

## Chapter 25 Guided Reading: The History of Life on Earth

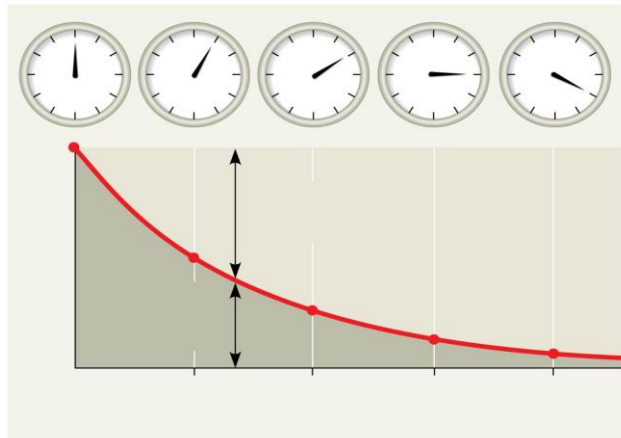
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1. The current theory of the origin of life suggests that chemical and physical processes could have produced simple cells through a sequence of four main stages. Summarize them here.

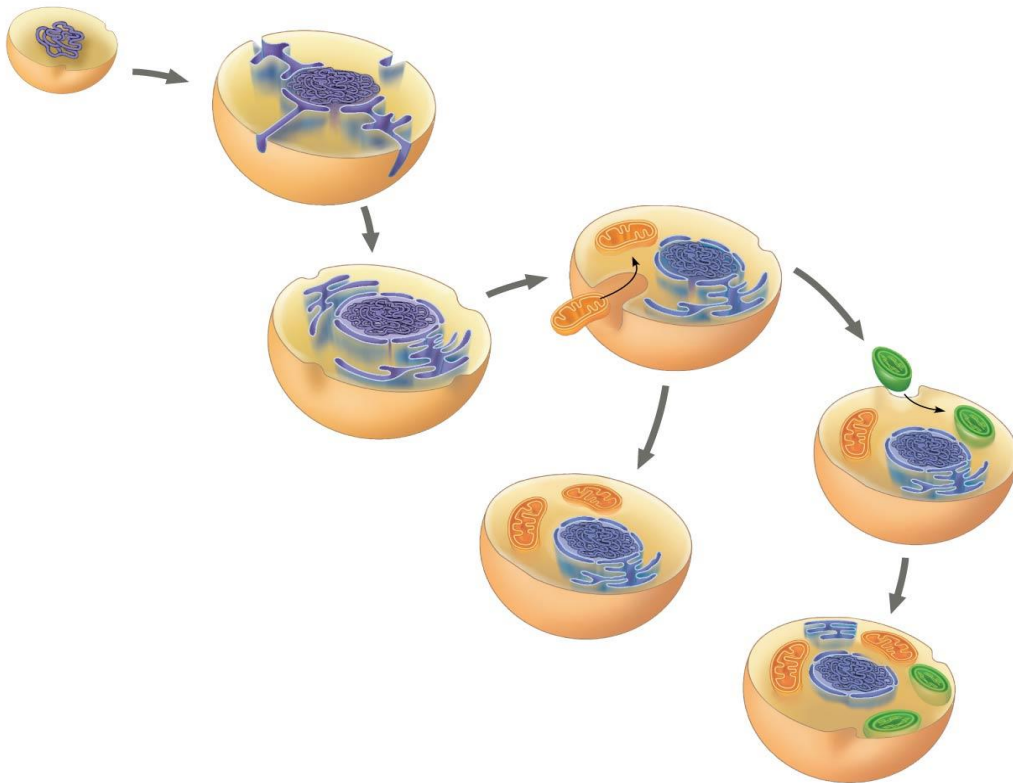
1	
2	
3	
4	

2. 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 methane, ammonia and hydrogen sulfide. What gas was missing from this early earth mix? Why?
3. How old is the planet? \_\_\_\_\_ How old is the earliest evidence of life on Earth? \_\_\_\_\_
4. 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 the energy for the early organic synthesis?
5. In 1953 at the Univ of Chicago, Stanley Miller and Harold Urey tested the *Oparin-Haldane hypothesis* with the apparatus you saw in Ch 4, figure 4.2 What was collected in the sample for chemical analysis? What was concluded from the results of this experiment?

6. 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?
  
7. What are *proto-cells*? What properties of life do they demonstrate? What conditions contribute to their formation?
  
8. What was most likely the first genetic material, DNA or RNA? \_\_\_\_\_
  
9. What are *ribozymes*?
  
10. Explain the evidence for an early “RNA World”
  
11. In what type of rock are fossils found?
  
12. What do we *not* know from analyzing rock strata?
  
13. Rocks and fossils are dated in several ways. *Relative dating* uses the \_\_\_\_\_ of rock strata to determine the relative age of the fossils. *Radiometric dating* uses the \_\_\_\_\_ to determine the age of the rocks or fossils. It is based on the rate of decay, or \_\_\_\_\_, of the isotope. To determine the *absolute* age of a fossil, \_\_\_\_\_ is used. Use this figure to explain the concept of radiometric dating. Label the key elements.



