

2- why might a water pipe break if left full of water during extended frigid weat...

[Environment](#), [Water](#)



1- The chapter opens with these words: " Neeru, shouei, maima, aqua. In any language, water is the most abundant compound on the surface of the Earth."

- Explain the term compound and also why water is not an element.

Answer: Compound is a chemical entity made from combination of two or more different elements. These elements lose their individual identities when they combine to form a compound and possess unique properties subjected to that compound. Water is made from two molecules of hydrogen and one molecule of oxygen. Hydrogen and oxygen individually are elements but when combined in the above said ratio, they form a molecule of water.

Answer: Water has the property of expanding when it cools. Thus, in frigid weather the water freezes and expands which might lead to breakage of a closed water pipe.

3 -Here are four pairs of atoms. Consult Table 5. 1 to answer these questions.

N and C N and H

S and O S and F

Arrange the bonds in order of increasing polarity.

Answer: Polarity is a property defined by the number of electrons shared between two atoms. It creates a polar bond whereby electrons are shared unequally as one of the two atoms attracts electrons more compared to another. This ability to attract electrons towards itself is defined as electronegativity. Hence, the more is the difference in electronegativities of

two elements, more will be their polarity. Let's first calculate the electronegativity differences in polarity of atoms:

Based on the electronegativity differences in bonds, the order of increasing polarity will be:

$N-C < N-H < S-O < S-F$

4-Consider a molecule of ammonia, NH_3 .-Does the NH_3 molecule contain polar bonds?

Explain?

Answer: A molecule of ammonia is made of three hydrogen atoms sharing their single electron with a nitrogen atom. The three N - H bonds in NH_3 molecule are polar in nature as the electronegativity difference between N and H is $3.0 - 2.1 = 0.9$. This sharing of electrons fulfills both hydrogen and nitrogen atoms by completing two and eight electrons in their outermost shells making them stable.

5- This Diagram represents two water molecules in a liquid state. What kind of bonding force does the arrow indicate? Is this an intermolecular or intramolecular force?

Answer: The arrow hereby indicated the intermolecular hydrogen bonding amongst the water molecules and not within the water molecules. These hydrogen bonds originate due to highly electropositive nature of hydrogen atoms in water molecules rendering a high boiling point to water. Hydrogen acquires significantly positive charge due to attachment with the highly electronegative atom i. e. oxygen. The two lone pairs of electrons on oxygen form a weak bond with hydrogen that is weaker than covalent bond but stronger than a dipole interaction, these hydrogen bonds tend to break and

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reform in liquid state of water.

6-Based on your experience, how soluble is each of these substances in water? Use terms such as very soluble, Partially soluble, or not soluble. Cite supporting Evidence. -chicken fat.

Answer: Chicken fat is not soluble in water as it a fatty substance and does not form hydrogen bonds with water molecules. Oils and fats do not dissolve in water as they are formed of hydrophobic long hydrocarbon chains of fatty acids.

7-Write the chemical formula for each compound. - magnesium chloride - magnesium sulfate

Answer: Chemical formula for Magnesium Chloride is $MgCl_2$

Chemical formula for magnesium sulfate is $MgSO_4$

8- Explain why $CoCl_2$ is named cobalt (II) chloride, whereas $CaCl_2$ is named calcium chloride.

Answer: Calcium is capable of forming only one ion with a valency of +2 whereas cobalt can form ions with valency +2 (known as cobaltous ion, $Co(II)$) and valency +3 (known as cobaltic ion, $Co(III)$). The roman numeral differentiates the valency state of cobalt in a compound whereas there is no need for calcium.

9- A student weighs out 5.85 g of NaCl to make a 0.10 M solution. What size volumetric flask does he or she need? Hint: See Figure 5.16.

Answer: 0.1M solution will be prepared by dissolving 5.85g of NaCl in 1000 ml water. A volumetric flask of 1000ml or 1.0L is required to prepare such solution.

10- An aqueous solution of KCl conducts electricity, but a solution of sucrose

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does not. Explain.

Answer: KCl (an ionic molecule) when dissolved in water breaks into K^+ and Cl^- ions whereas sucrose (a neutral molecule) dissolves without dispersing into ions. Electricity is conducted when there is flow of electrons. This flow of electrons is performed by K^+ and Cl^- ions towards anode and cathode.

11-Based on the generalizations in Table 5. 9, which compounds are likely to be water-soluble?

- LiOH

- $Ca(NO_3)_2$

Answer: Both these compounds are soluble in water. LiOH is an alkali and breaks into ions when dissolved in water. $Ca(NO_3)_2$ is a nitrate compound and breaks into ions making it soluble in water.

12- A diatomic molecule XY that contains a polar bond must be a polar molecule. However, a triatomic molecule XY_2 that contains a polar bond does not necessarily form a polar molecule. Use some examples of real molecules to help explain this difference.

Answer: NaCl, KCl is diatomic molecules that contains polar bond due to difference in electronegativities between their atoms. These molecules have a linear structure and the molecule's polarity is determined by the polarity of diatoms. In the triatomic molecules, the geometry of the molecule determines the polarity. CO_2 has polar C-O bonds with a linear geometry making the molecule non-polar. Whereas, $MgCl_2$ is a polar molecule as the geometry is bent structure.

13- Levels of naturally occurring mercury in surface water are usually less than 0.5 mg/L. The average intake of Mercury from food is 2-20 mg daily,

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but may be much higher in regions where fish is a staple of the diet.

a. Name three human activities that add Hg 21 (“Inorganic mercury”) to water.

-What is “organic mercury”? This chemical form of Mercury tends to accumulate in the fatty tissues of Fish. Explain why.

Answer: Inorganic mercury (example: mercuric chloride) is usually released from industries such as chemical, paper, etc and is most common form of mercury found in drinking water. It can be released into drinking water through:

- Burning of coal/ oil or from metal smelters,
- Improper dumping of mercury containing products such as batteries, paints that seep inorganic mercury through soil to the drinking water supplies,
- Passing of mercury from farmlands to water bodies that accumulated due to application of mercury containing pesticides or chemicals.

Organic mercury is the most harmful form of mercury. Mercury combines with certain organic molecules like methyl forming organic compounds like methyl mercury. These are easily absorbed in the body tissues of fish as well as humans. Fishes intake them through the algae they eat. The rate by which they excrete the mercury is very less compared to the rate of intake. The process of methylmercury accumulation in fish tissues is known as biomagnification.