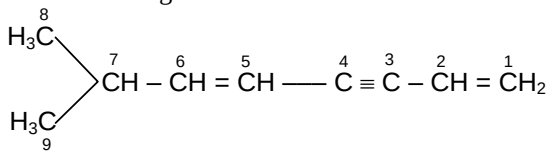
1. The number of p-orbital not involved in the hybridisation of middle carbon atom in $CH_2 = C = CH_2$ is
(a) 3 (b) 1 (c) 2 (d) Cannot be predicted

2. In the following structure



how many carbon atom is sp^2hybridised
(a) 1 (b) 2 (c) 3 (d) 4

3. The hybridisation of the central atom will change when -
(a) NH_3 combines with H^+
(b) H_3BO_3 combines with OH^-
(c) NH_3 form NH_2^-
(d) H_2O combines with H^+

4. Among the interhalide species
IF_2^{Θ}, IF_3, IF_4^{Θ} and IF_7
(a) All iodine centres are either sp^3d or sp^3d^2hybridised
(b) The minimum angular separation between fluorine atoms is 60°
(c)The anionic species are both isoelectronic and isostructural to XeF_2 and XeF_4
(d)There is no species having a single lone pair of electrons

5. LiF is least soluble among the fluorides of alkali metals, because
(a) Smaller size Li^+ impart significant covalent character in LiF
(b) The hydration energies of Li^+ and F^- are quite higher
(c) Lattice energy of LiF is quite higher due to the smaller size of Li^+ and F^-
(d) LiF have strong polymeric network in solid

6. Which of the following compounds has sp^2hybridisation ?
(a) CO_2 (b) SO_2 (c) N_2O (d) CO

7. $N(SiH_3)_3$ has -
(a) Sp^3hybridisation, pyramidal shape
(b) Sp^2hybridisation, planar shape
(c) Sp^3hybridisation, tetrahedral shape
(d) d sp^2hybridisation, square planar shape

8. Which of the following angle corresponds to sp^2 hybridisation?
(a) 90^0 (b) 120^0 (c) 180^0 (d) 109^0

9. On hybridisation of one s and three p-orbitals, we get
(a) Four orbitals with tetrahedral orientation
(b) Three orbitals with trigonal orientation
(c) Two orbitals with linear orientation
(d) Two orbitals with perpendicular orientation.

10. Which of the following shown dsp^2 hybridisation and a square planar geometry?
(a) SF_6 (b) BrF_5 (c) PCl_5 (d) $[Ni(CN)_4]^{2-}$

11. Which of the following statements is true about hybridisation?
(a) The hybridized orbitals have different energies for each orbital.
(b) The number of hybrid orbitals is equal to the number of atomic orbitals that are hybridized.
(c) Hybrid orbitals form multiple bonds.
(d) The orbitals with different energies undergo hybridisation.

12. Hybridisation state of Xe in XeF_2, XeF_4 and XeF_6 respectively are

(a) sp^2, sp^3, d, sp^3d^2 (b) sp^3d, sp^3d^2, sp^3d^3

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

13. Match the column I with column II and mark the appropriate choice.

Column I	Column II
(1) C_2H_2	(i) Sp^3d^2 hybridisation
(2) SF_6	(ii) Sp^3d^3 hydridisation
(3) SO_2	(iii) sp hybridisation
(4) IF_7	(iv) Sp^2 hybridisation

(a) (1) → (i), (2) → (iii), (3) → (ii), (4) → (iv)
(b) (1) → (iii), (2) → (i), (3) → (iv), (4) → (ii)
(c) (1) → (ii), (2) → (iii), (3) → (i), (4) → (iv)
(d) (1) → (iv), (2) → (i), (3) → (iii), (4) → (ii)

