

The Evolution of Creationism Problem Study Guide

1. What do we mean by **evolution**? What is the driving force behind evolution (i.e. what causes organisms to evolve?) What observations and inferences did **Darwin** make that lead him to this theory? What ideas by other people influenced Darwin theories concerning evolution?
 2. Be familiar with some of the claims of advocates for teaching **Intelligent Design (ID)** as an alternative to evolutionary theory in science classes (**irreducible complexity**, evolution goes against the **laws of thermodynamics**, something as complex as the human brain cannot come about by chance, evolution is only a theory, it has not been proved etc...).
 3. How do scientists who study evolution counter or refute the arguments for ID? What evidence/concepts/knowledge supports their arguments against ID? In other words, what is the evidence that natural selection drives evolution, and that natural selection acting over immense spans of time have led to the diversity and complexity of life on earth (i.e. fossil evidence, comparative anatomy (**homologous structural similarities**), age of the earth, **convergent evolution** and the development of **analogous similarities**, DNA/protein comparisons, **vestigial structures**, **extinction**, **biogeographic evidence**). Be familiar with some examples of each.
 4. What does it mean when we say that "it is **populations** of organisms that evolve, not individuals, however; **natural selection** acts directly upon individuals.
 5. What is **sexual selection**? How is it different from natural selection? What do we mean when we say that an individual's physical makeup (phenotype) is often a compromise between natural selection and sexual selection?
 6. What is a **mutation**? Why are mutations rare? Random? Sometime beneficial or adaptive? Sometimes detrimental to an organism's **fitness**? What is the source of new alleles in a population? What is the source of the majority of the variation from one generation to the next in most organisms (i.e. why are you not exactly like your siblings despite having the same parents)?
 7. Does natural selection fashion perfect organisms or structures? Explain?
 8. Are humans still evolving? If not, why not? If so, provide some examples.
 9. What is **genetic drift**? What role does it play in the evolution of species? What is an evolutionary bottleneck and what role does genetic drift and population size play in the development of bottlenecks? Why do species that undergo bottlenecks have an increased chance of extinction?
 10. What is the **biological concept of a species**?
 11. What kinds of **reproductive isolating mechanisms** (barriers) develop to prevent member of different species from interbreeding?
 12. Discuss how new species arise (**allopatric**, **sympatric**, **parapatric**). What is **adaptive radiation**, why does it occur? Why are isolated island archipelagos, like the Galapagos,
 13. What do we mean by a mass **extinction**? How often have they occurred in the history of life on earth? What are some of the hypothesis presented that explain these periods of **mass extinction**?
 14. What is a **phylogenetic tree** or **cladogram**? What kinds of evidence do evolutionary biologists use to construct a phylogenetic tree? Would you use analogous or homologous similarities to construct a tree? Explain. Could you use molecular similarities (ie similarities in the amino acid sequence of a protein or similarities in DNA sequence) to construct a tree? Explain.
 15. Complete the following sentence. With the widespread acceptance of evolution by natural selection, organisms were classified (or placed in taxonomic groups) so as to reflect
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16. What are some of the debates that scientists are still having about evolutionary theory?

Nature of Science

1. What is a scientific **theory**? If theories cannot be proved, how can we have confidence in their validity? Does ID meet the tenets of a scientific theory?
2. What is a **law** in science? How is it different from a theory? Do theories ever become laws?
3. What are the characteristics of a good **scientific hypothesis**? What is the difference between **deductive** and **inductive reasoning**? How do scientists use each of these modes of thinking in science? Is intelligent design an induction or a deduction?
4. In order for a hypothesis to be scientific it must be falsifiable. What does this mean?
5. How is a **fact** different from a theory in science? Give some examples?
6. Can theories change or be modified and still be widely accepted by the scientific community? How has Darwin's theory of evolution by natural selection "evolved" since it was first articulated in the mid 1800s in "The Origin of Species". Are theories ever rejected? If so how? Examples of rejected theories?
7. How do scientists and the scientific community insure that conclusions are not overly influenced by personal or professional biases?