**A-level Biology required practical No. 1**

**Student Sheet**

**Investigation into the effect of a named variable on the rate of an enzyme-controlled reaction**

**Learning Objectives**:

1. To develop practical skills **a, c, l** and begin to demonstrate **competencies 1a and 4a**
2. To investigate the effect of temperature on the rate of an enzyme controlled reaction.
3. Calculate the mean and standard deviation

**The effect of temperature on the rate of the reaction catalysed by trypsin**

Casein is a protein found in milk. Trypsin is an enzyme that digests casein. When trypsin is added to a dilute solution of milk powder, the casein is digested and the solution goes clear.

**Method**

You are provided with the following:

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| * 0.5% trypsin solution | * test-tube rack |
| * 3% solution of milk powder | * stopwatch |
| * pH 7 buffer solution | * marker pen |
| * a large beaker to use as a water bath | * syringes |
| * 12 test tubes | * thermometer. |

In this experiment your class is required to find the rate of reaction at **five** different temperatures. You will **all collect data at 20oC** and your teacher will tell you which other temperature you will investigate. You will get the rest of your results from other students in your class.

**You should read these instructions carefully before you start work**.

1. Using a marker pen write an ‘X’ on the glass halfway down one side of each of three test tubes.
2. Using the 10 cm3 syringe add 5 cm3 of the solution of milk powder to each of these three test tubes.
3. Using the 5 cm3 syringe add 1 cm3 of trypsin solution to 1 cm3 of pH 7 buffer in another set of three test tubes.
4. Now make a 20 °C water bath using the large glass beaker. The water level should just cover the liquid level in your test tubes so there is space to add more hot water if needed.
5. Stand the three test tubes containing the solution of milk powder and the three test tubes containing trypsin and buffer in a water bath at 20 °C.
6. Leave all six tubes in the water bath for 10 minutes.
7. Add the trypsin and buffer solution from one test tube to the solution of milk powder in another test tube and mix thoroughly.
8. Put the test tube back into the water bath.
9. Repeat steps 6 and 7 using the other test tubes you set up.
10. Time how long it takes for the milk to go clear. Do this by measuring the time taken to first see the ‘X’ through the solution.
11. Record the time for each of the three experiments.
12. Using the same method, find out how long it takes the trypsin to digest the protein in the solution of milk powder at your allocated temperature of either 30 °C, 40 °C, 50 °C, 60°C.
13. Record your data in a suitable table.
14. Process your data and draw a graph of your processed data.

**Risk assessment**

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| Hazard | Associated Risk | Method to reduce risk |
| Tyrypsin | irritant | Wash hands with soap and water  Wear lab coats |
| Waterbaths | Burning at 50/60OC | Care when using. |
| Glass wear | Cuts if broken | Inform teacher if break any glass wear. Don’t try to tidy up |
| Milk power | Possible allergen | Wash hands with soap and water  Wear lab coats |
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| Competencies demonstrated | |
| 1. Follows written procedures | a. Correctly follows instructions to carry out experimental techniques or procedures. |
| 4. Makes and records observations | a. Makes accurate observations relevant to the experimental or investigative procedure. |

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|  | Apparatus and techniques |
| AT a | use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH) |
| AT c | use laboratory glassware apparatus for a variety of experimental techniques |
| AT l | use ICT such as computer modelling, or data logger to collect data, or use software to process data |