

NZQA Approved

Remote Internal Assessment Resource

Biology Level 3

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| This resource supports assessment against:  Achievement Standard 91604  Demonstrate understanding of how an animal maintains a stable internal environment |
| Resource title: Coast to Coast |
| 3 credits |
| This resource:   * Clarifies the requirements of the standard when delivered remotely * Supports good remote 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 | Originally published December 2012 and edited 2020  To support remote internal assessment due to COVID-19 |
| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-5-2020-91604-01-6426 |
| 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. |

**Internal Assessment Resource**

Achievement Standard Biology 91604: Demonstrate understanding of how an animal maintains a stable internal environment

Resource reference: Biology 3.4A-R

Resource title: Coast to Coast

Credits: 3

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 Achievement Standard Biology 91604. 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

The task involves students demonstrating an understanding of a homeostatic control system and how it functions to maintain a stable internal environment despite fluctuating environmental conditions.

Students are asked to explain the biological ideas related to the purpose and mechanism of the thermoregulatory control system used by an athlete to maintain a stable internal environment. This involves describing how the mechanism incorporates the components of this system and explaining how the system responds to a range of external conditions in a scenario related to extreme environmental conditions (i.e. weather*).* To demonstrate comprehensive understanding they must link biological ideas about maintaining a stable internal environment in an athlete.

Conditions

It is suggested that assessment takes place over approximately 4 hours; this allows for up to 30 minutes group discussion of the stimulus material shared at the start of the assessment period via zoom/skype/teams etc then at least 3 hours individual work carried out remotely.

Facilitate a preliminary group discussion of the scenario resource(s) via your chosen channel to identify aspects relevant to control systems in humans. If possible, record the session so students can refer back to it. Students may take notes during the discussion, but you should not have direct input at any stage.Students work independently to produce their final report using the provided resources and any other resources they might locate. Resources used should be processed into the students’ own words and a list of all resources used should be included with the report along with some evidence of processing.

At least one checkpoint should be arranged with individual or small groups of students to allow them to check they are on the right track as they work remotely. The teacher’s role in the checkpoint is to facilitate unpacking of the task and engagement with any resource material, rather than to direct the student.

The final report could include evidence in written, visual, or electronic form or a constructed model. The diagram or model could be produced using an appropriate computer program/software.

Authenticity of student work needs to be assured by [appropriate measures](https://www.nzqa.govt.nz/about-us/publications/newsletters-and-circulars/covid-19-updates/covid-19-update-5/).

When you need to make an assessment judgement it might be useful to review this discussion to observe any contribution made by a student that demonstrates understanding of aspects included in the achievement criteria. This sort of naturally occurring evidence might also be collected during checkpoint exchanges (oral or written) between teacher and student while they are developing their final response.

Resource requirements

Stimulus material in the scenario could include route plans and topographical maps, weather forecasts, event programme, etc provided electronically as a resource bundle.

Student work including their final response/report and with supporting evidence of resource-processing is submitted in digital form via an agreed channel

Additional information

Prior learning should incorporate the indicators from *The New Zealand Curriculum* Level 8 Science Living World achievement objective on Life Processes, Ecology and Evolution: ‘Understand the relationship between organisms and their environment’, related to the material in the Teaching and Learning Guide for Biology, Ministry of Education, at <http://seniorsecondary.tki.org.nz>.

Conditions of Assessment related to this achievement standard can be found at [www.tki.org.nz/e/community/ncea/conditions-assessment.php](http://www.tki.org.nz/e/community/ncea/conditions-assessment.php).

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| Achievement | Achievement with Merit | Achievement with Excellence |
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| Demonstrate understanding of how an animal maintains a stable internal environment. | Demonstrate in-depth understanding of how an animal maintains a stable internal environment. | Demonstrate comprehensive understanding of how an animal maintains a stable internal environment. |

Student instructions

Introduction

This assessment activity requires you to produce a report that describes thermoregulation (the control of body temperature) and how it works to enable an athlete competing in the ‘Coast to Coast’ event to maintain a stable internal environment despite fluctuating environmental conditions. This will involve describing the purpose and components of the system and explaining how the components work together.

You will be assessed on the comprehensiveness of your report and the extent to which you link biological ideas about maintaining a stable environment in an animal.

Your teacher will facilitate a preliminary group discussion via [insert appropriate channel] of the resource materials provided to identify aspects relevant to your task. It would be useful to make notes during the discussion time. This discussion will be recorded for you to refer back to it.

Teacher note: Select a time frame that suits you and your students, ensuring they have enough time to complete the assessment. Specify milestone points to monitor progress and a due date.

Work independently to produce the report using the resources provided. You may carry out additional research to enhance your understanding of thermoregulatory control systems in humans or of the given context (the event you are focusing on). Keep a record of other resources used and save some evidence to show how you processed some of this resource material. Submit this evidence of processing along with your final report. Your teacher will arrange a checkpoint meeting at which time you can share your thinking and attest you approach to ensure you are on the right track. Make sure you are ready to make use of this checkpoint opportunity and can show evidence of your work in progress. Your teacher will be watching for evidence of your understanding throughout the initial group discussion and any checkpoints and this helps them to make their final judgement of your achievement against the criteria of the standard.

