

Unit 2 Study Guide - ANSWERS

Energy in Living Things: Chemosynthesis, Photosynthesis & Cellular Respiration

1. What is chemosynthesis?

Chemosynthesis is the process used by some bacteria to convert chemicals, like methane and hydrogen sulfide, into glucose which they use as food. This is how they get energy!

2. Which gases, that were common on early Earth, can be used for chemosynthesis?

Hydrogen sulfide and methane

3. What is a prokaryote? Be able to identify the structures in a prokaryote and describe the functions of each structure.

A prokaryote is a small, single-celled organism that lacks both a nucleus and membrane bound organelles.

1. **Identify the labeled structure and give its function:**

A – Pilus – used to transfer genetic material in conjugation

B – Cell wall – protection

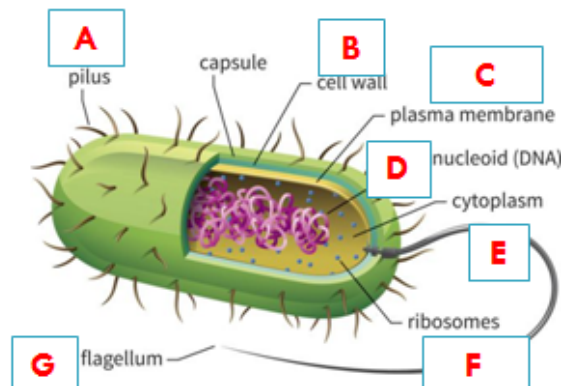
C – Plasma membrane – regulates what goes into and out of cell

D – DNA – stores genetic information

E – Cytoplasm – holds cell contents

F – Ribosome – makes proteins

G – Flagellum – movement



4. Which of these are prokaryotes: Animals, Bacteria, Plants, Archea

5. What were the first forms of life on Earth like?

i. Anaerobic (didn't use oxygen)

ii. Prokaryotic – small, simple cells, no nucleus, no membrane bound organelles

iii. Bacteria and Archea

iv. Chemosynthetic (photosynthesis hadn't evolved yet)

v. Possibly extremophiles

6. What are cyanobacteria?

Photosynthetic bacteria. They were the first cells to evolve the ability to do photosynthesis.

7. How did cyanobacteria affect Earth's atmosphere?

Cyanobacteria built up the oxygen in our atmosphere to its current level (21%).

8. Describe two ways cyanobacteria affected life on Earth.

1. Through endosymbiosis, they were incorporated into other single celled organisms and evolved into chloroplasts. The microbes that engulfed the cyanobacteria were the ancestors of all of the plants on Earth today.

2. The Great Oxygenation Event killed off most of the anaerobic life and allowed aerobic life become dominant.

9. Compare and contrast chemosynthesis and photosynthesis.

Both processes allow living things to transform one form of energy into a form that they can use which is glucose. They are different because they start with different forms of energy. In chemosynthesis, bacteria use energy from chemicals like methane and hydrogen sulfide. In photosynthesis, organisms use sunlight to make glucose.

10. What is an autotroph? Give two examples

An organism that makes its own food through photosynthesis or chemosynthesis. Examples: oak trees and phytoplankton.

11. What is a heterotroph? Give two examples

An organism that eats other organisms to get energy. Examples: Humans and fungus.

12. What is the purpose of photosynthesis?

To convert solar energy into chemical energy and to store the energy in glucose.

13. What is adenosine triphosphate (ATP) and what is its role in the cell?

ATP is a high-energy molecule found in every cell. Its job is to store and supply the cell with needed energy.

14. What is NADP+ and what is its role in photosynthesis?

NADP+ is an electron carrier. Its role is to carry electrons and their energy from the light dependent reactions to the light independent reactions or Calvin Cycle.

15. Why are electron carriers needed in photosynthesis?

Electrons are highly reactive, without a carrier they won't make it to the area of the cell that needs them. They will react with something else.

16. Write the balanced chemical equation for photosynthesis:



Sunlight is required.

17. In which organelle does photosynthesis occur?

Chloroplast

18. What is chlorophyll and what is its role in photosynthesis?

Primary light absorbing pigment found in plants. Chlorophyll absorbs red and blue and reflects green light.

