# Biology 2019 v1.3

IA2: Sample assessment instrument

## Student experiment (20%)

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

**Student name**

**Student number**

**Teacher**

**Issued**

**Due date**

# Marking summary

| Criterion | Marks allocated | Provisional marks |
|---|---|---|
| Research and planning | 6 | |
| Analysis of evidence | 6 | |
| Interpretation and evaluation | 6 | |
| Communication | 2 | |
| **Overall** | **20** | |

# Conditions

| | |
|---|---|
| **Technique** | Student experiment |
| **Unit** | Unit 3: Biodiversity and the interconnectedness of life |
| **Topic/s** | Topic 1: Describing biodiversity<br>Topic 2: Ecosystem dynamics |
| **Duration** | 10 hours class time |
| **Mode/length** | Written response (e.g. scientific report): 1500–2000 words |
| **Individual/group** | Individual response: students may collaborate to develop the methodology and perform the experiment |
| **Resources** | School science laboratory and library (online: internet and school intranet, databases, journals) |

# Context

You have completed the following practicals in class:

- Determine species diversity of a group of organisms based on a given index (mandatory practical).
- Use the process of stratified sampling to collect and analyse primary biotic and abiotic field data to classify an ecosystem (mandatory practical).
- Select and appraise an ecological surveying technique to analyse species diversity between two spatially variant ecosystems of the same classification, e.g. a disturbed and undisturbed dry sclerophyll forest (mandatory practical).
- Measure the wet biomass of producer samples.
- Measure the population of microorganisms in Petri dishes to observe carrying capacity.

# Task

Modify (i.e. refine, extend or redirect) an experiment in order to address your own related hypothesis or question.

You may use a practical performed in class, a related simulation or another practical related to Unit 3 (as negotiated with your teacher) as the basis for your methodology and research question.

**To complete this task, you must:**

- identify an experiment to modify*
- develop a research question to be investigated*
- research relevant background scientific information to inform the modification of the research question and methodology
- conduct a risk assessment and account for risks in the methodology*
- conduct the experiment*
- collect sufficient and relevant qualitative data and/or quantitative data to address the research question*
- process and present the data appropriately
- analyse the evidence to identify trends, patterns or relationships
- analyse the evidence to identify uncertainty and the limitations
- interpret the evidence to draw conclusion/s to the research question
- evaluate the reliability and validity of the experimental process
- suggest possible improvements and extensions to the experiment
- communicate findings in an appropriate scientific genre, i.e. scientific report.

*The steps indicated with an asterisk above may be completed in groups. All other elements must be completed individually.

# Checkpoints

☐ Term 2, Week 3: Select experiment and identify proposed modifications.

☐ Term 2, Week 4: Perform experiment and process data.

☐ Term 2, Week 6: Analyse and evaluate evidence.

☐ Term 2, Week 7: Submit draft.

☐ Term 2, Week 9: Submit final response.

# Authentication strategies

- The teacher will provide class time for task completion.
- Students will provide documentation of their progress at indicated checkpoints.
- The teacher will collect and annotate one draft.
- Students will use plagiarism-detection software at submission of the response.
- Students must acknowledge all sources.
- The teacher will compare the responses of students who have worked together in groups.

# Scaffolding

The response must be presented using an appropriate scientific genre (i.e. scientific report) and contain:

- a research question
- a rationale for the experiment
- reference to the initial experiment and identification and justification of modifications to the methodology
- raw and processed qualitative data and/or quantitative data
- analysis of the evidence
- conclusion/s based on the interpretation of the evidence
- an evaluation of the methodology and suggestions of improvements and extensions to the experiment
- a reference list.

**An example of how one of the practicals could be modified to develop a research question**

**Practical that will be modified:** Measure the population of microorganisms in Petri dishes to observe carrying capacity.

**Research question:** Does a 25% glucose solution limit the carrying capacity of *Saccharomyces cerevisiae*?

**Developing the research question:**

| Steps | Details |
|---|---|
| Identify the independent variable to be investigated. | Limiting factor related to chosen microorganism. |
| Identify the dependent variable. | Final population (carrying capacity) of microorganism. |
| Identify the methodology to be used. | Babraham Institute's yeast culture protocols: https://protect-au.mimecast.com/s/0-1dC71RlwUzQNBsWhzkZ?domain=babraham.ac.uk |
| Draft research questions. | Which type of sugar affects the carrying capacity of yeast? |
| Refine and focus the research question. | What level of glucose grows more yeast? |
| Present research question to teacher for approval. | Does a 25% glucose solution limit the carrying capacity of *Saccharomyces cerevisiae*? |

