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 $\overset{3}{C}H_2=\overset{2}{C}=\overset{1}{C}H_2$ the second carbon sp-hybridised.

25. (a) $:\ddot{\underset{\cdot\cdot}{Cl}}\cdot\cdot\ddot{\underset{\cdot\cdot}{Cl}}:$ 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

$$H-\underset{sp^2}{\overset{H}{\overset{|}{C}}}=O$$

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 $H\overset{O}{}H$ *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) $\overset{sp^2}{C}H_2 = \overset{sp}{C} = \overset{sp^2}{C}H - \overset{sp^3}{C}H_3$ 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≡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^o.

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 **≈ 92°** , close to the **p-orbital angle (90°)**.

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