Hydrogen bonding

1. (d) Hydrogen bonding will be maximum in *F-H* bond due to greater electronegativity difference.

2. (b) Ice has hydrogen bonding.

3. (b) $H - F$ has highest boiling point because it has hydrogen bonding.

4. **(a) HF**

   Explanation (Word-friendly format):
   Hydrogen bonding occurs when hydrogen is directly bonded to a **highly electronegative atom** like **F, O, or N**.
   In HF, the **H–F bond** is highly polar, and strong **intermolecular hydrogen bonds** form between HF molecules.
   Other hydrogen halides (HCl, HBr, HI) do not form hydrogen bonds because their halogen atoms are **less electronegative** and **larger in size**.

5. **(c) HF molecules are hydrogen bonded**

   Explanation:
   Unlike HCl, HBr, and HI (which are gases), **HF is a liquid** at room temperature due to **extensive hydrogen bonding** between its molecules.
   These hydrogen bonds hold the molecules together strongly, increasing the **boiling point** and making HF a **liquid** under normal conditions.

6. (d) co_2 is *sp*-hybridised

7. (b) *sp*-hybridization gives two orbitals at 180° with Linear structure.

8. (d) Hydrogen bonding increases the boiling point of compound.

9. (c) *o*-Nitrophenol has intramolecular hydrogen bonding but *p*-Nitrophenol has intermolecular hydrogen bonding so boiling point of *p*-Nitrophenol is more than *o*-Nitrophenol.

10. (c) The strongest hydrogen bond is in hydrogen fluoride because the power of hydrogen bond $\propto$ electronegativity of atom and

electronegativity $\propto \frac{1}{\text{atomic size}}$

So fluorine has maximum electronegativity and minimum atomic size.

11. (d) H_2O can form hydrogen bonds rest CH_4 and $CHCl_3$ are organic compound having no oxygen while *NaCl* has itself intraionic attraction in the molecule.

12. (b) PH_3 has the lowest boiling point because it does not form Hydrogen bond.

13. **(a) Hydrogen bonds**

Explanation (Word-friendly format):
In a DNA molecule, the two strands are held together by **hydrogen bonds** between complementary nitrogen bases:

- **Adenine (A)** pairs with **Thymine (T)** through **two hydrogen bonds**.
- **Guanine (G)** pairs with **Cytosine (C)** through **three hydrogen bonds**.

These hydrogen bonds provide **stability** to the DNA double helix while still allowing the strands to **separate easily during replication and transcription**.

14. (b) Hydrogen bonding increases heat of vaporisation.

15. (d) Only NH_3 forms H-bonds.

16. (a) Chloroform

Explanation:
Chloroform ($CHCl_3$) has no strong electronegative atom (like O or N) directly bonded to hydrogen. Hence, **no hydrogen bonding** occurs.
(Ethyl alcohol and acetic acid have –OH groups; ethyl ether shows weak hydrogen bonding through oxygen.)

17. (b) Hydrogen bonding

Explanation:
Two acetic acid molecules form a **cyclic dimer** in non-polar solvents like benzene because of **intermolecular hydrogen bonds** between –COOH groups.

18. (d) Liquid HCl

Explanation:
HCl does not form hydrogen bonds since **chlorine is less electronegative** than O, N, or F.
Phenol, water, and liquid NH_3 have hydrogen bonds.

19. (c) Hydrogen bond

Explanation:
The **α-helix and β-pleated sheet** structures in proteins are stabilized by **hydrogen bonds** between the –CO and –NH groups of peptide chains.

20. (c) Molecules aggregate because of hydrogen bonding

Explanation:
In HF, strong **H–F hydrogen bonds** cause association of molecules, giving it a **higher boiling point** than HCl.