

Concept Answer Key

This table shows the scientifically correct answers in parentheses under the column ‘Scientific Concept.’ If a student’s answer is not correct, their choice provides valuable information. By locating their incorrect answer choice under the ‘Alternative Conception’ column, you will find that their choice indicates a way they may be thinking about the concept. This table is from Anderson, Fisher, and Norman’s “Development and Evaluation of the Conceptual Inventory of Natural Selection,” printed in the December 2002 *Journal of Research in Science Teaching*.

964

ANDERSON, FISHER, AND NORMAN

Table 4

Scientific concepts and alternative conceptions addressed in CINS Version 3

Topic	Scientific Concept	Alternative Conception
Biotic potential	All species have such great potential fertility that their population size would increase exponentially if all individuals that are born would again reproduce successfully (1C, 11B)	a) Not all organisms can achieve exponential population growth (11C) b) Organisms only replace themselves (1A, 11A) c) Populations level off (1B, 11D, 1D)
Population stability	Most populations are normally stable in size except for seasonal fluctuations (3B, 12A)	a) All populations grow in size over time (3A, 12B) b) Populations decrease (3D, 12C) c) Populations always fluctuate widely/ randomly (3C, 12D)
Natural resources	Natural resources are limited; nutrients, water, oxygen, etc. necessary for living organisms are limited in supply at any given time (2A, 14D)	Organisms can always obtain what they need to survive (2B, 2C, 2D, 14A, 14B, 14C)
Limited survival	Production of more individuals than the environment can support leads to a struggle for existence among individuals of a population, with only a fraction surviving each generation (5D, 15D)	a) There is often physical fighting among one species (or among different species) and the strongest ones win (5B, 15B) b) Organisms work together (cooperate) and don't compete (5A, 5C, 15A)
Variation within a population	Individuals of a population vary extensively in their characteristics (9D, 16C)	a) All members of a population are nearly identical (9A, 16A) b) Variations only affect outward appearance, don't influence survival (9B, 9C, 16B) c) Organisms in a population share no characteristics with others (16D)
Variation inheritable	Much variation is heritable (7C, 17D)	a) When a trait (organ) is no longer beneficial for survival, the offspring will not inherit the trait (7B, 17B) b) Traits acquired during an organism's lifetime will be inherited by offspring (7A, 17A) c) Traits that are positively influenced by the environment will be inherited by offspring (7D)
Differential survival	Survival in the struggle for existence is not random, but depends in part on the hereditary constitution of the surviving individuals. Those individuals whose surviving characteristics fit them best to their environment are likely to leave more offspring than less fit individuals (10C, 18B)	a) Fitness is equated with strength, speed, intelligence or longevity (10A, 10B, 18A, 18C, 18D) b) Organisms with many mates are biologically fit (10D)

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Topic	Scientific Concept	Alternative Conception
Change in a population	The unequal ability of individuals to survive and reproduce will lead to gradual change in a population, with the proportion of individuals with favorable characteristics accumulating over the generations (4B, 13B)	<ul style="list-style-type: none"> a) Changes in a population occur through a gradual change in all members of a population (4A, 13A, 17C) b) Learned behaviors are inherited (4C, 13C) c) Mutations occur to meet the needs of the population (4D, 13D)
Origin of species	An isolated population may change so much over time that it becomes a new species (8A, 20B)	<ul style="list-style-type: none"> a) Organisms can intentionally become new species over time (an organism tries, wants, or needs to become a new species) (8C, 8D, 20A, 20D) b) Speciation is a hypothetical idea (8B, 20C)
Origin of variation	Random mutations and sexual reproduction produce variations; while many are harmful or of no consequence, a few are beneficial in some environments (6B, 19C)	<ul style="list-style-type: none"> a) Mutations are adaptive responses to specific environmental agents (6C, 15C, 19D) b) Mutations are intentional: an organism tries, needs, or wants to change genetically (6A, 6D, 19A, 19B)