Name_________________________________ Date ____________ Period_________

PHOTOSYNTHESIS STARTS WITH

1. Molecules that collect light energy are called _P_ __ __ __ __ __ __ __ __ .

2. _C_ __ __ __ __ __ __ __ __ __ __ __ is the main light absorbing pigment found in green plants.

3. The gel-filled space inside the chloroplast surrounding the thylakoid stacks is called the _S_ __ __ __ __ __.

4. _P_ __ __ __ __ __ __ __ __ __ __ __ I and II contain chlorophyll and absorb light energy during the _L_ __ __ __ __ _D_ __ __ __ __ __ __ __ __ reactions.

5. During the light dependent reactions, H^+ ions build up in the _T_ __ __ __ __ __ __ __ __ space when _W_ __ __ __ __ molecules are split.

6. The enzymes for the light dependent reactions are found in the _T_ __ __ __ __ __ __ __ __ _M_ __ __ __ __ __ __ __ , while the Calvin cycle happens in the _S_ __ __ __ __ __.

7. The stacks of thylakoids found inside chloroplasts are called _G_ __ __ __ __ .

8. The light independent reactions are also called the _C_ __ __ __ __ __ _C_ __ __ __ __.

9. Carbon and oxygen from _C_ __ __ __ __ __ _D_ __ __ __ __ __ __ end up as part of a _G_ __ __ __ __ __ __ molecule following the Calvin cycle.

10. _A_ __ __ and _N_ __ __ __ __ are made during the _L_ __ __ __ __ dependent reactions and carry energy and high energy electrons that are used during the Calvin cycle to produce _S_ __ __ __ __ __, like glucose.

11. The O in H_2O is given off as _O_ __ __ __ __ __ gas to the atmosphere when water is split during the light dependent reactions.

12. Electrons are transferred along the membrane from Photosystem II to Photosystem I using the _E_ __ __ __ __ __ __ __ _T_ __ __ __ __ __ __ __ __ _S_ __ __ __ __ __ .

13. _T_ __ __ __ __ __ __ __ __ __ __ , amount of _W_ __ __ __ __ , and _L_ __ __ __ __ intensity are all factors that affect the rate of photosynthesis.

14. __ __ __ __ __ __ __ __ __ __ __ __ pushes H^+ ions from the stroma across the membrane into the thylakoid space.

PHOTOSYNTHESIS: An Overview

CIRCLE ALL THAT ARE TRUE.

Plants gather the sun's energy with light-absorbing MOLECULES called _____.

A. thylakoids
B. pigments
C. chloroplasts
D. glucose

Chlorophyll absorbs light very well in the _____ regions of the visible spectrum.
(Circle all that are true)

A. blue-violet
B. green
C. red
D. yellow

Most plants appear green because chlorophyll _____.

A. reflects green light
B. absorbs green light

A student conducts an experiment by collecting the gas given off by a green plant in bright sunlight at room temperature. The gas being collected is probably _____.

A. ATP
B. water vapor
C. carbon dioxide
D. oxygen

Write the complete overall chemical equation for photosynthesis using chemical symbols instead of words:

_____ + _____ $\xrightarrow{\text{_____}}$ _____ + _____

How many molecules of carbon dioxide (CO_2) are used to make 1 molecule of glucose ($C_6H_{12}O_6$) ?

1 2 3 6 12

In addition to water and carbon dioxide, what two things are required for photosynthesis to happen?

_____ and _____

REACTIONS OF PHOTOSYNTHESIS

MULTIPLE CHOICE: Circle the letter of the answer that best completes the statement or answers the question.

Where are Photosystems I and II found?

A. in the stroma
B. in the thylakoid space
C. in the thylakoid membrane
D. in the Calvin cycle

The Calvin cycle is another name for _____

A. photosynthesis
B. the electron transport chain
C. light-dependent reactions
D. light-independent reactions

Why does the space inside the thylakoid become positively charged during the light-dependent reactions?

A. ATP synthase pushes H^+ ions from the stroma across the membrane into the space
B. H^+ ions build up in the space as water is split
C. Electrons have a + charge and are released here by Photosystem II
D. Carbon dioxide builds up in the stroma

CIRCLE ALL THAT ARE TRUE about the LIGHT DEPENDENT REACTION.

A. High-energy electrons move through the electron transport chain.
B. Pigments in photosystems II and I absorb light.
C. ATP synthase helps H^+ ions in the thylakoid space to pass through the membrane to the stroma.
D. ATP and NADPH are used to produce high-energy sugars.

CIRCLE ALL THAT ARE TRUE about the CALVIN CYCLE

A. ATP is produced by ATP synthase and oxygen is released
B. It is also called the light-independent reaction.
C. ATP and NADPH from the light-dependent reactions are used here
D. High energy sugar compounds are made from CO_2

Which step is the beginning of photosynthesis?

A. Pigments in photosystem I absorb light.
B. Pigments in photosystem II absorb light.
C. High energy electrons move through the electron transport chain.
D. ATP and NADPH produce high energy sugars.

CIRCLE ALL OF THE FOLLOWING THAT ARE FOUND INSIDE THE THYLAKOID MEMBRANE.

A. electron transport chain
B. photosystem I
C. photosystem II
D. ATP synthase

Which molecule acts as a carrier for high energy electrons during photosynthesis?

A. ATP
B. H_2O
C. $NADP^+$
D. CO_2

How is the Calvin cycle different from the light-dependent reactions?

A. It takes place in chloroplasts.
B. It takes place in the stroma.
C. It requires light.
D. It takes place in the thylakoid membrane

Oxygen produced during the light-dependent reaction is _____.

A. used in the Calvin cycle to make sugar
B. joined with the NADPH to make water
C. is released into the atmosphere
D. None of these, oxygen is NOT produced by the light-dependent reaction

How does $NADP^+$ become NADPH?

_____

Name 3 factors that affect the rate at which photosynthesis occurs.

1. _____
2. _____
3. _____

MODIFIED TRUE or FALSE

Circle T if the statement is TRUE.
Circle F if the statement is FALSE and *use the blank provided to correct the underlined word/phrase*.

T F Increasing light intensity decreases the rate of photosynthesis. _____

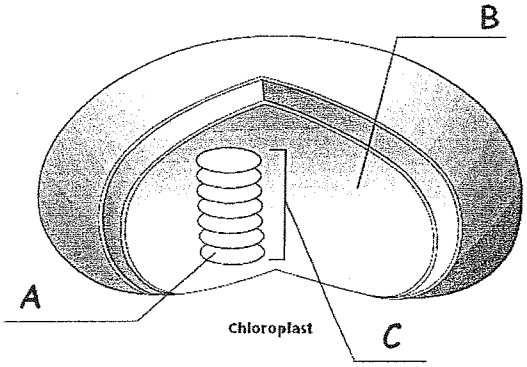
T F Carbon dioxide molecules enter the light-dependent reactions from the atmosphere. _____

T F Photosynthesis uses energy from ATP and high energy electrons from NADPH produced in the light-dependent reactions to make glucose in the Calvin cycle. _____

T F The light-dependent reaction produces ATP, NADPH, and carbon dioxide. _____

T F ATP synthase spins like a turbine as H^+ ions pass through it to generate ATP. _____

T F Electrons are energized twice during photosynthesis. _____



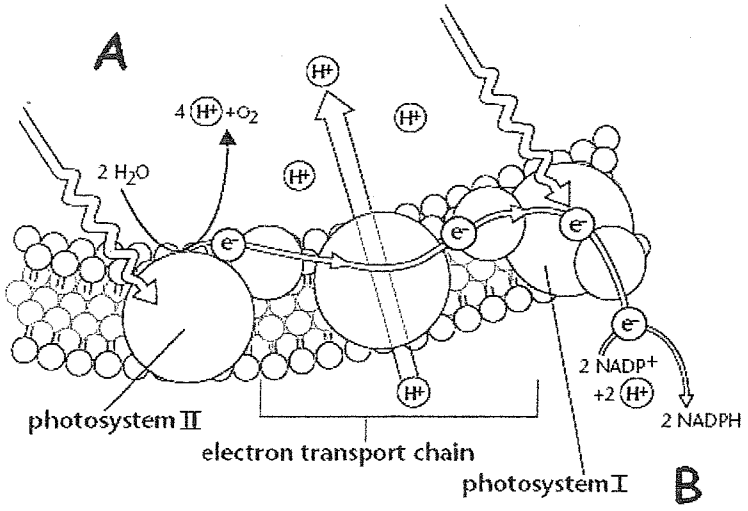
USE THE LETTERS IN THE DIAGRAM AT THE LEFT TO IDENTIFY:

_____ stroma

_____ thylakoid

_____ granum

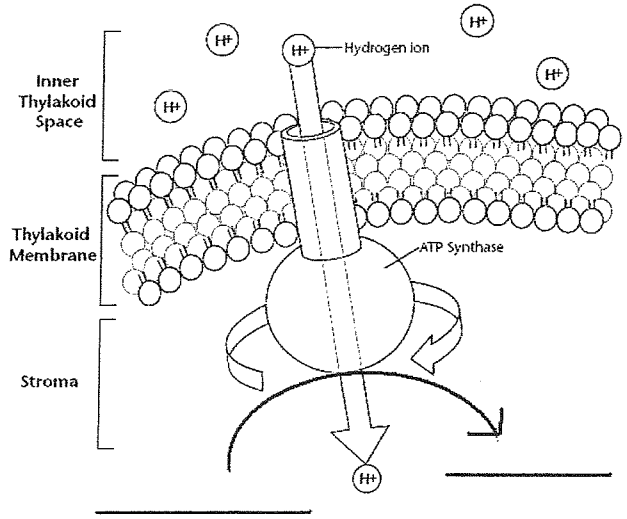
* * * * * * * * * * * * * * *



COLOR THE DIAGRAM AS DESCRIBED:
Color the energy from sunlight YELLOW
Color the two places where light energy enters the reactions ORANGE
Color the hydrogen ions RED
Color the electrons GREEN
Color the thylakoid membrane BLUE

On which side of the membrane would you find the STROMA? A or B
(Hint: look to see where NADPH is being made)

On which side of the membrane is the INNER THYLAKOID SPACE? A or B
(Hint: look to see where water molecules are being split)



Where does ATP formation happen?