14. The hybridisation of the underline atom changes in :

(a) AlH_3 changes to AlH_4^- (b) H_2O changes to H_3O^+

(c) NH_3 changes to NH_4^+ (d) In all cases

15. In which of the following compounds B – F bond length is shortest ?

(a) BF_4^- (b) $BF_3 \rightarrow NH_3$

(c) BF_3 (d) $BF_3 \leftarrow N(CH_3)_3$

16. Number of bonds in SO_2 are :

(a) two σ and two π (b) two σ and one π

(c) two σ, two π and one lone pair (d) none of these

17. Choose the molecules in which hybridisation occurs in the ground state ?

(a) BCl_3 (b) NH_3 (c) PCl_3 (d) BeF_2

The correct answer is -

(a) 1, 2, 4 (b) 1, 2, 3

(c) 2, 3 (d) 3, 4

18. sp^2 – hybridisation is shown by :

(a) $BeCl_2$ (b)) BF_3

(c) NH_3 (d) XeF_2

19. The hybridisation of carbon in diamond, graphite and acetylene is (respectively) –

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

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

20. Each carbon in carbon suboxide (C_3O_2) is :

(a) sp^2 - hybridized (b) sp^3-hybridized

(c) sp-hybridized (d) sp^2-hybridized but linked with one co-ordinate bond

21. Among the following pairs in which the two species are not isostructural is :

(a) SiF_4 and SF_4 (b) IO_3^- and XeO_3

(c) BH_4^- and NH_4^+ (d) PF_6^- and SF_6

22. Consider the following iodides :

	PI_3	AsI_3	SbI_3
	102°	100.2°	99°

The bond angle is maximum in Pl_3, which is :

(a) due to small size of phosphorus (b) due to more bp–bp repulsion in PI_3

(c) due to less electronegativity of P (d) none of these

23. OF_2 is gS %

(a) Linear molecule and sp hybridised (b) Tetrahedral molecule and sp^3 hybridised

(c) Bent molecule and sp^3 hybridised (d) None of these

24. Select the correct statement for the sulphuric acid.

(I) It has high boiling point and viscosity.

(II) There are two types of bond lengths in its bivalent anion.

(III) pπ-dπ bonding between sulphur and oxygen is observed.

(IV) Sulphur has the same hybridisation that is of boron in diborane.

(a) II and III only (b) II, III and IV only

(c) I, III and IV only (d) III and IV only

25. Identify the correct match.

(i) XeF_2	(a) Central atom has sp^3 hybridisation and bent geometry.
(ii) N_3^-	(b) Central atom has sp^3d^2 hybridisation and octahedral.
(iii) PCl_5 (s) anion	(c) Central atom has sp hybridisation and linear geometry.
(iv) I_2Cl_6 (ℓ) cation	(d) Central atom has sp^3d hybridisation and linear geometry.

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

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

26. Correct statement regarding this reaction :

$$BF_3 + NH_3 \longrightarrow [F_3B \leftarrow NH_3]$$

(a) hybridisation of only N changes (b) hybridisation of only B changes

(c) hybridisation of N and B both change (d) none of these.

(a) dsoy N dk ladj.k cnyrk gS (b) dsoy B dk ladj.k cnyrk gSA

(c) N rFkk B nksuksa ds ladj.k cnyrs gaSA (d) buesa ls dksbZ ugha

27. The type of hybrid orbitals used by chlorine atom in ClO^-, ClO_2^-, ClO_3^- and ClO_4^- are :

(a) sp, sp^2, sp^3 and sp^3d (b) sp and sp^3

(c) only sp^3 (d) only sp

28. The hybridisation of orbitals of N atom in NO_3^-, NO_2^+ and NH_4^+ are respectively :

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

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

29. The species in which the N atom is in a state of sp hybridization is :

(a) NO_2^- (b) NO_3^-

(c) NO_2 (d) NO_2^+

30. The type of hybridisation and number of lone pair(s) of electrons of Xe in $XeOF_4$, respectively, are :

(a) sp^3d^2 and 1 (b) sp^3d^2 and 2

(c) sp^3d and 1 (d) sp^3d and 2

1. (c)
The middle carbon atom is sp hybridised therefore the number of p-orbitals not involved in hybridisation is 2

2. (d)
Here $\overset{1}{C}$, $\overset{2}{C}$, $\overset{5}{C}$, & $\overset{6}{C}$ are sp^2 hybridised
So total no. of carbon atoms having sp^2 configuration is 4

