Demonstrate understanding of evolutionary processes leading to speciation.

Level 3, 4 Credits

This achievement standard involves demonstrating understanding of evolutionary processes leading to speciation.

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of evolutionary processes leading to speciation.	Demonstrate in-depth understanding of evolutionary processes leading to speciation.	Demonstrate comprehensive understanding of evolutionary processes leading to speciation.

- ❑ Evolutionary processes involve the following biological ideas:
  - role of mutation
  - gene flow
  - role of natural selection and genetic drift
  - modes of speciation (sympatric, allopatric)
  - reproductive isolating mechanisms that contribute to speciation (geographical, temporal, ecological, behavioural, structural barriers, polyploidy)
  - patterns such as divergence, convergence, adaptive radiation, co-evolution, punctuated equilibrium, and gradualism

- ❑ Scientific evidence for evolution, which may include examples from New Zealand's flora and fauna, will be selected from:
  - fossil evidence
  - comparative anatomy (homologous and analogous structures)
  - molecular biology (proteins and DNA analysis)
  - biogeography

Learning Outcomes:

At the end of this topic I can –

- ❑ Show how natural selection and genetic drift can lead to evolution. Including the importance of mutations.
  - best suited individuals have greater chance of reproductive success
  - survival of species is promoted
  - individuals with more suited / better adapted phenotypes will compete more favourably than others and are more likely to reproduce, passing on their favourable alleles
  - favourable alleles increase in frequency within the population

- ❑ Explain ways in which speciation (process of forming new biological species) occurs
  - sympatric (e.g. penguins could undergo speciation in the same place by occupying different niches/habitats)

- allopatric (e.g. penguins could undergo speciation in different geographical areas)
- instant speciation (polyploidy)

❑ Understand and describe how isolating mechanisms that contribute to speciation (pre zygotic, post zygotic and others)
- geographical boundaries (e.g. different islands, uplifting causing formation of mountain ranges)
- ecological (habitat) (e.g. different, genetic differences to cope with different ecological habitats i.e. temperature & humidity)
- temporal (e.g. different breeding time)
- behavioural (e.g. different mating rituals)
- structural barriers (e.g. incompatibility in anatomy)
- polyploidy (e.g. different numbers of chromosomes so even if gametes fuse / pollen fertilises other species the embryo cannot develop to maturity)
- post zygotic isolating mechanisms
  - hybrid sterility
  - hybrid inviability
  - hybrid breakdown

❑ Identify and explain the different patterns of evolution
- convergent evolution (where similar selection pressures result in similar adaptations in species from different ancestors)
- divergent evolution including adaptive radiation (individuals with slightly different adaptations fill a variety of available niches, leading to adaptive radiation)
- co-evolution (species evolving in response to each other, mutualistic relationship)

❑ Explain the two theories for the rate of evolution
- punctuated equilibrium. (long periods of stasis with sudden speciation/periods of evolution leading to genetic change)
- gradualism (slow genetic change over a long period of time)

Terms:

Demonstrate understanding involves using biological ideas and/or scientific evidence to describe evolutionary processes leading to speciation.

Demonstrate in-depth understanding involves using biological ideas and/or scientific evidence to explain how or why evolutionary processes lead to speciation.

Demonstrate comprehensive understanding involves linking biological ideas and/or scientific evidence about evolutionary processes leading to speciation. The linking of ideas may involve justifying, relating, evaluating, comparing and contrasting, or analysing the evolutionary processes that lead to speciation.