

Internal Assessment Resource

Biology Level 1

This resource supports assessment against Achievement Standard 90925 version 3

Standard title: Carry out a practical investigation in a biological context, with direction

**Credits:** 4

Resource title: Exercise and breathing rate

**Resource reference:** Biology 1.1C

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| This resource:  • Clarifies the requirements of the standard  • Supports good assessment practice  • Should be subjected to the school’s usual assessment quality assurance process  • Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic |

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| Date version published by Ministry of Education | February 2015  To support internal assessment from 2015 |
| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-90925-01-9029 |
| Authenticity of evidence | Teachers must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.  Using this assessment resource without modification may mean that students’ work is not authentic. The teacher may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

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Teacher guidelines

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

This activity requires the student to plan and carry out a comprehensive practical investigation to collect primary data on the effect of exercise on breathing rate, process and interpret the data collected, and report on the conclusions drawn.

This resource is not ready to use. Before using it, you need to select, finalise, or negotiate an exercise context that will engage your students. You then need to adapt the activity by specifying this context and a relevant purpose, and identifying the method your students are to use to collect and present evidence as a fair test investigation.

You also need to modify the assessment schedule to align with your activity in its final form, including the addition of specific examples of evidence in the context chosen.

Conditions

*With direction* (EN 4) means that you provide general instructions for the investigation in the form of a purpose, an outline of the method, and the equipment and/or organisms from which students will choose (that is, what to do, but not how to do it). Provide students with a template or other suitable format for planning the investigation. Graph paper should be provided for students to accurately process their data to determine a trend or pattern (or its absence) and reach a valid conclusion.

In selecting the type of investigation the students are to carry out, the conditions need to be modified accordingly.

The total time needed and times for each individual part of the task will depend on the particular investigation and must be specified in the student instructions. A suggested time is one hour for each of the fourparts of the task.

Students can either work individually throughout the investigation or in small groups for collecting and recording their own data where manageability of large classes/resources may be an issue. For group work, you need to be able to verify that each student has actively participated while working in the group.

Resource requirements

Students will need access to stopwatches, and a suitable space to carry out the exercise task for their investigation.

Additional information

*Fair test investigations* are those where the student manipulates a single variable, the independent variable, measures the dependent variable, and controls or measures any other variables so the effect of changes in the independent variable can be identified. An example of a fair test investigation could be the effect of changing the duration of a specific type of exercise on breathing rate.

Other suitable contexts could involve investigating exercise and pulse rate, exercise over time and the effect on recovery of breathing or pulse rate.

Alternatively, students could carry out a pattern-seeking investigation in this context by investigating the effect of different types of exercise on breathing or pulse rate.

Before carrying out this investigation, students need to have a base of knowledge and understanding about the biological ideas applicable to the context to be investigated.

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Student instructions

Introduction

This assessment requires you to carry out a practical investigation on the effect of exercise on breathing rate.

Teacher note: The context can be modified to suit your students. Refer to the Teacher Guidelines.

You will complete all work individually and have one week to complete this assessment. You have one hour to complete each part of the task.

Your teacher will collect all work in at the end of each lesson and return it to you as required. This is to ensure the authenticity of your work.

Teacher note: Modify the conditions to suit the context by specifying: time(s) allowed, due date for completion, individual and/or group work and safety instructions.

Task

You are to carry out a practical investigation on the effect of exercise on breathing rate. Breathing rate is the number of breaths in 30 seconds.

Your method should enable you to take and record your breathing rate while resting before and after exercise.

You will write a report of your investigation that includes: a purpose written as a hypothesis, a step-by-step method, accurately recorded and appropriately processed data, and a valid conclusion that is based on your interpretation of the processed data that links to the purpose.

You are going to be assessed on the quality of your investigation. The task involves four stages. See Resource A for further guidance.

Develop a method

You have the following equipment and materials:

Teacher note: Specify the equipment and materials provided.

Trial the equipment and materials provided to develop a suitable method for the investigation.

Collect and record data

Follow your method to accurately collect data and record the results in a table or other appropriate way.

Record any changes to your method, and the reasons for the changes, as you go.

Describe how you will ensure that your results are reliable and that you have enough data to enable you to determine any trend or pattern (or lack of one).

Process and interpret the data

Process your results appropriately to show the trend or pattern (or lack of one) in your recorded data. This usually involves some calculations (for example, table of averages) and/or a graph.

Explain your conclusion by using your knowledge of the relevant biological ideas.

Evaluate your final method to justify the choices you made to collect the data for your investigation. This includes commenting on how you ensured this method was valid and reliable.

Present your report

Present a written report that includes all details of your investigation purpose and hypothesis, your final step-by-step method and your findings. (Refer to Resource A for additional information that may be of help.)