3. (b)
$B(OH)_3 + OH^- \rightarrow B(OH)_4^-$
sp^2 sp^3

4. (c)
Hybridisation and structure of $IF_2^- \rightarrow sp^3d$ & linear
Hybridisation and structure of $XeF_2 \rightarrow sp^3d$ & linear
So Both XeF_2 and IF_2^- are isostructural and isoeletronic
Hybridisation and structure of $IF_4^- \rightarrow sp^3d^2$ & square
Planar
Hybridisation and structure of $XeF_4 \rightarrow sp^3d^2$ & square
Planar
$\Rightarrow$ Both XeF_4 and IF_4^- are isoelectronic and isostructural

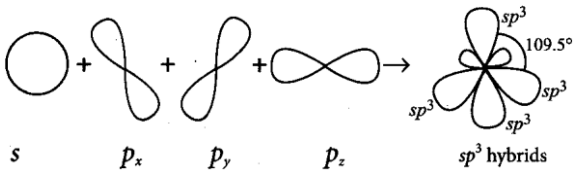
5. (c)
The small size of both Li^+ and F^- ion leads to a very high value of lattice energy and thus crystal of LiF is very difficult to break

6. (b)
Rest of the molecules are sp hybridized

7. (b)
lp of e^-s of nitrogen is donated to the vacant d-orbital of Si.

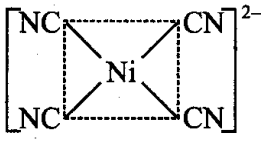
8. (b) : The angle corresponds to sp^2 hybridisation triangular planar is 120^0

9. (a) :

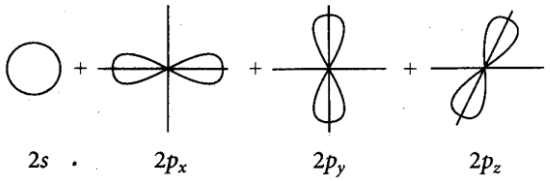


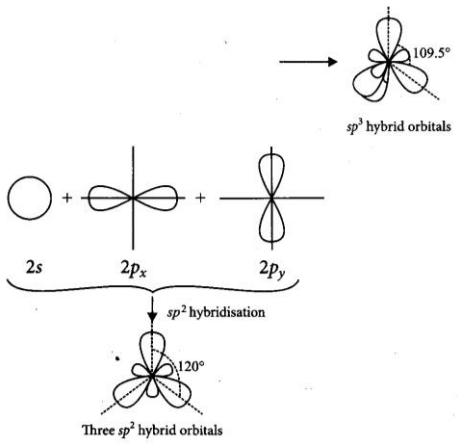
Four sp^3 hybrid orbitals are formed when one s and three p – orbitals hybridise.

10. (d) :

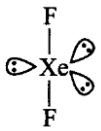


11. (b) : The number of orbitals which hybridise remains same after the hybridisation also. E.e.,





12. (b) : $XeF_2 - sp^3d$



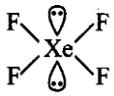
Total no. of valence electrons = 22

$\frac{22}{8} = 2(Q) + 6(R), \frac{6}{2} = 3(Q)$

X = 2 +3 = 5

Hybridisation is sp^3d.

EeF_4 –



Hybridisation is sp^3d^2

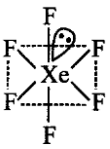
Total no. of electrons in outermost shells = 8 +28 =36

$\frac{36}{8} = 4(Q) + 4(R), \frac{4}{2} = 2(Q) + 0(R)$

X = 4 + 2 +0 =6

Hybridisation is Sp^3d^2

XeF_6



Total no. of valence electrons = 8+ 42 = 50

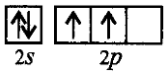
$\frac{50}{8} = 6(Q) + 2(R), \frac{2}{2} = 1(Q)$

X= 6+ 1 = 7

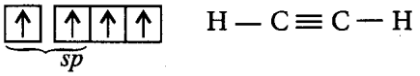
Hybridisation is Sp^3d^3.

13. (b) : In C_2H_2, C undergoes, sp hybridisation.

