

4. Existing isolated brook trout populations in Newfoundland, Canada, were once part of a larger population that was fragmented at the end of the most recent glaciation period about 10,000 to 12,000 years ago. Researchers investigated 14 naturally separated stream populations of brook trout. They found that the populations are all genetically distinct and show differences in morphology.
- (a) **Describe** the prezygotic barrier that results in these genetically distinct populations.
- (b) Brook trout with longer fins are able to swim faster than brook trout with shorter fins. In one of the Newfoundland streams, the main prey of the brook trout evolved to move faster. For brook trout living in this stream, **explain** the difference in fitness between longer-finned individuals and shorter-finned individuals.
- (c) If two morphologically and behaviorally distinct populations of brook trout remain isolated for many generations, **predict** the likely impact on both populations.
- (d) Researchers claim that there are more genetic differences between any two current brook trout populations than there are between any single current population and the ancestral brook trout population from which all the trout are descended. Provide reasoning to **justify** their claim.

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**Write your responses to this question only on the designated pages in the separate Free Response booklet.**

**Question 4: Conceptual Analysis****4 points**

Existing isolated brook trout populations in Newfoundland, Canada, were once part of a larger population that was fragmented at the end of the most recent glaciation period about 10,000 to 12,000 years ago. Researchers investigated 14 naturally separated stream populations of brook trout. They found that the populations are all genetically distinct and show differences in morphology.

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| <b>(a)</b> <b>Describe</b> the prezygotic barrier that results in these genetically distinct populations.  | <b>1 point</b> |
| <ul style="list-style-type: none"><li>• Geographic isolation prevents gene flow between the populations.</li></ul>   |                |
| <b>(b)</b> Brook trout with longer fins are able to swim faster than brook trout with shorter fins. In one of the Newfoundland streams, the main prey of the brook trout evolved to move faster. For brook trout living in this stream, <b>explain</b> why there is a difference in fitness between longer-finned individuals and shorter-finned individuals.  | <b>1 point</b> |
| <ul style="list-style-type: none"><li>• Individuals with longer fins are more likely to capture prey and reproduce.</li></ul>  |                |
| <b>(c)</b> If two morphologically and behaviorally distinct populations of brook trout remain isolated for many generations, <b>predict</b> the likely impact on both populations.<br>Accept one of the following: <ul style="list-style-type: none"><li>• The two populations will become separate species.</li><li>• The two populations will continue diverging (behaviorally/morphologically/genetically).</li></ul>   | <b>1 point</b> |
| <b>(d)</b> Researchers claim that there are more genetic differences between any two current brook trout populations than there are between any single current population and the ancestral brook trout population from which all the trout are descended. Provide reasoning to <b>justify</b> their claim.<br>Accept one of the following: <ul style="list-style-type: none"><li>• Each single population has <u>accumulated mutations/experienced genetic drift</u> (distinguishing it from the ancestral population). The mutations each population accumulated are likely to differ (as a result of different selective pressures).</li><li>• Allele production (as a result of random mutation) and <u>genetic drift/selection by local environmental conditions</u> has resulted in a collection of alleles unique to each population.</li></ul> | <b>1 point</b> |

**Total for question 4 4 points**