Hydrogen bonding

21. (a) Hydrogen bonding

Explanation:
HF molecules form **strong intermolecular hydrogen bonds**, requiring more energy to separate during boiling.

22. (a) Water molecule has hydrogen bonding so molecules get dissociated so it is liquid.

23. (d) In case of water, five water molecules are attached together through four hydrogen bonding.

24. (a) **Ethanol**

Explanation:
Ethanol (C_2H_5OH) has an –OH group where hydrogen is directly bonded to a highly electronegative oxygen atom.
This allows **strong intermolecular hydrogen bonding**, making it the compound with **maximum hydrogen bonding** among the given options.

- **Diethyl ether** → Only weak H–bond acceptor (no –OH or –NH).
- **Ethyl chloride** → No H–bonding (Cl not sufficiently electronegative in this context).
- **Triethyl amine** → Nitrogen is hindered; weak or no H–bonding.

25. (c) Hydrogen bond is strongest in hydrogen fluoride.

26. (a) Hydrogen bonding

High boiling point of ethanol:
Ethanol molecules form **strong intermolecular hydrogen bonds** through the –OH group, which requires more energy to break during vaporization.

Dimethyl ether lacks an –OH group and cannot form such extensive hydrogen bonding, so it has a **much lower boiling point**.

27. (b) Hydrogen bonding character

Miscibility of methanol and ethanol in water:

Both alcohols can form **hydrogen bonds with water molecules** (between their –OH groups and water's oxygen/hydrogen), making them **completely miscible** in water.

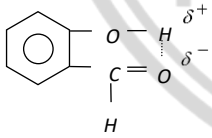
28. (c) Boiling point of H_2O is more than that of H_2S because H_2O forms hydrogen bonding while H_2S does not.

29. (a) Van der Waals and covalent

Explanation:

The **hydrogen bond** is weaker than a **covalent bond** but stronger than **Van der Waals forces**.

Hence, its strength is **intermediate between Van der Waals and covalent bonds**.

30. (c)  Interamolecular *H*-bonding.

31. (a) Hydrogen bond is formed when hydrogen is attached with the atom which is highly electronegative and having small radius.

32. (d) **C_6H_6 (benzene)** does **not** have hydrogen bonding because it lacks hydrogen atoms attached to highly electronegative elements (N, O, or F).

33. (b) Among **HF, NH_3, H_2S, and PH_3**, only **HF** and **NH_3** form **hydrogen bonds**, since **F** and **N** are sufficiently electronegative to create strong dipoles needed for hydrogen bonding.

34. (a) Water is dense than ice because of hydrogen bonding interaction and structure of ice.

35. (a) Ethanol have hydrogen bonding so its boiling point is higher than its isomer dimethyl ether.

36. (a) A compound having maximum electronegative element will form strong Hydrogen bond.

37. (a) Due to electronegativity difference of N_2 and H_2, NH_3 form hydrogen bond.

38. (b) Intermolecular hydrogen bonding compound contain more b.p. compare to intramolecular hydrogen bonding compound.

39. (d) Water molecule contain hydrogen bonding.

40. (c) It contain intermolecular hydrogen bonding.