Stroma inner thylakoid space

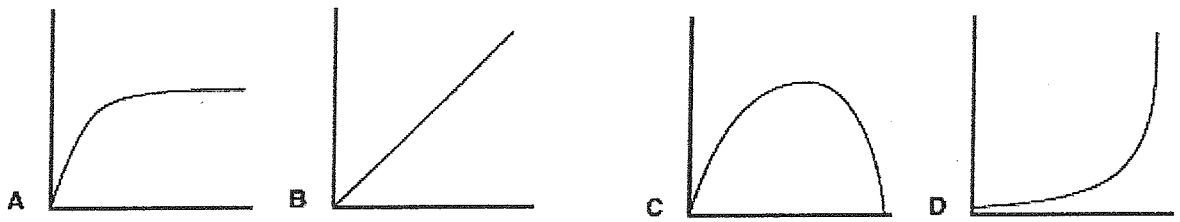
Add an equation to the diagram in the correct location that shows the formation of ATP from ADP.

USE WORDS FROM THE WORD BANK TO FILL IN THE CHART COMPARING AND CONTRASTING THE LIGHT-DEPENDENT REACTIONS AND THE CALVIN CYCLE: (You can use them more than once!)

in stroma	in thylakoid membrane	O_2	ATP	CO_2	H_2O	NADPH
Requires light	Doesn't require light	SUGARS (glucose)				

	LIGHT-DEPENDENT REACTIONS	CALVIN CYCLE
LOCATION		
REACTANTS		
PRODUCTS		
LIGHT?		

THINK ABOUT IT



Which of these graphs represents the effect of temperature on the rate of photosynthesis? _____
(Hint: Many molecules that help with photosynthesis are enzymes)

EXPLAIN YOUR ANSWER. _____

_____

Which of these graphs represents the effect of light intensity on the rate of photosynthesis? _____

EXPLAIN YOUR ANSWER. _____

_____

Name Date Class

Master 12

Photosynthesis

Basic Concepts

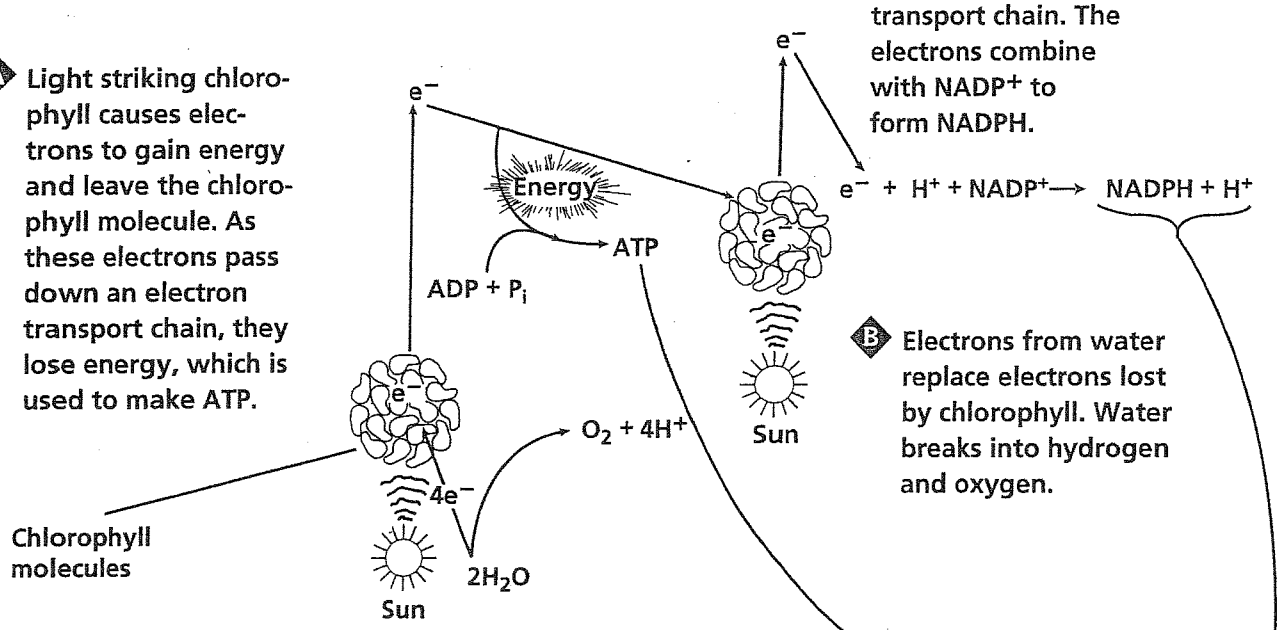
Use with Chapter 9, Section 9.2

Light-Dependent Reactions

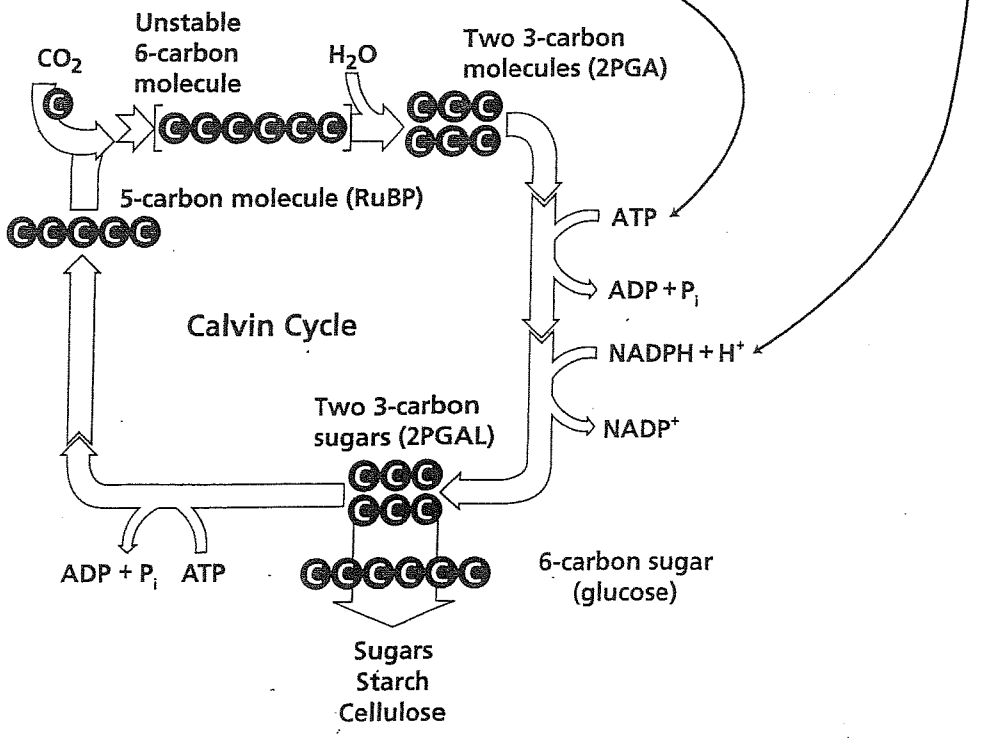
A Light striking chlorophyll causes electrons to gain energy and leave the chlorophyll molecule. As these electrons pass down an electron transport chain, they lose energy, which is used to make ATP.

C Electrons move down another electron transport chain. The electrons combine with $NADP^+$ to form NADPH.

B Electrons from water replace electrons lost by chlorophyll. Water breaks into hydrogen and oxygen.



