its effect decreases with distance.

66.(D) Enantiomers are non-superimposable mirror images and have same physical properties while diastereomers are non super imposable mirror images having different physical properties.

67.(A) $C_2H_5-\overset{*}{C}H(CH_3)-CH=CH_2$ Optically active alkene with minimum carbon.

68.(C)



Total 6 functional group.

69.(D)

$$H-\overset{O}{\overset{\|}{C}}-\overset{\ominus}{C}H-\overset{O}{\overset{\|}{C}}-H > \underset{+I}{CH_3}-\overset{O}{\overset{\|}{C}}-\overset{\ominus}{C}H-\overset{O}{\overset{\|}{C}}-H > \underset{+I}{CH_3}-\overset{O}{\overset{\|}{C}}-\overset{\ominus}{C}H-\overset{O}{\overset{\|}{C}}-\underset{+M}{\ddot{O}}-CH_3$$

Electron donating group decreases stability of anion.

70.(D) A, B and C are optically inactive due to plane of symmetry.

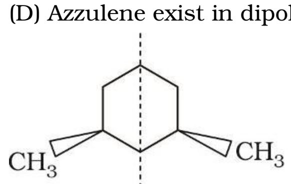
71.(ABD) (A) $\rightarrow$ due to conformers of 1, 4-di hydroxybenzene.

(B) $\rightarrow$ due to + M for $-NH_2$ and – M for $-NO_2$ group.

(C) same value of μ

(D) Azzulene exist in dipolar zwitterionic structure having dipole moment of 1.0 D

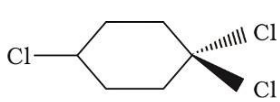
72.(B)



Plane of symmetry - Meso

73.(B) Check carefully, not mirror image of each other. Cis-trans only

74.(D)



Exchange of both –Cl will produce same molecule.

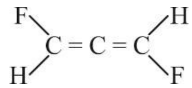
75.(A) Enantiomeric excess means how much one enantiomer in excess of racemic mixture.

Amount of racemic mixture = 100 – 50

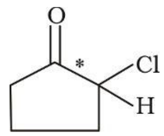
= 50 % (25% (+) and 25% (–))

Total (+) – 2 – bromobutane = 50% + 25% = 75%

Total (–) – 2 – bromobutane = 25%

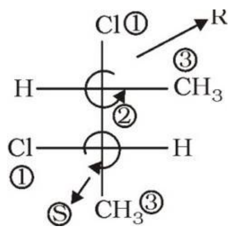
76.(B) 

→ Non-planar
→ Dipole moment $\neq$ 0
$\mu \neq 0$

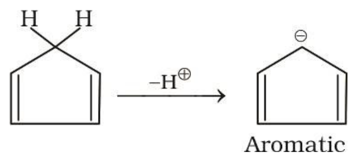
77.(B) 

Rest compounds are optically inactive due to symmetry.

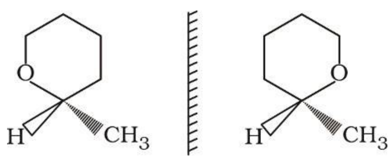
78.(C) Due to hindrance molecule is not planar. No symmetry. Hence optically active.

79.(B) 

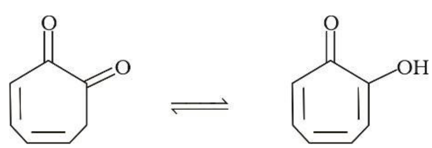
Compound is Meso, Optical rotation is zero.

80.(C) 

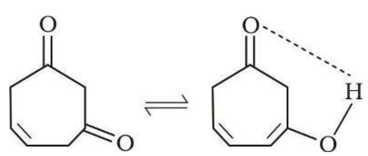
81.(B) Same functional group, but different chain.

82.(C) 

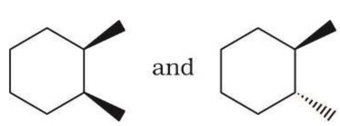
Same formula, and structure, but different spatial arrangement in 3-D.

