

- **PHYSICALLY PRINT OUT** this PDF and **HANDWRITE** (with a black or blue pen) your answers directly on this PDF. Typed or digitally-written work is **not** be accepted. Do **not** answer questions on separate paper.
 - **Importantly, study guides are NOT GROUP PROJECTS!!!** You, and you alone, are to answer the questions as you **read** your assigned textbook. You are **not** to share answers with other students. You are **not** to copy any answers from any other source, including the internet.
 - **Get in the habit of writing LEGIBLY, neatly, and in a medium-sized font.** AP essay readers and I will skip grading anything that cannot be easily read so start perfect your handwriting, and don't write so large you can't add all the relevant details and key elaborations in the space provided.
 - **SCAN physical documents in color and with good resolution. Then, upload your final work as PDFs to Archie.** Avoid uploading dark, shaded, washed out, side ways, or upside down scans of homework. Keep completed physical study guides organized in your biology binder to use as future study and review tools.
 - **READ FOR UNDERSTANDING and not merely to complete an assignment.** *First*, read a section quickly to get an overview of the topic covered. Then, read it a **second** time slowly, paraphrasing each paragraph **out loud** and analyzing every figure. Finally, read it a **third** time as you answer the study guide questions if assigned and to start building your memory. Try to write answers out in your own words when possible and to purposefully and accurately use all new terminology introduced.
1. Evolution (descent with modification) explain both the **unity** (that different species of organisms share certain traits) **AND** the **diversity** (the idea that inherited changes occurred after two species diverged from their common ancestor) seen between species. Define the term **evolution**.

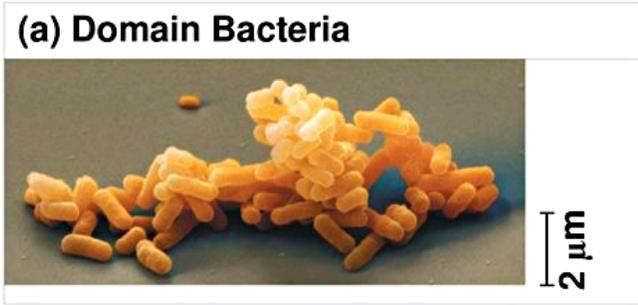
 2. How do we **name species scientifically**?

 3. a. Biologists, at the broadest level, **divide all of Earth's life forms into three Domains**. Which domain(s) is/are made up of prokaryotic organisms and which is/are made up of eukaryotic organisms?

Domain(s) of life containing Prokaryotes = _____

Domain(s) of life containing Eukaryotes = _____
 - b. The Domain Eukarya is subdivided into four subgroups, three of which are referred to as Kingdoms. List the **four subgroups of the Domain Eukarya**.
 1. _____
 2. _____
 3. _____
 4. _____
 4. The Domain Eukarya used to be divided into four kingdoms: Plantae, Animalia, Fungi, Protista. This has been changing, however. Today **among the four subgroups of the Domain Eukarya, three are called Kingdoms (Plantae, Animalia, & Fungi)**, though **the subgroup with the Protists is no longer technically called a Kingdom**. Today, scientists are debating how to classify protists better, the old Kingdom Protista being divided into various groups instead. Why are researchers changing how they classify protists?

5. Within the **Eukaryotic Domain**, organisms are **divided up into the four subgroups of kingdoms based partially on their modes of nutrition**. Fill in the figure below, highlighting the **major characteristics of each Domain and each Eukaryotic kingdom**.



Bacteria are the most _____ and _____ prokaryotes on Earth.

Certain Archaea live in Earth's most _____ environments, like very salty lakes or boiling hot springs



[Empty box for Kingdom Plantae characteristics]

[Empty box for Kingdom Fungi characteristics]

[Empty box for Kingdom Animalia characteristics]

[Empty box for Protists characteristics]

6. What is the name of **Charles Darwin's influential book on evolution** published in November of 1859?

7. In his book, Darwin referred to evolution as "**Descent with Modification.**" What were the **two main points Darwin articulated in this seminal piece of work?**
 - 1.