Light-Independent Reactions



Name Date Class

Worksheet 12

Photosynthesis

Basic Concepts

Use with Chapter 9, Section 9.2

1. Describe what happens when sunlight strikes chlorophyll.

2. What happens as an electron moves down an electron transport chain?

3. What is produced from the splitting of water during the light-dependent reactions? What is this process called?

4. What is the importance of the oxygen produced during the light-dependent reactions?

5. What products of the light-dependent reactions are used in the light-independent reactions?

6. When does carbon fixation occur?

7. What is the source of energy for converting PGA into PGAL during the light-dependent reactions?

8. What is the final product of the light-dependent reactions? What kinds of substances are formed from it?

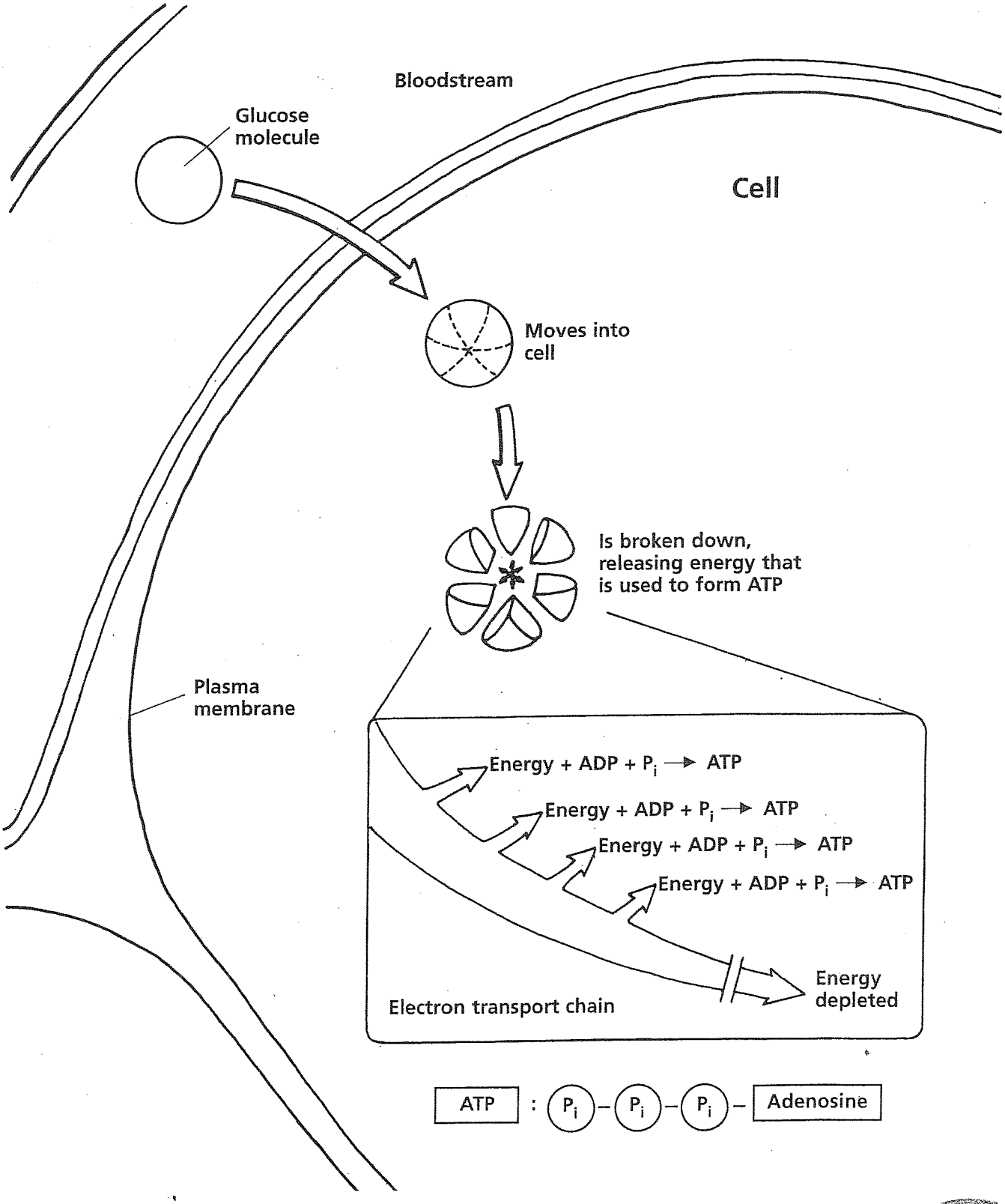
Name Date Class

Master 14

Electron Transport Chain

Reteaching Skills

Use with Chapter 9, Section 9.3



Name Date Class

Worksheet 14

Electron Transport Chain

Reteaching Skills

Use with Chapter 9, Section 9.3

1. How does a plant get glucose molecules?

2. How does an animal get glucose molecules?

3. What is the structure of ATP?

4. How does the structure of ATP help a cell perform its functions?

5. Why is it necessary to release the energy stored in glucose in small amounts?

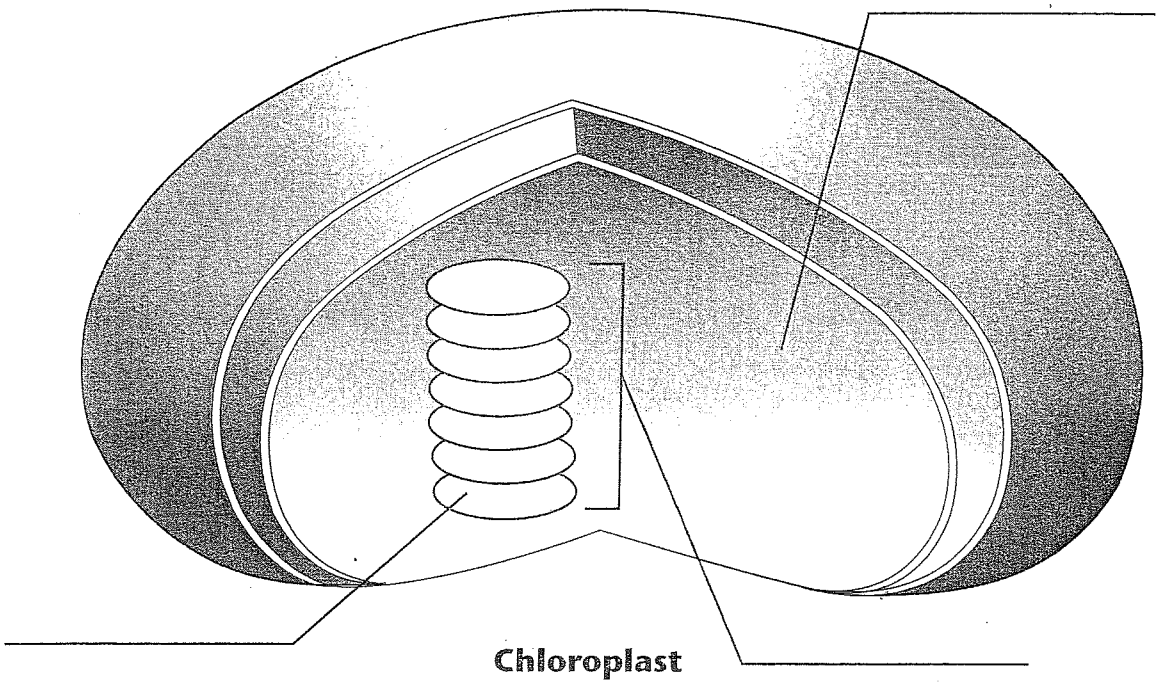
6. Where in a cell is the electron transport chain shown in the transparency found?

7. Describe at least ten ways that your body is using energy as you work on this worksheet.

The Chloroplast

In plants, photosynthesis takes place in chloroplasts. Inside chloroplasts are saclike membranes called thylakoids. These thylakoids are arranged in stacks. A stack of thylakoids is called a granum. The region outside of the thylakoids, but inside the chloroplast is called the stroma.

In the diagram of the chloroplast, label a thylakoid, *the* stroma, *and the* granum.



Chloroplast

Answer the following questions. Circle the correct answer.

1. Where are the photosystems, or light-collecting units of photosynthesis, found?

   thylakoid membranes stroma

2. In what part of the chloroplast does the Calvin cycle take place?

   thylakoid membranes stroma

3. In what part of the chloroplast do the light-dependent reactions of photosynthesis take place?

   thylakoid membranes stroma

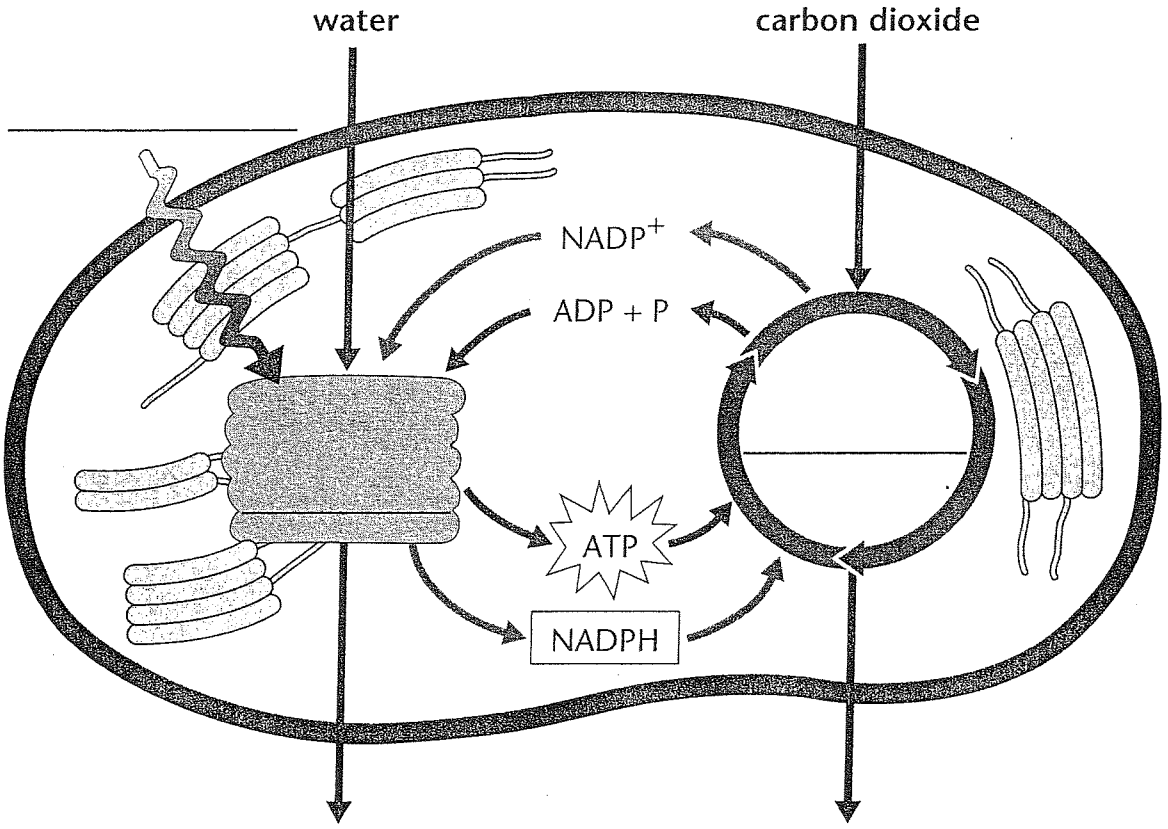
Name_____ Class_____ Date _____

Photosynthesis Overview

Photosynthesis uses light energy to convert water and carbon dioxide into oxygen and high-energy sugars. The picture below shows an overall view of the process of photosynthesis.

