Preparing a Buffer Solution

There are a couple of ways to prepare a buffer solution of a specific pH. In the first method, prepare a solution with an acid and its conjugate base by dissolving the acid form of the buffer in about 60% of the volume of water required to obtain the final solution volume. Then, measure the pH of the solution using a pH probe. The pH can be adjusted up to the desired value using a strong base like NaOH. If the buffer is made with a base and its conjugate acid, the pH can be adjusted using a strong acid like HCl. Once the pH is correct, dilute the solution to the final desired volume.

In a third method, you can determine the exact amount of acid and conjugate base needed to make a buffer of a certain pH, using the Henderson-Hasselbach equation:Alternatively, you can prepare solutions of both the acid form and base form of the solution. Both solutions must contain the same buffer concentration as the concentration of the buffer in the final solution. To get the final buffer, add one solution to the other while monitoring the pH.

pH=pKa log([A−][HA])

where pH is the concentration of [H], pKa is the acid dissociation constant, and [text{A}-] and [text{HA}] are concentrations of the conjugate base and starting acid.

Isotonic Buffers

The addition of any compound to a solution will affect the isotonicity since isotonicity is a property of the number of particles in solution. So the osmotic pressure of a solution will be affected not only by the drug but also by any buffer compounds that are included in the formulation. But after these compounds have been added, it is still possible that the solution will not be isotonic. It may be necessary to add additional sodium chloride to bring the solution to isotonicity, but that would require doing the calculations as shown above.

An alternative to this approach is to use an isotonic buffer. There are two approaches to using isotonic buffers.

Isotonic Solution

Imagine you're in the hospital and the nurse hooks you up to an IV. What is in that IV? Is it just water? No way. If you were pumped full of pure water, your blood cells would burst. How horrible would that be? That IV is full of saline, a liquid with the same concentration of solutes as your blood cells. Why is this important? Because you want your blood cells to sit in an isotonic solution.

An isotonic solution is when two solutions, separated by a semipermeable membrane, have equal concentrations of solutes and water. Imagine you're at a party and there are an equal number of guests in the living room and in the kitchen. It doesn't make much of a difference where you stand because you are equally as comfortable in either room. You have just as much space, you can move just as easily, and you have equal access to food. You don't spend a lot of energy trying to get out of one room or into another. This party is like an isotonic solution; everything is equal from room to room.

Now, compare this with a party where the living room is packed full of guests, while there are only a few in the kitchen. I don't know about you, but I would be trying to get to the kitchen as fast as possible. The concentration in each room is different, so people are moving around trying to equal things out. Nature likes equality and that is apparent when it comes to solutions.