## Stage 2 Biology – Assessment Type 1: Investigation Folio Task

## Topic 2: Cells as the Basis of Life

## Deconstruct and Design Task: Effect of various factors on Photosynthesis

**Introduction and Purpose of Task:**

Photosynthesis is a vital process that converts light energy from the sun into chemical energy in the form of glucose. Organisms that have chlorophyll or other related pigments are able to undertake this process and are said to be “photosynthetic”.

Photosynthesis can be represented by the reactions:

 

Factors that affect photosynthesis could include: the concentration of carbon dioxide, availability of water, presence or absence of light, light frequency, and the concentration of chlorophyll.

In this task, students design an investigation to determine how one factor could affect photosynthesis.

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

There are many different methods that can be used to investigate photosynthesis, both provided by the teacher and those you find yourself.

Brainstorm the various aspects of the question: What makes an plant photosynthesise faster?

A table may be an appropriate way to organise your thinking and ideas.

|  |  |
| --- | --- |
| Considerations | Aspects of the Question: What makes an organism respire faster? |
| type of organism | type of respiration | Method options | Measurement of respiration | Other variables |
| Options |  |  |  |  |  |
| Questions to research |  |  |  |  |  |
| Findings: |  |  |  |  |  |
| Possible Limitations |  |  |  |  |  |

Use these to help you to design an experiment to test the effect of your chosen factor on photosynthesis.

Keep a list of references used to design your method.

Please note: this task provides an opportunity to use data loggers to collect the data, if the equipment is available.

Design your experiment individually to test one factor that could affect photosynthesis. In your design include all details required to undertake a reliable and valid experiment. Also consider the safety aspects of this experiment. Reference your information appropriately.

* 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 (Include a blank data table to show how you will record the data)

Annotate your deconstruction and design to justify the decisions you have made about such things as the organism 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).

Submit to the teacher for feedback. Due Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B: Complete the experiment**

1. Your teacher will allocate you into groups to undertake one experiment designed by one of your groups’ members or another appropriate method. This design will be chosen with your teacher, based on equipment availability and feasibility.
2. Complete the experiment and record the data in an appropriate results table.
3. Write the report, with the discussion component focused on the data collected.

The Investigation Report must include: (individual report)

[Aspects in bold font are **included** in the word count of the report]

Part A: Design Component:

Aim/Hypothesis, Identification of all the variables

Materials and Method with Safety Considerations (Include a blank data table to show how you will record the data)

Reference List (Harvard Referencing System)

Part B: Completion Component:

**An appropriate introduction – introduces the theory behind the practical**

**Aim: what is the purpose of the experiment?**

Hypothesis suitable to experiment that was undertaken

**Identification of all the variables**

Materials and Method (with Safety Considerations) for the investigation actually undertaken in Part B

Results Table(s) and Graph(s)

**Discussion- includes analysis of the data and evaluation of the method. Sources of uncertainty are identified and the effect on data discussed.**

**Conclusion- with justification and consideration of limitations.**

**Assessment Conditions for this task:**

Class time will be given for students to individually design the investigation question/hypothesis. They submit the design to the teacher for feedback. Students may update their design and submit with the final report. This component is not included in the final word count. It must be attached to the final report.

A double lesson will be allocated to undertake the practical in a group. Each student submits an individual practical report.

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

Word Count: maximum of 1500 words or 9 minutes for an oral presentation for the **introduction, variables, analysis, evaluation and conclusion** sections of the 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

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

|  |  |  |
| --- | --- | --- |
| **Section of the Report** | **Requirements/Indicators** | **Performance Standards** |
| **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** | **Designs and 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 identified and related to 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****KA1** |
| **Communication** | **Use of appropriate biological terms and conventions** | **KA4** |
| **Reference List** | **Harvard Referencing Used****Sources correctly cited.****Bibliography provided** | **KA4** |

**Stage 2 Biology Performance Standards**

| - | 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. |