Use the words below to label the diagram.

Calvin cycle	light energy	sugars
light-dependent reactions	oxygen	



_____ _____

Use the diagram to answer the questions.

1. Finish the equation for photosynthesis.

carbon dioxide + water $\xrightarrow{\text{light}}$ _____

2. Which of the following is also called the light-independent reactions of photosynthesis? Circle the correct answer.

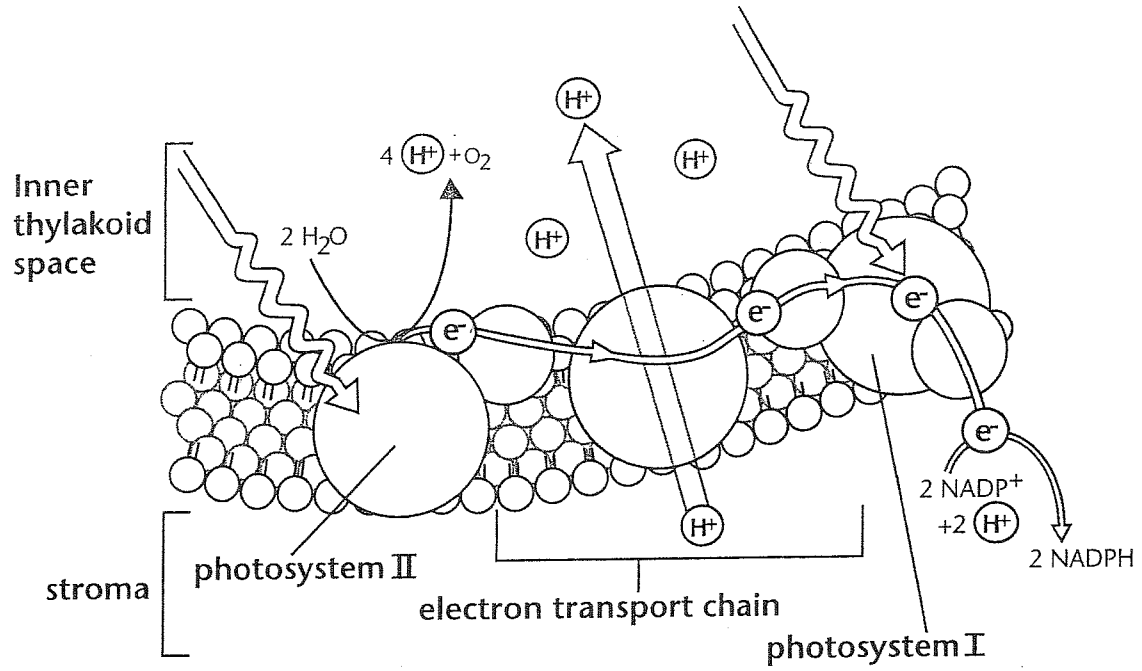
Calvin cycle electron transport chain

Photosystems I and II

Photosystems I and II are important parts of the light-dependent reactions of photosynthesis. In photosystem II, light energy is absorbed by electrons. These high-energy electrons are then passed down an electron transport chain. The electrons are then passed to photosystem I. In photosytem I, the electrons are reenergized by light energy and used to make NADPH.

Color the diagram according to the prompts below.

- Color the two places where light energy enters the reactions yellow.
- Color the hydrogen ions red.
- Color the electrons green.
- Color the thylakoid membrane blue.



Use the diagram to answer the questions.

1. Where does light energy enter the system?

_____

2. What uses energy from the high-energy electrons to transport hydrogen across the thylakoid membrane? Circle the correct answer.

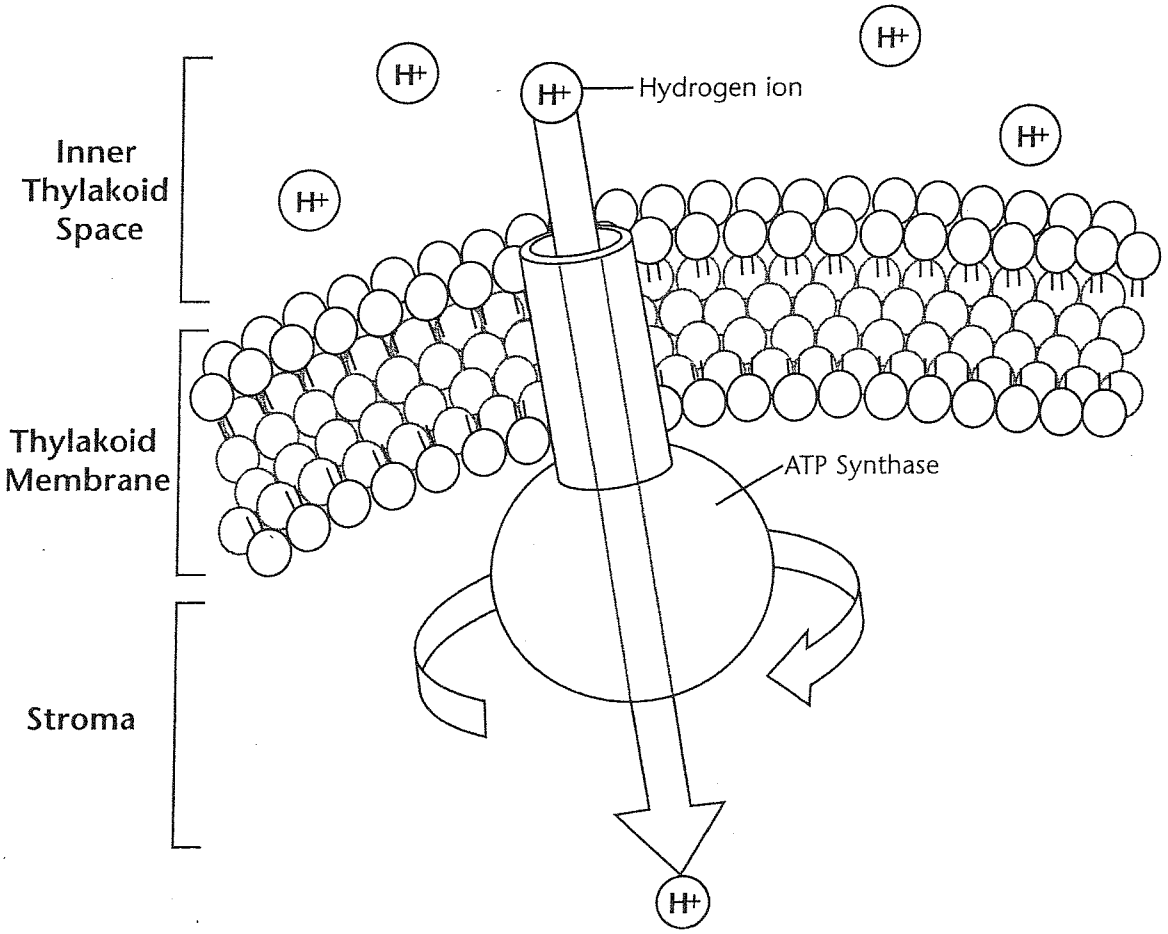
photosystem II electron transport chain

Name_____ Class_____ Date _____

ATP Formation in the Light-Dependent Reactions of Photosynthesis

In the light-dependent reactions of photosynthesis, the electron transport chain transports hydrogen ions across the thylakoid membrane. ATP synthase uses these hydrogen ions to power the formation of ATP. Hydrogen ions move through ATP synthase and cause it to spin. As it spins, it forms ATP from ADP and a phosphate.

Color the arrow that shows how ATP synthase spins. Then, draw in the formation of ATP *from* ADP.



Use the diagram to answer the question. Circle the correct answer.

1. Where does the formation of ATP take place?

inner thylakoid space stroma

CELLULAR RESPIRATION

MULTIPLE CHOICE. Circle ALL that are TRUE. There may be MORE THAN one correct answer.

_____ is the first step in cellular respiration that begins releasing energy stored in glucose.

A. Alcoholic fermentation
B. Lactic acid fermentation
C. Glycolysis
D. Electron transport chain

The carriers for energy and high energy electrons during GLYCOLYSIS are _____.

A. ATP
B. NADH
C. $FADH_2$
D. NADPH

If oxygen is NOT present, glycolysis is followed by _____

A. Krebs cycle
B. electron transport chain
C. fermentation

Name the 3 carbon molecule produced when glucose is broken in half during glycolysis.

A. pruvate
B. lactic acid
C. Acetyl-CoA
D. citric acid

Since fermentation does not require oxygen it is said to be _____.