Resource A: Further guidance

Teacher note: Modify to suit as *either* a fair test *or* a pattern-seeking investigation.

Fair test investigation

* Rewrite the purpose you have been given as a hypothesis.
* Describe the key variables involved in developing your method.
* *Independent variable* (the variable that is to be changed). Decide on a suitable range of values to be used for the independent variable (with units of measurement) and how these values will be changed. Trialling will help you establish this range. You must provide at least three values.
* *Dependent variable* (the variable that will be measured). Describe how you will measure the dependent variable and in what units of measurement.
* *Controlled variables* (significant or relevant variables that will need to be kept the same to make your investigation valid and fair). Describe how these variables will be controlled or measured to make your results show only the effect of changing the independent variable. Consider factors such as sampling bias and/or how sources of error will be overcome.
* Write a detailed step-by-step method you will use to collect the data on your own paper. You may change your method as you carry it out as long as you describe any changes made to the final method in your report and give the reasons for them.
* Describe what you did to make sure your method was valid (did you investigate the hypothesis? How did you overcome limitations and minimise possible sources of error?) and produced reliable, accurate results (did your investigation produce results that can be trusted? How did you deal with outliers?).

Your report

In your report make sure you include all of the following:

* the purpose written as a hypothesis
* the detailed step-by-step final methodyou used
* your appropriately recorded data
* your appropriately processed data
* a valid conclusion based on the interpretation of the processed data that links to the purpose (that is, hypothesis) of the investigation
* an explanation of your conclusion in terms of the biology ideas involved
* a justification of the choices you made during the investigation by evaluating:
* the validity of the method, for example, how it overcame limitations or sources of error
* the reliability of the data, for example, repeats and dealing with outliers.

Assessment schedule: Biology 90925 – Exercise and breathing rate

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student carries out a practical investigation on the effect of exercise on breathing rate, with direction. The report includes the final method with sequential steps for collecting primary data, including:   * the range of the independent variable (at least three values) with units   For example: The student identifies three different fixed times for or distances for walking/jogging/running or three different types of exercise for a fixed time period.   * how the dependent variable is measured, with units as breaths/min * collecting, recording, and processing data relevant to the purpose   For example:  The student shows the effect of slow, medium or fast walking for five minutes on breathing rate as a table or graph. Minor processing or computational errors can be ignored; the raw data must be within a range of values feasible for the context.   * a conclusion based on an interpretation of the processed data   For example:  The student describes the trend shown for slow, medium or fast walking as an increase in breathing rate.  *The examples above are indicative samples only.* | The student carries out an in-depth practical investigation on the effect of exercise on breathing rate, with direction. The report includes:   * the purpose written as a hypothesis   For example:  The student predicts an increase in the breathing rate with an increase in the intensity of exercise.   * the final method with sequential steps for collecting primary data including: * a valid range of the independent variable (at least three values with repeats or an extended range) with units * the accurate measurement of the dependent variable, with units, and * the control of at least two other significant variables that may affect the results, or * consideration of at least two factors such as sampling bias and/or sources of error   For example:   * same person exercising * same time period/distance for duration of exercise. * collecting, recording, and processing data that enables a trend or pattern (or its absence) to be determined   For example: The data is collected with repeats and is averaged to accurately show the effect of exercise on breathing rate as a table or graph before and after exercise.   * a valid conclusion based on an interpretation of the processed data links to the purpose of the investigation   For example:  The student describes the trend shown in breathing rate immediately before and after exercise stops in regular time intervals, and links this to the purpose written as a hypothesis. The description is consistent with the data collected and processed.  *The examples above are indicative samples only.* | The student carries out a comprehensive practical investigation on the effect of exercise on breathing rate, with direction. The report includes:   * the purpose written as a hypothesis * the final method with sequential steps for collecting primary data including: * a valid range of the independent variable (at least three values with repeats or an extended range) with units * the accurate measurement of the dependent variable, with units, and * the control of at least two other significant variables that may affect the results, or * consideration of at least two factors such as sampling bias and/or sources of error * collecting, recording, and processing data that enables a trend or pattern (or its absence) to be determined * a valid conclusion based on an interpretation the processed data links to the purpose of the investigation * justification of the choices made in the investigation by evaluating either: * the validity of the method   For example:  *The student describes how significant variables that may affect the results were controlled, how the accurate measurement of the dependent variable was carried out.*  OR:   * the reliability of the data   For example:  *The student describes how factors such as sampling bias, and/or sources of error were considered.*   * explaining the conclusion in terms of applicable biological ideas   For example:  The explanation gives reasons for the changes to the level of oxygen/carbon dioxide in the blood during vigorous exercise and how the breathing process maintains the oxygen/carbon dioxide level during recovery.  *The examples above are indicative samples only.* |

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.