1. Low density of ice compared to water is due to:

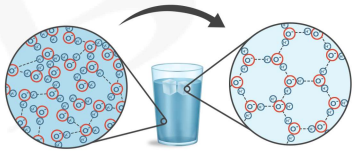
A. Dipole - induced dipole interactions

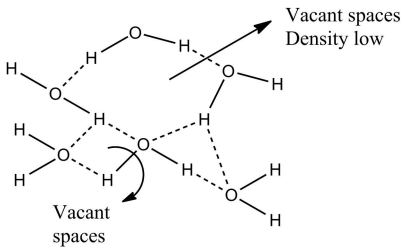
B. Induced dipole - induced dipole interactions

C. Hydrogen bonding interactions

D. None of the above

Density of ice is lesser than that of water because of the way hydrogen bonds are arranged in the crystalline structure of ice. Ice forms crystals having a hexagonal lattice structure.
When ice is formed, there remains certain empty spaces in the structure of ice. These empty spaces are due to the directional nature of hydrogen bonds. H_2O forms a cage like structure in solid ice and the density is reduced.
H_2O molecules form a crystal structure that causes the molecules to be more spread out than they were before.
Hence, the volume occupied is more in the case of ice.





2. Which of the following bonds/forces is the weakest?

A. Covalent bond

B. Ionic bond

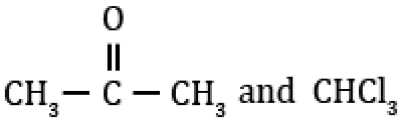
C. Hydrogen bond

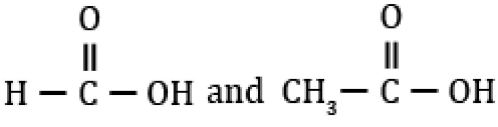
D. London force

Order of strength of weak forces:
Ion-dipole > Dipole-dipole > Ion-induced dipole > Dipole-induced dipole > London force
Ionic bonds and covalent bonds are strong while hydrogen bonds and London forces are weak. London forces are weaker than hydrogen bonds since london forces involve only instantaneous dipoles.
That's why they are the weakest of all the bonds/forces given.

3. Intermolecular hydrogen bonding is not present in which of the following pairs of molecules?

A. SiH_4 and SiF_4

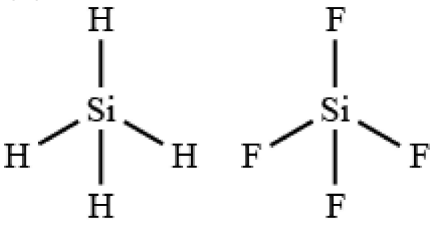
B.  and $CHCl_3$

C. 

D. All have intermolecular H-Bonding

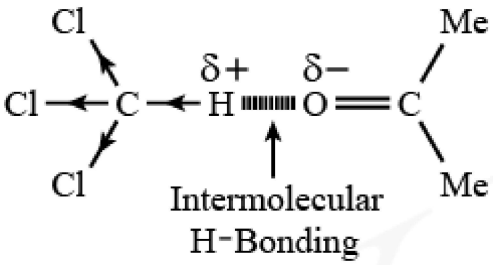
Intermolecular hydrogen bonding is formed between the hydrogen atom (attached to an electronegative atom) of one molecule and an electronegative atom of another molecule.

(a)

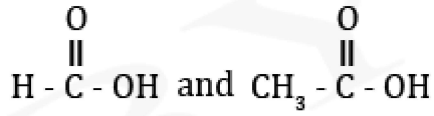


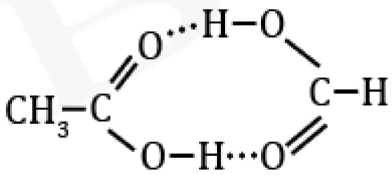
As the electronegativity of Si is less than that of H, the H atom does not have a partial positive charge here instead, it will have a partial negative charge. So, there would not be any H-bond formation between H and F.

(b) $CHCl_3$ and CH_3COCH_3



(c)





In both (b) and (c) there is intermolecular hydrogen bonding. Hence option (a) is the correct answer.

Intermolecular H bonding:

4. Which property is not due to H-bonding?

A. High boiling point of water

B. High viscosity of glycerol

C. Solubility of ammonia in water

D. Polar nature of halogen acid

(a) High boiling point of H_2O is due to intermolecular H - bonding.

(b) Glycerol has 3 $-OH$ groups and these three are involved in H-bonding. This means that the intermolecular forces are much greater because of these hydrogen bonds. Therefore, the viscosity is high.

(c) The solubility of a substance in water depends on its polar nature. NH_3 molecules, being polar, readily bond with H_2O molecules by H-bonding, making it water soluble.

(d) Polar nature of halogen acids (HX) is due to the electronegativity difference between H and halogen atoms. Except Fluorine, other halogens do not show H-bonding due to their large sizes and diffused electrons, reducing the charge density that is required for H-bonding.

5. The strongest hydrogen bonding is present in:

A. HF

B. HCl

C. HBr

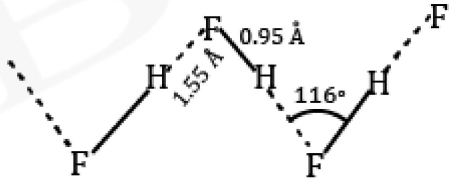
D. HI

The following conditions are to be satisfied for effective hydrogen bonding:
(i) Hydrogen atom should be bonded to a highly electronegative atom such as F, O or N. Greater the electronegativity of the other atom, greater is the strength of the hydrogen bond. For example, the electronegativities of F, O, N decrease as $F > O > N$. Consequently, the strength of H-bond decreases as

F—H·····F > O—H·····O > N—H·····N

(ii) The size of the

electronegative atom should be small. If the size of electronegative atom is large, its attractive force with the hydrogen atom would be less and consequently, the strength of H-bond will be reduced. For example, N and Cl has almost the same electronegativities but no hydrogen bonds are formed in the case of $H - Cl$ because of the larger size of Cl atom.



Zig-zag chains of H-F molecules