L3 SPECIATION
CHEAT SHEET

STUDY TIME

SPECIFIC AREAS TO STUDY

- A concept that commonly trips students up year after year is polyploidy. We'd recommend putting some extra time into studying this content, as it can be pretty hard to grasp. The key ideas to remember are:
    - Polyploidy comes from nondisjunction during meiosis, which is basically where the chromosomes don't split up evenly during cell division, so one gamete gets too many chromosomes -maybe even all of them.
    - Organisms with an odd number of chromosomes are not fertile, so for example a triploid (3n) organism can't have any offspring, so it's not going to become a new species. An infertile plant won't have any seeds! But if a polyploid plant has 4 sets of chromosomes (called tetraploid), or six, or eight... then it can be fertile and breed with other polyploid plants, so a new species is created!
    - This process results in instant speciation, because the polyploid plant immediately has a super different set of genes compared to the original species, so they probably can't make fertile offspring – a postzygotic barrier has been formed.
- The exam really commonly includes a question on either convergent or divergent evolution – or both . Both of these come back to the selection pressures that act on the species.
    - Convergent evolution happens when two unrelated species experience such similar selection pressures that they develop similar features totally independently. This is associated with *analogous structures,* which are those body structures that look really similar and have the same purpose but are on unrelated organisms – like the wings on bats and birds.
    - Divergent evolution happens when a species evolves into more than one new species because some form of reproductive barrier has been formed between groups and the groups are experiencing different selection pressures. When this process leads to lots of different species, it's called *adaptive radiation*. This pattern of evolution is associated with homologous structures, which are body structures that might look different but actually share a common ancestor – like the arm of a human and the fins of a whale!
- Because this paper generally focuses on New Zealand species, being familiar with the basics of New Zealand's geographical and ecological history is pretty helpful.
    - For example, there were no mammalian predators in New Zealand until (relatively) recently, so native birds didn't have to evolve to escape many predators.
    - Things like the formation of the Southern Alps also created new climates and environments.
    - These kinds of things make for really strong examples of the selection pressures acting on species in your answers – especially if you've done a bit of study on them beforehand and can confidently explain their effects!

WRITING ANSWERS

- Whenever you're talking about evolution, you want to link into the actual genetic processes behind this rather than just the large-scale changes you see.
    - When a species evolves, what's really happening is that the population is accumulating *changes in allele*

    frequency in the gene pool from one generation to the next.
    - Alleles that make organisms more likely to *survive and reproduce* will become more and more common in their populations each generation.
    - New mutations will also happen that will add new alleles to the gene pool.
    - If you can link these fundamental ideas to the context from the resource material, you'll be able to pull together a solid answer.
- The resource material will often throw you a bunch of different species along with some features of their structure and niche, and you should make sure you're specifically referring to these species by name in your explanations.
- Something that has come up in markers' comments in previous years is that students often put too much focus in their answers on plant and animal relationships, which isn't the main point of this exam! It's true that the two papers are super related, but even if you are talking about interactions between species you need to be bringing everything back to those key points of patterns of evolution, mutations and, most importantly, *selection pressures*.
- All of your answers should basically follow the structure of explaining what evolutionary pattern is seen in the context given, what selection pressure(s) caused that pattern and how, and then using that along with really specific examples from the resource material to answer the overall question.

REMEMBERING JARGON & DEFINITIONS

- One specific area to bear in mind: students often get the definition of 'genetic drift' wrong or mix it up with natural selection.
    - Genetic drift is changes in allele frequency by *chance*
    - Natural selection is changes in allele frequency for a *reason*
    - On a similar note, when the selection pressure at play is based on how members of the species select mates, make sure to use the specific words 'mate selection' or 'sexual selection' in your answer.
- More generally, a strategy that can help to remember all the similar-sounding jargon in this topic is to find out the actual roots of the words. For example, the 'homo' in homologous means 'same', so these are physical structures that came from the same ancestor. The 'allo' in 'allopatric' means 'different', so it means speciation happening in *different* locations.