## Stage 1 Biology: Investigation Folio Task

## Topic 3: Multicellular Organisms

## Design Task: Effect of various factors\* digestive system enzymes

**Introduction and Purpose of Task:**

The digestive system is responsible for the breakdown of food that is ingested. It is vital the molecules consumed are broken down into smaller molecules so that they can be absorbed and then used by the cells for growth, maintenance, and synthesis.

Enzymes in the digestive system are responsible for catalysing the reactions that enable larger macromolecules and other chemicals to be broken down into smaller molecules that can be absorbed.

Enzymes work most efficiently within optimal conditions; these include pH, temperature, presence of inhibitors or cofactors and substrate concentration.

In this task, students will investigate an unknown factor related to the activity of an enzyme (*See teacher notes*).

**Part A: Design your own experiment**

**Here is the question to investigate:**

**Either**

How can you determine the identity of an unknown digestive enzyme supplied?

*or*

How can you determine order of the concentrations of various solutions of an enzyme?

You will be provided with the appropriate solutions and a range of substrates including appropriate substrate for the enzymes in each of the solutions.

Any equipment required as per the Materials and Equipment in the design of the investigation will be supplied if available.

You may do research to find methods that could be suitable for the design of your experiment. These methods should be referenced appropriately.

Steps to be followed:

1. Deconstruct the question you have chosen to investigate.
2. Design your experiment individually.

In your design include all details required to undertake a reliable and valid experiment. Use textboxes or a different coloured font to annotate your design to justify the steps you have included in the design.

You must also consider the safety aspects of this experiment.

* 1. Variables, measurement of the dependent variable, one independent variable, constant variables, factors that cannot be controlled.
  2. Hypothesis
  3. Materials and Equipment required
  4. Method suitable to test the hypothesis
  5. Results collection and presentation (Include a blank data table to show how you will record the data)

1. In defined groups, students in consultation with the teacher will select one method to perform and to collect data.
2. Individually write a practical report.

The Investigation Report must include: (needs to be an individual report)

* An appropriate introduction – introduces the theory behind the practical, including
* Aim: what is the purpose of the experiment?
* Hypothesis, Identification of all the variables
* Materials and Method with Safety Audit for the investigation that you undertook in Step 3 above.
* Results Table(s) and Graph(s)
* Discussion- includes analysis of the data and evaluation of the method
* Conclusion- relates to the data, is justified based on the data
* Reference List (Harvard Referencing System)

**Assessment Conditions for this task:**

Class time will be given for students to individually deconstruct and design the investigation question/hypothesis.

A double lesson to undertake the practical in a group. Each student to submit a practical report.

Students may submit one draft for feedback, due one week after the experiment is completed.

Word Count: maximum of 1000 words or 6 minutes for an oral presentation for the **introduction, analysis, evaluation and conclusion** sections of the report.

The evidence of the deconstruction and design component must be attached to the practical report.

Final copy is due 2 weeks after the experiment is completed.

**Assessment Design Criteria**

Investigation, Analysis and Evaluation: IAE 1, 2, 3, 4 Knowledge and Application: KA 1, 4

**Note to Teacher:**

This is an opportunity to provide choice. You can enable the students to *either* deconstruct and design an investigation for one of the experiments below *or* the teacher could select one that all the students in the class will design (individually):

**Option 1**

Provided with 5 different and unknown concentrations of a known digestive enzyme– design an investigation to work out the least concentrated to most concentrated solution?

**Or**

**Option 2**

Provided with a sample of an unknown digestive enzyme – work out what it is?