A. aerobic
B. anaerobic

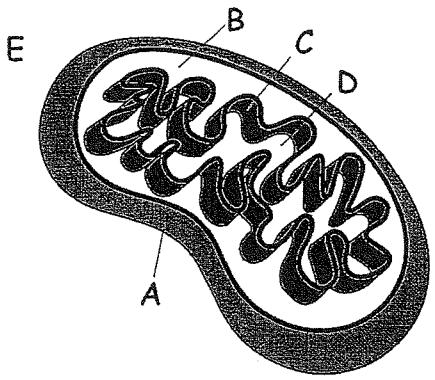
Which high energy electron carrier is regenerated during fermentation that allows cells to continue to make ATP using glycolysis?

A. NAD^+
B. NADPH
C. ATP
D. ADP

How many ATP molecules are added to get glycolysis started? _____

Since glycolysis produces 4 ATP molecules, this results in a NET GAIN of _____ ATP's

MATCH THE LETTER IN THE DIAGRAM WITH THE LABEL:
(You can use them MORE THAN ONCE)



_____ MATRIX

_____ INTERMEMBRANE SPACE

_____ CYTOPLASM

_____ OUTER MEMBRANE

_____ INNER MEMBRANE (CRISTAE)

_____ Place GLYCOLYSIS happens

* * * * * * * * * * * * * *

Write the complete overall chemical equation for cellular respiration using chemical symbols instead of words:

_____ + _____ → _____ + _____ + _____

Compare this reaction to the one you learned about last chapter for PHOTOSYNTHSIS
(6 H_2O + 6 CO_2 + light energy → $C_6H_{12}O_6$ + 6 O_2) How are these equations related?

_____

* * * * * * * * * * * * * * *

Tell the kind of fermentation used in each example:

Yeast uses this to make bread dough rise _____

Your muscle cells use this during rapid exercise when oxygen is low _____

Bacteria and yeast use this to make beer and wine _____

Bacteria use this to make cheese, yogurt, and sour cream _____

If alcoholic fermentation is used to make bread dough rise, how come you don't become intoxicated when you eat the bread?

_____

The Krebs Cycle and Electron Transport

MULTIPLE CHOICE:

Circle the answer or answers that best complete the statement or answer the question. (THERE MAY BE MORE THAN ONE RIGHT ANSWER.)

Which of the following shows the correct sequence during cellular respiration?

A. Electron transport chain → glycolysis → Krebs cycle
B. Glycolysis → Electron transport chain → Krebs cycle
C. Krebs cycle → Electron transport chain → glycolysis
D. Glycolysis → Krebs cycle → Electron transport chain

Where do the carbon atoms in pyruvate end up following the Krebs cycle?

A. They enter the electron transport chain and make ATP
B. They become part of a carbon dioxide molecule and end up in the atmosphere
C. They join with citric acid to make Acetyl-CoA
D. They build up in the intermembrane space

Because cellular respiration requires oxygen it is said to be _____

A. aerobic
B. anaerobic

How many total ATP molecules are produced by 1 molecule of glucose completing cellular respiration ?

2 6 24 36

WHICH OF THE FOLLOWING ARE PRODUCED DURING THE KREBS CYCLE?

A. ATP
B. NADH
C. $FADH_2$
D. CO_2

What molecule is the final electron acceptor at the end of the Electron transport chain?

A. oxygen
B. carbon dioxide
C. glucose
D. NADH

The movement of which ion across the membrane from the intermembrane space to the matrix causes ATP synthase to spin and make ATP and

A. Na^+ ions
B. oxygen
C. H^+ ions
D. water

Which stage of cellular respiration produces the most ATP?

A. glycolysis
B. Krebs cycle
C. Electron transport
D. Acetyl-CoA charging

Which of the following happens as electrons pass down the Electron Transport chain?

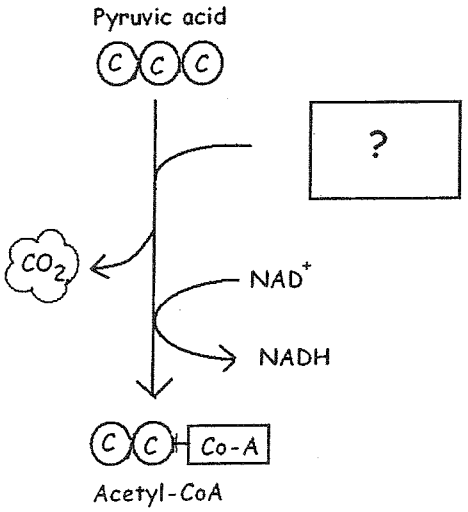
A. Energy from the moving electrons transports H^+ ions into the intermembrane space
B. Carbon dioxide is released
C. Energy from H^+ ions crossing back into the matrix causes ATP synthase to make ATP.
D. Water is produced

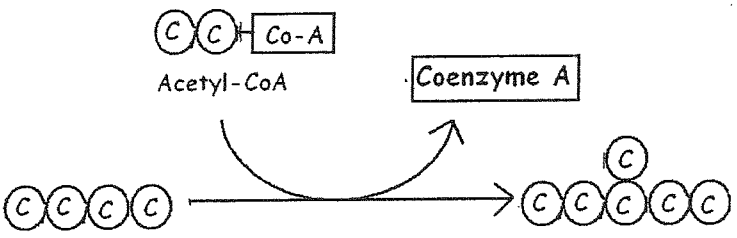
Name the ? molecule that joins in this reaction to make Acetyl-CoA.

A. ATP
B. $NADP^+$
C. Coenzyme A
D. citric acid

If oxygen is present, what will happen to the NADH produced in this reaction?

A. Its electrons will enter the Electron transport chain
B. It will donate its H^+ ions to make glucose
C. It will join with ATP to make citric acid
D. It will join with oxygen to make CO_2

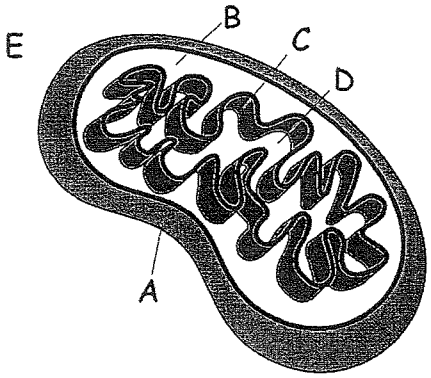




Name the 6 carbon molecule that forms when Acetyl-CoA joins its 2 carbons to a 4 carbon molecule during the Krebs cycle.

A. ATP
B. pyruvic acid
C. glucose
D. citric acid

MATCH THE LETTER IN THE DIAGRAM WITH THE LABEL:
(You can use them MORE THAN ONCE or NOT AT ALL)



_____ Place where glycolysis happens

_____ Place where enzymes for the Electron Transport Chain are located

_____ Place that fills with H^+ ions as electrons move down the Electron transport chain

_____ Place where ADP and P join to make ATP

_____ Place where oxygen acts as the final electron acceptor to make water

* * * * * * * * * * * * * *

CELLULAR RESPIRATION VOCABULARY REVIEW

1. __ __ __ __ __ __ __ __ __ __ __ __ is a 6 carbon molecule that is produced first when acetyl-CoA joins with a 4 carbon molecule to enter the Krebs cycle.

2. __ __ __ __ __ __ __ __ __ __ __ is the process of splitting a glucose molecule into 2 pyruvic acid molecules.

3. The molecule used by cells to store and transfer energy is __ __ __.

4. Glycolysis happens outside the mitochondria in the __ __ __ __ __ __ __ __ __ of the cell.

5. __ happens when oxygen is present and includes glycolysis, Krebs cycle, and Electron transport.

6. This describes a process that requires oxygen = __ __ __ __ __ __ __

7. This high energy electron carrier produces fewer ATP's than NADH as its electrons pass through the Electron Transport Chain because it enters farther down the chain
=__ __ __ __ __

10. This atmospheric gas is required for aerobic respiration = __ __ __ __ __ __.

11. This describes a process that does NOT require oxygen; it means "without air"
= __ __ __ __ __ __ __ __ __

12. Type of fermentation used by human muscles in low oxygen conditions and microorganisms to make yogurt, cheese, pickles, sauerkraut and kimchi. = __ __ __ __ __ __ __ __ __ __

13. As electrons pass down the electron transport chain, H^+ ions build up in the
__ __ __ __ __ __ __ __ __ __ __ __ __ space.

