**Guided Notes: Darwin and Natural Selection**

1. Charles Darwin was an English scientist who developed the Theory of Evolution by \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. Numerous ideas helped to shape Darwin’s theory:

1. Thomas Malthus – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ who predicted the human population would grow faster than the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ required to sustain it (Influenced competition for limited resources)
2. James Hutton – proposed Earth was much \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than scientists currently believed (gave time for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to occur)
3. Charles Lyell – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ who stressed that processes occurring now have shaped Earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ features over long periods of time (made Darwin ask, if the Earth could change over time, could \_\_\_\_\_\_\_\_\_\_ change as well?)
4. Jean-Baptiste Lamarck – first to propose a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to explain how organisms change over time (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of acquired traits/behavior).

3. At 22, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sailed around the world on a ship called the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*. He studied for a long time on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** off the coast of S. America.

4. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* = change in a species over time

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = process by which individuals that are better suited to their environment **survive** and **reproduce** at a higher rate.

5. How Natural Selection Works:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tend to over produce offspring, and have the potential to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in numbers \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Populations are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variable due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and genetic recombination (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
3. There is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ supply of resources \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for life.
4. Changing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ select for specific genetic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variations out-compete, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and reproduce to pass on their alleles.
6. The accumulation and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in favored alleles leads to changes in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ over time.

6. Evidence for Evolution:

* Biogeography: Geographical distribution of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Fossil Record: Fossils and the order in which they appear in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of sedimentary rock (strongest evidence).
* Taxonomy: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of life forms.
* Homologous structures: Structures that are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because of common ancestry (comparative anatomy)
* Comparative embryology: Study of structures that appear during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ development.
* Molecular biology: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and proteins (amino acids)
1. What is the best evidence of evolution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Anatomy – *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* may have a common evolutionary origin EX: forelimb in humans, cat, whale, and bat. Some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ structures appear to have no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These structures are so reduced in size that they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or traces, of homologous organs. Why do we still have \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of these organs if they serve no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_? If the organ doesn’t affect an organism’s ability to survive and reproduce, natural selection will not cause the organ to be eliminated.
3. Similarities in the early \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of vertebrate embryos during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The same groups of embryonic cells \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same order and in similar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce the tissues and organs of all vertebrates.
4. Biochemistry - Comparing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between different species. Similar organic molecules are seen across all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. EX: 20% of human DNA identical to mouse DNA 98% of human DNA identical to chimp DNA
5. An *adaptation* is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ that allows better \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a given \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
6. Examples of natural selection include \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with specialized \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for food. EX: Woodpeckers are adapted for eating insects and waterbirds are adapted for eating fish.

7. Natural selection has three modes of action:

1. Stabilizing selection - Acts upon \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and favors the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Directional selection - Favors variants of one \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. Diversifying selection - Favors variants of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

8. Speciation is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of new species.

9. Allopatric speciation occurs when the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ population becomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by a geographical\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.** Example:Grand Canyon and ground squirrels

10. Adaptive radiation the emergence of numerous \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from a common ancestor introduced to new and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ environments. Example: Darwin’s Finches

11. Sympatric speciation - When a new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is formed from an existing species while living in the same geographic region (more rare than allopatric speciation).

12. Convergent evolution - Species from different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ branches may come to resemble one another if they live in very similar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

13. Coevolution - Evolutionary change, in which one species act as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force on a second species, inducing adaptations that in turn act as selective force on the first species.