

**Subject:** Biology

**Level:** 3

**Standards:** 91603, 91605, 91606

## Part A: Commentary

Many candidates showed a clear understanding of the processes and principles needed in each achievement standard, and there was evidence they had revised previous examinations to prepare. Candidates this year were more focused on the actual question a lot more than in 2021, however, at times they wrote a lot of information not asked for. Candidates are best advised to only answer the questions given. This was particularly noticed in 91606.

Where possible, candidates should divide their time equally for each of the three questions. Candidates could consider allowing a small amount of time for planning their responses to ensure all aspects are touched on. Candidates should always refer to the stem of the question and use the bullet points to scaffold their responses, rather than numbering the bullets and using them to directly answer the question. Candidates should incorporate and / or link the relevant resource material into their responses and avoid rewriting material verbatim from the question in their answers.

## Part B: Report on standards

### 91603: Demonstrate understanding of the responses of plants and animals to their external environment

#### Examination

The exam had three questions, each with bullet points that needed to be answered and linked together to then relate to the stem of the question. Candidates were expected to use the context, not rewrite the question. Candidates were expected to show biological knowledge linked to the concepts, principles, and processes named in the achievement standard and the specification documents.

#### Observations

Many candidates understood the benefits of the behaviours asked in both question one and question two, however candidates were unsure of the costs of the behaviour, and this limited a lot of candidates' grades. They often stated that 'the benefits outweighed the costs', but the evidence for the specific cost was lacking.

With the plant response question, most candidates had some understanding of the action of auxin, however the adaptive advantages of parasitism were not as well understood. Many candidates repeated the information already given in the paper in their answers. Many candidates wrote all they know about plant timing, for example the phytochrome system, but the question was on the synchronised flowering behaviour.

## Grade awarding

Candidates who were awarded **Achievement** commonly:

- attempted all questions
- could define and describe the key terms and state the advantages and disadvantages of the courtship strategy, but were not able to explain WHY they were an advantage or disadvantage
- described migration, the biological rhythm, the cue, and the navigational method, but were not able to explain stellar / magnetic field navigation or the benefits / costs of migration in
- named and defined the interspecific relationship, the growth response, SDP and LDP, but were unable to explain the action of auxin, the adaptive advantages of parasitism, or the benefits of synchronised flowering.

Candidates who were awarded **Not Achieved** commonly:

- did not attempt all questions
- unable to define and describe key terms
- could not identify and describe the interspecific relationship.

Candidates who were awarded **Achievement with Merit** commonly:

- explained the adaptive advantages and disadvantages of courtship behaviours, group nesting, hierarchy, and territories, but could not link them to the costs, in terms of maintenance of the population through more young surviving
- explained the costs and benefits of migration, but could not link them to reproductive success and survival
- explained the adaptive advantages of parasitism and synchronised flowering, but could not link it to reproductive success and survival
- explained key concepts well, but failed to link this to the big picture of reproductive success.

Candidates who were awarded **Achievement with Excellence** commonly:

- were able to link the costs and benefits of the four behaviours to maintenance of the population through more young surviving
- linked the costs and benefits of migration to reproductive success and survival of the bunting, and expanded on 'benefits outweigh the costs'
- linked the adaptive advantages of parasitism and synchronised flowering to reproductive success and survival
- planned their answer to link the observed and described responses to reproductive success and survival.

## **91605: Demonstrate understanding of evolutionary processes leading to speciation**

### **Examination**

The exam had three questions, each with bullet points that needed to be answered and linked together to then relate to the stem of the question. Overall, the resource material provided was clear and relevant to the questions with the use of colour images helpful for candidates when interpreting the diagrams. However, many candidates found the graph difficult to interpret, or did not quote data from the information provided. Candidates are expected to use the context, including any graphical data, and not rewrite the question. Candidates are expected to show biological knowledge linked to the concepts, principles, and processes named in the achievement standard and the specification documents.

### **Observations**

Candidates this year showed they had prepared well for this standard by demonstrating a comprehensive understanding of the biological processes involved in evolution and speciation. Candidates need to provide more detail when defining terms at this level of Biology. The term “endemic” was not well described. Candidates with good literacy skills had a clear advantage when linking biological concepts. Candidates should avoid the use of anthropomorphisms and should always refer to the stem of the question. Clear handwriting is needed to ensure candidate responses are not misinterpreted.

### **Grade awarding**

Candidates who were awarded **Achievement** commonly:

- attempted all questions
- provided accurate definitions across **all** questions.
- interpreted a trend from the graph
- identified “predation avoidance” as selection pressure for production of TTX or identified “TTX poison” as selection pressure for resistance in snakes
- identified that the fish species have ‘preferred’ temperature zones
- identified that mutations bring new phenotypes
- described that chromosome number / compatible chromosomes are needed for successful reproduction
- described an appropriate RIM
- provided a labelled diagram of a polyploidy scenario.

Candidates who were awarded **Not Achieved** commonly:

- did not attempt one or more of the questions
- were unable to accurately define evolutionary concepts
- did not correctly identify the evolutionary concepts present in the examination question or resource material
- repeated information in the resource material and / or reworded the question.