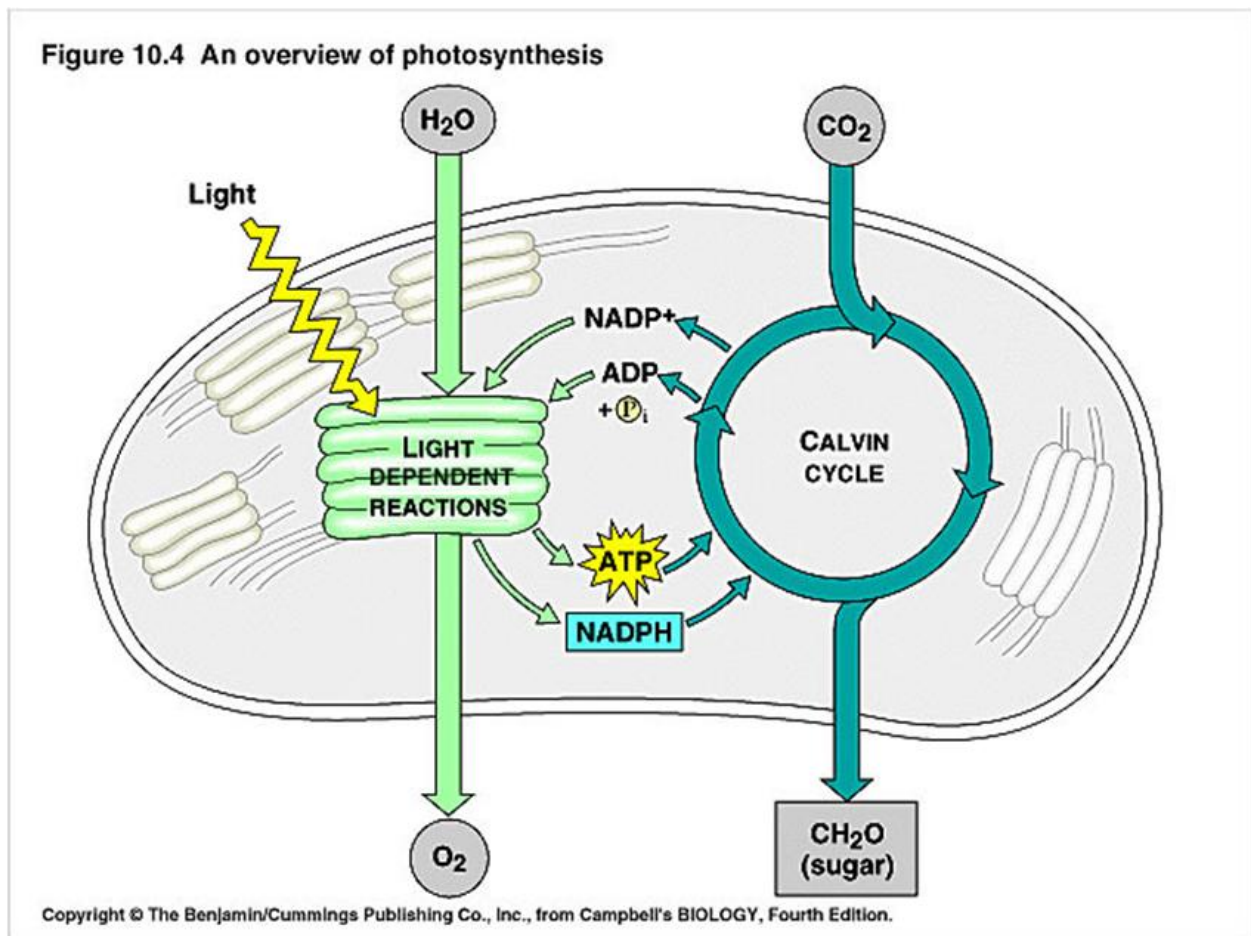
19. Where do the light dependent reactions occur?

Thylakoid membrane of the chloroplast.

20. Where do the light independent reactions occur?

Stroma of the chloroplast.

21. Fill in the diagram. Try to do this without any help.



22. What is the other name for the light independent reactions?

Calvin Cycle

23. **True** or False: Photosynthesis occurs in the light only. Cellular Respiration occurs in the light and the dark.

24. Plants use photosynthesis to store energy in glucose. How do plants get energy out of glucose when they need it?

Like us, plants do cellular respiration to get energy out of glucose.

25. What are the four factors that affect the rate of photosynthesis?

1. *Temperature*
2. *Light Intensity*
3. *Concentration of CO₂*
4. *Availability of water*

26. What is the purpose of cellular respiration?

To release the energy stored in the bonds of glucose so it can be used by the cell/organism.

27. Write the balanced chemical equation for cellular respiration:



28. True or False: The chemical equation for cellular respiration is the opposite of the equation for photosynthesis.

29. List the three stages of aerobic cellular respiration and their locations.

1. *Glycolysis*
2. *Kreb's Cycle*
3. *Electron Transport System*

30. What does aerobic mean?

"living in the presence of air". Uses oxygen.