Ground state

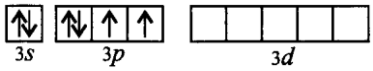


Excited state

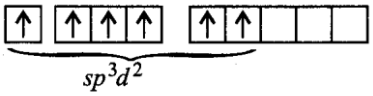


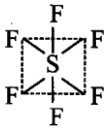
In SF_6, S undergoes sp^3, d^2 hybridisation.

Ground state)

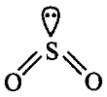


Excited state



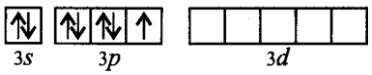


In So_2, S undergoes sp^2 hybridization.

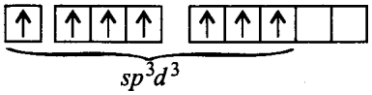


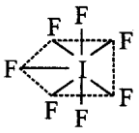
In IF_7 I undergoes sp^3d^3 hybridization.

Ground state

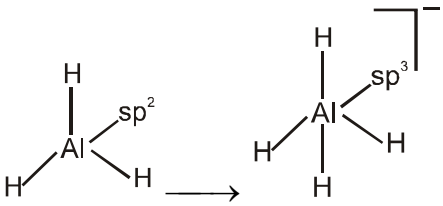


Excited state



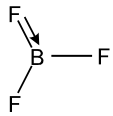


14. (a)



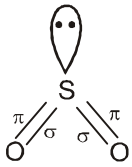
15. (c)

Partial double bond character is developed in B–F bond of BF_3 (due to formation of dative p bond)

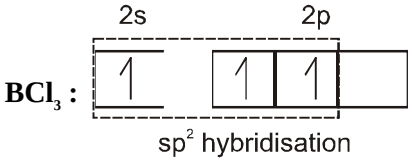


In other case B is sp^3 hybridised (tetrahedral molecule or ion) and the possibility for π bonding no longer exists.

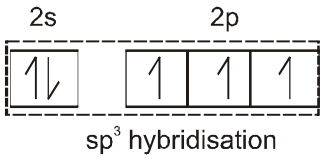
16. (c)



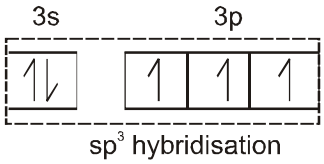
17. (c) (a) Electronic configuration of boron in ground state is $1s^2 2s^2 2p^1$.



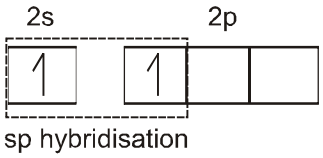
(b) Electronic configuration of nitrogen in ground state is $1s^2 2s^2 2p^3$.



(c) Electronic configuration of phosphorus in ground state is $1s^2 2s^2 2p^6 3s^2 3p^3$.



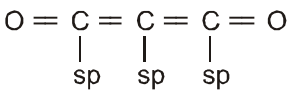
(d) Electronic configuration of boron in ground state is $1s^2 2s^2$.



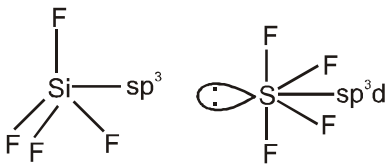
18. (b) Steric number = 0 + 3 = 3; so sp^2 hybridisation

19. (a) Diamond sp^3; graphite = sp^2 ; Acetylene = sp

20. (c)



21. (a) (a) Tetrahedral and see-saw shaped.

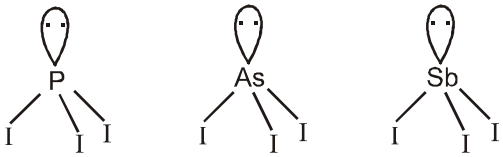


(b) Both are sp^3 hybridised and trigonal pyramid.

(c) Both are sp^3 hybridised and tetrahedral.

(d) Both are sp^3d^2 hybridised and octahedral.

