Year 12 Biology

Module 5 - Heredity Assessment Task 1 2024

TOPIC: Scientific Investigation	**MARKS:** /40	
SUBMISSION REQUIREMENTS: *Wednesday, 27 November Week 7, Period 1 in class.*	**WEIGHTING:** 25%	**COMPONENTS:** K&U – 15% Skills – 10%

TASK DESCRIPTION:

The Task

In this task students will explore how the genetic similarities and differences within and between species can be compared. Students will investigate reproduction and inheritance patterns in a chosen plant and will conduct a first-hand investigation to collect, record and present data to represent frequencies of a characteristic in a population, in order to identify trends, pattern, relationship and limitations in data. Students will present their findings in a Scientific Report which is to be completed in class over the three-week period.

Task Outline

Pre-submission

1. Students will conduct a first-hand investigation and produce a written Scientific Report in class to examine the mode of inheritance of a genetic trait in a monohybrid cross.
2. Students will collect individual and class data to calculate the ratio of genetic traits.
3. Students will predict the outcomes of crosses between two heterozygous plants based on what they have learnt about inheritance.
4. Students will predict the genotype of the seeds.
5. Students will write a Scientific Report using the provided format to structure their report.

In-class on Submission

6. Students will collect and present the findings of the class data in the results section.
7. Students will answer in-class discussion questions and formulate a conclusion.

Instructions

- Ensure your name, class, and teacher is clearly labelled.
- All work submitted must be original and completed individually.
  (NOTE: Any work deemed to be plagiarised will be treated as a non-serious attempt and dealt an appropriate consequence in accordance with the school and faculty policy)

The First-Hand Investigation and Scientific Report must be completed in class, in the time provided.

OUTCOMES TO BE ASSESSED:

Outcomes/Competencies to be assessed in this task:

BIO12-1 - develops and evaluates questions and hypotheses for scientific investigation
BIO12-2 - designs and evaluates investigations in order to obtain primary and secondary data and information
BIO12-3 - conducts investigations to collect valid and reliable primary and secondary data and information
BIO12-12 - explains the structures of DNA and analyses the mechanisms of inheritance and how processes of reproduction ensure continuity of species

DIRECTIONAL VERBS:

Develop - to create or change into a more advanced, larger, or stronger form
Evaluate - Make a judgement based on criteria.
Design - the concept of or proposal for an object, process, or system
Conduct - to organise and perform a particular activity
Explain - Relate cause and effect

MARKING GUIDELINES

YEAR 12 BIOLOGY – FIRST-HAND INVESTIGATION – HEREDITY

Introduction

BIO12-1

Criteria	Mark
• Develops a clear and focused introduction with scientific knowledge included from secondary research	3
• Develops a clear introduction with some scientific knowledge included	2
• Develops a simple introduction with limited scientific knowledge	1

Aim

BIO12-1

Criteria	Mark
• Develops a concise and well-structured aim from the inquiry question	2
• Develops an aim with links to the inquiry question	1

Hypothesis

BIO12-1

Criteria	Mark
• Provides a hypothesis with both variables and a cause-and-effect scenario included.	3
• Provides a hypothesis with both variables identified	2
• Developed hypothesis is limited with no scientific metalanguage or variables identified	1

Risk Assessment

BIO12-2

Criteria	Mark
• Provides an extensive and detailed risk assessment with clear mitigations.	3
• Provides a risk assessment with mitigations where possible	2
• Provides a limited risk assessment, with little to no attempt to mitigate risks	1

Apparatus and Methodology

BIO12-2

Criteria	Mark
• Develops a clear and focused method, written in past tense, that obtains valid and reliable results • Method details a logical progression of steps with accurate information of qualities of materials used	4
• Develops a clear method, written in past tense that obtains valid and reliable results • Method details a progression with information and quantities of materials used	3
• Develops a method, written in past tense that attempts to obtain valid and reliable results • Method details a progression with information and most quantities of materials used	2
• Develops a method in past tense, and with some details of apparatus used	1

Results

BIO12-3

Criteria	Mark
• Selects and processes quantitative data (group and class set) in a manner that clearly addresses validity and reliability of experiment • Clearly displays data in tables in a well thought out manner • Correct use of Punnett squares to support collected data, including clear identification of genotype, phenotype and percentages of each.	9 – 10
• Selects and processes quantitative data (group and class set) in a manner that substantially addresses validity and reliability of experiment • Clearly displays data in tables with no errors • Correct of Punnett squares to support collected data, including clear identification of genotype, phenotype and percentages of each.	7 – 8

• Displays data in tables with minor errors • Use of Punnett squares to support collected data, with minor errors in genotype, phenotype and percentages of each	5 – 6
• Attempts to display data in tables with some errors • Attempts to use Punnett squares to support collected data	3 – 4
• Presents primary data collected in experiment in a non-organised manner • Limited use of tables and/or Punnett squares	1 – 2

Discussion Questions (in class) BIO12-2 + BIO12-12

Criteria	Mark
Criteria given after the class task.	12

Conclusion (in class) BIO12-3 + BIO12-12

Criteria	Mark
Criteria given after the class task.	3

TOTAL	**Rank:**	**/40**	**%**

TEACHER FEEDBACK

Genetic Plants – A Monohybrid Cross

BACKGROUND INFORMATION

Pigmentation in species of plants are controlled by a single gene with two alternative alleles:
A: Pigment produced – purple
a: No Pigment Produced – albino (white/green stems)
In the heterozygote, expression of purple pigment masks the effect of the allele coding for no pigment (albino). The genetic plant used in this experiment is the result of a cross between plants heterozygous for the gene locus in question: **Aa x Aa**

A total number of 250 seeds will be grown by the class. Your group will be assigned a number of seeds, and collate results with the class to aid in your investigation

TASK - Investigate the result of crossing two plants heterozygous for pigment

Your group will be provided with ~ 50 seeds that have been obtained as a result of crossing plants heterozygous for pigment. You will be responsible for collecting the results for these seeds. The results will then be combined with the results from all groups in the class to make a larger sample size.

