NAME Answer Key DATE _____

Speciation Organizer

Instructions

1. Fill in the populations and the name of the evidence document you'll be analyzing.
2. Analyze your evidence document, then use it to fill in the questions below. *Your document may not address all of the questions.*
3. Add evidence from the other groups (or evidence documents) to each question, as applicable.
4. Consider all of the evidence under each question. Circle the number on each scale that best fits.
5. Consider the answers to questions 1-4. Circle where you think these populations fit on the speciation continuum. Summarize the evidence that supports your choice.

Populations being evaluated Apple and Hawthorn flies

Evidence document(s) Fruit preference, Life cycle timing, and Alleles

Questions

When evaluating whether populations are the same or different species, scientists often ask the questions listed below.

1. **Are there barriers to reproduction?** Is there evidence that something (geography, differences in habitat, inherited physical or behavioral traits) is preventing individuals from the two populations from interbreeding?

   Example: Stickleback populations in the ocean and in Loberg Lake are physically separated from one another, so they cannot interbreed.

   Barrier Evidence

   (Fruit group) Fruit preference / location: As adults, most flies go back to the fruit they grew up in. This makes flies more likely to mate with others from their own group.

   (Life cycle group) Timing: Apple fruit are ripe earlier than Hawthorn fruit. Apple fly adults emerge, mate, and lay eggs earlier than hawthorn flies, closer to when apple fruit are ripe. There still might be overlap, but differences in timing make apple flies more likely to go to apples and hawthorn flies to go to hawthorn fruit.

Consider the evidence together. Do you think there are barriers to reproduction?

	No barrier		Some barrier		Complete barrier
N/A	1	2	3	4	5

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2. Are different heritable traits being selected for? Is there evidence that natural selection has caused different heritable traits to become more or less common in the different populations?

Example: Eurasian blackcap birds that overwinter in Britain have trait differences from the birds that overwinter in Spain. Because they fly less, eat different food, and live in colder weather, the British population's average wing shape, beak thickness, and body size have changed over time.

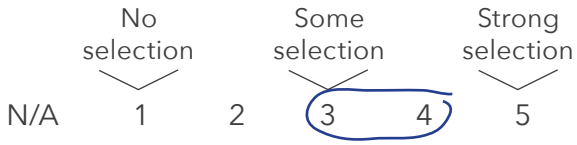
Evidence:

(Fruit odor document) Natural selection has caused fruit odor preference in the apple fly group to change over time so that they prefer the odor of apples, not hawthorn fruit.

(Life cycle document) Natural selection has caused early emergence time to become more common in the apple fly population. This gave apple flies access to a new food source: apples, which get ripe earlier than hawthorn fruit.

(Allele mixing) Earlier emergence time is an inherited trait (associated with gene 2, allele 2), and natural selection has caused it to become more common in the apple fly population.

Consider the evidence together. Do you think different heritable traits are being selected for?



3. Can the populations make hybrid offspring? Is there evidence that individuals from the populations interbreed to make hybrid offspring? If so, are the offspring plentiful, healthy, and able to reproduce?

Example: Lions and tigers don't normally mate in nature, but in captivity they sometimes produce hybrid offspring. These offspring are rare, short-lived, and unable to reproduce.

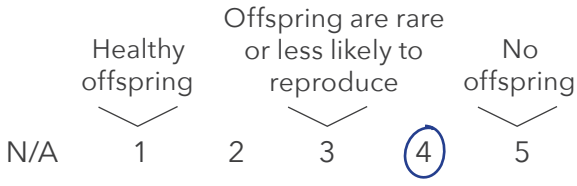
Evidence:

(Fruit odor document) Apple and hawthorn flies can breed together to make hybrid offspring. However, hybrid flies aren't attracted to either apple or hawthorn fruit odors. Since fruit are where flies meet, mate, and lay eggs, and hybrid flies don't go to fruit, they are less likely to reproduce.

(Life cycle document) N/A

(Allele mixing) N/A

Consider the evidence together. Do you think the populations make healthy hybrid offspring?



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4. Are alleles mixing between the populations? Is there evidence from DNA that alleles (variations of the same genes) are not freely mixing between the populations? Are some alleles more or less common in one population than another?

Example: DNA analysis has shown that Australian blacktip sharks have variations in their DNA that are very rare in common blacktips, and vice versa.

Evidence:

(Fruit odor document) N/A

(Life cycle document) N/A

(Allele mixing) Allele frequencies for some genes are different between apple and hawthorn fly populations. This suggests that the populations are not freely interbreeding and alleles are not mixing.

Consider the evidence together. Do you think alleles are mixing between the populations?

		Freely mixing		Some mixing		No mixing
N/A	1	2	(3)	4	5	

Is it Speciation?

Consider all of the available evidence. Where do you think these populations best fit on the speciation continuum?

	Same species		Somewhere between		Different species
1	2	(3	4)	5	

Summarize the evidence that supports your choice:

Student answers may vary, but they should be able to list evidence that backs up their choice.

Basically, the populations appear to be on their way to becoming different species. But they don't seem quite different enough to be different species yet.