

Ccea as biology coursework: an investigation to measure

[Science](#), [Biology](#)



An investigation to measure the percentage light transmission, using a colorimeter, through a solution, from pH 2 - pH 9, in which jelly cubes were immersed over a 24 hour period Interpretation Written Communication of the Data C1 Pepsin is an enzyme that works in the stomach and has an optimal pH between pH 1 and 4 or in acidic conditions. From our graph it can be seen that that the lowest mean percentage light transmission for pepsin is when the buffer has a pH of 2. Trypsin is an enzyme that works in the small intestine and has an optimum pH between pH 7 and 8 or in neutral conditions.

From our graph it can be seen that the lowest mean percentage light transmission for trypsin is when the buffer has a pH of 8. C2 and C3 As the pH of the pepsin buffer increases from pH 2 to pH 9 so too does the percentage light transmission through the buffer solution after a 24 hour period. Although when the trypsin buffer has a pH between pH 2 and 8 the percentage light transmission through the buffer solution after a 24 hour period decreases, but from pH 8 to pH 9 the percentage light transmission through the buffer solution after a 24 hour period increases. At a low pH (pH 2) the amount of gelatine broken down by the pepsin is high.

We can tell this as this is when there is a low mean percentage light transmission (16.86%) because a lot of colour of the jelly will leak in the solution causing the colour to be deeper. But at a higher pH (pH 9) the amount of gelatine broken down by the pepsin is low. We can tell this as this as there is a low mean percentage light transmission is high (34.14%) because a little colour of the jelly will leak in the solution causing the colour

to be lighter. At a low pH (pH 2) the amount of gelatine broken down by the trypsin is low so this means there is a high mean percentage light transmission (41.5%) because a little colour of the jelly will leak in the solution causing the colour to be lighter. At a high pH (pH9) the amount of gelatine broken down by the trypsin is high so this means that there is a low mean percentage light transmission (29%) because a lot of colour of the jelly will leak in the solution causing the colour to be deeper. C4 and C5 An enzyme is a biological catalyst which speeds up a chemical reaction without itself undergoing a permanent change. Most enzymes are globular proteins and contain active sites. The active site is the part of the enzyme which combines with the substrate.

Enzymes are specific which means that one enzyme will work on one substrate. All enzymes work best at a particular pH, their optimum pH. The proteins structure of the enzyme is altered in a more alkaline or acidic solution than the specific optimum pH. When an enzyme structure is altered it cannot fit successfully with the substrate. Activity is therefore limited to a few enzyme molecules that are still unaltered or may totally stop. The protein digesting enzymes, pepsin and trypsin, will hydrolyse the substrate, gelatine. This substrate is a major component of jelly.

When a coloured jelly, such as raspberry, is exposed to a protein digesting enzyme, the colour is released into the solution as the gelatine is broken down. The intensity of the colouring released into the buffer can be estimated with a colorimeter. Trypsin is often found naturally in neutral or slightly alkaline conditions. Therefore the most enzyme activity and most

colour is released from the jelly would be expected at a pH 7 or 8 and in solutions above or below this pH there would be less colour released. Pepsin is often found naturally in very acidic conditions.

Therefore the most enzyme activity and most colour is released from the jelly would be expected at a pH 1 or 2 and in solutions above or below this pH there would be less colour released. Evaluation D1 I consider my results to be appropriate in meeting the aims of the investigation because we used a colorimeter. This measures the percentage light transmission as a numerical value. It is more appropriate than measuring the light intensity by eye as some of the results looked extremely similar and it could be hard to distinguish between samples.

It is also more appropriate than measuring the percentage change in mass of the jelly cube before and after the 24 hour period as it is difficult to extract what is left of the jelly and it is not as accurate. D2 In order to try to obtain accurate results a number of procedures had to be carried out; Firstly, we used the same specimen of jelly. Although the jelly is from the same company there could be a difference in the composition of gelatine. If this was allowed to happen it could mean that it would take longer to break down some samples than others.

This would then affect the overall results of the experiment as it would create an anomaly. Secondly, we also used a colorimeter which is extremely accurate when it comes to measuring the percentage light transmission. As it measures the percentage light transmission as a numerical value. Thirdly, we only handled the side of the cuvette as if we touched the front where the

light passed through it would affect how much light passed through as it will leave a finger print on the glass and make it harder for the light to pass through. Fourthly, we kept the temperature at a constant 25°C using a water bath.

At low temperatures, an increase in temperature causes an exponential increase in enzyme activity. This is because an increase in temperature provides more kinetic energy for the collisions of enzymes and substrates, so the formation of enzyme-substrate complexes increases. At high temperatures (above 40°C), an increase in temperature causes a sharp decline in enzyme activity. This is because the bonds holding the tertiary structure of the enzyme are broken and so the active site is denatured. We tried to use the same amount of jelly as this could affect the substrate concentration.

If the surface area of the substrate increases it means that it has an increased substrate concentration. As the substrate concentration increases so too does the enzyme activity. This is because a greater concentration of substrate increases the chances of collisions and the formation of enzyme substrate complexes. D3 Although the experiment was as fair as it could have been, there were some factors that were beyond our control; Firstly, we could not accurately cut the cubes into equal sizes as we did not have the equipment to make a straight incision.

This would increase the surface area of the substrate which will increase the substrate concentration. This would increase the enzyme activity as it will increase the chance of collision between the enzyme and substrate and

more enzyme substrate complexes can be formed. Secondly, we could not check the temperature of the water bath on a regular basis as the experiment was carried out over a 24 hour period. If the temperature had went above 25°C it would increase the rate of reaction as it provides more kinetic energy for the collision of the enzyme and the substrate, so the rate at which enzyme-substrate complexes form is increased.

Although, if the temperature decreased below 25°C it would have the opposite effect. It would slow the rate of reaction as it will provide less kinetic energy for the collision of enzymes and the substrate, so the rate at which enzyme-substrate complexes form is decreased. D4 and D5 My experiment is reliable as it was repeated six times in the form of the pooled class result and all of the results seemed to follow the same general trend. Although, if we had more time we may have been able to do the experiment again which would make the average or mean more accurate.

However, there were a few anomalies among the group results. As you can see from table 1, in the test for trypsin at pH 9, group 2's result decreased from the previous result (pH 8) whereas every other group increased except for group 3 who's stayed the same as the previous result (pH 8). This could be caused from a fingerprint being put on the cuvette where the light passes through; this could lower the percentage light transmission through the solution as it will cover the glass.