Assessment Schedule – 2005

Biology: Describe patterns of evolution (90717)

Evidence Statement

Q	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	Describes the process of divergent evolution. Eg: • Divergent evolution occurs when one species develops into two or more species (in different habitats).		
1(b)	Describes **an appropriate change** that might have led to the speciation of northern rātā from southern rātā. Requires some sort of **appropriate separation** – geographical. Eg: • During the time this speciation occurred New Zealand was warming up after an **ice age**. • The north of New Zealand has been warmer than the south during this period. • **Sea levels were rising**, isolating areas of land from each other such that the North and South Islands formed. • North and South Island were originally one land mass – separation by Cook Strait.	**Explains** how change in New Zealand during this time may have led to geographic isolation and subsequently the development of reproductive isolating mechanisms. Must be an **Explanation.** Eg: • During this time New Zealand's climate was warming, which caused **sea levels to rise**. The islands formed would have had slightly **different climates** (warm north, cold south), which would mean **different selection pressures**. This led to the development of **reproductive isolation / new species.** Needs to be some explanation of selection pressures.	

Q	Achievement	Achievement with Merit	Achievement with Excellence
1(c)	**Describes ONE** of the processes: adaptive radiation, punctuated equilibrium or gradualism. Eg: • **Adaptive radiation** is the evolutionary diversification of related species, from a single ancestor, to occupy different niches. • **Gradualism** is thought to occur when species slowly and steadily diverge from one another over time. • **Punctuated equilibrium** is thought to occur when there are long periods of little change in species, and then short bursts when there is rapid change, often associated with speciation. Note, the description must have key characteristics.	**Explains how ONE** of the processes adaptive radiation, punctuated equilibrium or gradualism, **is linked** to the situation shown by *Metrosideros* in the Pacific. eg **Justify why it is Punctuated Equilibrium OR why it is not Gradualism**. Eg: • Adaptive radiation is the evolutionary diversification of related species, from a single ancestor, to occupy different niches. So when climate and geological changes occurred, the ancestral species Southern rätä radiated out to occupy the new niches formed. • Gradualism is thought to occur when species slowly and steadily diverge from one another over time due to **gradual changes** the ancestral population encounters. This does not seem to occur with *Metrosideros* because there are not regular and gradual changes in speciation. • Punctuated equilibrium is thought to occur when there **are long periods of little change in species and then short bursts when there is rapid change often associated with speciation**. This seems to occur with *Metrosideros* because there are three periods of rapid change and dispersal shown. Needs to relate to the resource material.	**Discusses** how *Metrosideros* shows adaptive radiation **with punctuated equilibrium, rather than gradualism**, probably due to climate changes. Discussion needs to include both, and needs to relate to the resource information provided. Eg: Adaptive radiation is the evolutionary diversification of related species, from a single ancestor, to occupy different niches. So when climate and geological changes occurred the ancestral species Southern rätä radiated out to occupy the new niches formed. Its adaptations are widely suited to the wind pattern changes that would accompany an ice age such as occurred 2 million years ago, or to the colonisation of new volcanic islands. Such events favour the idea of punctuated equilibrium rather than gradualism for *Metrosideros*, which it shows at times of rapid warming or cooling of the climate. Punctuated equilibrium is thought to occur when there are long periods of little change in species, and then short bursts when there is rapid change, often associated with speciation. This seems to occur with *Metrosideros* because there are three periods of rapid change and dispersal shown. It shows times of change when there is rapid warming or cooling of the climate. It does not show the idea of gradualism, which is thought to occur when species slowly and steadily diverge from one another over time due to gradual changes the ancestral population encounters. With *Metrosideros* there are not regular and gradual changes showing gradual speciation. Needs to be a discussion that relates evolution of new species to environmental, climatic changes.

Q	Achievement	Achievement with Merit	Achievement with Excellence
1(d)	Describes a feature of convergent evolution in relation to the pollinators of *Metrosideros.* Eg: • Convergent evolution occurs when very different species, develop similar features. Needs to imply they are **very different species that are not related** • The honey-eater birds and short-tailed bats have similar tongue adaptations to **get nectar from *Metrosideros* – must indicate same food source or similar.**	Explains how the similar adaptations of the tongues of the pollinators of *Metrosideros* are, an example of Convergent Evolution. Eg: Convergent evolution occurs when very different unrelated species develop similar features. This is seen here because the honey-eater birds and short-tailed bats have developed similar tongue adaptations **to get nectar from *Metrosideros*, which they both pollinate.** (Need to have definition of convergent evolution **AND** similar structure in bird and bat to get nectar).	
2	Describes a relevant feature of instantaneous speciation. Eg: • If a new individual forms that has an **extra set of chromosomes** (it cannot interbreed with its parents). • **Polyploidy** makes individuals with **multiple sets of chromosomes** (that can't interbreed with each other). Extra chromosomes is not enough.	Explains how instantaneous speciation can occur OR that polyploid speciation is sympatric speciation. Eg: • An individual gets an extra set of chromosomes due to a malfunction of meiosis. The new organism can self-fertilise **but can't breed with the parent stock**. Eventually a population of these organisms grow that cannot breed back with the parent stock and **so they are a new species.** **AND** • Instantaneous speciation by polyploidy **occurs in the same geographical area as the parent population so it is also sympatric speciation.** Need both these ideas.	Discusses how instantaneous speciation can occur, what reproductive isolating mechanisms develop and why it is considered sympatric speciation. Eg: An individual gets an extra set of chromosomes **owing to non-disjunction / failure of the chromosomes to separate during meiosis**. The new organism can self-fertilise but is **reproductively isolated from the parent stock**. The reproductive isolating mechanism that prevents the parent stock and the new species interbreeding is a post-zygotic isolating mechanism. The **hybrids are sterile** because they have odd numbers of chromosomes and **cannot form gametes by meiosis because it breaks down.** They may self-fertilise, and if they are plants without the sex determining chromosomes, a population of these organisms grow that cannot breed back with the parent stock. So they are a new species in a very short time. This is said to be instantaneous speciation and because it occurs in the **same geographical area as the parents it is sympatric speciation as well.** Need both these ideas.

Judgement Statement:

Achievement	Achievement with Merit	Achievement with Excellence
Total of THREE opportunities answered at Achievement level (or higher). 3 × A	Total of FOUR opportunities answered. TWO at Merit level *and* TWO at Achievement level (or higher). 2 × M + 2 × A	Total of FOUR opportunities answered. ONE at Excellence level *and* TWO at Merit level *and* ONE at Achievement level (or higher). 1 × E + 2 × M + 1 × A