Your report could include evidence in written, visual, or electronic form or a constructed model. For example, a diagram or model could be produced using an appropriate computer program/software.

[Insert a suggested time for students to work on producing their response] to analyse the scenario given in the task below and to produce your report.

Task

Working individually, **review the scenario** (Student Resource A below) for an athlete competing in the ‘Coast to Coast’ event in the South Island of New Zealand.

Use the information in Resource A and any notes from the preliminary group discussion to produce a report on the biological ideas related to the thermoregulatory homeostatic control system for the athlete to maintain a stable internal environment.

Include in your report:

* a description of the *purpose and components* of this homeostatic control system, which may include annotated diagrams or models
* an explanation of the *mechanism* of this control system, i.e. how and why it responds to the normal range of environmental fluctuations, the interaction and feedback mechanisms between parts of the system
* an explanationof how balance is re-established following the potential effect of one specific disruption to this control system by internal or external influences in the scenario below (Student Resource A), e.g. extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders.

In your report,link biological ideas about maintaining a stable internal environment for any one of the following:

* a discussion of the significance of this control system in terms of its adaptive advantage
* an explanation of the biochemical and/or biophysical processes underpinning the mechanism of this control system, e.g. equilibrium reactions, changes in membrane permeability, metabolic pathways
* an analysis of a specific example of how external and/or internal environmental influences, e.g. extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders, may result in a breakdown of this control system.

Student Resource A

Longest Day ‘Coast To Coast’ Multisport Event

The ‘Coast to Coast’ is a mountain race held annually in the South Island of New Zealand. Participants begin at Kumara on the West Coast, run, kayak, and cycle their way over the Main Divide on their way to Sumner Beach on the east coast near Christchurch. They cross a variety of terrain and are exposed to a wide range of weather and track conditions as they complete the ‘Longest Day’. The race begins at 6am and first arrivals in the [one-day](http://www.coasttocoast.co.nz/program.htm) event usually reach Sumner about 11 hours later, with most arriving 3 to 4 hours after that. Expected total time from start to finish is in the range of 11 to 17 hours.

Competitors have to manage their own fluid and food intake, clothing, and equipment throughout the event to avoid problems such as heat stroke or heat exhaustion.

Typical fluid intake for stages of the event to compensate for water loss:

Stage One 1–2 litres

Stage Two 4–5 litres

Stage Three 3 litres

Stage Four 5 litres.

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| **Stage description** | **Local conditions** | **Map** |
| Stage One (5am assembly)  A 3km run followed by 55km cycle on sealed roads, gaining 500m elevation over the distance, reaching the Aickens transition – expected time 1.5 to 2.5 hours. | Stage One  Temperature 14**°**C  Wind speed 5km/h  No rain | Include profile map of stages from ‘Coast to Coast’ website  [www.coasttocoast.co.nz](http://www.coasttocoast.co.nz) |
| Stage Two  With a day pack, a 33km mountain run, along mountain tracks, through rivers, up riverbeds with some off-track running, cross Goat Pass at 1100m, and down into Mingha riverbed, cross Bealey River and run to Klondyke Corner – expected time 3 to 8 hours. | Stage Two  Temperature drops to -3**°**C at Goat Pass  Wind speed 30km/h  Hail and rain | Goat Pass  Klondyke Corner  Aickens |
| Stage Three  Cycle 15km on road, carrying warm clothing, 800m run down to 67km kayaking section, wearing kayak helmet through 25km flat braided river, followed by 25km gorge with Grade 2 rapids then 17km flat kayaking – expected time 4 to 8 hours. | Stage Three  Temperature 16°C  Wind speed blustery gusts to 45km/h  Cloudy, rain stopped | 25km easy  25km in narrow gorge rapids  67km total |
| Stage Four  Cycle 70km from Waimakariri Gorge to Sumner Beach on roads (road falls 250m over this section). | Stage Four  Temperature rising to 35C  Wind speed gusts to 60km/h  No rain, clear skies | Gorge Bridge  70km  Sumner |