31. What does anaerobic mean?

"living without air." Does not require oxygen.

32. If oxygen isn't present, what happens to the process of cellular respiration?

If oxygen isn't present, the Kreb's cycle and electron transport chain can't occur. Glycolysis will occur to make pyruvic acid and the pyruvic acid will be used for fermentation.

33. What is fermentation?

Anaerobic respiration that occurs when oxygen is not available. Pyruvic acid is broken down into lactic acid (animals) or alcohol (yeast). This is a very inefficient way to make ATP, only 2 ATP are made.

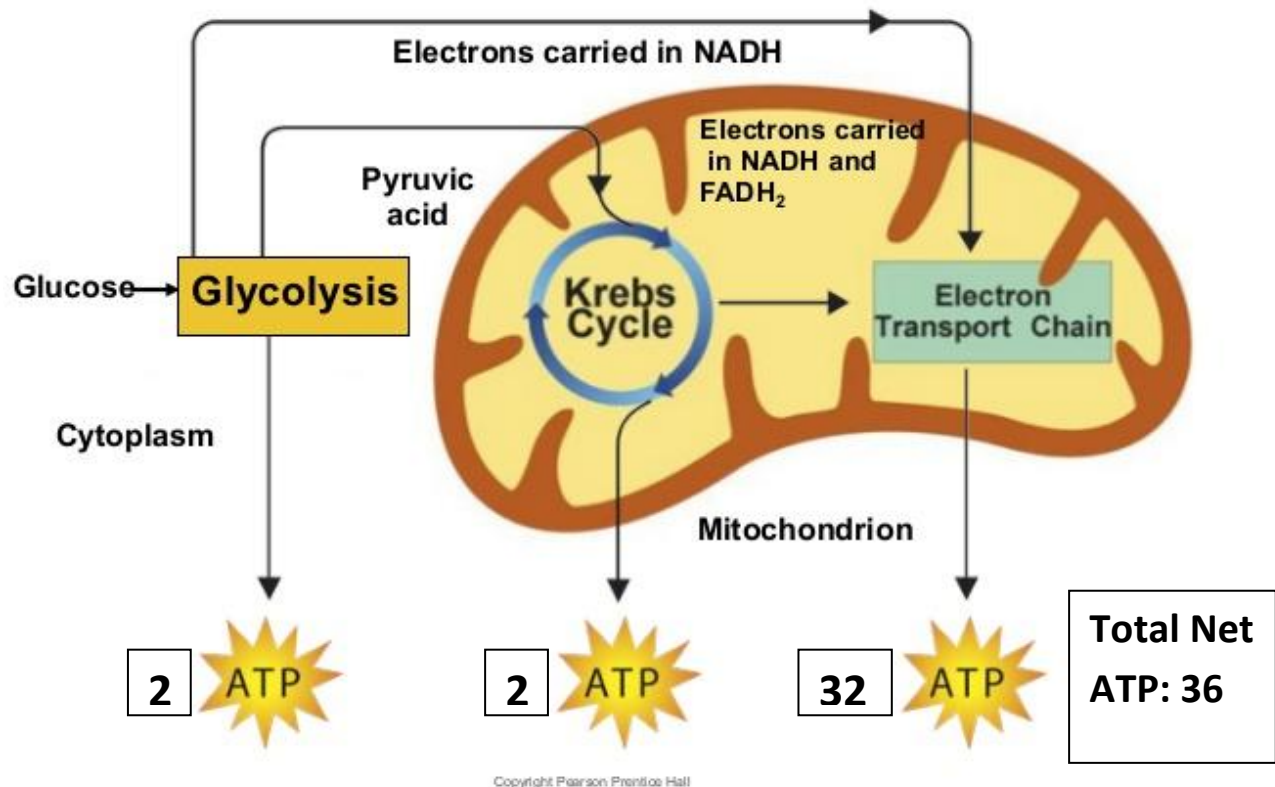
34. What are the two different types of fermentation?

Lactic acid fermentation – animals

Alcoholic fermentation - yeast

35. Fill in the diagram below. Try to do this without any help.

Overview of Cellular Respiration



36. What is required for glycolysis?

Glucose and 2 ATP (NAD⁺ is also required)

37. What is required for the Krebs Cycle and the Electron Transport Chain?

Oxygen must be present in order for these stages to occur. See table of additional inputs.

38. What are the electron carriers used in cellular respiration?

Electron carriers are needed to carry electrons and their energy from one stage to the next.