 - 2.

8. a. Darwin developed his theory of natural selection from three key observations. What are the specific details of these **three key observation?**
 - 1.

 - 2.

 - 3.

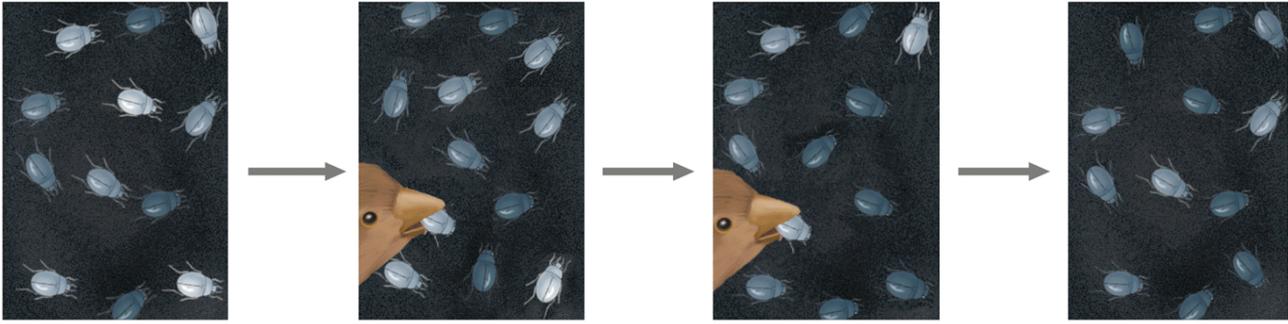
- b. From his three observations, Darwin made three main **inferences.** What were they?
 - 1.

 - 2.

 - 3.

9. Why did Darwin call the **mechanism that causes the evolution of adaptations** (*characteristics that help an organism survive and reproduce*) **natural selection?**

10. a. Using the imaginary beetle population example presented in Figure 1.18, explain, step-by-step, how natural selection causes this beetle population, the beetle being preyed upon by a population of birds that hunts visually, to gradually evolve to be a darker shade of gray, on average, than it was before the brush fire darkened the soil in the beetle's environment.



1.	2.	3.	4.
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- b. Take note of the following important aspect about **how evolution by natural selection occurs** and also **how to properly explain the process** with the biological terminology you need to learn to use accurately yourself:

Evolution happens at the level of the population (not the individual)!!! It is the population of beetles that changes in its average coloration over MULTIPLE GENERATIONS, not an individual beetle that changes coloration in its life time. After all, an individual beetle is born with the versions of genes - alleles of genes - that it inherited from its parents and this beetle cannot change its DNA because a different coloration would be more useful in the current environment.

The HERITABLE VARIATION in a characteristic (the genetic variation that causes variation in a characteristic like beetle color) **has to already be present in the population for evolution by means of natural selection to occur AS A CONSEQUENCE of these variations causing individuals to experience DIFFERENTIAL reproductive success within the environment.** If no darker beetles existed in the population because the variation in the DNA influencing coloration was absent, the beetles could not decide to suddenly become darker. If all beetles were equally light and no genetic variation in coloration existed, and a new visual predator entered their environment, these beetles may just get eaten to the point where none are left to reproduce. The beetle population would disappear from that habitat, therefore, or, if these beetles were the last of its kind of Earth, that beetle species would go extinct. Thankfully, **genetic mutations**, though a **random process**, do occur over time and, sometimes, a new, useful version of a genes even arises that alters an organism's characteristic in such a way that it now survives better, and, thus, has a better chance at reaching reproductive age and passing this genetic variation on to its offspring.

