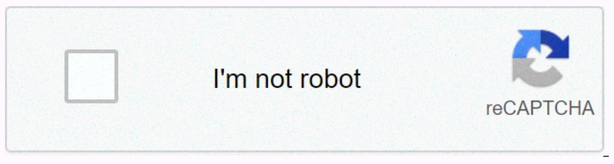

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Hypotonic egg in water

What you need: Several raw eggs vinegar corn syrup water food coloring scales to weigh egg (if possible) What you do: Weigh the uncooked eggs and place them carefully in a large glass of vinegar, cover and leave for 2 days. Remove the eggs and rinse gently under the faucet. The entire shell should now be gone (you can wipe leftover small bits). Weigh the egg again. You have to be really careful with the egg now as it is still raw and if you burst the outer skin it will make a big mess. Place some of the eggs in corn syrup and some in water. Rinse overnight and weigh again. (If you don't have dandruff, you can look at the egg and record all the differences in this way). Try some food coloring in the water and see what happens. What happened? Osmosis is the process by which water enters our tissues. All our cells are surrounded by a membrane that selectively allows everything the cell needs but prevents unwanted molecules from penetrating. An egg also has a membrane that surrounds it so we can use it to represent a cell and see how osmosis works. The first phase of the experiment was to soak the egg in vinegar. You will have seen that the shell disappears completely. Vinegar does indeed contain acetic acid and this reacts with the calcium carbonate that makes the shell of the ice. This reaction releases carbon dioxide, so if you've been careful, you'll have seen bubbles coming out of the egg once it's added to the vinegar. After soaking in vinegar, you should also have noticed that the egg is getting a little larger. This is because the water in the vinegar can enter the egg through the membrane, from the higher water concentration in vinegar to the lower concentration in the egg. If you put the egg in water now, it will become much larger due to the much larger water concentration gradient across the membrane. When you add food coloring to the water, you can see the process of osmosis in action as the colored water enters the egg. Water is known as hypotonic, i.e. very diluted and contains more water than the egg. If you put the vinegar-soaked egg in corn syrup instead, you will see the opposite. There is a much higher water concentration in the egg than in the syrup, so water goes in the opposite direction. This means that the egg shrinks in size. Corn syrup is a hypertonic liquid, i.e. very concentrated with not much water compared to the egg. Demonstrations - Solutions - 13.1A Solutions 13.1A Egg in Sugar Solution (requires several days lead time) Topics: solutions, osmosis, osmotic pressure, conflicting properties Description: Egg (shell removed) is placed in a sugar solution. The egg shrinks. Conversely, when an egg is placed in distilled water, it will swell. Materials: 3 raw eggs with removed shells (eggs must be provided and prepared by instructor in advance) Distilled water 3 400 ml cup 1 large cup for soaking egg vinegar. Vinegar is in the solution cabinets with the other household chemicals. Preparation: 1. Soak the 3 eggs in vinegar for 2-3 days in a large cup until the shell has dissolved and the translucent membrane remains. Do not use stronger acid, or the membrane can be dissolved. Carefully remove the eggs and dry. Method: 1. A descaled egg in the sugar solution, one in the distilled water and the third into the empty beaker without solution as a comparison. 2. Observe. Over time, the egg in syrup will decrease in size. The egg in the water grows larger. This can take the entire class period to see the results. Let the eggs soak until the next class period for improved effect. Discussion: Osmosis is a process in which solvent molecules flow through a semipermeable membrane. This membrane allows the passage of the solvent, but not the dissolved. Water flows from the area with low dissolved concentration (hypotonic) to high dissolved concentration (hypertonic). The movement of the solvent through a membrane creates a pressure called osmotic pressure. The movement of the solvent through the membrane continues until a balance is reached. This occurs when the pressure in the compartment into which the solvent flows is increased to the equivalent of the pressure of the solvent moving from the hypotonic side through the membrane (osmotic pressure). Osmosis is a conflicting property because it depends on the concentrations of the dissolved, but not on the identity of the dissolved. The solution in the egg membrane contains a complex solution of salts, proteins, lipids and carbohydrates. Compared to distilled water, the solution in the egg membrane is hypertonic. So when the decalcified egg is placed in water, the water flows through the membrane into the egg. A concentrated sugar solution is hypertonic compared to the solution in the egg. Therefore, when the egg is placed in the concentrated sugar solution, water flows out of the egg, causing it to shrink. Safety: No disposal: Eggs can be disposed of in the garbage. Solutions can be flushed into the drain with water. References: 1.B. Z. Shakhashiri; Chemical demonstrations: A manual for chemistry teachers; Wisconsin; Volume 3; 1989; 283-285 2nd Kotz, Treichel, Townsend; Chemistry & Chemical Reactivity; 7. Ed; Teachers Edition; Brooks/Cole; 2009; 635-637 3. A video of this experiment can be found at: