

Name _____ Period _____

Chapter 25: The History of Life on Earth

How could the first organic molecules have formed? What were the earliest life-forms? This chapter looks at evidence to support hypotheses about the origins of life and will help you understand EU 1.D: The origin of living systems is explained by natural processes.

Overview

1. In the last chapter, you were asked about *macroevolution*. To begin this chapter, give some examples of *macroevolution*. Include at least one novel example not in your text.

Concept 25.1 Conditions on early Earth made the origin of life possible

2. The current theory of the origin of life suggests that chemical and physical processes could have produced simple cells through a sequence of four main stages. Summarize them here.

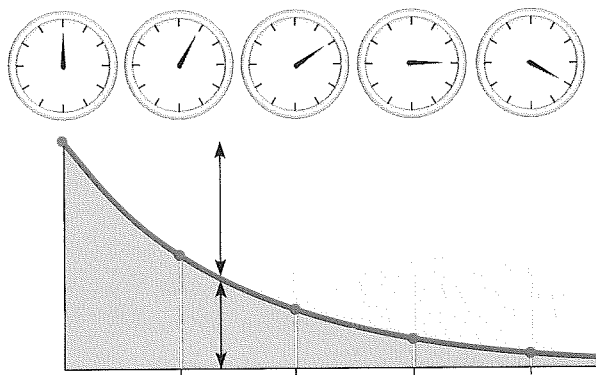
1.	
2.	
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3. In the previous chart, the first stage is the synthesis of organic molecules. Consider the early planet, which was probably thick with water vapor and stinky with methane, ammonia, and hydrogen sulfide. What gas was missing from this early mix? Why?
4. How old is the planet? _____ How old is the earliest evidence of life on Earth? _____.
5. A. I. Oparin and J. B. S. Haldane hypothesized that the early atmosphere was a *reducing environment*. What did they suggest was the source of energy for early organic synthesis?
6. In 1953 at the University of Chicago, Stanley Miller and Harold Urey tested the *Oparin-Haldane hypothesis* with the apparatus you saw in Chapter 4, Figure 4.2. Turn back now in your Reading Guide to Concept 4.1, page 16, where you labelled it. What was collected in the sample for chemical analysis? What was concluded from the results of this experiment?
7. Besides the Miller-Urey-type experiments that have demonstrated one way organic compounds may have been generated, what are some other hypotheses that show alternative situations?

8. What are *proto-cells*? What properties of life do they demonstrate? What conditions contribute to their formation?
9. What was most likely the first genetic material, DNA or RNA? _____
10. What are *ribozymes*?
11. Explain the evidence for an early “RNA world.”

Concept 25.2 *The fossil record documents the history of life*

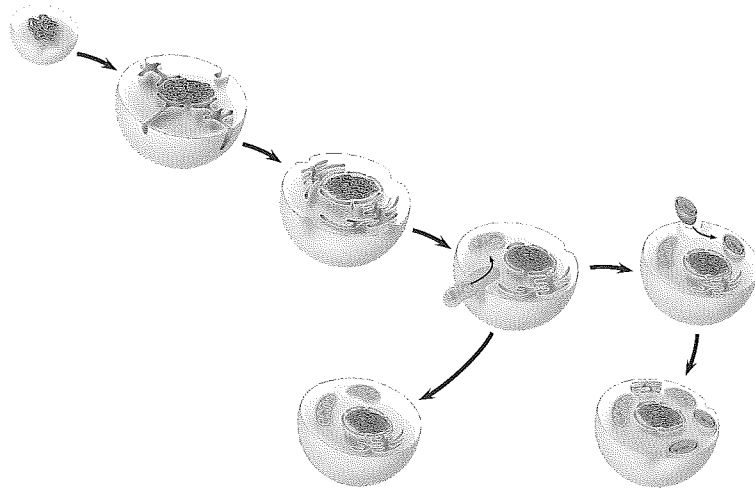
12. In what type of rock are fossils found?
13. What do we *not* know from analyzing rock strata?
14. Rocks and fossils are dated in several ways. *Relative dating* uses the order of rock strata to determine the relative age of fossils. *Radiometric dating* uses the decay of radioactive isotopes to determine the age of the rocks or fossils. It is based on the rate of decay, or **half-life**, of the isotope. To determine the *absolute* age of a fossil, *radiometric dating* is used. Use this figure to explain the concept of radiometric dating. Label the key elements.



15. What is the age range for which carbon-14 dating may be used?
16. To date fossils outside the range of carbon-14 dating, researchers use indirect methods of establishing absolute fossil age. Explain how this can be done using radioisotopes with longer half-lives.

