## Stage 2 Biology: Investigation Folio Task

Assessment Type and Task clearly identified.

## Topic 3: Homeostasis

## Deconstruct and Design Task: Tolerance Factors in plants

## Introduction and Purpose of Task:

Organisms survive best when they exist within their tolerance limits. Each species of plants, for example, has a set of environmental conditions within which it can best survive and reproduce.

Many abiotic factors can affect where different plant are able to live. These include temperature, humidity, soil, pH, nutrients in the soil, salinity, and light intensity.

Gardeners are often keen to try growing different plants that appeal to them but do not necessarily match the abiotic conditions in their garden.

In this investigation, you will investigate an aspect of the tolerance limits for a species of plant *not normally grown in your area.* An example may be trying to grow a plant that is usually grown in a tropical area in an arid area instead.

To deconstruct this problem, you may need to consider the various aspects of this question including (but not limited to: types of plants, abiotic factors such as temperature, humidity, soil pH, nutrients in the soil, salinity, and light intensity which may restrict the growth of plants in your area.

You will undertake an investigation and then prepare a report. The details are as follows:

Purpose provides guidance and provides a problem to deconstruct which leads to the design of a method.

## Part A: Research, Deconstruct the problem and Design your own experiment

*1.* ***Research***:

Undertake some research to help you understand the impact of growing in areas outside the tolerance limits of a plant.

*2.* ***Deconstruct the problem*:**

Brainstorm the various aspects of the problem:

What is the impact of the tolerance limits for a species of plant not normally grown in your area?

A table may be an appropriate way to organise your thinking and ideas. An example is provided below; however, various formats could be used. *The ideas in the table are starting points only.*

**Note for Teachers**:

Please note that the table that follows has been partially filled in with some of the aspects of the question provided for you, the teacher, to assist with how you might discuss deconstructing the question with your students. However, it would *not* be appropriate to *give* these questions/suggestions to the students. They should explore the problem and develop their own ideas about the factors that could be considered.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Factors | Aspects of the Question | | | |
| type of plant | Usual Tolerance | Range in this area | Method options |
| Options |  | Optimum Temperature range?  Optimum Soil pH? | Our temperature range?  Our soil pH | What range to trial? |
| Questions to research | What type of plants don’t usually grow in our area?  Can I access seeds/seedlings?  Should I do a trial in my garden? |  |  | Choose a plant that is readily available.  See if it will grow at all. |
| Findings: |  | Temperature range for plant I have chosen? |  |  |
| Possible Limitations | Number of species tested - can the findings be applied to others? | What if nothing grows? |  | Controlling the environment in the garden.  Should I do it in the laboratory? |

3. ***Design***:

Choose one plant and one factor.

Individually design an experiment to test the effect of your chosen factor on your chosen plant. You will need to determine your independent and dependent variable to do this effectively. In this design you should have only one independent variable.

In your design include all details required to undertake a reliable and valid experiment. Use annotations or some other method to justify the choices you have made in the design of your investigation. You must also consider the safety aspects of this experiment. Reference your information appropriately.

Include the following in your design:

* 1. Variables, measurement of the dependent variable, one independent variable, constant variables
  2. Hypothesis
  3. Materials and equipment required
  4. Method suitable to test the hypothesis
  5. Blank data table

Annotate your deconstruction and design to justify the decisions you have made about such things as the plant you have chosen, the independent and dependent variables, how and why you will control other variables, number of trials, measurements.

Evidence of deconstruction, the method/procedure chosen as most appropriate, and a justification of the plan of action must be a maximum of 4 sides of an A4 page (minimum font size 10). Annotations may be used to show justifications.

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

Submit the deconstruction and design for assessment on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Part B: Complete the experiment

Students have an opportunity to work collaboratively.

1. Your teacher will allocate you into groups to undertake one of the experiments designed by one of your groups’ members or provide another appropriate method. This design will be chosen with your teacher, based on equipment availability and feasibility.
2. You will complete the experiment and record the data in an appropriate results table.

## Part C: Write an individual report

You will write the report, with the discussion component focused on the data collected.

Your practical report must include:

* introduction with relevant biological concepts, and either a hypothesis and variables, or an investigable question
* materials/apparatus
* method/procedure that outlines the method that was implemented in Part B
* identification and management of safety and/or ethical risks
* results table(s) and graph(s)
* analysis of results, identifying trends, and linking results to concepts
* evaluation of procedures and data, and identifying sources of uncertainty
* conclusion, with justification and consideration of limitations.

The report should be a maximum of 1500 words if written, or a maximum of 9 minutes for an oral presentation, or the equivalent in multimodal form.

Only the following sections of the report are included in the word count:

Requirements of the task and timelines are clear to students.

• introduction

• analysis of results

• evaluation of method/procedure

• conclusion.

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

## Assessment Conditions for this task:

* Class time will be given for students to individually deconstruct the problem and design the method for the experiment.
* A double lesson will be provided to collaboratively undertake the practical in a small group. Each student will submit an individual practical report.
* Students may submit one draft for feedback for Part A (deconstruct and design of the method) and Part C. Part C will be due one week after the experiment is completed.
* 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: KA1, 4

## Links between report components and Performance Standards:

|  |  |  |
| --- | --- | --- |
| 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 in the design. | IAE1 |
| Introduction | * Relevant biological Information presented that relates specifically to the practical being investigated. * Information relates to the aim of the experiment. | KA1 |
| * Hypothesis stated in correct format. * Independent and dependent variables are identifiable. * Controlled and other variable considered | IAE1 |
| Method (Design) | * Detailed method to test the hypothesis. * Describes how the independent variable is changed. * Describes how the dependent variable is measured. * All variables should be identified. | IAE1 |
| Safety Audit | * Detailed analysis of the potential risks, hazards and how they are managed and the precautions taken in the classroom | IAE1  KA1 |
| Results | * Blank data table with correct format (in ‘Design’ section) | IAE1 |
| * 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   * Analysis of results * Evaluation of procedures and data | * Explains all the data obtained. Trends are identified and related to relevant biological concepts. * Provides reasoning based on the data for supporting or rejecting the hypothesis * Discuss the need for controlled variables * Identifies potential sources of random and systematic error specifically * Discusses the data’s reliability, precision, accuracy and validity * Evaluates the experimental method and effect on data. | KA1,  IAE3  IAE4 |
| Conclusion | * Indicates whether the aim of the experiment has been met. * Restates the overall trend of the results to justify conclusion. | IAE3 |
| Communication | * Use of appropriate biological terms and conventions | KA4. IAE2 |
| Reference List | * Harvard referencing used * Sources correctly cited. * Bibliography provided | KA4 |

Performance Standards for Stage 2 Biology

| - | 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. |

Task meets assessment specifications as described in the subject outline:

* Individual practical report submitted
* At least one practical investigation gives the students the opportunity to deconstruct a problem in order to design their own procedure and justify their plan
* At least one practical investigation gives the opportunity to investigate a question for which the outcome is uncertain
* At least one investigation or skills and applications task should involve collaborative work
* Requirements of the report are clearly listed