**Guided Notes: History of Life on Earth**

1. Earth is \_\_\_\_\_ billion years old. Early Earth was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, very hot, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Ancient Earth’s environment contained lots of \_\_\_\_\_\_\_\_\_\_ vapor, \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. By 3.9 billion years ago, Earth might have cooled enough for \_\_\_\_\_\_\_\_\_\_\_ in the atmosphere to condense. Millions of years of rainstorms filled the oceans. It is in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_, 3.9-3.5 billion years ago, that scientists propose the first \_\_\_\_\_\_\_\_\_\_\_\_ organisms appeared.

3. \_\_\_\_\_\_\_\_\_\_\_ evidence gives us an idea of what these early organisms looked like. A \_\_\_\_\_\_\_\_\_\_\_ is evidence of an organism that lived long ago. Fossils are formed when organism are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in small particles of soil soon after dying. The soil particles are compressed over time to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rock.

4. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_fossil is a marking left by an animal (footprint, trail, burrow, etc.). A \_\_\_\_\_\_\_\_\_\_\_ is formed when minerals in rocks fill a space left by a decayed organism to make a replica of the organism. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fossil is formed when minerals penetrate and replace the hard parts of an organism (makes copy). An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fossil occurs when a thin object (leaf) falls into sediment and leaves imprint when sediment hardens. In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ preserved fossils, the organism quickly trapped in tree sap (also frozen in ice). A \_\_\_\_\_\_\_ fossil forms when an organism is buried in sediment and decays, leaving an empty space.

5. There are two main ways to determine the age of a fossil. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dating determines the specific age of fossils. It is based on the fact that radioactive isotopes decay at a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rate. As the elements decay, they turn in to something \_\_\_\_\_\_\_\_ (a new element is formed). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the time it takes for half of the radioactive isotope to decay and turn in to something new.

6. A scientist was dating a fossil using carbon-14. If he began with 20 grams, and all that remained were 5 grams, how old is the fossil (hint: the half life of C-14 = 5730 years)

7. In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dating, fossils are found in different layers of rock. The top layers are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the bottom layers are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This method \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ determine the actual age!

8. Based on earliest observations, it was believed that life came from nonliving things, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

9. In the 1950s, American scientists \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_ conducted experiments to determine if organic molecules could have been created from the harsh environment of early earth. They simulated early atmosphere conditions by filling a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ with hydrogen, methane, ammonia, and water to represent the atmosphere. Then they passed electric sparks through the mixture to simulate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

10. Over a few days several \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ appeared! What is made up of amino acids? \_\_\_\_\_\_\_\_\_\_\_\_\_

11. The first living organisms were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, because Earth’s early atmosphere lacked oxygen. The food they consumed were small \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the early ocean. If they had to obtain their food, where they heterotrophs or autotrophs? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. Over time fossil evidence shows organisms evolved to survive in the presence of oxygen….but where did oxygen originate from? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ prokaryotes! These prokaryotes made their own \_\_\_\_\_\_\_\_\_, and the product of photosynthesis is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The continual production of oxygen led to the formation of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ layer.

13. The rise of oxygen in the atmosphere led to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of some life forms, while other life forms evolved new, more efficient metabolic pathways that used oxygen for *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.*

14. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ theory proposes that eukaryotic cells arose from living communities formed by prokaryotic organisms.



15. Evidence for the Endosymbiotic Theory comes from:

1. Mitochondria and choloroplasts contain \_\_\_\_\_\_\_\_\_\_ similar to bacterial DNA

2. Mitochondria and bacteria have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ whose size and structure closely resembles bacteria

3. Mitochondria and bacteria \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the same way – binary fission

16. Most prokaryotes reproduce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ via \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Sometime after eukaryotes developed, cells began to reproduce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Remember sexual reproduction (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) results in greater \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ diversity and variation. Increasing the number of gene combinations \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the probability that favorable combinations will be produced – favorable combinations greatly \_\_\_\_\_\_\_\_\_\_\_\_\_ the chance of evolutionary change in a species.