INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 23

Total Marks : 26

Max. Time : 27 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. The order of strength of hydrogen bond is :
(A) Cl–H....Cl > N–H....N > O–H....O > F–H....F
(B) N–H....N > Cl–H....Cl > O–H....O > F–H....F
(C) O–H....O > N–H....N > Cl–H....Cl > F–H....F
(D) F–H....F > O–H....O > N–H....N > Cl–H....Cl

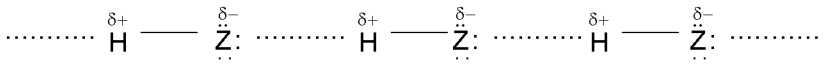
2. Which one among the following does not have hydrogen bonds :
(A) boric acid (solid) (B) N_2H_4 (liquid)
(C) H_2O_2 (liquid) (D) C_6H_6 (liquid)

3. When two ice cubes are pressed over each other, they unite to form one cube. Which of the following force is responsible for holding them together :
(A) Vander Waal's forces (B) Hydrogen bond
(C) Covalent attraction (D) Dipole-dipole attraction.

4.* Correct order of boiling point is/are :
(A) $CH_3 — O — CH_3 < CH_3 — CH_2 — OH$ (B) $F_2 < Cl_2 < Br_2 < I_2$
(C) HF < HCl < HBr < HI (D) $NH_3 > PH_3 > AsH_3$

Comprehension # (Q.5 to Q.7)

When a H-atom is bonded to a highly electronegative atom with lone pair of electron (say, Z) by a covalent bond, the bond pair of electrons is displaced towards the electronegative atom. When solitary electron of hydrogen atom lies away from it, its nucleus gets exposed and behaves as a bare proton. Such a bare hydrogen nucleus exerts a strong electrostatic attraction on the electronegative atom of the adjacent molecule. This interaction



between hydrogen atom of one molecule and the electronegative atom of the other molecules is referred to as hydrogen bond.
Larger the electronegativity of the other atom, greater is the strength of hydrogen bond. For example, electronegativities of F, O and N decrease as F > O > N consequently, strengths of H-bonds decreases. If the size of electronegative atom is large, its attractive force with hydrogen atom will be less and consequently, strength of H–bond will be less. Strength of H-bond increases with the increase in availability of lone pair of electron on the electronegative element. The order of the availability of lone pair of electron is N > O > F.
The presence of two hydrogen atoms and two lone pair of electrons in each water molecule results in a three dimensional tetrahedral cage like structure. This accounts for the fact that ice is less dense than water at 0°C. If temperature is increased hydrogen bond starts breaking and molecule come closer. Which increases the density but after 4°C density of water decreases with increase in temperature due to normal thermal expansion.

5. Which of the following substances does not form H-bond with water :

(A) CH_3CH_2OH (B) $CH_3-\overset{\overset{O}{\|}}{C}-OH$ (C) $CH_3-CH_2-CH_3$ (D) $CH_3-\overset{\overset{O}{\|}}{C}-NH_2$

6. Which of the above statement is true :

I. When ice is melted, hydrogen bond starts breaking & molecule of water come closer by moving into vacant space. As a result, density of water decreases upto 4°C.

II. Due to open cage like structure, ice has a relatively large volume for a given mass of liquid water.

III. In ice, there are four water molecules attached tetrahedrally.

(A) I, II and III (B) I and III (C) II and III (D) II only

7. Which of the following conditions is required for the formation of hydrogen bond :

(A) Hydrogen atom should be bonded to a highly electronegative atom.

(B) The size of electronegative atom should be small.

(C) There should be a lone pair of electron on the electronegative atom.

(D) All of the above.

8. State the type of force of attraction existing in the sample of following compounds :

(i) $CH_3 — O — CH_3$ (ii) sugar (iii) ice (iv) CH_3COCH_3

(v) $CH_3 — OH$ (vi) $N(CH_3)_3$ (vii) gold (viii) $CH_3 — NH_2$

(ix) H_2S (x) $Na^+(aq.)$ (xi) CCl_4 (xii) diamond

(xiii) Cl_2 (xiv) NH_4Cl (xv) HCl and Cl_2 (xvi) Ar

Answer Key

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1. (D) **2.** (D) **3.** (B) **4.*** (AB) **5.** (C)

6. (C) **7.** (D)

8.

(i) dipole-dipole attraction. (ii) H – bonding (iii) H – bonding (iv) dipole-dipole attraction.

(v) H–bonding (vi) dipole-dipole attraction. (vii) metallic bonding (viii) H–bonding.

(ix) dipole-dipole attraction. (x) ion-dipole attraction. (xi) dispersion forces (xii) covalent bond.

(xiii) disperison forces (xiv) ionic bond (xv) dipole - induced dipole attraction.

Hints & Solutions

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1. Bond polarity is a more dominating factor for strength of H–bond than lone pair availability.

2. **[D]**
Benzene has hydrogens connected to carbons and the bonds are almost non polar. Hence no question of hydrogen bonding. It is a liquid owing to vander waal forces.

3. Two ice cubes unite due to H–bond developed between water molecules of two cubes.

4.* (A) H–bonding exists in $CH_3 - CH_2 - OH$ due to polar O – H bond.
(B) I_2 has maximum moecular mass, thus stronger vander waal forces and higher b.p.
(C) H–bonding exists in HF, so it has highest b.p.
(D) H–bonding exists in NH_3, so it has highest b.p.

5. No polar bond of H–atom (N – H or O – H) is present in $CH_3 - CH_2 - CH_3$, but in all other compound, it is present.

6. I – density of water increases up to 4°C
II – in case of ice each water molecule is attached with four other molecules tetrahedrally forming a cage like structure.

7. Conditions for H–bonding :
(A) Positive charge density on H–atom should be high.
(B) Availability of lone pair of EN atom should be high.
(C) Size of EN atom should be small.

8.

(i) dipole-dipole attraction.	(ii) H – bonding	(iii) H – bonding
(iv) dipole-dipole attraction.	(v) H–bonding	(vi) dipole-dipole attraction.
(vii) metallic bonding	(viii) H–bonding.	(ix) dipole-dipole attraction.
(x) ion-dipole attraction.	(xi) dispersion forces	(xii) covalent bond.
(xiii) disperison forces	(xiv) ionic bond	(xv) dipole - induced dipole attraction.
(xvi) disperison forces.		