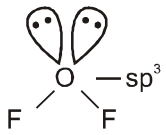
22. (b)



102º **100º** **99º**

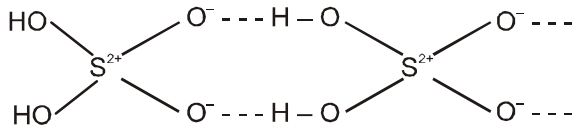
Phosphorus is the most electronegative of the central atoms. Consequently, it exerts the strongest pull on shared electrons, concentrating these electrons near P and increasing bonding pair-bonding pair repulsions–hence, the largest angle in PI_3. Sb, the least electronegative central atoms, has the opposite effect : Shared electrons are attracted away from Sb, reducing repulsions between the Sb–I bonds. The consequence is that the effect of the lone pair is greatest in SbI_3, which has the smallest angle.

Atomic size arguments can also be used for these species. Larger outer atoms result in larger angles ; larger central atoms result in smallest angles.



23. (c) (bent)

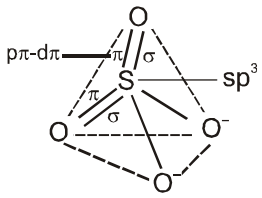
24. (c) (I)



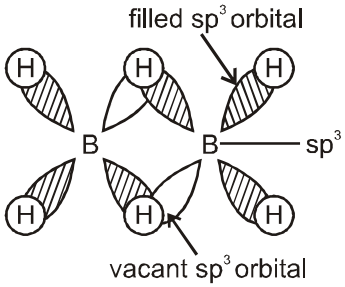
As a result of H-bonding, number of sulphuric acid molecules are associated to form cluster. Hence it has high boiling point and viscosity.

(II) All S — O bond lengths are equal due to resonance.

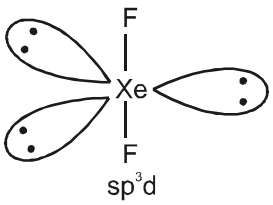
(III)



(IV)

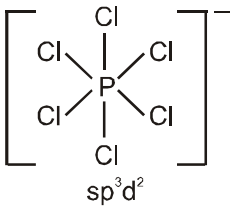


25. (d) **(i)**

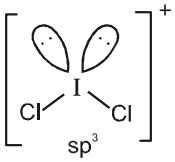


(ii) $[N \overset{+}{=} N = N]^{2-}$ (sp)

(iii) PCl_5 (s) exists as $[PCl_4]^+$ and $[PCl_6]^-$,



(iv) $I_2Cl_6(\ell) \rightleftharpoons [ICl_2]^+ + [ICl_4]^-$

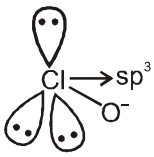


self ionisation

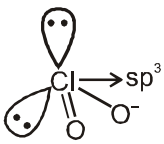
26. (b) $BF_3\ (sp^2) + NH_3\ (sp^3) \longrightarrow F_3B \leftarrow NH_3$

$sp^3 \quad sp^3$

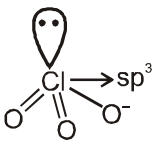
27. (c) ClO^- :



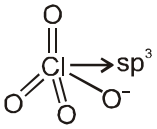
; ClO_2^- :



; ClO_3^- :



; ClO_4^- :

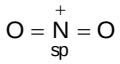


28. (b) NO_2^+ Number of electron pairs = 2

Number of bond pairs = 2

Number of lone pair = 0

So, the species is linear with sp hybridisation.

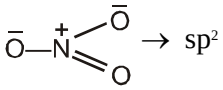


NO_3^- Number of electron pairs = 3

Number of bond pairs = 3

Number of lone pair = 0

So, the species is trigonal planar with sp^2 hybridisation.

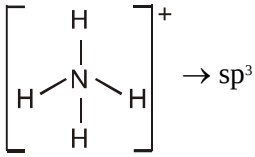


NH_4^+ Number of electron pairs = 4

Number of bond pairs = 4

Number of lone pair = 0

So, the species is tetrahedral with sp^3 hybridisation.



29. (d) NO_2^- = sp^2

NO_3^- = sp^2

NO_2 = sp^2

NO_2^+ = sp

30. (a)