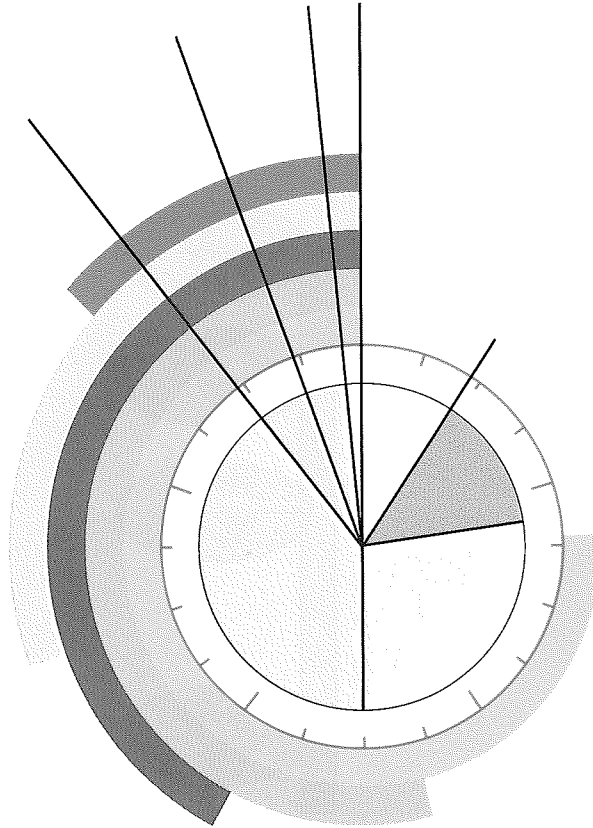
Concept 25.3 Key events in life's history include the origins of unicellular and multicellular organisms and the colonization of land

17. What was the earliest form of life on the planet? How long ago did this life-form first occur?
18. What unique ability originated with *cyanobacteria*? How did this alter life on Earth and lead to a wave of mass extinctions?
19. The first *eukaryotes* did not appear until approximately 1.8 billion years ago. Using Figure 25.10, label and explain the evolution of eukaryotes by *endosymbiosis*.



20. Summarize three lines of evidence that support the model of endosymbiosis.

21. Use the clock model to note the following events in the life of the planet: *origin of Earth*, *appearance of prokaryotes*, *evolution of atmospheric oxygen*, *occurrence of eukaryotic cells*, *multicellularity*, and *life moves onto land*. For each event, also label the number of years ago it occurred.

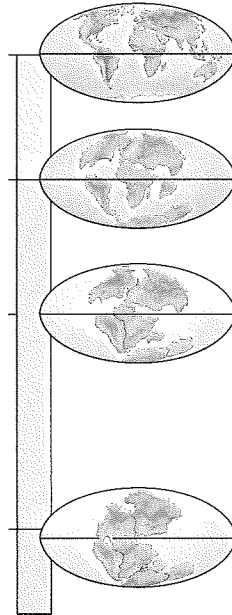


Study Tip

You will not be expected to know the names of the eons or eras or their ages for the AP exam, but you *will* be expected to know the sequence of major events in the origin of life, and this exercise will help you visualize this.

Concept 25.4 The rise and fall of groups of organisms reflect differences in speciation and extinction rates

22. If you have not studied geology, you will find this concept introduces a fascinating look at the changes in our planet as explained by continental drift. Define *continental drift*. How can continents move?
23. On the following figure, complete the time line on the left, then label *Pangaea*, *Gondwana*, and *Laurasia*. Describe what is occurring with each part of this figure.



24. Based on the movement of the continents over time, answer the following:
- What is the *San Andreas Fault*?
 - Where was India 65 million years ago?
 - What caused the uplift of the Himalayas?
 - How can a fossil freshwater reptile be found in both Brazil and West Africa, areas separated today by a wide expanse of ocean?
 - Why are no *eutherian* (placental) mammals indigenous to Australia?
25. A *mass extinction* is the loss of large numbers of species in a short period, caused by global environmental changes. What caused the *Permian mass extinction* 250 million years ago (mya)?

26. Everyone's favorite group, the dinosaurs, was lost, along with more than half of all marine species, in a second important mass extinction, the *Cretaceous mass extinction*, which occurred about 65 mya. What caused it?
27. What are *adaptive radiations*?
28. Why did large-scale adaptive radiations occur after each mass extinction?

Concept 25.5 *Major changes in body form can result from changes in the sequences and regulation of developmental genes*

29. What two areas of biology are merged in the field of study commonly called *evo-devo*?
30. What is an evolutionary change in the rate or timing of developmental events?
31. *Homeotic genes* are master regulatory genes that determine the location and organization of body parts. Mutations in a *homeotic gene* can have a profound effect on morphology. Homeotic gene mutations can contribute to the potential for evolutionary change. The *Hox* genes are one class of homeotic genes. What do they control?
32. Explain evidence that changes in gene regulation may result in evolutionary changes rather than changes in a gene's sequence. Why is this significant?

Concept 25.6 *Evolution is not goal oriented*

33. When a structure that has evolved in one context becomes co-opted for another purpose, this event is called _____. Does exaptation imply that organisms are anticipating future needs? _____ Explain.

Test Your Understanding Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
7. _____