14. The __ __ __ __ __ cycle breaks down pyruvic acid into carbon dioxide and produces NADH, $FADH_2$, and ATP.

15. The NADH and FADH2 produced during the Krebs cycle pass their electrons down the
__ chain to produce ATP.

16. The passage of H^+ ions through __ __ __ __ __ __ __ __ __ __ __ causes it to spin and produce ATP.

17. This 3 carbon molecule is produced during glycolysis when glucose splits in half
= __ __ __ __ __ __ __ __ __ __ __ __

18. Cell organelle which acts as the cell's power plant to burn glucose and store energy as ATP
= __ __ __ __ __ __ __ __ __ __ __ __

19. If oxygen is NOT present, glycolysis is followed by __ __ __ __ __ __ __ __ __ __ __ __ __.

20. Type of fermentation used to make bread dough rise and produce beer and wine.
= __ __ __ __ __ __ __ __ __

21. This molecule has the formula $C_6H_{12}O_6$ and is split in half during glycolysis = __ __ __ __ __ __ __

22. The carbon atoms in pyruvic acid end up as __ __ __ in the atmosphere following the Krebs cycle.

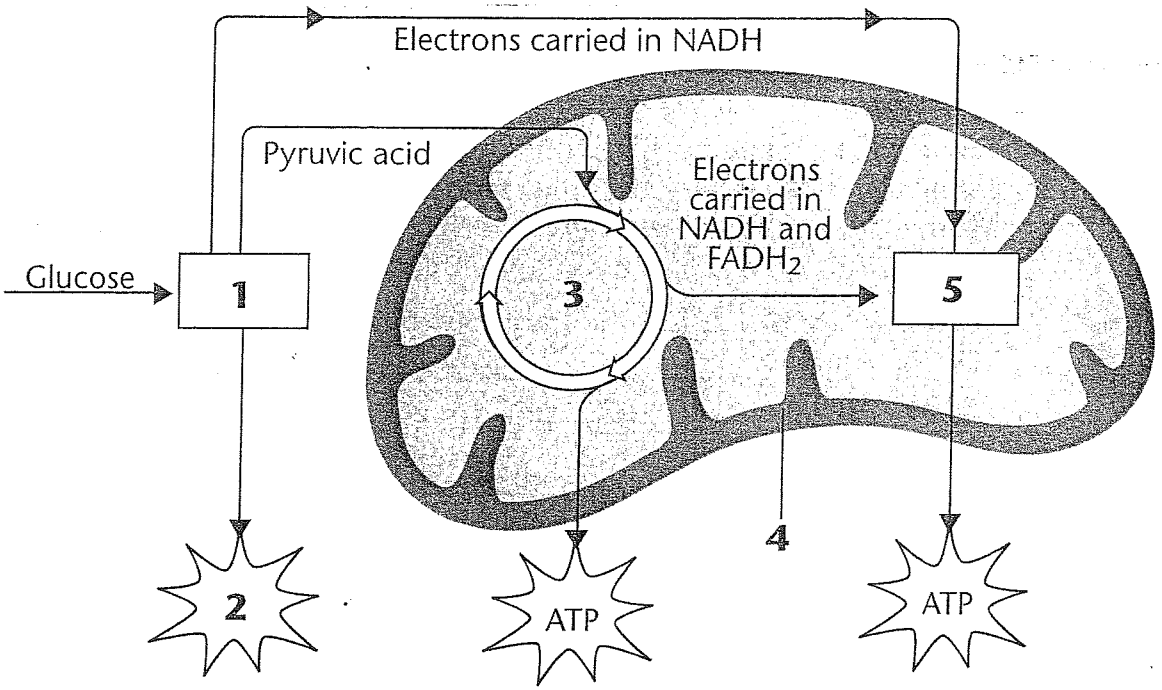
23. The folded inner membranes inside a mitochondrion are called __ __ __ __ __ __ __.

24. This molecule reacts with pyruvic acid to release CO_2, produce NADH, and acetyl-CoA.
= __ __ __ __ __ __ __ __ __

25. __ __ __ __ __ __ __ __ __ forms when Coenzyme A attaches to two carbons from pyruvic acid.

Cellular Respiration Overview

Cellular respiration is the process that releases energy from food in the presence of oxygen.



Use the words below to label the diagram of cellular respiration on the lines provided.

ATP	glycolysis	mitochondrion
electron transport chain	Krebs cycle	

1. _____
2. _____
3. _____
4. _____
5. _____

Use the diagram to answer the questions.

1. Where does glycolysis take place?

_____

2. Where do the Kreb cycle and electron transport chain take place?

_____

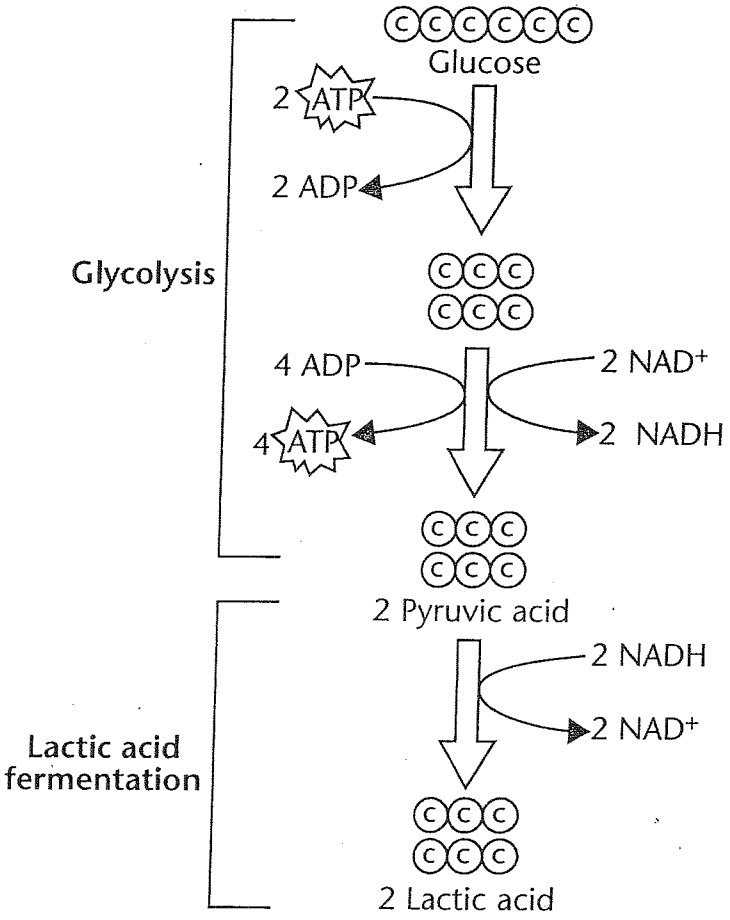
Name_____ Class_____ Date _____

Glycolysis and Fermentation

Glycolysis uses ATP to break a molecule of glucose in half, producing pyruvic acid. When oxygen is not present, glycolysis is followed by fermentation. Fermentation enables cells to produce energy in the absence of oxygen.

Follow the prompts to identify important parts of glycolysis and fermentation.

- Color the carbon atoms blue.
- Circle the place where ATP is formed.
- Mark an X on the place where ATP is used.



Answer the questions.

1. How many carbon atoms are in one molecule of glucose?

_____

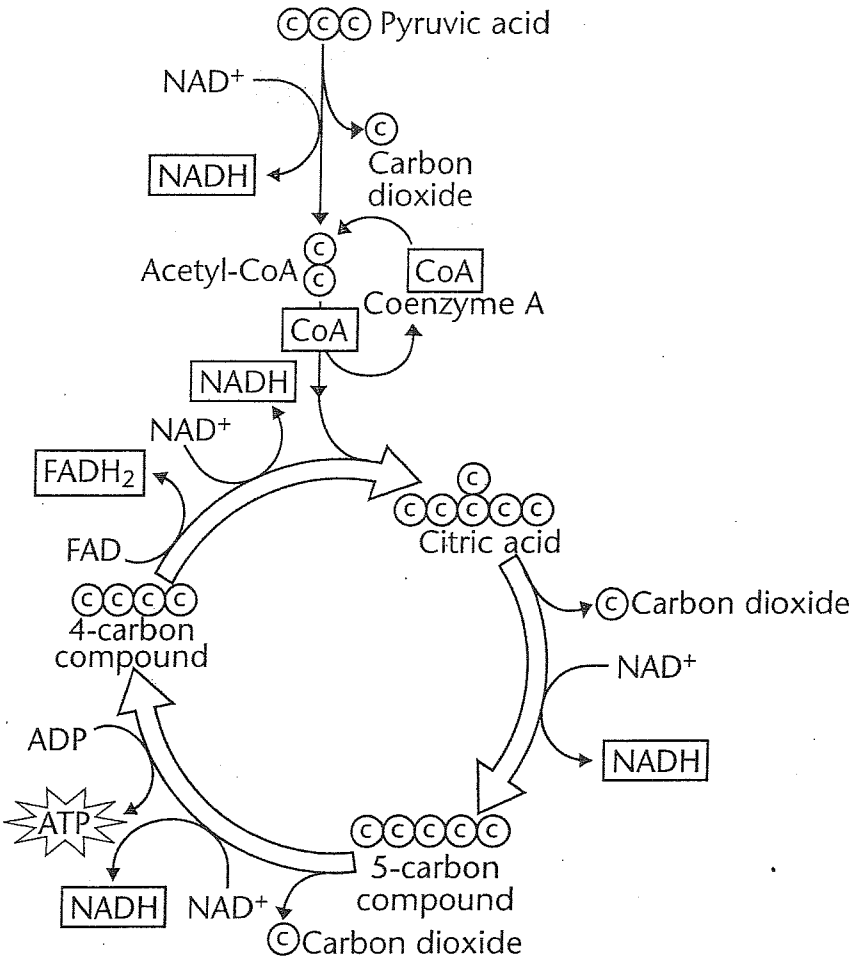
2. What is the product of glycolysis? _____

The Krebs Cycle

If oxygen is present, the pyruvic acid formed during glycolysis moves into the Krebs cycle. The Krebs cycle converts pyruvic acid into carbon dioxide. As carbon dioxide is formed, high energy electrons are accepted by NAD^+ and FAD. This results in the formation of NADH and $FADH_2$. NADH and $FADH_2$ will be used later to produce ATP.

Follow the prompts to identify important parts of the Krebs cycle.

- Color the carbon atoms blue.
- Circle the electron carriers in green.
- Circle ATP in orange.



