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Isotonic solution definition class 12

10upon10.com 12-chemistry-home Isotonic solutions Two solutions with the same osmotic pressure at a certain temperature are known as isotonic solutions. In the case of isotonic solutions, there is no osmosis between them. Example – The sodium chloride solution, which is 0.9% (mass/volume) sodium chloride solution, has an equivalent osmotic pressure as the fluid in the blood cells. This is the cause that 0.9% of the sodium chloride solution, i.e. normal saline solution is injected intravenously in case of dehydration and other emergencies. Saline solution (solutions) containing more than 0.9% (mass/volume) sodium chloride is called hypertonic. Saline solution (solutions) containing less than 0.9% (mass/volume) sodium chloride is called hypotonic. If the blood cell is stored in a solution containing more than 0.9% sodium chloride, the fluid in the blood cells will flow out due to osmosis. And due to loss of water; blood cells would collapse. On the other hand, if the blood cell is stored in a solution containing less than 0.9% sodium chloride, water flows into the blood cells due to osmosis, resulting in swelling of blood cells. There is a medical condition called edema, in which people experience water retention in tissue cells and intermolecular spaces resulting in puffiness or body swelling. This happens to people who have more salt or salty food. Taking more salty foods increase the concentration of salt in tissues; this creates imbalance in osmotic pressure between fluid in the blood cells and tissues. And to maintain balance, water flows from outside the tissue into the tissues and intermolecular spaces in the body. Meat is preserved by salting. By salting the bacteria on meat loses water due to osmosis and dies. In this way, salting protects the meat from bacterial action. Sugar is added to fruits for preservation. By adding sugar to the fruits, bacteria over fruits loses water due to osmosis due to imbalance in osmotic pressure, and dies. 12-chemistry-home Reference: An isotonic solution is one that has the same osmolarity, or resolution concentration, as another solution. If these two solutions are separated by a semipermeable membrane, the water will flow in equal parts from each solution and into other streams. The effect is zero water flow between the two solutions, although the water moves in both directions. In biology, some cells need to be maintained in an isotonic solution to support cellular functions. Many animal cells, which do not have a cell wall to support against the effects of water pressure, rely on the stability of the external environment to maintain their shape. Most animals retain the pH and osmolarity of the fluids in their body to create isotonic solutions to bathe their cells. This solution can carry nutrients and water, but only in proportions similar to those in the cell. An image of a cell in an isotonic isotone can be seen above. Note that because there is the same concentration of dissolved molecules inside and outside the cell that water molecules are simply exchanged through the cell membrane. This can be compared to the effects of a hypertonic solution, in which water molecules leave the cell, or a hypotonic solution in which water enters the cell. When the plasma surrounding blood cells is an isotonic solution, compared to the solution in the blood cells, the cells function normally. The isotonic solution allows the cells to move water and nutrients in and out of the cells. This is necessary for blood cells to perform their function of delivering oxygen and other nutrients to other parts of the body. If the cells are in a hypertonic environment, they become plasmolysed and do not contain enough water to perform cellular functions. If the cells exist in a hypotonic environment, they will lyse, spilling their contents into the bloodstream. This can lead to dangerous side effects, as well as the loss of many blood cells. These events can be seen in the image below. To prevent any of the negative situations from occurring during the transfusion of nutrients and medications, the solution that carries the drug should be an isotonic solution, compared to the patient's blood. The osmolarity of the IV liquid can be adjusted using special salts and sugars that simply act as solvent to dilute or strengthen a substance. Once a drug is an isotonic solution compared to the blood, it can be added via an IV and no damage will occur to blood cells. In nature there are two types of organisms: those that meet the osmolarity of the environment, and those that regulate the osmolarity of their body to be different from the environment. The first are known as osmoconformers and have evolved to have cells that match the osmolarity of the environment. These animals always exist in an isotonic solution, because they have evolved to the same concentration as the environment. This condition can be seen in many of the lower forms of life, such as sea snails, coral and jellyfish. The other group, the osmoregulators, does not exist in an isotonic environment. This means that water tends to want to enter or leave their bodies, and they have different methods to deal with this. However, inside an osmoregulators, the cells will still exist in an isotonic solution, because the organism needs its cells to remain functions. Both osmoregulators and osmoconformers have several benefits for performing life as they do, but an isotonic solution is usually made around cells. Hypotonic – When a has relatively more water and less solvent. Hypertonic – A solution with less water and more soluble than any other solution. Osmolarity – The overall resolution concentration of a solution. 