39. How many ATP are produced during cellular respiration?

Aerobic: 38 ATP molecules are produced from one molecule of glucose. Since 2 ATP molecules are used in glycolysis, the net amount of ATP created is 36.

Anaerobic: Only 2 ATP molecules are created during fermentation.

40. Short Answer Practice: Yeast cells can carry out both fermentation and cellular respiration, depending on whether oxygen is present. In which case would you expect yeast cells to grow more rapidly?

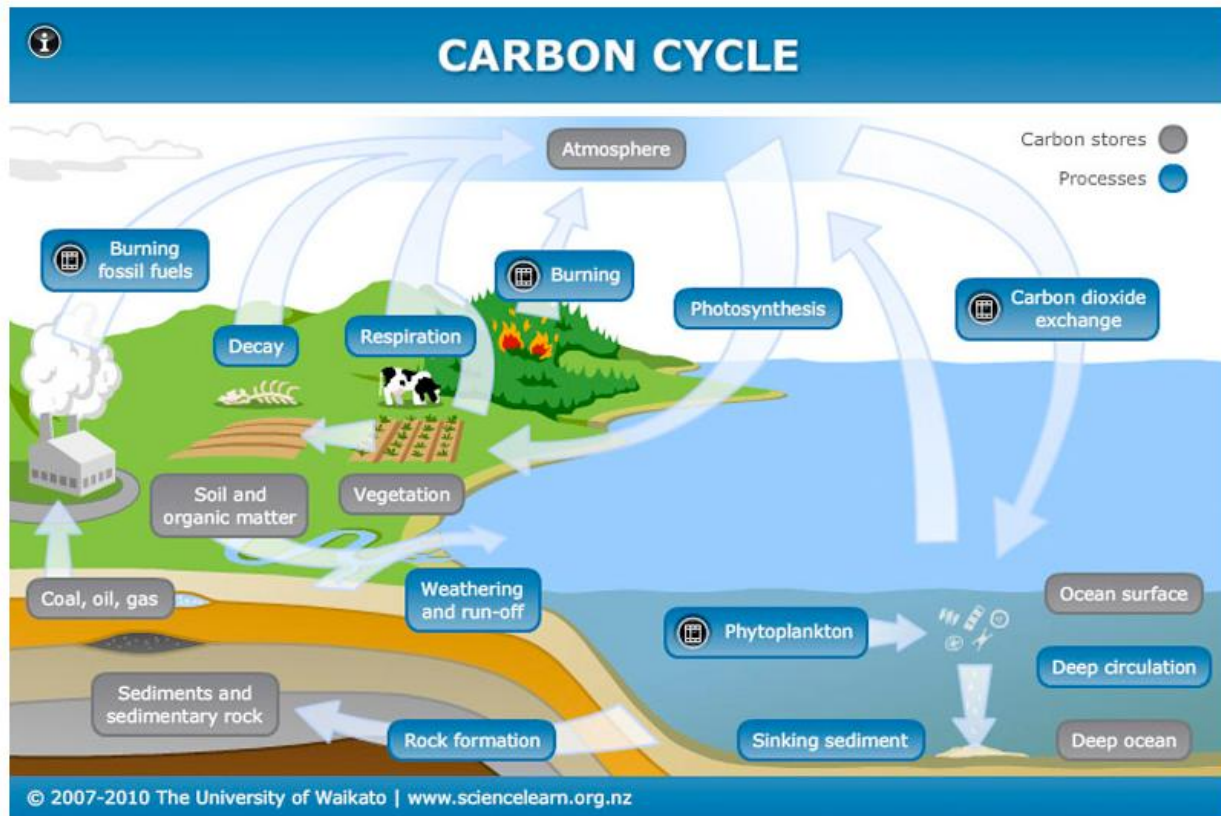
Explain

Yeast would grow faster when oxygen is present because they can do aerobic cellular respiration.

Aerobic cellular respiration produces 36 ATP molecules while fermentation (anaerobic respiration) only

produces 2 ATP. Yeast need as much ATP as possible to grow, so they grow best when they can do aerobic cellular respiration.

41. Short Answer Practice: Would a plant grow better under a red light or a green light? Explain
A plant would grow faster under a red light because green plants absorb most colors except green. They reflect green.
42. Draw the carbon cycle. Understand each geological and biological process.



Practice Analyzing Data – Complete at least one set of questions below:

- A. Problem 1, 2, & 3 on pg. 240
- B. Problem 36 & 37 on pg. 246
- C. Problem 1, 2, & 3 on pg. 251
- D. Problem 38 and 39 on pg. 270
- E. Problem 9 and 10 on pg. 271