Dipole moment

21. (d) The BF_3 molecule must be planar triangular

Explanation:

BF_3 has a **trigonal planar structure** with bond angles of 120° . The three B–F bond dipoles are equal and symmetrically arranged, cancelling each other out, resulting in **zero dipole moment**.

In contrast, PF_3 has a **trigonal pyramidal structure** due to the lone pair on phosphorus, so the dipoles do not cancel, giving it a **net dipole moment**.

22. (b) Ammonia have some dipole moment.

23. (b) Charge of $e^- = 1.6 \times 10^{-19}$

Dipole moment of $HBr = 1.6 \times 10^{-30}$

Inter atomic spacing $= 1\text{Å} = 1 \times 10^{-10} m$

% of ionic character in

$$HBr = \frac{\text{dipole moment of } HBr \times 100}{\text{inter spacing distance} \times q}$$

$$= \frac{1.6 \times 10^{-30}}{1.6 \times 10^{-19} \times 10^{-10}} \times 100$$

$$= 10^{-30} \times 10^{29} \times 100 = 10^{-1} \times 100 = 0.1 \times 100 = 10\%$$

24. (b) **Carbon tetrachloride**

Explanation:

- **Carbon tetrachloride (CCl_4)** is a **non-polar solvent** because it has a **symmetrical tetrahedral structure**.
- The four C–Cl bond dipoles cancel each other out, resulting in **zero net dipole moment**.
- Other options like dimethyl sulphoxide, ammonia, and ethyl alcohol are **polar solvents** due to their unequal charge distribution and hydrogen bonding.

25. (a) Carbon tetrachloride has a zero dipole moment because of its regular tetrahedral structure.

26. (c) **$PbSO_4$**

Explanation:

- **$PbSO_4$ (lead sulphate)** is an **ionic compound** that forms a **crystalline lattice** with a **symmetrical arrangement** of ions, resulting in **no net dipole moment**.
- **H_2O**, **AgI**, and **HBr** are **polar molecules** because they have an **uneven distribution of charge** due to differences in electronegativity.

27. (b) BF_3 has zero dipole moment.

28. (b) **Absence of dipole moment**

Explanation:

- The **N_2 molecule** is **non-polar** and has a **triple bond (N≡N)** with **no dipole moment**, making it **very stable and less reactive**.
- In contrast, the **cyanide ion (CN^-)** has a **charge** and hence a **dipole**, which increases its **reactivity** due to the presence of an **unshared electron pair** and **ionic character**.

29. (c) Given ionic charge $= 4.8 \times 10^{-10}$ e.s.u. and ionic distance $= 1A^\circ = 10^{-8} cm$ we know that dipole moment = ionic charge $\times$ ionic distance $= 4.8 \times 10^{-10} \times 10^{-8}$

$= 4.8 \times 10^{-8}$ e.s.u. *per cm* $= 4.8$ debye.

30. (a) Higher is the difference in electronegativity of two covalently bonded atoms, higher is the polarity. In *HCl* there is high difference in the electronegativity of *H* and *Cl* atom so it is a polar compound.

31. (a) Linear molecular has zero dipole moment CO_2 has linear structure so it does not have the dipole moment $O=C=O$.

32. (c) SF_6 is symmetrical and hence non polar because its net dipole moment is zero.

33. (a) Polarity create due to the difference in electronegativity of both atom in a molecule except H_2 all other molecule have the different atom so they will have the polarity while H_2 will be non polar.

34. (bd) *cis* isomer shows dipole moment while that of trans is zero or very low value. Trans 1, 2 di-chloro-2-pentene will also show dipole moment due to unsymmetry.

35. (a) % of ionic character $= \frac{\text{Experiment al value of dipole moment}}{\text{Expected value of dipole moment}}$

$= \frac{1.03}{6.12} \times 100 = 16.83\% \approx 17\%$