83.(B) 

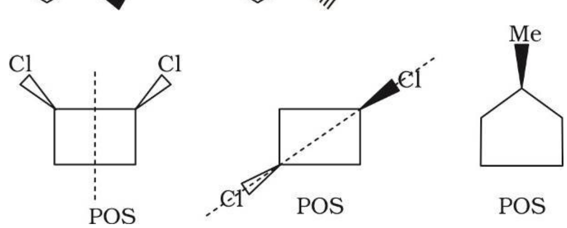
→ More conjugated and aromatic compound. So enol is very stable.

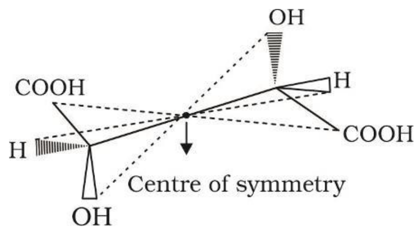


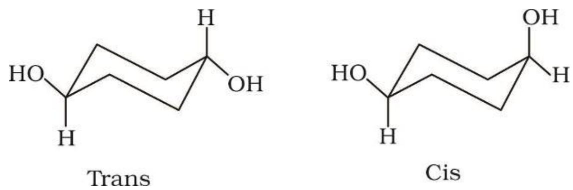
Intramolecular H-bond
more enol content

84.(C) 

85.(D) Eclipsed form has torsional strain.

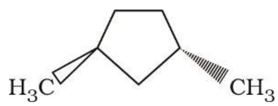
86.(C) 

87.(A) 

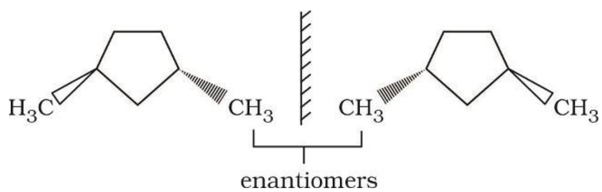
88.(B) 

Cis and trans-isomers of same compound are diastereomers.

89.(D) Both are diastereomers



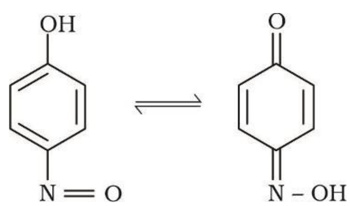
$\rightarrow$ No symmetry, optically active compound.



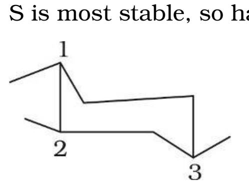
90.(D) In (P) $-NO_2$ due to steric hinderence loose planarity with benzene ring, hence not able to involve in resonance and – M effect of NO_2 is inhibited.

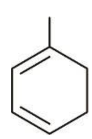
91.(A) Very less hinderence with respect to ortho position. Lone pair of nitrogen is able to involve in resonance.

92.(C) C has sp^3 carbon.

93.(A) 

94.(D) S is most stable, so has minimum heat of combustion.



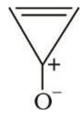
95.(A) 

$\rightarrow$ Conjugated alkene

$\rightarrow$ More alkylated alkene

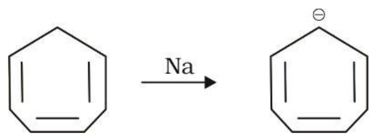
$\rightarrow$ Heat of hydrogenation $\propto \dfrac{1}{\text{stability of alkene}}$

96.(B) Due to more stable contributor because of aromatic nature.



97.(C) Hyper conjugation needs α -hydrogen.

98.(C)



$\rightarrow$ Anti aromatic
$\rightarrow$ Very unstable
$\rightarrow$ Will not react with Na

99.(B) Compound having both C and N produce Prussian blue colouration.

100.(ABCD) Compounds having nitrogen in the form of nitro group, azo group, can't estimated by Kjeldahl's method. For such compounds Duma's method is used.