ChemistryNow Screen 14.1 Puzzler and Screen 14.9, Colligative Properties. Download a printable version now while you read this, there are millions of things that are in your entire Happen. The food you ate a little ago is made by an aqueous slurry in your stomach and small intestine. Your kidneys work hard to reduce waste Water. The tear glands near your eyes are secretions that close your eyelids without damaging your eyeballs. What do all these processes have in common? They all rely on osmosis: the diffusion of water from one place to another. Osmosis factors strong in each of these processes and is an important force for every single cell in your body to keep healthy. Osmosis is difficult to see without a microscope. But when we create our own model of a cell with a shellless chicken egg, we can see what happens when we manipulate the osmotic balance in the cell! Materials 3 eggs 3 jars (large enough to fit the egg plus liquid) 3 butter knives White vinegar (about 3 cups) Distilled water (about 2 cups) Light corn syrup (approx. 1 1/4 cups) Slotted spoon measuring cup (1 cup) measuring spoon (1 tablespoon and 1/2 tablespoon) sticky notes and marker scale (optional) Place an egg in each glass. Pour enough vinegar to cover each egg. Bubbles begin to form around the egg, and it will float upwards. To keep it underwater, place a butter knife in the glass to hold it. Place the three glasses in the fridge and leave to sit for 24 hours. Carefully hold the egg in the glass, pour out the old vinegar. Replace with fresh vinegar and leave to sit in the fridge for another 24 hours. Repeat this process until the shells are completely dissolved and only the membrane remains. This should take about 2-3 days. Carefully remove the eggs with the slotted spoon and rinse with tap water in the sink. Rinse the empty glasses. Carefully place the bowlless eggs on a plate for a moment. Prepare three different sugar-water solutions as follows, labeling with sticky notes: glass 1: label hypertonic. Pour into a cup of corn syrup. Glass 2: Label isotonic. Put 1 1/2 tablespoons of corn syrup in one cup and fill the rest with distilled water. Pour into glass (make sure you get all the corn syrup out!) and stir to dissolve. Glass 3: Label hypotonic. Pour into a cup of distilled water. Carefully place a bowlless egg in each of the jars and leave to sit in the fridge for another 24 hours. Remove the glasses from the fridge and gently place the eggs on a plate. If you have weighed the eggs before placing them in each solution, weigh them again. What happened to each of the eggs? How does osmosis work? Osmosis is the scientific term that describes how water flows to different places depending on certain conditions. In this case, water moves on the basis of a concentration gradient into different areas, i.e. solutions that concentrations of dissolved particles (solutes) in them. Water always flows into the area with the most dissolved solutes, so that at the end Solutions have an equal concentration of dissolved. Think about it if you added a drop of food dye to a cup of water – even if you didn't stir it, it would eventually dissolve into the water by itself. In biological systems, the various solutions are usually separated by a semipermeable membrane, such as cell membranes or renal tubules. These act like a net that traps thieves, but they still allow water to pass freely. In this way, cells can contain all their guts, but still exchange water. Now think of the inside of an ice cream. There is a lot of water in the egg, but many other things (i.e. solutes) too, such as protein and fat. If you put the egg in the three solutions, how do you think that the concentration of dissolved between the inside of the ice and outside the ice was different? The egg membrane acts as a semi-permeable membrane and keeps all dissolved dissolved separately, but allows the water to pass through. How did osmosis change the eggs to size (or not)? If the above steps are performed correctly, the results should look like this. In the hypertonic solution, there were more dissolved in corn syrup than in the egg. So water flowed from the egg into the corn syrup, and as a result the egg shrank. In the isotonic solution, the corn syrup/water solution had about the same amount of dissolved as in the egg, so there was no mesh movement in or out of the egg. It remained the same size. In the hypotonic solution, there were more dissolved in the egg than in pure water. So water flowed into the egg, and as a result it grew in size. Osmosis and you Every cell in your body needs the right amount of water in it to keep its shape, produce energy, become waste-free, and other functions that keep you healthy. For this reason, drugs injected into patients must be carefully designed in such a way that the solution has the same concentration of dissolved cells as their cells (i.e. isotonic). If you were sick and dehydrated, for example, you would get a 0.90% saline IV drip. If it was too far from this mark, it would no longer be isotonic, and your blood cells could shrink upwards or even explode, depending on the concentration of dissolved dissolved in the water. Osmosis works in your cells just like in our egg-cell model. Luckily, however, the semi-permeable membrane of the ice is much stronger, so you don't have to worry about the egg exploding as well! Well!