Name: _____ AP Biology

Chapter 24 Active Reading Guide
Early Life and the Diversification of Prokaryotes

Section 1

1. How old is the planet? _____
   How old is the earliest evidence of life on Earth? _____

2. The current theory of the origin of life suggests a sequence of four main stages. Summarize them here.
   1.

   2.

   3.

   4.

3. In the previous chart, the first stage is the synthesis of organic molecules. Consider the early planet, probably thick with water vapor and stinky with methane, ammonia, and hydrogen sulfide. What gas was missing from this early mix? Why?

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 energy for early organic synthesis?

5. In 1953 at the University of Chicago, Stanly Miller and Harold Urey tested the Oparin-Haldane hypothesis with this apparatus. Explain the elements of this experiment, using arrows to indicate what occurs in various parts of the apparatus.

6. What was collected in the sample for chemical analysis? What was concluded from the results of this experiment?

7. What are protocells? What properties of life do they demonstrate?

8. What did Thomas Cech propose was the first genetic material, DNA or RNA? _____

9. What are ribozymes?

10. Explain the evidence for an early "RNA world."

Section 2

11. Which two domains include prokaryotes? _____

12. Let's focus on some general details about prokaryotes.
    a. Are they multicellular or unicellular?

    b. Compare their size relative to eukaryotic cells.

    c. What three shapes are most common? Label them on the figure.

    d. What is the composition of the typical bacterial cell wall?

13. A key feature of prokaryotic cells is the cell wall. What three functions does it provide for the cell?

14. Quick review! What material comprises the cell wall of plants? _____ of fungi? _____

15. The cell walls of archaeans are different. They lack _____ but contain _____ and _____.

16. Explain the difference between gram-positive and gram-negative bacteria.

17. What is a bacterial capsule? What functions may it serve?

18. Many prokaryotes are capable of directional movement. What is this called?

19. What structure makes movement of bacteria possible?

20. What are the small, circular, self-replicating pieces of DNA found in bacteria called?

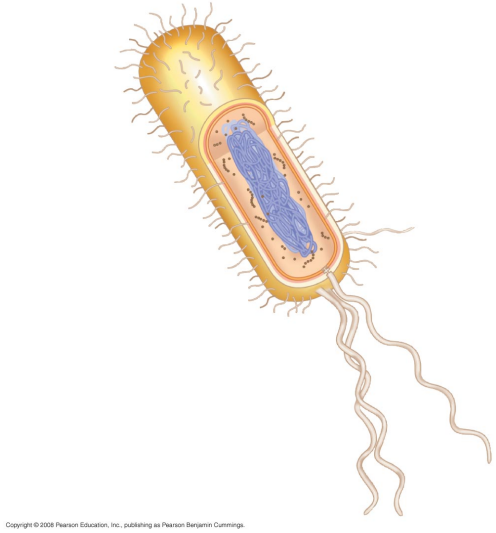
21. Compare prokaryotes to eukaryotes in terms of the following characteristics:

	Prokaryotes	**Eukaryotes**
Size		
Genome		
Membranes		
Location of Genome		
Plasmids		
Ribosomes		

22. Under ideal conditions, how quickly can E. coli divide? What conditions check prokaryotic reproduction?

23. What three key features allow prokaryotic populations to consist of trillions of individuals?

24. Label the following structures of a typical prokaryote seen here: cell wall, sex pilus, circular chromosome, nucleoid region, ribosomes, flagella, capsule, and fimbriae. Sketch in a plasmid or two, and label them. For each structure, know the function. (Go to the end of the chapter, page **495** for help with this figure.)



Section 3

25. You should now have some idea why there is so much potential for genetic diversity with bacterial populations. Although mutation is the major source of genetic variation in prokaryotes, listed below are the other three ways variation is introduced. Explain each one.

Source of Variation	**Summary Explanation**
Recombination	
Transformation	
Transduction	

26. What is horizontal gene transfer? How is it accomplished in bacteria?

27. What is a sex pilus? What is the F factor? And how are the two related?

28. The F factor is an episome. This is a piece of DNA that can be integrated within the main chromosome of the bacterium, or able to exist as an independent plasmid. What is the bacterial cell called:

    when the F factor is in plasmid form? _____

    when it lacks an F plasmid? _____

    when it is integrated within the chromosome? _____

29. What occurs in bacterial conjugation?

30. When a mating bridge forms between an F^+ cell and an F^- cell and the F plasmid is replicated and transferred, what is the status of the F^- cell afterward?

31. What is an Hfr cell?

32. How are Hfr cells created?

33. Summarize the transfer of genetic information from an Hfr cell to an F^- cell.

34. An understanding of R plasmids and antibiotic resistance will be important when you do a bacterial transformation lab. What are R plasmids?

Section 4

35. Compare the three domains of life in this chart by filling in either present or absent. One row is done for you.

A COMPARISON OF THE THREE DOMAINS OF LIFE

Characteristic	Bacteria	Archaea	Eukarya
Nuclear envelope			
Membrane-enclosed organelles			
Introns			
Histone proteins associated with DNA	Absent	Absent	Present
Circular chromosome			

36. Many archaea live on the edge and so are termed extremophiles. Where would you find these types of archaea?
    extreme halophiles:

    extreme thermophiles:

The thermophiles are interesting because their DNA and enzymes are stable at high temperatures. DNA polymerases from thermophiles are important in the polymerase chain reaction.

37. Pee-yoo! Methanogens are found in many habitats. What are some of these habitats? What do they all have in common?

Section 5

38. Define each of these terms, and give a specific example of the role that prokaryotes play in the terms marked with an asterisk (*):
    decomposers*:

    symbiosis:

    host:

    symbiont:

mutualism*:

commensalism*:

parasitism*:

parasite:

pathogens*:

39. There are many bacterial diseases. Make a list of six bad ones here, and give as much information about each disease as you can find in your text.

40. What are antibiotics? Why are they becoming less effective?

41. Explain how a normally harmless symbiont of our gut, E. coli, can be the agent of serious food poisoning. (Tell the story of 0157:H7.)

42. Not all bacterial activity is negative. Humans employ bacteria for many diverse activities. Cite three human applications using prokaryotes in research and technology here.
    1.

    2.

    3.