Assessment Schedule – 2025

Biology: Demonstrate understanding of evolutionary processes leading to speciation (91605)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
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; linking of ideas may involve justifying, relating, evaluating, comparing, and contrasting, or analysing the evolutionary processes that lead to speciation.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0–7	8–13	14–18	19–24

Evidence

Question One

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
Speciation is the formation of a new species. A reproductive isolating mechanism (RIM) is a mechanism / process that prevents individuals in a population / different species from interbreeding and producing fertile offspring. RIMs relevant to this example include: • Habitat (ecological) isolation: a subset of the original population shifted to laying eggs on apple tree fruit (introduced by humans) / apple and hawthorn flies have different enzymes so flies (larvae) can consume only a specific fruit, reduces interbreeding. • Temporal isolation: flies that use apples emerge earlier than flies that use hawthorn fruit / reduces interbreeding / maggot groups have different development times, which may lead to different mating times, therefore reduces the opportunity to interbreed. • Behavioural isolation: flies prefer the fruit they were born on when choosing a mate and laying eggs; this reduces gene flow between apple and hawthorn populations. • Reduced hybrid viability / fitness: hybrids may inherit enzyme combinations that make them less fit to digest either fruit, lower survival rates (post-zygotic) • Reinforcement of isolation: natural selection would favour flies that mate only with others that feed on the same fruit, reinforcing prezygotic isolation through habitat isolation. • Isolating mechanisms: RIMs will reduce gene flow between populations. The mechanisms in this case are likely to be prezygotic as there do not seem to be physical differences. The difference in preferred food source would act to reduce gene flow between groups as they prefer mating and laying eggs on the food source they hatch on. Differences in the enzymes would suggest the existence of genetic differences between the groups. The difference in the rate of development would also mean the two groups are likely to be seeking mates at different times. Speciation occurs over a long period of time, and, in evolutionary terms, 200 years is relatively short. In this case, it is insufficient for full reproductive isolation to occur as apple maggot flies and hawthorn flies can still interbreed	Defines: • speciation • reproductive isolating mechanism • species: individuals that interbreed to produce fertile offspring • describes isolating mechanisms as **reducing gene flow** between the two groups • describes the isolating mechanisms as (most likely) prezygotic. Identifies / names: • one relevant general RIM that may have caused the formation of the two groups • a second relevant general RIM that may have caused the formation of the two groups.	Explains how: • one RIM may have caused the formation of the two groups *(must link in context)* • a second RIM may have caused the formation of the two groups *(must link in context)* • the arrival of the apples provided a new habitat for the flies, which reduced intraspecific competition in the population • enzyme differences infer different enzymes to digest the different fruits / that genetic differences have started to occur.	Provides detailed discussion of: • the RIMs leading to the formation of the different groups of flies • the process of speciation and why the two groups are not yet considered separate species.

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
and produce fertile offspring. While hybrid offspring may have reduced fitness, they are not sterile or inviable so can reproduce. Gene flow is still occurring between the two groups, therefore, are not yet considered separate species.			

N1	N2	A3	A4	M5	M6	E7	E8
ONE evidence point at Achievement.	TWO evidence points at Achievement.	THREE evidence points at Achievement.	FOUR evidence points at Achievement.	TWO evidence points at Merit.	THREE evidence points at Merit.	ONE evidence point at Excellence.	TWO evidence points at Excellence.

N0 = No response; no relevant evidence.

Question Two

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
Convergent evolution is when species / organisms that are not closely related independently develop / evolve similar appearances / physical features / phenotypes in response to living in an environment which has similar selection pressures. Convergent evolution **causes** analogous structures in organisms. An analogous structure is a similar morphology / feature / body part that has a similar function in unrelated species / organisms. Examples of analogous structures in lampreys and eels: long flexible body, no pelvic fins, covered in mucus. Divergent evolution is when two (or more) species share a common ancestor but evolve different traits over time due to different selection pressures. Selection pressure is any environmental (biotic / abiotic) factor that affects an organism's ability to survive and reproduce. Selection pressures affecting lampreys and eels are similar as they live in similar environments and have similar 'problems' to solve for survival: • Long flexible body is influenced by the selection pressures such as: efficient swimming, both use undulations for thrust / movement in water, this is ideal for energy efficiency and manoeuvrability / keeping a low profile from predators. It allows lampreys to keep a better hold on their hosts when feeding parasitically, minimising drag in the water as their host swims around. It also allows them to better dig into decaying flesh when scavenging, a feeding strategy employed by both eels and lampreys, while eels don't employ parasitism and are often active predators rather than scavengers. • Lack of paired fins could be influenced by the selection pressure of burrowing and wriggling in small spaces, reduction in fins minimises resistance when moving through tight spaces / any reasonable link. • Mucus is influenced by the selection pressure of avoiding predators, making them more difficult to grasp / any reasonable link. • Low oxygen environments: survive in low oxygen (hypoxic) environments such as stagnant water and deep sediment, allowing them to access a niche other organism (who require high oxygen levels) / any reason ideas why they can survive in low-oxygen environments.	Defines: • convergent evolution • analogous structure • divergent evolution. Describes: • selection pressures • one selection pressure that influenced the similarities *(named structure AND function)* • a second selection pressure that influenced the similarities *(named structure AND function)* • one example of scientific evidence used to determine the example is convergent evolution • a second example of scientific evidence used to determine the example is convergent evolution.	Explains: • how convergent evolution and analogous structures are linked • the difference between convergent and divergent evolution *(some comparison required)* • one selection pressure, linking it to a similar trait in lampreys AND eels • a second selection pressure, linking it to a similar trait in lampreys AND eels • one example of scientific evidence and how it is used to determine the example is convergent evolution • a second example of scientific evidence and how it is used to determine the example is convergent evolution.	Provides a detailed discussion of: • convergent evolution in species that are **not** closely related and how selection pressures are linked to analogous structures • TWO examples of scientific evidence and how the methods can be used to determine that the physical similarities are convergent evolution, as **opposed** to divergent.

