Chardakov method essay

All cells require essential materials to ensure their survival. Chemical, physical, and biological processes are used to move these materials inside of cells. Similar processes move waste materials outside of cells. These processes can be passive, occurring as a result of basic physical laws and requiring no outside energy from the cell or they can be active, requiring energy expenditure. Since all molecules possess kinetic energy (energy of motion), they are constantly moving enabling the passive transfer of certain substances into and out of cells.

Diffusion is the passive movement of molecules from an area of higher concentration to areas of lower concentration. In a closed environment, molecules will disperse until they reach a state a dynamic equilibrium. As the molecules approach equilibrium, the net or overall rate of diffusion begins to slow and occurs equally in all directions. In an open environment, there are no “ walls” to confine the molecules so the molecules will always appear to move away from the immediate source. For instance, odours in a confined room persist much longer, whereas odours outside will dissipate more quickly.

Molecular weight indirectly affects the rate of diffusion. When a concentration gradient (difference in concentration) exists, the net effect of this random molecular movement is that the molecules eventually become evenly distributed throughout the environment. There are many examples of diffusion in non-living systems – for example, the ability to smell a friend’s cologne shortly after he or she has entered the room. It can also be seen if you drip food colouring or ink into a clear glass of water.

Water will let other molecules move among the water molecules so freely that the water carries or transports them. The diffusion of particles into and out of cells is regulated by the plasma membrane, which constitutes a physical barrier. In general, molecules diffuse passively through the plasma membrane if they can dissolve in the lipid portion of the membrane (as in the case of CO2 and O2). The diffusion of solutes (particles dissolved in water) through a semi-permeable membrane is called simple diffusion.

The diffusion of water through a semi-permeable membrane is called osmosis. Both simple diffusion and osmosis involve the movement of a substance from an area of its higher concentration to one of lower concentration – down the concentration gradient. Certain molecules, for example glucose and ions move through the membrane by a passive transport process called facilitated diffusion. The transported substance either binds to protein carriers in the membrane and is ferried across or moves through water-filled protein channels.

As with simple diffusion, the substance moves down the concentration gradient. Osmosis occurs where a semi-permeable membrane (a membrane through which water can pass but some other particles cannot) separates two bodies of fluid. Plant and animal cell membranes are semi-permeable. As long as the number of particles or the concentration of ions in both of the cell compartments remains equal, osmosis helps to maintain that equalized state in each compartment. If particles are added to one compartment only, then the concentration is increased.

The process of osmosis must be tightly controlled by cells, otherwise they will die. For example, if you place a red blood cell in pure (distilled) water, it will quickly take up water until it bursts. That is why plasma, the liquid portion of our blood is made of water with proteins and salts dissolved in it, preventing the unnecessary gain of water by our blood cells. In plants, osmosis is just as important. Plants with too little water will wilt. This happens when water moves out of the cells by osmosis.

Without this water there is little pressure inside the cells and the plant can no longer support itself against the pull of gravity. However, after watering the plant, the cells become reflated with water and the plant stands upright. Because many solutes cannot easily pass through these membranes, water shifts from the compartment of low solute concentration to the compartment of high solute concentration. Osmosis is the simple (passive) diffusion of water across a semi-permeable membrane.

Water flows from an area of high water concentration (high water potential) to areas of lower water concentration (low water potential). Water will always move from an area of higher water potential (higher free energy; more water molecules) to an area of lower water potential (lower free energy; fewer water molecules). Water potential, measures the tendency of water to leave one place in favour of another place. You can picture the water diffusing ‘ down’ a water potential gradient. When two solutions have the same concentration of solutes, they are said to be isotonic to each other.

If the two solutions are separated by a selectively permeable membrane, water will move between the two solutions by osmosis, but there will be no net change in the amount of water in either solution. If two solutions differ in the concentration of solutes that each has, the one with more solute is hypertonic to the one with less solute. The solution that has less solute is hypotonic to the one with more solute. These words are used to compare solutions. Now consider two solutions separated by a selectively permeable membrane. The solution that is hypertonic to the other must have more solute and therefore less water.

The water potential of the hypertonic solution is less than the water potential of the hypotonic solution, so the net movement of water will be from the hypotonic solution into the hypertonic solution. The epidermis, or outer layer of the skin, is made up of cells called keratinocytes, which form a very strong intracellular skeleton made up of a protein called keratin. These cells divide rapidly at the bottom of epidermis, pushing the higher cells upward. After migrating about halfway from the bottom of this layer to the top, the cells undergo a programmed death.

The nucleus involutes, leaving alternating layers of the cell membrane, made of lipids, and the inside, made largely of water-loving keratin. The outer layer of the epidermis, called the stratum corneum is composed of these alternating bands. When hands are soaked in water, the keratin absorbs it and swells. The inside of the fingers does not swell. As a result, there is relatively too much stratum corneum and it wrinkles. This bunching up occurs on fingers and toes because the epidermis is much thicker on the hands and feet than elsewhere on the body. Soaking in the tub does hydrate the skin, but only briefly.

All the added water quickly evaporates, leaving the skin dryer than before. The oils that hold the water in have usually been stripped out by the bath especially if soap and hot water are involved. But if oil is added before the skin dries, much of the absorbed water is retained. Applying a bath oil or heavy lotion directly after a bath or shower is a good method of hydrating the skin. Osmotic Potential in Different Plant Cells Water potential is a measure of the energy state of water. The contribution to water potential by dissolved solutes, termed osmotic potential is always negative in sign.

In other words, solutes decrease the water potential. In this lab we will use the Gravimetric and Chardakov techniques to determine the water potential of four different plant cells (potato, celery, carrot, and apple). The Gravimetric technique for measuring water potential is simple to perform and doesn’t require expensive equipment. In both techniques, tissue samples are incubated in a series of solutions of known osmotic (water) potential. In contrast to the Chardakov method which analyzes changes in solution density after incubation, the Gravimetric technique monitors tissue weight changes.

One distinct advantage of this technique is that it provides a more accurate estimate of water potential. In this method, tissue samples are weighed before and after incubation in a series of solutions of known osmotic (water) potential. Then, the percent change in weight of the tissue is plotted versus solution concentration (or osmotic potential). The water potential of the tissue is considered to equal the osmotic potential of the incubating solution at which there is no change in tissue weight (i. e. , where the curve intercepts the x-axis).