Use the diagram to answer the question. Circle the correct answer.

1. Which of the following is formed during the Krebs cycle?

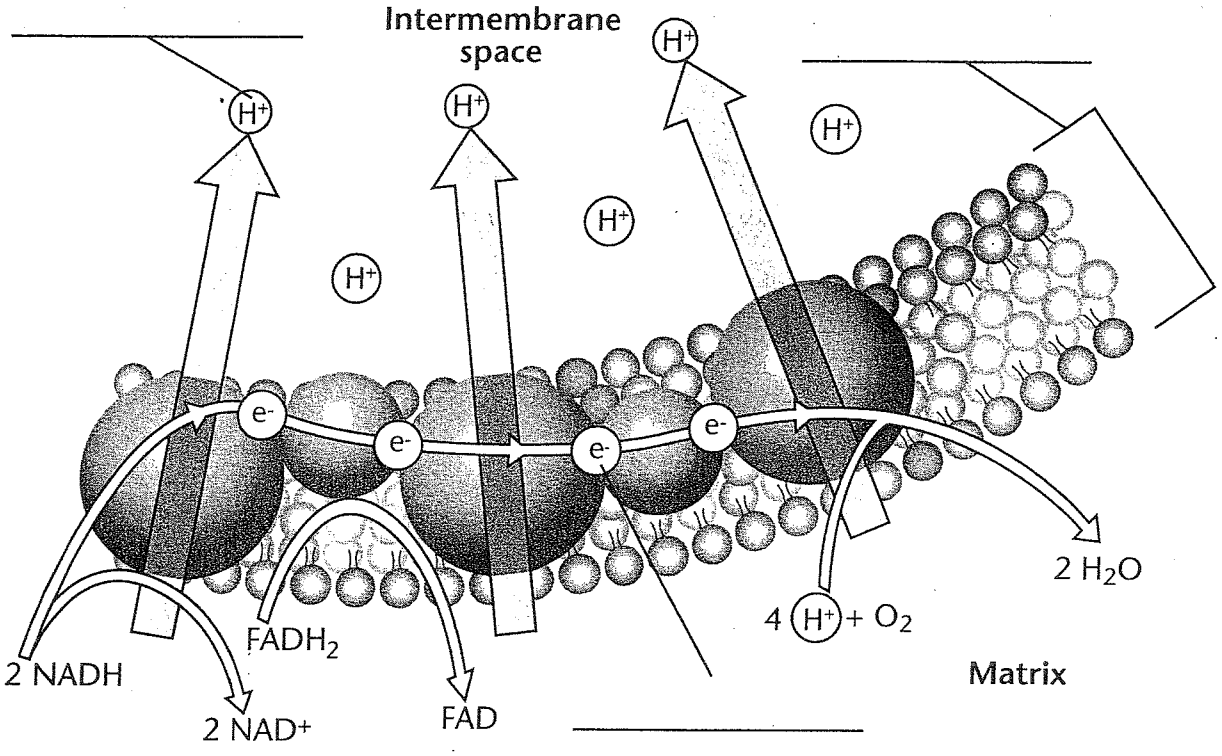
$FADH_2$ pyruvic acid

Name_____ Class_____ Date _____

Electron Transport Chain

The electron transport chain uses the high-energy electrons produced by the Krebs cycle to move hydrogen ions from one side of the inner membrane to the other.

Label the diagram with the following terms: electron, hydrogen ion, *and* inner membrane.



Use the diagram to answer the questions.

1. Where in the mitochondrion does the electron transport chain take place?

_____

_____

2. What happens to the high-energy electrons from the Krebs cycle?

_____

_____

Name _____ Date _____ Class _____

Study Guide

CHAPTER 8

Section 3: Cellular Respiration

In your textbook, read about cellular respiration and glycolysis.

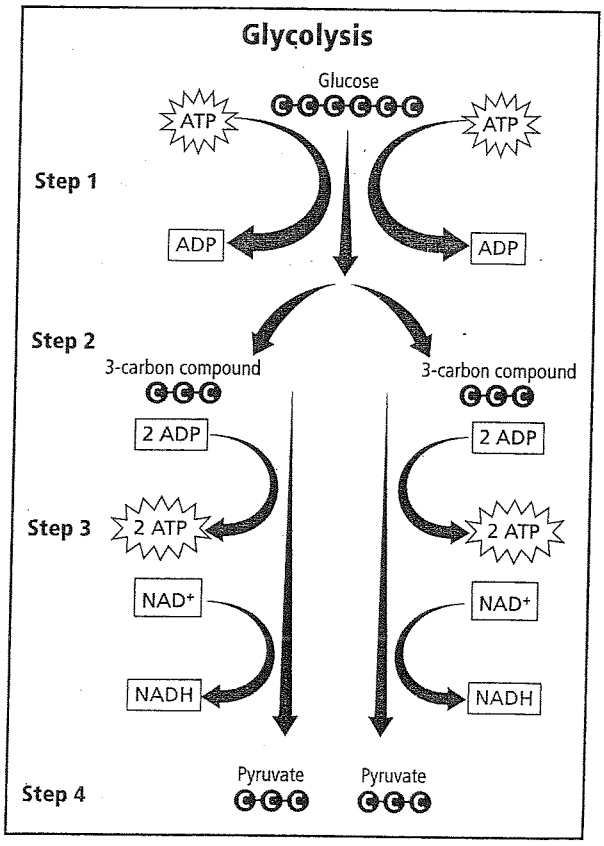
Use each of the terms below only once to complete the passage.

aerobic	**anaerobic**	**ATP**	**cellular respiration**	**cytoplasm**	**energy**
glucose	**glycolysis**	**mitochondria**	**NADH**	**oxygen**	

Organisms obtain energy in a process called (1) _____. This process harvests electrons from carbon compounds, such as (2) _____, and uses that energy to make (3) _____. ATP is used to provide (4) _____ for cells to do work. In (5) _____, glucose is broken down into pyruvate. Glycolysis is a(n) (6) _____ process because it does not require oxygen. Glycolysis takes place in the (7) _____. Two molecules of ATP and two molecules of (8) _____ are formed for every glucose molecule that is broken down. (9) _____ respiration takes place in the (10) _____. It is aerobic because the process requires (11) _____.

Refer to the diagram of glycolysis. Label the steps in the description to match the diagram.

12. Step _____. Each three-carbon compound is converted into a three-carbon pyruvate.
13. Step _____. A six-carbon compound is broken down into two three-carbon compounds.
14. Step _____. Phosphate groups from two ATP molecules are transferred to a glucose molecule.
15. Step _____. Two NADH molecules and four ATP molecules are produced.



Respond to each question.

16. **Interpret** How many total ATP molecules are produced from the glycolysis of one six-carbon glucose?

_____

17. **Explain** Why is there a net gain of only two ATP molecules in the glycolysis of one six-carbon glucose?

