Acid base ph lab essay sample

Background Information:

The pH is the measurement of how acidic or how basic a substance can be. The pH scale is used to measure how acidic or basic a living cell can be. The pH scale ranges from 0-14; 0-6 being acidic, 8-14 being basic and 7 being neutral. There are many factors that could be accounted for that might influence the pH of cells. The location of a cell might affect the pH of it. For example, a cell living in an acidic environment might have a pH level ranging from 0-7. Also cellular metabolism may affect the cytoplasmic pH and as a result also affect the surrounding medium (Biohazard, 2007). Because of the change in pH levels, cells will have to maintain a constant pH because of enzyme activity. Most human enzyme work best with pH ranges of 6-8 (Biohazard, 2007). Some function in acidic environments, such as, stomach enzymes. Cells regulate by controlling their pH levels for proper functions of enzymes.

Problem:

How do acids and bases affect living cells?

Hypothesis:

If the amount of acid/base that is exposed to a living cell increases then the cell’s pH level will remain neutral because of the buffers that are within the living cell. The buffers will be able to neutralize small increasing amounts of acids and bases that are exposed to the cells; thus
maintaining the pH levels that are exposed to the cells making it relatively stable (Larsen, n. d.). This is relatively true for the commercial buffer and

potato solution that was used in the experiment. As for water, the pH level will also remain constant because as more drops of acid/base are added to the water, it will be able to maintain its pH because water molecules (H2O) can dissociate into hydroxide ions (OH-) and hydrogen ions (H+). Cells can regulate their pH by increasing their hydrogen concentration, which causes the pH level to lower and vice versa (Biohazard, 2007).

When calculating pH changes from each solution some trends can be seen. One major trend that can be seen is within the commercial buffer. The change in pH of the commercial buffer is 0. This is because the small amounts of acid and base that has been added to the buffer have been neutralized. Therefore, the pH of the commercial buffer stays the same. When Hydrochloric acid (HCl) was added to water it was seen that the pH of the water became more acidic. The pH started off with 7 and reduced to 3. It can be seen that as more drops of HCl have been added to the water, the pH of water has become more acidic. When the base, Sodium Hydroxide (NaOH) was added to water, the overall trend was that, as more drops of NaOH were added, the pH level of water became more basic. However, the change was close to neutral, with pH level of 5. When the base was added to the potato solution, the pH levels stayed close to neutral. The values ranged from a pH of 5-6. This can also be said the same for when NaOH has been added: most values ranged from 5-6, so therefore the change in pH was close to neutral.

Discussion:

The pH is the measurement of the concentration of a hydrogen ion, how acidic or basic it is. Solutions that have high concentration of Hydrogen ions have a low pH level, and solutions that have a low concentration of hydrogen ions, have a high pH level. A pH scale is used in order to further classify solutions as acidic, basic, or neutral. The pH scale ranges from 0-14, 7 being neutral, 0-6 being acidic and 8-14 being basic. In order to maintain ideal pH ranges, many organisms rely on what is called buffers. A buffer is a solution that is able to resist pH changes upon the addition of acidic or basic substances (Larsen, n. d.). Buffers resist changes in pH by releasing hydrogen ions when a fluid is too basic; and when a fluid is too acidic, the buffer accepts hydrogen ions (Carter-Edwards et al ., 2011). Many buffers exist in specific pairs of acids and bases (Carter-Edwards et al., 2011). A buffer is composed of a weak conjugate acid-base pair. So, it can either be a weak acid and the conjugated base or it either can be a weak base and its conjugated acid (Larsen, n. d.).