**Note:** You cannot use this sample research question for your experiment.

# Instrument-specific marking guide (IA2): Student experiment (20%)

## Criterion: Research and planning

### Assessment objectives

2. apply understanding of biodiversity or ecosystem dynamics to modify experimental methodologies and process primary data
5. investigate phenomena associated with biodiversity or ecosystem dynamics through an experiment

| The student work has the following characteristics: | Marks |
|---|---|
| • informed application of understanding of biodiversity or ecosystem dynamics to modify experimental methodologies demonstrated by<br>– a considered rationale for the experiment<br>– justified modifications to the methodology<br>• effective and efficient investigation of phenomena associated with biodiversity or ecosystem dynamics demonstrated by<br>– a specific and relevant research question<br>– a methodology that enables the collection of sufficient, relevant data<br>– considered management of risks and ethical or environmental issues. | 5–6 |
| • adequate application of understanding of biodiversity or ecosystem dynamics to modify experimental methodologies demonstrated by<br>– a reasonable rationale for the experiment<br>– feasible modifications to the methodology<br>• effective investigation of phenomena associated with biodiversity or ecosystem dynamics demonstrated by<br>– a relevant research question<br>– a methodology that enables the collection of relevant data<br>– management of risks and ethical or environmental issues. | 3–4 |
| • rudimentary application of understanding of biodiversity or ecosystem dynamics to modify experimental methodologies demonstrated by<br>– a vague or irrelevant rationale for the experiment<br>– inappropriate modifications to the methodology<br>• ineffective investigation of phenomena associated with biodiversity or ecosystem dynamics demonstrated by<br>– an inappropriate research question<br>– a methodology that causes the collection of insufficient and irrelevant data<br>– inadequate management of risks and ethical or environmental issues. | 1–2 |
| • does not satisfy any of the descriptors above. | 0 |

## Criterion: Analysis of evidence

### Assessment objectives

2. apply understanding of biodiversity or ecosystem dynamics to modify experimental methodologies and process primary data
3. analyse experimental evidence about biodiversity or ecosystem dynamics
5. investigate phenomena associated with biodiversity or ecosystem dynamics through an experiment

| The student work has the following characteristics: | Marks |
|---|---|
| • appropriate application of algorithms, visual and graphical representations of data about biodiversity or ecosystem dynamics demonstrated by correct and relevant processing of data<br>• systematic and effective analysis of experimental evidence about biodiversity or ecosystem dynamics demonstrated by<br>– thorough identification of relevant trends, patterns or relationships<br>– thorough and appropriate identification of the uncertainty and limitations of evidence<br>• effective and efficient investigation of phenomena associated with biodiversity or ecosystem dynamics demonstrated by the collection of sufficient and relevant raw data. | 5–6 |
| • adequate application of algorithms, visual and graphical representations of data about biodiversity or ecosystem dynamics demonstrated by basic processing of data<br>• effective analysis of experimental evidence about biodiversity or ecosystem dynamics demonstrated by<br>– identification of obvious trends, patterns or relationships<br>– basic identification of uncertainty and limitations of evidence<br>• effective investigation of phenomena associated with biodiversity or ecosystem dynamics demonstrated by the collection of relevant raw data. | 3–4 |
| • rudimentary application of algorithms, visual and graphical representations of data about biodiversity or ecosystem dynamics demonstrated by incorrect or irrelevant processing of data<br>• ineffective analysis of experimental evidence about biodiversity or ecosystem dynamics demonstrated by<br>– identification of incorrect or irrelevant trends, patterns or relationships<br>– incorrect or insufficient identification of uncertainty and limitations of evidence<br>• ineffective investigation of phenomena associated with biodiversity or ecosystem dynamics demonstrated by the collection of insufficient and irrelevant raw data. | 1–2 |
| • does not satisfy any of the descriptors above. | 0 |

## Criterion: Interpretation and evaluation

### Assessment objectives

4. interpret experimental evidence about biodiversity or ecosystem dynamics
6. evaluate experimental processes and conclusions about biodiversity or ecosystem dynamics

| The student work has the following characteristics: | Marks |
|---|---|
| • insightful interpretation of experimental evidence about biodiversity or ecosystem dynamics demonstrated by justified conclusion/s linked to the research question<br>• critical evaluation of experimental processes about biodiversity or ecosystem dynamics demonstrated by<br>– justified discussion of the reliability and validity of the experimental process<br>– suggested improvements and extensions to the experiment that are logically derived from the analysis of evidence. | 5–6 |
| • adequate interpretation of experimental evidence about biodiversity or ecosystem dynamics demonstrated by reasonable conclusion/s relevant to the research question<br>• basic evaluation of experimental processes about biodiversity or ecosystem dynamics demonstrated by<br>– reasonable description of the reliability and validity of the experimental process<br>– suggested improvements and extensions to the experiment that are related to the analysis of evidence. | 3–4 |
| • invalid interpretation of experimental evidence about biodiversity or ecosystem dynamics demonstrated by inappropriate or irrelevant conclusion/s<br>• superficial evaluation of experimental processes about biodiversity or ecosystem dynamics demonstrated by<br>– cursory or simplistic statements about the reliability and validity of the experimental process<br>– ineffective or irrelevant suggestions. | 1–2 |
| • does not satisfy any of the descriptors above. | 0 |

## Criterion: Communication

### Assessment objectives

7. communicate understandings and experimental findings, arguments and conclusions about biodiversity or ecosystem dynamics

| The student work has the following characteristics: | Marks |
|---|---|
| • effective communication of understandings and experimental findings, arguments and conclusions about biodiversity or ecosystem dynamics demonstrated by<br>– fluent and concise use of scientific language and representations<br>– appropriate use of genre conventions<br>– acknowledgment of sources of information through appropriate use of referencing conventions | 2 |
| • adequate communication of understandings and experimental findings, arguments and conclusions about biodiversity or ecosystem dynamics demonstrated by<br>– competent use of scientific language and representations<br>– use of basic genre conventions<br>– use of basic referencing conventions | 1 |
| • does not satisfy any of the descriptors above. | 0 |