

Hybridisation

21. (c) $C_2H_4Br_2$ has all single bonds so $C-H$ bond distance is the largest.

22. (c) sp^3

Explanation:

- In CH_2Cl-CH_2Cl (1,2-dichloroethane), each carbon atom is bonded to **two hydrogen atoms, one chlorine atom, and one carbon atom**.
- Since each carbon forms **four single (σ) bonds**, it undergoes **sp^3 hybridisation**, leading to a **tetrahedral** geometry around each carbon atom.

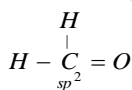
23. (a) In methane molecule C is sp^3 hybridised so its shape will be tetrahedral.

24. (c) In compound $\overset{3}{CH_2} = \overset{2}{C} = \overset{1}{CH_2}$ the second carbon sp -hybridised.

25. (a) $:\ddot{Cl}:\ddot{Cl}:$ is the correct electronic formula of Cl_2 molecule because each chlorine has 7 electrons in its valence shell.

26. (a) XeF_4 has sp^3d^2 hybridisation, its shape is square planar.

27. (b) In $HCHO$, carbon is sp^2 hybridized



28. (c) Because of the triple bond, the carbon-carbon bond distance in ethyne is shortest.

29. (b) The hybridisation of Ag in complex $[Ag(NH_3)_2]^+$ will be sp because it is a Linear complex.

30. (a) Structure of CO_2 is linear $O=C=O$ while that of H_2O is $\begin{array}{c} O \\ \diagup \quad \diagdown \\ H \quad \quad H \end{array}$ i.e. bent structure so CO_2 resultant dipole moment is zero while that of H_2O has some value.

31. (d) CO_2 is not sp^3 hybridised, it is sp hybridised.



32. (a) As compare to pure atomic orbitals, hybrid orbitals have low energy.

33. (d) $\overset{sp^2}{CH_2} = \overset{sp}{C} = \overset{sp^2}{CH} - \overset{sp^3}{CH_3}$ 1, 2-butadiene.

34. (c) 2

Explanation:

According to **Molecular Orbital Theory (MOT)**, the electronic configuration of O_2 is

$$\sigma(1s)^2 \sigma^*(1s)^2 \sigma(2s)^2 \sigma^*(2s)^2 \sigma(2p_z)^2 \pi(2p_x)^2 = \pi(2p_y)^2 \pi^*(2p_x)^1 \pi^*(2p_y)^1$$

→ Hence, **2 unpaired electrons** are present, making O_2 **paramagnetic**.

35. (c) **sp orbital**

Explanation:

Each of the marked carbon atoms is involved in a **triple bond ($C \equiv C$)** — one σ bond and two π bonds.

The σ bond is formed by **sp-sp** overlap, and each carbon uses **sp hybrid orbitals**, resulting in a **linear geometry (180°)**.

36. (b) CCl_4 is sp^3 hybridised so bond angle will be approximately 109° .

37. (b) **Double covalent bond**

Explanation:

A **single bond** involves one shared pair of electrons, while a **double bond** involves **two shared pairs** (e.g., $O=O$ or $C=C$).

38. (b) **sp^2**

Explanation:

In **boron trichloride (BCl_3)**, boron forms **three σ bonds** with chlorine atoms and has **no lone pairs**.





- Hybridization = sp^2
→ Geometry = Trigonal planar (120°)

39. (b) H_2S

Explanation:

In H_2S , the hybridization of sulfur is **almost pure p-character** (very little sp^3 mixing).

→ The bond angle is $\approx 92^\circ$, close to the **p-orbital angle (90°)**.

40. (b) Ethene has sp^2 hybridised carbon so bond angles are 120° .

