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

**Learning Objectives**:

1. To develop practical skills **a** and **c** and begin to demonstrate **competencies 1a and 4a**
2. To investigate the effect of pH on the rate of an enzyme controlled reaction.

**The effect of pH on the rate of decomposition of hydrogen peroxide catalysed by catalase**

The enzyme catalase, which is present in potatoes, naturally decomposes hydrogen peroxide (H2O2) to water and oxygen; the following reaction summarises this process:

2H2O2 2H2O + O2

You are to investigate how pH affects the rate of this reaction.

**Method**

You are provided with the following:

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| * Potato
* Core borer
 | * Test-tube rack
* Stop clock
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| * 20 vol hydrogen peroxide solution (H2O2)
 | * Kettle
 |
| * Large beaker
* Kettle
 | * Marker pen
 |
| * Washing up liquid
 | * Syringes
 |
| * 4 Boiling tubes
* Scalpel
* White tile
 | * pH buffer solutions at pH7, 8 and 9
* Sieve
* Ruler
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**You should read these instructions carefully before you start work**.

1. Using the core borer remove a solid cylinder of potato tissue.
2. On a white tile use the scalpel to make discs 1mm thick from cores of potato provided. Cut enough discs so that you have 10 discs for each boiling tube. (40 discs)
3. Place 10 discs in a beaker and cover with boiling water. Leave for 5 minutes. Pour contents of beaker into a sieve over the sink. Refill beaker with cold water. Add the potato from the sieve back into the beaker of cold water.
4. Label your boiling tubes pH6, pH7 or pH8. Label the fourth tube ‘control’
5. Using a syringe add 1cm3 of water to the tube labelled ‘Control’ (tap water is fine)
6. Using separate syringes to avoid contamination add 1cm3 of the appropriate buffer solution to the remaining 3 labelled boiling tubes.
7. Add 1cm3 of washing liquid to each boiling tube
8. Add 5cm3 of the 20 vol H2O2 to each boiling tube
9. Place all boiling tubes into the large beaker and add water from the tap and kettle to create a 25oC water bath. Leave tubes for 5 minutes to allow them to equilibrate.
10. Add the boiled and cooled potato discs to the control tube
11. Place 10 potato discs into the boiling tubes labelled pH6, pH7 and pH8. Start the stop clock. Keep the boiling tubes in the water bath.
12. After 5 minutes measure the height of the foam above the H2O2 solution in each boiling tube.
13. Record your data in a suitable table

**Risk assessment**

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| Hazard | Associated Risk | Method to reduce risk |
| Hydrogen Peroxide | irritant | Can cause serious eye irritation so wear eye protection |
| Casein | irritant | Wash hands with soap and water following handlingWear lab coats |
| Glass wear | Cuts if broken | Inform teacher if break any glass wear. Don’t try to tidy up |

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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.  |
|  | 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  |