Assessment schedule: Biology 91604 Coast to Coast

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student demonstrates understanding using biological ideas of how a human in the scenario maintains a stable internal environment by including a description and/or annotated diagrams or a modelof:   * the purpose and components of the thermoregulatory homeostatic control system   For example:  *Due to thermoregulation in humans the body temperature is maintained at 37סC. This involves a negative feedback system that uses a range of mechanisms such as sweating and shivering to adjust the temperature back to its normal point.*   * the mechanism of this homeostatic system to show how the components of the system work together.   For example:  The student uses the scenario to demonstrate how balance is re-established following onepotential specific disruptionto this homeostatic system by internal or external influences such as extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders.  For example:  *The hypothalamus in the brain detects when the temperature exceeds 37סC. It sends nervous signals to the skin telling the sweat glands to increase production of sweat, which lowers the body temperature.*  *As an athlete cycles uphill in Stage One, his or her body temperature is likely to rise above 37סC because the major leg muscles are respiring at a higher rate than normal. This results in the blood temperature rising. The hypothalamus that monitors the blood temperature detects this change and sends nervous signals to the sweat glands in the skin, causing them to increase sweat production to lower the body’s temperature.*  *The examples above relate to only part of what is required, and are just indicative.* | The student demonstrates in-depth understanding using biological ideas of how a human in the scenario maintains a stable internal environment by including a description and/or annotated diagrams or a modelof:   * the purpose and components of the thermoregulatory homeostatic control system * the mechanism of this homeostatic system to show how the components of the system work together.   The student uses the provided scenario to demonstrate how balance is re-established following onepotential specific disruptionto this homeostatic system by internal or external influences such as extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders.  The student explainsthe mechanism of this homeostatic system to show how or why the components of the system work together.  For example:  *In a negative feedback system, the system switches on to counteract the initial fluctuation in body temperature and restores it to its set point and then switches off.*  The student uses the scenario to explain how balance is re-established following onepotential specific disruptionto this homeostatic system by internal or external influences such as extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders.  For example:  *Thermoregulation by sweating ensures metabolic reactions within body cells such as brain and muscle cells can continue. The reason for this is that enzymes have a narrow optimum temperature range – which for humans is around 37סC – if this is exceeded the enzymes can denature as they are proteins, and metabolic processes they catalyse will not occur.*  *As the athlete cycles uphill in Stage One, his or her body temperature is likely to rise above 37סC because the major leg muscles are respiring at a higher rate than normal. This releases additional heat within the muscle tissue; the blood collects and circulates this extra heat. This results in the blood temperature rising, which begins to increase the core body temperature.*  *The hypothalamus in the brain (which monitors the core body temperature) detects when the temperature exceeds 37סC and initiates the negative feedback response.*  *It sends a nervous impulse to the sweat glands in the skin, so the athlete will start to sweat to lower his or her body temperature by an evaporative cooling process.*  *The examples above relate to only part of what is required, and are just indicative.* | The student demonstrates comprehensive understanding using biological ideas of how a human in the scenario maintains a stable internal environment by including a description and/or annotated diagrams or a modelof:   * the purpose and components of the thermoregulatory homeostatic control system * the mechanism of this homeostatic system to show how the components of the system work together.   The student uses the scenario to demonstrate how balance is re-established following one potential specific disruptionto this homeostatic system by internal or external influences such as extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders.  The student explainsthe mechanism of this homeostatic system to show how or why the components of the system work together.  The student uses the scenario to explain how balance is re-established following onepotential specific disruptionto this homeostatic system by internal or external influences such as extreme environmental conditions, disease or infection, drugs or toxins, genetic conditions, or metabolic disorders.  The student links biological ideas about maintaining a stable internal environment to include at least one of:   * a discussion of the significance of the control system in terms of its adaptive advantage * an explanation of the biochemical and/or biophysical processes underpinning the mechanism (such as equilibrium reactions, changes in membrane permeability, metabolic pathways) * an analysis of a specific example of how an extreme external and/or internal environmental influences result in a breakdown of the control system.   For example:  *The athlete needs to manage aspects such as clothing, water and food intake, stress, and training to support the body’s natural homeostatic mechanisms in order to successfully complete the event.*  *In the long term, if metabolic processes can continue despite a fluctuating environment, an organism is able to inhabit a wider range of habitats and reproduce more successfully to maintain its population.*  *The more advanced an animal’s thermoregulatory system, the greater its chance of survival with a changing environment, e.g. heatwave or ice age (climate change).*  *When the athlete is in Stage Three or Four, the high wind speed will substantially increase total heat loss by convection. A 15km/h breeze results in a fivefold increase in heat loss by convection. Evaporative cooling by sweating only works if the surrounding air is not saturated by water. If the weather changed in these stages, sweating would become less effective at maintaining a constant body temperature.*  *In the ‘Coast to Coast’, as the athlete cycles uphill in Stage One, his or her body temperature is likely to rise above 37סC because the major leg muscles are respiring at a higher rate than normal. This releases additional heat within the muscle tissue; the blood collects and circulates this extra heat. This results in the blood temperature rising, which begins to increase the core body temperature. One role of the hypothalamus is to monitor the core body temperature via the blood temperature, detect any significant changes, and initiate the negative feedback response. A nervous impulse is sent to the sweat glands in the skin, so the athlete will start to sweat to lower his or her body temperature by an evaporative cooling process.*  *If the rate of cooling cannot match the rate of heat generation, then the body moves to a hyperthermic state resulting in heatstroke. If body temperature goes over 39סC, the athlete will become disoriented. Heatstroke should not be treated with ice-cold water, as it makes blood vessels constrict, which can hinder cooling because less blood flow means the body takes longer to cool down.*  If heat exhaustion results, for example when the body temperature is between 37ס and 39סC, the skin will become cool ... other factors contributing will be dehydration … Heat exhaustion is treated by …  *The examples above relate to only part of what is required, and are just indicative.* |

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