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
Scientific methods that can be used to determine convergent or divergent evolution include: • Comparative anatomy: Biologists compare structures (analogous and homologous) to determine if similarities resulted from a shared ancestor or evolved independently. If species have similar physical features (homologous structure) that can be linked to a common ancestor, it will indicate divergent evolution. If species have analogous structures (similar features that cannot be linked back to a recent common ancestor), it would indicate convergent evolution. • Molecular biology: Biologists could compare proteins / DNA/mtDNA. If species have a higher DNA sequence / protein match, they are likely to have divergence from a common ancestor. If species look alike but have different DNA sequences / proteins, their similarities most likely came about by similar selection pressures / convergent evolution. • Fossil record: Biologists use the fossil record to analyse evolution changes. Fossils showing changes in structural adaptations over time from a common ancestor could indicate divergent evolution, whereas fossils that show the same trait in multiple, distantly related species indicate convergent evolution. • Biogeography: Biologists can analyse where species live and can determine if traits came about by a common ancestor or came about independently. Species that have a recent common ancestor but live in different environments and evolve different adaptations would indicate divergent evolution. Species with similar traits found in different locations but with similar environments would indicate convergent evolution.			

N1	N2	A3	A4	M5	M6	E7	E8
ONE evidence point at Achievement.	TWO evidence points at Achievement.	THREE evidence points at Achievement.	FOUR evidence points at Achievement.	TWO evidence points at Merit.	THREE evidence points at Merit.	ONE evidence point at Excellence.	TWO evidence points at Excellence.

N0 = No response; no relevant evidence.

Question Three

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
Hybridisation is when two different species (or genetically different populations) interbreed. Polyploidy is when a normally diploid cell (2n) / organism gets a second **set** of chromosomes. This occurs when there are errors in meiosis / gamete formation. Chromosomes fail to separate (non-disjunction) during meiosis, producing diploid (2n) gametes instead of haploid (n) gametes. Allopatric speciation refers to a speciation event due to a geographic barrier (e.g. a river or mountain range). A population is separated by a geographic barrier and gene flow is prevented; over time, processes such as mutation / genetic drift / natural selection cause the two populations to become separate species. This is not an example of allopatric species because the frog species developed in the same geographic area. Sympatric speciation is when speciation occurs in the same geographical area. It is caused by isolating mechanisms such as temporal / behavioural / ecological / structural phenotype barriers / polyploidy. This is an example of sympatric speciation because the frogs lived in the same geographic region and gene flow could have occurred. Hybridisation in the gray treefrog: Cope's gray treefrog and other extinct species produced polyploid (diploid) gametes. These different species, with polyploidy (2n) gametes, interbred to produce hybrids that were tetraploid (4n). Therefore, the offspring / hybrids were an instant species as they could not reproduce with either parent species due to differences in the chromosome number. Gene flow could not occur / gametes were incompatible due to postzygotic mechanisms. The gray treefrog can reproduce only with other polyploidy individuals to form a new species (instantly). Punctuated equilibrium involves rapid evolutionary change in short periods of time (followed by periods of stability). The gray treefrog is an example of punctuated equilibrium because a species has developed in a short period of time / instant species in a small number of generations / one generation. In contrast, gradualism is slow, continuous change, with small changes accumulating over millions of years; therefore, this example cannot be gradualism because the hybrids could not mate with either parent species (2n) as the hybrid had double the number of chromosomes (4n).	Defines: • hybridisation • polyploidy. *(Accept a well annotated diagram.)* Describes: • sympatric speciation • allopatric speciation • punctuated equilibrium • gradualism.	Explains: • how polyploidy produces hybrid frogs • sympatric speciation • allopatric speciation • punctuated equilibrium gradualism.	Provides detailed discussion of: • how polyploidy can produce hybrid frogs, and why the process of speciation in treefrogs is an example of sympatric speciation and **not** allopatric species • why this is an example of punctuated equilibrium and **not** gradualism.

N1	N2	A3	A4	M5	M6	E7	E8
ONE evidence point at Achievement.	TWO evidence points at Achievement.	THREE evidence points at Achievement.	FOUR evidence points at Achievement.	TWO evidence points at Merit.	THREE evidence points at Merit.	ONE evidence point at Excellence.	TWO evidence points at Excellence.

N0 = No response; no relevant evidence.