1. A cell has a concentration of 10 g/L. environment has a concentration of 10 g/L. Which of the following is true? A. The cell exists in an isotonic solution; There will be no water flowing. B. The cell exists in an isotonic solution; water will flow both in and out of the cell. C. The cell exists in a hypertonic environment; water will flow out of the cell. B is correct. If the concentrations of the internal solution are equal to the external solution, it is said that the two solutions are isotonic. An important caveat to remember is that while there is no water pressure in or out of the cell, water is still allowed to exchange. Simply because of the molecular forces that repel and attract water, it will continue to be cycled through the cell. Cells use water to transport nutrients and oxygen, and rely on the constant flow. 2. Plant cells rely on the turgidity of their cells, or the water pressure inside, to maintain their shape. What happens to a plant cell when it is placed in an isotonic solution? A. It remains turgid and can B function. It loses all its pressure and can't function C. It gets limp, but can still function C correctly. Plant cells placed in a perfect isotonic solution will lose their turgor pressure, as water no longer wants to enter the cell. Typically, plants keep their cells in a hypotonic environment, which pushes water into the cell. Without this pressure, the cell can still function, but will lose much of its structure. Large plants need to monitor and adjust their tonicity to stay long and harvest sunlight. 3. A student tries to create a solution that is grown isotonic isotone for the cells. It is known that the concentration of the cytosol in the cells is 1 g/mL. The student has 2 liters of water to create a nutrient solution. Which of the following would create an isotonic solution for the cells? A. Addition of 2 grams of solvent B. Adding 1000 grams solvent C. Adding 2000 grams solvent C is correct. 2 litres of water equals 2000 mL of water. Therefore, if the contents of the cell has an osmolarity of 1 g/mL, a gram of solvent must be added to each mL water. To achieve this concentration, 2000 grams must be added to the 2000 mL of water. This creates an isotonic solution, compared to the cells. As a result of the EU General Data Protection Regulation (GDPR). We do not currently allow internet traffic to byju's website from countries within the European Union. This page did not display any tracking or performance measurement cookies. Semi-permeable membrane: Some membranes appear to be continuous, but they have tiny pores that allow small molecules to pass through. Such a membrane is called semi-permeable membrane. Osmosis: When a membrane between a solvent and solution is placed, the solvent molecules flow through the membrane from pure solvent to solution. This process of the flow of solvent is called osmosis. Osmotic pressure: the flow of from solvent silk to solution side (over a semi-permeable membrane) can be stopped by applying some extra pressure. The pressure that is just enough to stop osmosis is called osmotic pressure of the solution. Pre-depleted solutions, osmotic pressure is proportional to the molar (C) of the solution at a certain temperature. 'Π =text(CRT)' Here is Π osmotic pressure and R is the gas constant. Now, 'Π=(n_2)/VRT' Here is V volume solution in liters with n2 solvent dissolvers. As w2 g of solvent, molar mass M2 is present in solution other than 'n_2=(w_2)/(M_2)' Thus, 'ΠV=(w_2RT)/(M_2)' Or, 'M_2=(w_2RT)/(ΠV)' Meaning of osmotic pressure: Osmotic pressure can be used to determine molar masses of solutes. This method has advantage over other methods because pressure measurement is around room temperature and molarity is used instead of molality. Compared to other colligative properties, its size is large, even for highly diluted solutions. This method for determining the molar mass of solvent is especially useful for biomolecules because biomolecules are not stable at higher temperatures and polymers have poor solubility. Isotonic solution: Two solutions with the same osmotic pressure at a certain temperature are called isotonic solutions. No osmosis happens when two isotonic solutions are separated by a semi-permeable membrane. Hypertonic Solution: A solution with a higher osmotic pressure compared to another solution is called hypertonic solution related to the second solution. In this case, osmosis happens from the second solution to the first solution. Hypotonic solution: A solution with a lower osmotic pressure compared to another solution is called hypotonic solution with respect to the second solution. In this case, osmosis happens from the first solution to the second solution. Example: 200 cm3 of a watery solution of a protein condensians 1.26 g of the protein. The osmotic pressure of such a solution at 300 K turns out to be 2.57 'xx' 10-3 bar. Calculate the molar mass of the protein. Answer: Π = 2.57 'xx' 10-3 bar V = 200 cm3 = 0,200 liters T = 300 K R = 0,083 L bar mol-1 K-1 Now the mol can be calculated as follows: 'M_2=(w_2RT)/(ΠV).' 1.26xx0.83xx300)/(2.57xx10^(-3)xx0.200)' '=61.022' g mol-1 Reverse Osmosis: The direction of osmosis can be reversed by applying a pressure greater than the osmotic pressure on the solution side. This phenomenon is called reverse osmosis. Copyright © excellup 2014

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