The seeds can be germinated by spreading them out over cotton wool soaked with water. The cotton wool must be kept moist and not allowed to dry out. Seedlings can be assessed as containing or not containing chlorophyll when they have reached a height of 4-5 cm. This takes 3-5 days at 22-24 °C, and 6-7 days at lower temperatures.

You are required to write a Scientific Report on your investigation and findings.

Scientific Investigation Structure

Introduction

The introduction gives the reader background information about the topic of the practical report and places your report in the context of that background information. You should begin by summarising what is already known about the topic. The introduction should then highlight how your report relates to the background information, e.g., through investigating a research gap, examining the physical properties of a rock or demonstrating a scientific law.
The inquiry question should form the report title. This question forms the scientific process in investigating to answer a question. The inquiry question must link to your aim and hypothesis and be the overarching topic of your investigation.

Your hypothesis is a tentative explanation for an observation that is based on evidence and prior knowledge. A hypothesis must be testable and falsifiable. Written as a short statement, a hypothesis should include the variables to be tested and a statement of the measurable, predicted outcome.

Experiments measure relationships between variables.

- An independent variable is the one that is changed.
- A dependent variable is the one responding to the change in the independent variable.
- Controlled variables are kept constant throughout the experiment.

The introduction should culminate in a clear statement of the aim of the experiment.

Structure your introduction to answer the following two questions:

1. What is known about this topic?
2. Why was the experiment performed?

Apparatus

The materials section should include a list of all the materials used throughout the experiment.

Methodology

The methodology section thoroughly describes how you carried out your experiment and includes the quantity, volume, concentration and mass of materials used. Structure your methodology section to provide a detailed account of what you did when you performed the experiment, in order to provide the reader with sufficient information to replicate the experiment.

Use past tense because you are providing a description of what you did, however avoid the use of personal pronouns, e.g., I or we. Do not write the method in the normal 'dot point style' instruction, change it into narrative form.

For example, change "Add 0.2 mL aliquot of enzyme to start the reaction and incubate for 30 min at 25 °C."

*to: "*The reaction was started by the addition of a 0.2 mL aliquot of enzyme and incubated for 30 min at 25 °C."

Results

The results section is where you present the data obtained in your experiment in a logical order. Depending on how much data you have, it is usually best to summarise results. It is desirable to display results using tables or figures (e.g., graphs or photographs). Tables and figures must also have labels and titles. The title belongs above a table and below a figure.

Examples of presenting a figure in the results section:

- *This study compared the memory of mice and guinea pigs using a maze with a reward at the end. Results show that mice completed the maze without error after an average of 15 attempts compared to an average of 24 attempts for guinea pigs (Figure 1).*
  OR
- *This study compared the memory of mice and guinea pigs using a maze with a reward at the end. Figure 1 shows that mice completed the maze without error after an average of 15 attempts compared to an average of 24 attempts for guinea pigs.*

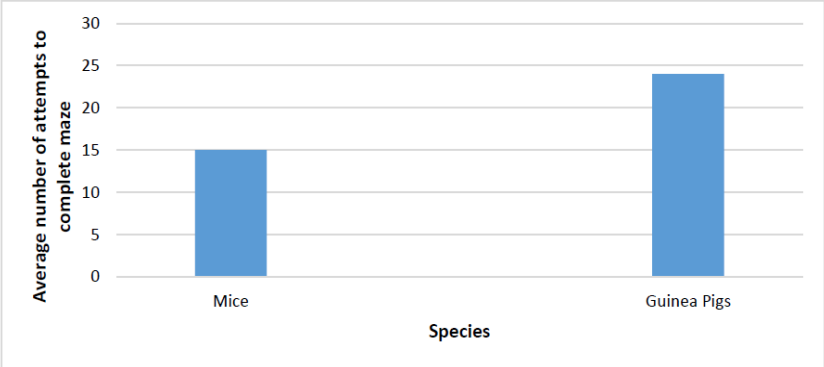

Figure 1. Average number of attempts to complete the maze without error for mice and guinea pigs.

Importantly, do not include interpretations of your data in the results section. Save that for the discussion. Instead, simply present the data for what it is.

Discussion Questions

The purpose of the discussion section is provide an explanation for your results and to interpret those results in the context existing theory and knowledge.

For your discussion, you will be given questions around your investigation to be answered in class.

Conclusion

The conclusion summarises key results and interpretations of the experiment. The conclusion should be concise and brief. Importantly, the conclusion should not introduce any new information.

Scientific Report – Genetic Plants: A Monohybrid Cross

Introduction **Marks 3**

Aim **2**

Hypothesis **3**

Apparatus