Senior School Assessment Task

Subject: Biology (Stage 2)
Teacher: Tirzah McKee
Task Title: Task 1 | Enzymes Practical

Draft Due Date: Tuesday, 8 March 2016
Final Due Date: Tuesday, 15 March 2016

Please note that failure to submit the task by this date will result in academic detention until completed.

Learning Requirements:
- Design and conduct individual and collaborative biological investigations.
- Manipulate apparatus and use technological tools and numeracy skills to obtain, represent, analyse, interpret, and evaluate data and observations from biological investigations.
- Communicate their knowledge and understanding of biological concepts using appropriate biological terms and conventions.
- Demonstrate and apply biological knowledge and understanding of concepts and interrelationships to a range of contexts and problems, including by presenting alternative explanations.

Outcomes Assessed:
I3 Manipulation of apparatus and technological tools to implement safe and ethical investigation procedures.
I4 The obtaining, recording, and display of findings of investigations using appropriate conventions and formats.
AE1 Analysis of data and concepts and their connections, to formulate conclusions and make relevant predictions.
AE2 Evaluation of procedures, with suggestions for improvement.
A2 Use of appropriate biological terms, conventions, formulae, and equations.
A3 Demonstration of skills in individual and collaborative work.
KU3 Communication of knowledge and understanding of biology in different formats.
Task Outline:

**ASSESSMENT TYPE 1: Investigations Folio**

**Practical: ENZYMES**

**Purpose**
This assessment provides you with the opportunity to investigate concepts relating to enzyme activity, and to demonstrate your ability to:

- conduct an investigation in a collaborative environment
- identify variables and collect, analyse, and interpret data
- evaluate results, form conclusions, and communicate your understanding of concepts relating to enzyme activity.

**Description of assessment**
This is a 'completion' type practical in which you use the method provided.

You work in pairs to complete the practical but you need to individually record your results and write your report.

In your report, include:
- Introduction
- Materials and Method
- Results
- Safety Assessment
- Data interpretation
- Evaluation and Conclusion
- Review

You are to determine the effect of changing one variable on the rate of the activity of the enzyme catalase.

**Part A**
Carry out your approved investigation with your partner.

**Part B**
Individually write a practical report using the structure provided.

**Assessment conditions**

**Part A**
The practical is completed in a 80 minute lesson in the laboratory, during which collaboration skills and manipulation of apparatus are assessed.

**Part B**
An individual practical report is completed and submitted for assessment no later than the date given after completion of Part A.

In the report the following are assessed:

- the use of appropriate biology terms, conventions, formulae and equations
- communication of knowledge and understanding of biology in different forms.
Task and Report details

Introduction
Catalase is an enzyme which occurs in the cells of many living organisms. Certain of the energy-releasing reactions in the cell produce hydrogen peroxide as an end-product. This compound, which is toxic to the cell, is split to water and oxygen by the action of catalase. \(2H_2O_2 \rightarrow 2H_2O + O_2\).

Cells have a phospholipid membrane that is sensitive to detergents. Excessive detergent can cause the membrane to rupture.

Aim:
To conduct an experiment to investigate how temperature and pH can affect the rate at which an enzyme (catalase) acts on hydrogen peroxide (H\(_2\)O\(_2\)).

Materials:
cube of potato
10 mL measuring cylinders
H\(_2\)O\(_2\) (at various temperatures)
Thermometer (0\(^\circ\)C-100\(^\circ\)C)
Water bath (set at 70\(^\circ\)C)
Detergent
2M hydrochloric acid
2M sodium hydroxide
Distilled water
Stop watches
Universal indicator solution

Procedure:
Part A: Temperature
1. Place a \(\frac{1}{2}\) cm\(^3\) cube of liver/potato into a water bath at 0\(^\circ\)C.
2. Add 2mL of hydrogen peroxide to a 10mL measuring cylinder. Place into water bath and allow to come to 0\(^\circ\)C.
3. Add 2 drops of detergent to the cylinder and mix.
4. Add the small amount of the liver.
5. Measure the maximum height of the bubbles that occurred in 60 seconds (or less).
6. Repeat this process at a least three temperatures 0\(^\circ\)C, 30\(^\circ\)C & 70\(^\circ\)C
7. For each test have a control tube which is at the same temperature but does not have any potato added.

Part B: pH
1. Place a cube of potato into 1mL of acidic pH solution. Record the pH of the solution.
2. Add 2 mL of hydrogen peroxide to a 10mL measuring cylinder
3. Add 2 drops of detergent to the cylinder and mix.
4. Add a small amount of the potato with acid.
5. Measure the maximum height of the bubbles that occurred in 60 seconds (or less)
6. Repeat this process for 3 different pH levels – acid, neutral & alkali.
7. For each test have a control which is at the same pH but does not have any potato added.

Safety Assessment
You need to identify the hazards associated with your experiment before commencing. For each hazard that you identify you need to suggest safe operating procedures.
Data Interpretation

1. Given the above method, state a hypothesis relating to the effect of temperature/pH on the amount of enzyme activity.

2. Did the reaction occur without the potato? Explain why you used the controls.

3. Identify the temperature/pH at which the enzyme was most active. What is your evidence for this?

4. Describe the shape of your graph. What conclusion can you draw about the effect of temperature/pH on enzyme activity.

5. Explain the effect on the enzyme action of low temperatures and high temperatures.

6. Explain the effect of altering pH on the action of the enzyme.

Evaluation and Conclusion

Write a report, using appropriate and effective biological language, of this investigation in which you:

- evaluate the procedures used and suggest possible improvements
- discuss the reliability and possible sources of random and systematic errors in your data
- make a relevant conclusion based on your data.

Review

Write a short paragraph to review your own performance in this collaboration task. Consider the following: How well do you think you worked in the group? Was it collaborative or did one person do all the tasks? Have you learnt anything about working in a team situation through your involvement in this task?
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