*In these options: The hypothesis* is replaced by *Inquiry* *Question.*

**Guidelines for how to address the Performance Standards in the report:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Section of the Report** | | **Requirements/Indicators** | | **Performance Standards** |
| **Deconstruct (Design)** | | **Explores the various aspects of the problem and this links to the aim, hypothesis and method. Justifies decisions made for design.** | | **IAE1** |
| **Introduction** | | **Relevant biological Information presented that relates specifically to the practical being investigated.**  **The information relates to the aim of the experiment.** | | **KA1** |
| **Aim** | | **Has the correct format**  **Indicates the purpose of the experiment**  **Independent and dependent variables are identifiable.** | | **KA1** |
| **Hypothesis** | | **Has the correct format- is not in the form of a question**  **Links the independent and dependent variable and is a prediction.** | | **IAE1** |
| **Method** | | **Describes how the independent variable is changed, is detailed and describes how the dependent variable is measured.**  **All variables should be identified.** | | **IAE1** |
| **Results** | | **Table has the correct format**  **Data is represented in an appropriate manner- all data is shown**  **Significant figures are correct**  **Graphs are drawn appropriately- axis are labelled, appropriate scale used, title, size, correct format** | | **IAE2** |
| **Discussion** | | **Explains all the data obtained. Trends are identified and related to the relevant biological concepts.**  **Provides reasoning based on the data for supporting or rejecting the hypothesis**  **Evaluates the experimental method**  **Identifies potential sources of random and systematic error specifically and effect on data**  **Discusses the data’s reliability, precision, accuracy and validity** | | **KA1,**  **IAE3**  **IAE4** |
| **Conclusion** | | **Indicates whether the aim of the experiment has been met and restates the overall trend of the experiment.**  **Provides justification and discusses any limitations of the experiment and the conclusion drawn.** | | **IAE3** |
| **Safety Audit** | | **Detailed analysis of the potential risks, hazards and how they are managed and the precautions taken in the classroom** | | **IAE1**  **IAE2** |
| **Communication** | | **Use of appropriate biological terms and conventions** | | **KA4** |
| **Reference List** | | **Harvard Referencing Used**  **Sources correctly cited.**  **Bibliography provided** | | **KA4** |
|  | Investigation, Analysis and Evaluation | | Knowledge and Application | | |
| A | Critically deconstructs a problem and designs a logical and coherent biological investigation with detailed justification.  Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively.  Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.  Critically and logically evaluates procedures and their effect on data. | | Demonstrates deep and broad knowledge and understanding of a range of biological concepts.  Applies biological concepts highly effectively in new and familiar contexts.  Critically explores and understands in depth the interaction between science and society.  Communicates knowledge and understanding of biology coherently, with highly effective use of appropriate terms, conventions, and representations. | | |
| B | Logically deconstructs a problem and designs a well-considered and clear biological investigation with reasonable justification.  Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.  Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.  Logically evaluates procedures and their effect on data. | | Demonstrates some depth and breadth of knowledge and understanding of a range of biological concepts.  Applies biological concepts mostly effectively in new and familiar contexts.  Logically explores and understands in some depth the interaction between science and society.  Communicates knowledge and understanding of biology mostly coherently, with effective use of appropriate terms, conventions, and representations. | | |
| C | Deconstructs a problem and designs a considered and generally clear biological investigation with some justification.  Obtains, records, and represents data, using generally appropriate conventions and formats, with some errors but generally accurately and effectively.  Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.  Evaluates procedures and some of their effect on data. | | Demonstrates knowledge and understanding of a general range of biological concepts.  Applies biological concepts generally effectively in new or familiar contexts.  Explores and understands aspects of the interaction between science and society.  Communicates knowledge and understanding of biology generally effectively, using some appropriate terms, conventions, and representations. | | |
| D | Prepares a basic deconstruction of a problem and an outline of a biological investigation.  Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.  Describes data and undertakes some basic interpretation to formulate a basic conclusion.  Attempts to evaluate procedures or suggest an effect on data. | | Demonstrates some basic knowledge and partial understanding of biological concepts.  Applies some biological concepts in familiar contexts.  Partially explores and recognises aspects of the interaction between science and society.  Communicates basic biological information, using some appropriate terms, conventions, and/or representations. | | |
| E | Attempts a simple deconstruction of a problem and a procedure for a biological investigation.  Attempts to record and represent some data, with limited accuracy or effectiveness.  Attempts to describe results and/or interpret data to formulate a basic conclusion.  Acknowledges that procedures affect data. | | Demonstrates limited recognition and awareness of biological concepts.  Attempts to apply biological concepts in familiar contexts.  Attempts to explore and identify an aspect of the interaction between science and society.  Attempts to communicate information about biology. | | |