_____

_____

_____

Name Date Class

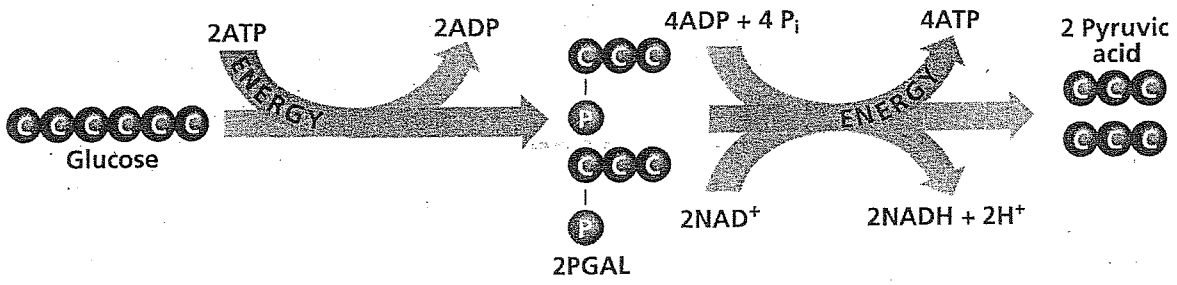
Master 13

Cellular Respiration

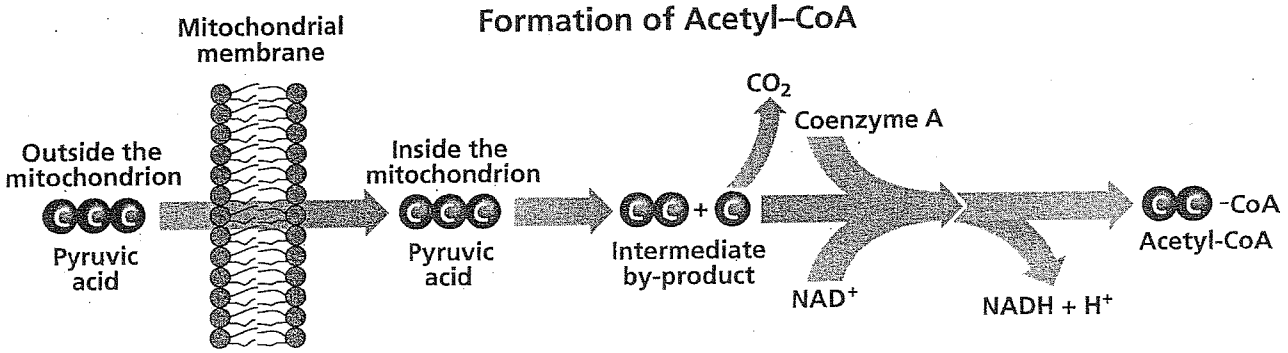
Basic Concepts

Use with Chapter 9, Section 9.3

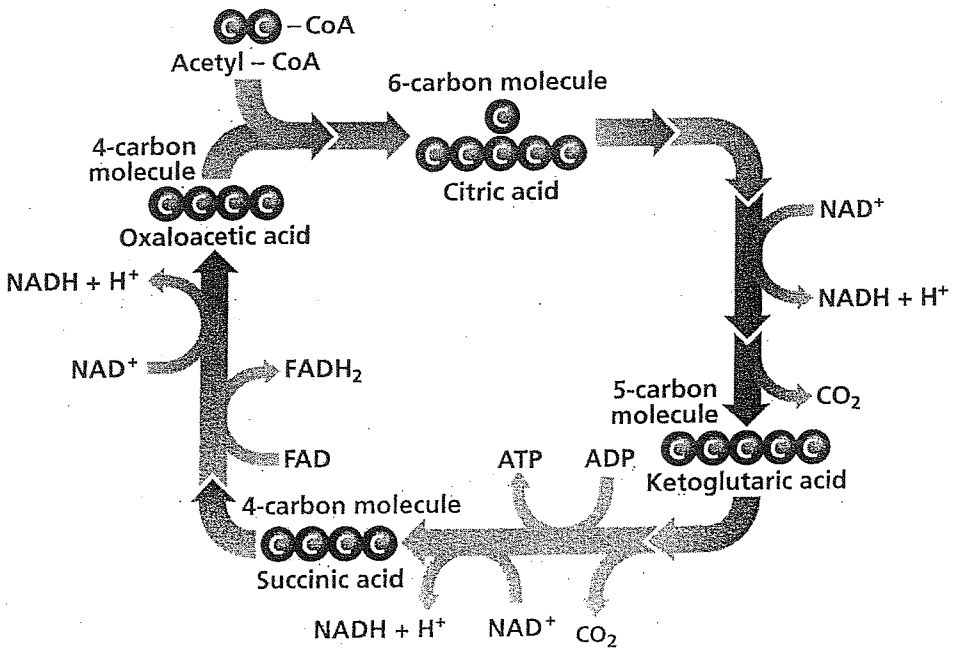
Glycosis



Formation of Acetyl–CoA



Citric Acid Cycle



Name Date Class

Worksheet 13

Cellular Respiration

Basic Concepts

Use with Chapter 9, Section 9.3

1. What is the source of energy for the first step of glycolysis?

2. In glycolysis, what carbon compound is broken down? What carbon compound is the end product?

3. In glycolysis, what is the ratio of glucose molecules to the net number of ATP molecules at the end of the process? Explain your response.

4. Which of the processes shown in the transparency is anaerobic? Which of the processes is aerobic?

5. Where does the breakdown of pyruvic acid occur?

6. What is the end product of the breakdown of pyruvic acid?

7. How is the breakdown of pyruvic acid related to the citric acid cycle?

8. As citric acid breaks down, what substance is released?

9. What happens to the NADH and $FADH_2$ molecules produced during cellular respiration?

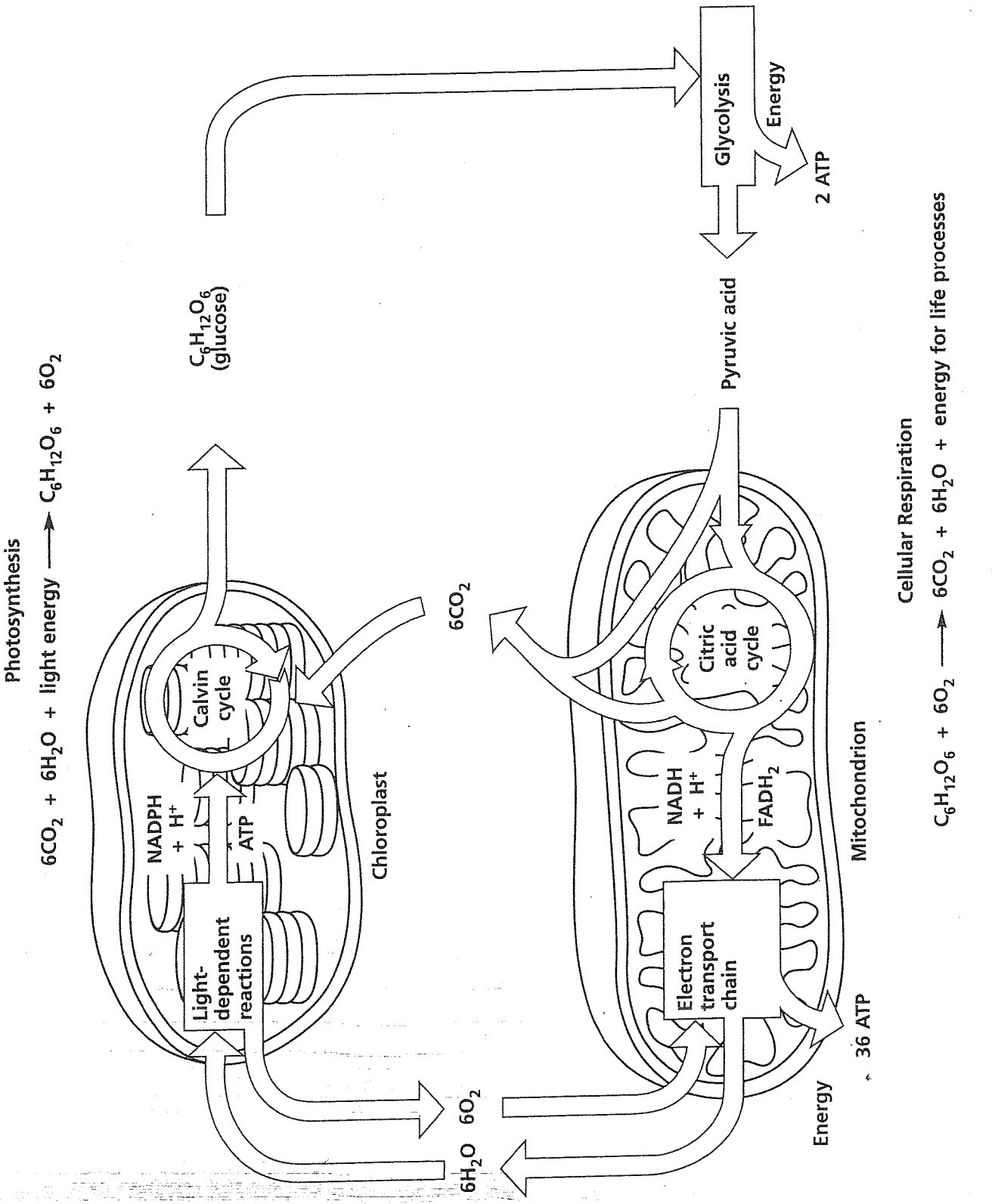
Name Date Class

Master 15

Photosynthesis and Cellular Respiration

Reteaching Skills

Use with Chapter 9, Section 9.3



Name Date Class

Worksheet 15

Photosynthesis and Cellular Respiration

Reteaching Skills

Use with Chapter 9, Section 9.3

1. In what organelles do photosynthesis and cellular respiration take place?

2. Trace the path of oxygen, water, carbon dioxide, and glucose in the transparency.

3. Which organelle requires sunlight to function?

4. In what ways are photosynthesis and cellular respiration alike?

5. In what ways are photosynthesis and cellular respiration different?

6. What is the source of energy used by mitochondria?

7. Which two cycles are linked by the production and utilization of carbon dioxide? Where do these cycles occur?

8. Explain how the equations for photosynthesis and cellular respiration compare.

Name : _____ Period : _____

Two Factors Affecting Photosynthesis

The rate at which photosynthesis occurs is not always the same. The amount of light, the level of temperature, the supply of carbon dioxide, the supply of water, and the availability of minerals are important factors that affect the rate of photosynthesis in land plants. The rate also varies by the plant's species, health, and maturity. The tables below give information which shows the effects of light intensity and temperature on the rate of photosynthesis in land plants (Light intensity is measured in lumens, the SI unit of light flow; the rate of photosynthesis is measured by the percent of active cells). These factors affect many enzymes that control photosynthetic reactions.

Make one graph for each table below and answer the following questions.

Light Intensity (Lumens)	Rate of Photosynthesis
0	10%
1000	32%
2000	44%
3000	55%
4000	60%
5000	65%
6000	68%
7000	71%
8000	73%
9000	74%
10,000	75%
11,000	76%
12,000	76%
13,000	75%
14,000	74%
15,000	73%

Temperature (°C)	Rate of Photosynthesis
0	15%
5	15%
7.5	17%
10	19%
12.5	22%
15	25%
17.5	28%
20	35%
22.5	43%
25	53%
27.5	70%
30	80%
33	90%
35	83%
37.5	50%
39	5%

1. What environmental factors does the rate of photosynthesis depend on? _____

_____

_____

2. What biological factors does the rate of photosynthesis depend on? _____

_____

_____

3. What does the first graph show about the effect of light intensity on the rate of photosynthesis? _____

_____

_____

4. What happens when light intensity reaches over 12, 000 lumens? _____

_____

_____

5. What does the second graph show about the effect of temperature on the rate of photosynthesis? _____

_____

_____

6. What happens when the temperature rises past 33 °C (117 °F)? _____

_____

_____

7. What light intensity and temperature levels allow the highest photosynthesis rate? _____

_____