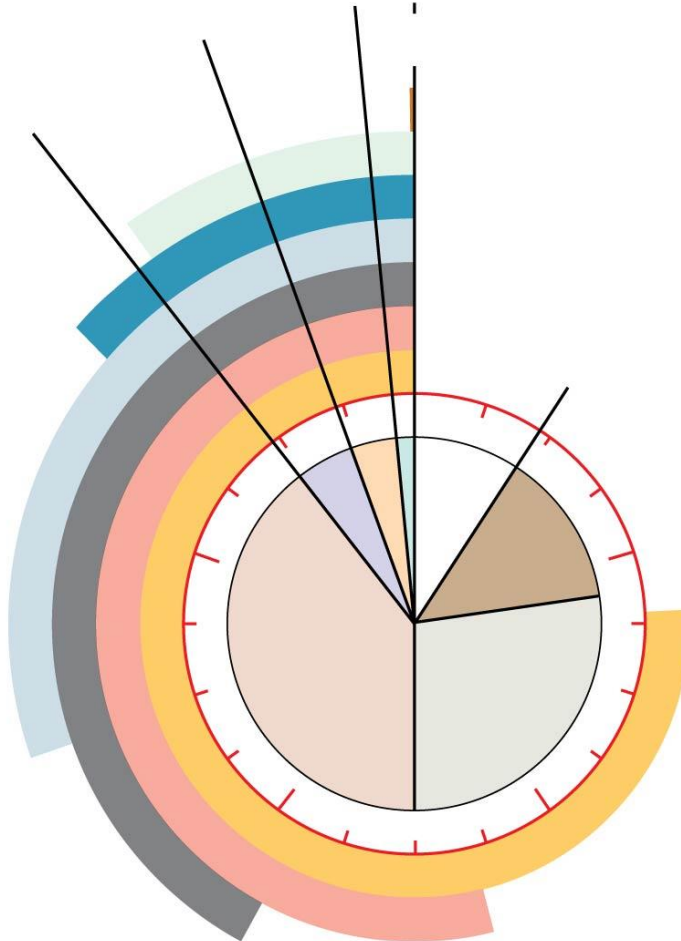
14. What is the age range from which carbon-14 dating may be used?
15. To date fossils outside the range of carbon-14 dating, researchers use indirect methods of establishing absolute fossil age, Explain how this can be done using radioisotopes with longer half-lives.
16. What was the earliest form of life on the planet? How long ago did this life-form first occur?
17. What unique ability originated with *cyanobacteria*? How did this alter life on Earth and lead to a wave of mass extinctions?
18. 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*.



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

- 1.
- 2.
- 3.

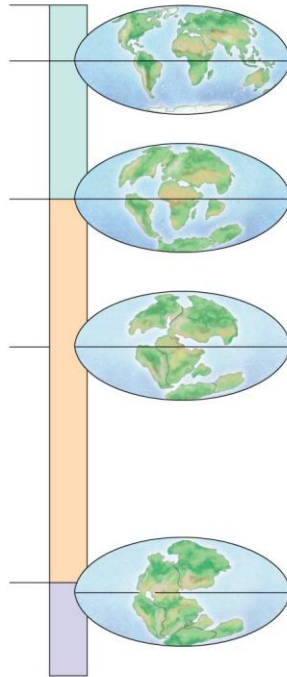
20. Use the clock model to note the following events in the life of the planet: *origin of Earth*, *appearance of prokaryotes*, *evolution of atmospheric oxygen*, *occurrence of eukaryotic cells*, *multicellularity*, and *life moves onto land*. For each event, also label the number of years ago it occurred.



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21. Define *continental drift*. How can continents move?

22. On the following figure, **complete** the time line on the left, than **label** *Pangaea*, *Gondwana* and *Laurasia*. **Describe** what is occurring with each part of the figure.



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23. 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?
24. 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)?
25. 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?

26. What are *adaptive radiations*?

27. Why did large-scale adaptive radiations occur after each mass extinction?

28. What two areas of biology are merged in the field of study commonly called *evo-devo*?

29. What is an evolutionary change in the rate or timing of developmental events?

30. 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 \_\_\_\_\_. Homeotic gene mutations can contribute to the potential for \_\_\_\_\_. The *Hox* genes are one class of homeotic genes. What do they control?

31. Explain evidence that changes in gene regulation may result in evolutionary changes rather than changes in a gene's sequence? Why is this significant?

32. 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.**