The buffer will be able to neutralize cells that are bare to acidic or basic substances. As seen in Graph 1 (on the left), the graph shows the change in pH of various solutions (water, potato solution, and commercial buffer) as the amount of Hydrochloric acid (HCl) increases. In figure 1, the blue line which represents water shows that as the amount of HCl drops have increased the pH of water has been decreasing. This means that as more HCl drops were added the pH level of water had become more acidic. This is because HCl tends to give off Hydrogen (H+) ion. When HCl dissociates in water, it will dissociate into H+ ions and chlorine (Cl-) ions (pH, n. d.). For every H+ ion there will be a Cl- ion, because of this there will be no electrical charge. However, the water is now not balanced at this point. There are more H+ ions in the water than there are OH- ions in the water (pH, n. d.).

The larger concentration of H+ ions in the water is what makes it become more acidic. If more acid is added into the water, this trend will continue and the water will become even more acidic then it is. Similarly, when looking at Graph 2 (above), the pH level of Sodium Hydroxide (NaOH) in water, represented by the blue line shows that the water becomes more basic as more drops of NaOH are added into the solution. This is because When NaOH dissociates in water, it splits into hydroxide (OH-) ions and sodium (Na+) ions; for every Na+ ion there will be a OH- ion, thus, there will be no electric charge and the water is imbalanced. Now there is an increase in OH- ions than H+ ions, this causes the water to become basic (pH, n. d.). Similarly, to acid, if more NaOH is added to the water, this trend will continue in the same way and the water will become more basic.

This however will differ from using results obtained using tap water. This is because distilled water does not have carbonate hardness (KH) (Narten, 2014). This means that by adding little amounts of acid will change the pH levels greatly because of the instability of water. Tap water would be used to increase the KH and General Hardness (Narten, 2014) In Graph 1, Potato Solution is represented by a red line; it shows that as more drops of HCL are added into the potato solution, the solution becomes almost neutral. Most pH values ranged from 5-6. This is because potatoes have proteins in them and proteins can act as buffers; they use the protein buffer system (Tamarkin, 2011). Proteins are made up of amino acids, and they have a carbon backbone that has a carboxyl group, amino group, hydrogen atom and an R-group that branches off, as seen in figure 1 to the right. The Carboxyl and amino groups is what makes proteins act like buffers (Tamarkin, 2011).

When the carboxyl group is close to a neutral pH level, the carboxyl group becomes –COO instead of –COOH. If the protein finds itself in an acidic situation, the Carboxyl will be able to take back an extra H+ ion and return to a –COOH composition; gaining back an H+ ion makes it return to its normal pH level (Tamarkin, 2011). As for amino acids they can accept or donate H+ ions making them excellent buffers. This is also the same for when NaOH is added into the potato solution. Finally, in both figures, a straight green line can be seen, this represents the pH levels of the commercial buffer solution over 5 drops of HCl/NaOH. The reason why the commercial buffer shows a straight line is because it is able to resist pH changes because of its two components: conjugate base and a conjugated acid. These two components that are present at equilibrium are able to neutralize all small amounts of the HCl and NaOH that was added to the solution (Larsen, n. d.). Because of this there is zero change in pH being seen while doing the experiment.

The same trend will still continue even if the amount of acid/base increases. While doing the experiment, many things could be accounted for as to why there might be inaccurate results. One source of errors was that the pH paper was not credible, and this could lead inaccurate results. For example, when dipping a pH paper into a solution and taking it back out, it was hard to figure out the exact colour pf the paper, and this lead to difficulties in identifying what the new pH level was. The new colour of pH paper did not give an exact colour; it was between two different colours. Because of this, inaccurate results were given. This can be prevented if there is a more accurate pH scale that can easily read off to identify colours.

Another source of error could be that the thickness of each solution could easily affect results when scientists see the pH paper. For instance, the potato solution was much thicker than the commercial buffer or water. This can affect the colour change of the pH paper because when the pH paper was dipped into the solution it may not have fully absorbed the acid or based mixed into it. The thickness of the potato solution could have prevented the acid/base from allowing a full colour change of the pH paper. Because of this, it will lead to inaccurate results. To prevent this, all solutions next time should be all of the same thickness for more accurate results.

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