ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

- **Subject :Chemistry Answers of Worksheet-5 Class IX**
- **Date 15.05.2020**
- **Chapter: Acid, bases and salts**
- **Answer the following questions (MCQ) : (1×15)**

1). Water is liquid at room temperature, the most important reason for this is the:

a. High boiling point of water
b. High melting point of water
c. High heat of vaporization of water
d. Cohesive forces due to hydrogen bonds in water

1. Ans. (d). Cohesive forces due to hydrogen bonds in water

(2). Water is a ____

a. Polar
b. Nonpolar
c.Anamphipathic
d. Non polar uncharged solvent

2. Ans. (a). Polar solvent

Water is a polar solvent. Water molecule consists of two hydrogen atoms bonded to an oxygen atom. The two hydrogen atoms in water are not arranged linearly, because the oxygen atom's four sp3 hybrid orbitals extend roughly toward the corners of a tetrahedron. Hydrogen atoms occupy two corners of the tetrahedron, and the nonbonding electron pairs of the oxygen atom occupy the other two corners. Thus water molecules have an angular geometry. Due to the high difference in the electronegativity difference between oxygen and hydrogen, the oxygen atom with its unshared electrons carries a partial negative charge and the hydrogen atom each carry a partial positive charge. These electrostatic attraction create a diploes and thus the water molecule become polar in nature

(3). Polar molecules can readily dissolve in water. This is because:

a. Polar molecules can form hydrogen bonds with water
b. Polar molecules can replace water-water interaction with more energetically favourable water-solute interactions
c. Polar charged water can interact with the charge of polar molecules
d. All polar molecules are amphipathic in nature

3. Ans. (b). Polar molecules can replace water-water interaction with more energetically favourable water-solute interactions

(4). Most important reason for the unusual properties of water is:

a. The covalent bonding pattern in water molecule
b. The bond angle between the two hydrogen atoms in water
c. Hydrogen bonding between water molecules
d. Water can be immediately ionized at room temperature

4. Ans. (c). Hydrogen bonding between water molecules

(5). The H – O – H bond angle in water molecule is:

a.104.0^{o}
b.104.5^{o}
c.105.0^{o}
d. 105.5^{o}

5. Ans. (b). 104.5^{o}

(6). Which of the following statement is true regarding the electronegativity of atoms in water molecule?

AHydrogen is more electronegative than oxygen
b.Hydrogen is less electronegative than oxygen
c. Electronegativity of hydrogen and oxygen is same
d. Oxygen and hydrogen do not have significant electronegativity in water

6. Ans. (b). Hydrogen is less electronegative than oxygen

Electronegativity is the affinity of atomic nuclei towards electrons. Each atom has specific electronegativity values, which means that they have different degree of affinity towards electrons. Oxygen, nitrogen etc. are highly electronegative atoms. The electronegativity of hydrogen is very less. When covalent bond is formed between two atoms, one with high electro-negativity and the other with lesser electronegativity, the paired electron cloud in the covalent bond will shift more towards the highly electro-negative atom and this will create a dipole in the molecule.

(7). Which of the following represent the current melting point, boiling point and heat of vaporization of water?

a. 0^oC ;100^oC ; 2260J/g
b.100^oC ; 0^oC ; 2260J/g
c. 0^oC ; 100^oC ; 1260J/g
d. 100^oC ; 0^oC ; 1260 J/g

7. Ans. (a). 0^oC ; 100^oC ; 2260 J/g

Water is an unusual solvent. Water has got high boiling point (100^oC), high melting point (0^oC) and high heat of vaporization (2260 J/g) when compared to other solvents.

Heat of vaporization: The heat energy required to convert 1.0 g of a liquid at its boiling point and at atmospheric pressure into its gaseous state at the same temperature. It is a direct measure of the energy required to overcome attractive forces between molecules in the liquid phase.

(8). The oxygen atom in the water molecule due to its high electronegativity bears _____

a. $1\delta^+$ charge
b. $2\delta^+$ charges
c. $1\delta^-$ charge
d. $2\ \delta^-$ charges

. Ans. (d). 2 δ^- charges

Oxygen is highly electronegative than hydrogen, hence oxygen will pull the shared electron pairs in the covalent bond between O and H more towards it an with this oxygen will get a partial negative charge called δ^-. Since there are two hydrogen atoms in water molecule, there will be a total of $2\delta^-$ charges in a single water molecule. Similarly, each hydrogen in the water molecule will bear one partial positive charge called δ^+.

(9). Hydrogen bond is best represented as the electrostatic attraction between:

a. A hydrogen covalently bounded to an electronegative atom and another hydrogen atom
b. A hydrogen covalently bounded to an electronegative atom and another electronegative atom

c. Two electronegative atoms and a hydrogen atom
d. Two hydrogen atoms

9. Ans. (b). A hydrogen covalently bounded to an electronegative atom and another electronegative atom

(10). The bond dissociation energy of hydrogen bonds in water molecule is

a. 10kJ/mol
b. 23kJ/mol
c. 470kJ/mol
d. 348 kJ/mol

10. Ans. (b). A hydrogen covalently bounded to an electronegative atom and another electronegative atom

11. Which of the following statement is correct regarding the hydrogen bonds in water?

a. Hydrogen bond is 10 % covalent and 90 % electrostatic
b. Hydrogen bond is 25% covalent and 75 % electrostatic
c. Hydrogen bond is 50% covalent and 50% electrostatic
d. Hydrogen bond is 100 % electrostatic

11. Ans. (a). Hydrogen bond is 10 % covalent and 90 % electrostatic

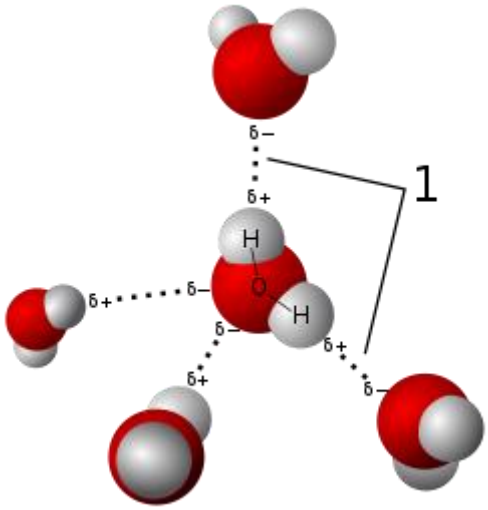
Hydrogen bond in water is 10 percent covalent due to the overlaps in the bonding orbitals and 90 percent electrostatic

12. A single water molecule can form how many hydrogen bonds at a time? (theoretically possible value)

a. 1
b. 2
c. 3
d. 4

12. Ans. (d). 4

A single water molecule can form four hydrogen bonds with four different water molecules in liquid water as shown in the figure below



13. The life span of a hydrogen bond between two water molecule in liquid water is:

a. 1–20seconds
b. 1–20microseconds
c. 1–20nano-seconds
d. 1 – 20 pico-seconds

13. Ans. (d) 1 – 20 pico-seconds

Hydrogen bonds in water are highly dynamic. They life span of each hydrogen bond in water is very short. The lifetime of each hydrogen bond is just 1 to 20 picoseconds (1 ps = 10-12S)

14. The bond dissociation energy of O – H bond in water is:

a. 470kJ/mol
b. 348kJ/mol
c. 23kJ/mol
d. 10 kJ/mol

14. Ans. (a). 470 kJ/mol

15. What is the bond length of hydrogen bond between two water molecules in liquid water?

a. 0.0177nm
b. 0.177nm
c. 1.177nm
d. 17.70 nm

15. Ans. (b). 0.177 nm

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