Candidates who were awarded **Achievement with Merit** commonly:

- provided detailed explanations of evolutionary and speciation concepts by linking in and incorporating the resource material in their responses across **all** three questions
- explained that a random mutation would lead to a selective advantage, or explained idea of independent mutations having the same phenotypic effect
- explained selection pressure in terms of the idea of an “arms race” / predator: prey relationship
- explained how the data shows the pattern with a reason, such as reproduction success or survival in the species given
- explained how natural selection acting on fish can result in many species
- explained how a relevant RIM could result in divergence / adaptive radiation
- explained the process of polyploidy by linking it to non-disjunction of chromosomes during meiosis, or explaining it through a well annotated diagram
- explained a relevant RIM that could lead to sympatric speciation.

Candidates who were awarded **Achievement with Excellence** commonly:

- demonstrated an excellent understanding of how mutations linked to both processes (convergence and co-evolution) by discussing both newts AND snakes and this evolutionary relationship, while also linking clearly to the implications for the newts AND incorporating the data provided from the graph
- discussed fully how speciation processes resulted in the adaptive radiation of NZ Triple Fin fish using the data shown in the examination question, and linked to the specific selection pressure of temperature of the various rock pools
- discussed polyploidy as a means of sympatric speciation linked to reproductive isolation, both in terms of chromosome number and chromosome compatibility, alongside TWO clear RIMS that can lead to the speciation of the named plant(s).

## **91606: Demonstrate understanding of trends in human evolution**

### **Examination**

The exam had three questions, each with bullet points that needed to be answered and linked together to then relate to the stem of the question. Candidates were expected to use the context, not rewrite the question. Candidates were expected to show biological knowledge linked to the concepts, principles and processes named in the achievement standard and the specification documents.

### **Observations**

Candidates need to provide more detail when defining terms at this level of Biology. Some candidates included knowledge in their answer even if not asked, for example writing all the changes for bipedalism. Candidates should use a small amount of time for planning their responses to the question. Common vocabulary issues in candidate responses included: descendants vs ancestors; biological vs molecular clock. Many candidates were not able to distinguish between mitochondrial DNA and nuclear DNA and their origins; for example, candidates would often state that mtDNA was passed onto mother to daughter only, and that nuclear DNA was passed on from father to son only. A few candidates didn't know whether to write about *H. erectus* or *H. sapiens* for the Out of Africa question.

## Grade awarding

Candidates who were awarded **Achievement** commonly:

- stated *Homo sapiens* evolved in Africa, but did not explain the two waves of migration
- provided lengthy answers on bipedalism features
- did demonstrate understanding of formation of land bridges, but could explain how populations may become dispersed based on their incorrect assumption of land bridge = frozen water
- stated the same ideas without expanding on them to for a full explanation
- stated that mtDNA came from the maternal line only and did not undergo recombination
- defined endocranial capacity and hominin
- stated an advantage to caring for injured group members as well as a disadvantage and gave a reason for Neanderthal demise
- described how Africa changed from dense woodland to arid savannah, along with how bipedalism benefited early hominins, along with how small teeth relates to softer food
- gave a clear advantage of domesticating dogs and pigs, but struggled to create links to their descriptions to survival or adaptive advantage.

Candidates who were awarded **Not Achieved** commonly:

- did not attempt all questions
- did not write clear accounts of how DNA is used especially mtDNA
- did not answer the question that was asked
- wrote about advantage / disadvantage of caring to individual not society
- were not able to define hominin and/or endocranial capacity
- could give a benefit to the change in hand or brain but did not state what the change was
- rewrote the question/ resource material verbatim
- wrote about anything they knew about human evolution – remotely linked to the question
- wrote out a past exam model answer.

Candidates who were awarded **Achievement with Merit** commonly:

- provided definitions and explanations, linking back to survival or adaptive advantage, but did not fully link back to the question, such as would not relate changes to cranium or hand bone to earlier hominins, or would not fully discuss how the DNA evidence supported OOA theory
- explained the advantage to caring for injured group members, but would miss the link back to migration and movement of Neanderthals, or not provide explanations of how tools enabled them to survive
- explained that Africa changed from dense woodland to arid savannah, but would miss the link of how domestication, biological and cultural evolution enabled *H sapiens* to successfully migrate

- clearly explained two or three points, or did not tie all ideas together.

Candidates who were awarded **Achievement with Excellence** commonly:

- placed themselves in the position of a Neanderthal or early *H. sapiens*, and explain why the advantages led to success, e.g. tools or domestication
- explained how mtDNA is used to determine time from divergence, and how nDNA evolutionary relationships through similar genes
- demonstrated understanding of how the benefits of caring for the injured benefitted a group in terms of the retention of cultural knowledge, e.g. Lavallois tool making
- answered all parts of the question, linking ideas to each other and the given context.
- demonstrated good knowledge of the biological trends and clearly articulated implications of changes
- addressed the bullet points to answer the question
- used the correct biological terminology
- demonstrated understanding of the ice age environment in relation to sea levels rising and falling related to land bridges for easy travel
- answered every part of the questions asked, added depth and specifics to their explanations.