Because the coloration of each beetle will influence the probability that it survives or not and, thus, gets to reproduce or not, we say **each individual beetle is acted on by Natural Selection**. Each beetle will have more or less success in reproducing compared to other beetles in the population in the environment it is living in. So, **while evolution happens at the population level, natural selection happens at the individual organismal level.**

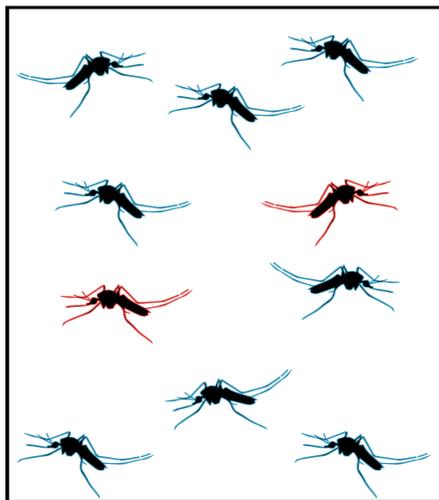
Over time, certain colored beetles are more successful in surviving and they go on to reproduce more often than those that don't survive as often. **In the beetle case we say that the darker coloration is being SELECTED FOR by natural selection while the lighter coloration is being SELECTED AGAINST by natural selection. Over many generations, as a consequence of this differential survival and reproductive success, the beetle population will exhibit, on average, darker beetle coloration. This feature, darker coloration, is beneficial as it helps the organisms in the population survive and reproduce.**

What did Darwin call **a variation of a characteristic that helps an organism in a particular environment SURVIVE & REPRODUCE** ?

An A _____

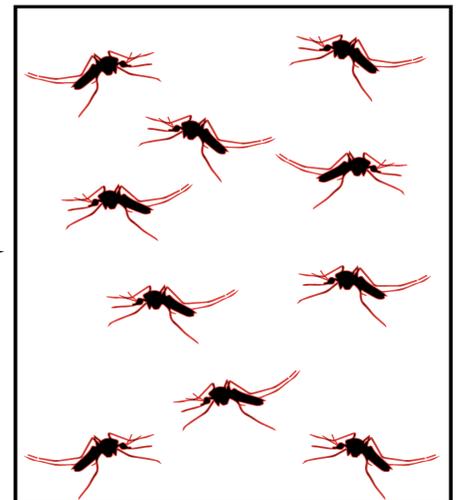
11. Evolution by natural selection is observed throughout nature. DDT is a toxic chemical that has been used in the past to control mosquito populations. In the 1950s, there was a worldwide effort to eradicate malaria by eliminating the organisms that transmit the disease to humans, a certain type of mosquito. Though mosquitos used to die when exposed to DDT, many of these mosquitos today are now resistant and no longer die in its presence. Over time, the DDT became less and less effective. Now that you understand how natural selection works to influence the characteristics of future generations, explain in the box below exactly what has happened in the mosquito population from start to finish that led to the evolution of a population of mosquitos that are now resistant to DDT. In your answer, **be sure to explain fully the following three items:**

1. The characteristics that **had to be present** in the original mosquito population prior to extensive DDT exposure.
2. The **initial effects** of spraying the mosquitos with DDT and **why** this change in the mosquitos' environment influenced the differential survivability and reproductive success of these mosquitos.
3. The **long term, multigenerational consequence to the genetic make up of this mosquito population** which make DDT an ineffective chemical to kill mosquitos with in these areas today.



Original Population

Several
Generations
of Time Later



**Current Population, which
exhibits DDT Resistance**

12. How did Darwin think that **natural selection (in varying environments) could cause an ancestral species (the common ancestor) to give rise to two or more different descendant species.**

13. a. Study figure 1.20, which depicts an **evolutionary tree**. What is represented by each **twig** or **branch** of this tree?

b. Draw an arrow pointing to three different branch points in this tree. What do these **branch points represent**?

c. The finches Darwin observed in the Galapagos are descendants of one ancestral finch species that lived on the mainland of South America. Some of the birds in this ancestral bird population are thought to have migrated west, coming to inhabit the various islands of the Galapagos. Provide a possible explanation for **how, over many generations, the Large Ground Finch evolved to have, on average, a beak that is so much later than the ancestral finch.** *To provide a complete answer, revisit the review in 10.b and write out your answer using the step-by-step logic and proper terminology presented.*

