

## Biology Unit 4: Metabolism – Photosynthesis & Cellular Respiration

### Essential Skills

- 5-1. Be able to name the reactants and products of **Aerobic Cellular Respiration**.  
 5-2. Be able to name the reactants and products of **Photosynthesis**.  
 5-3. Explain **how** the reactants and products of photosynthesis and respiration **relate** to each other.

### Study Guide

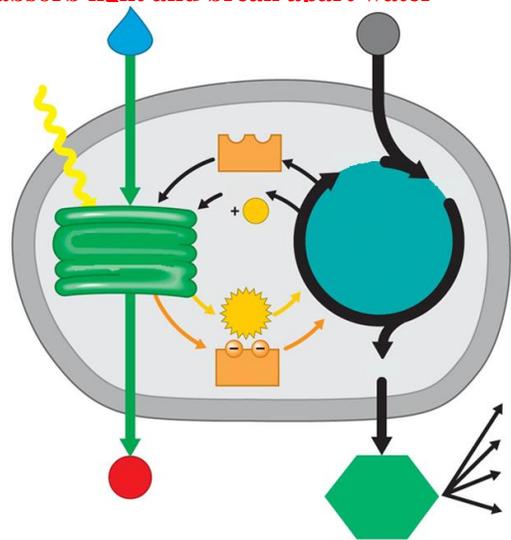
#### Photosynthesis

1. Write the overall chemical equation for **photosynthesis** (label the reactants & the products).



2. What is the role of the following items in photosynthesis:  
 a. **Chloroplast: Site of Photosynthesis**  
 b. **Thylakoid membrane: Site of the light reaction**  
 c. **Pigments (chlorophyll a, chlorophyll b, carotenoids: absorb light and break apart water)**
3. Label the diagram on the right with the following terms:

- a. Calvin Cycle
- b. ATP
- c. NADPH
- d. Light
- e. Light Reaction
- f. O<sub>2</sub>
- g. H<sub>2</sub>O
- h. CO<sub>2</sub>
- i. PGAL (Sugar)



4. Complete the following chart that summarizes the 2 steps of **photosynthesis**:

Reaction	Location	Reactants	Products
Light Reaction	Thylakoid	Sunlight + water	ATP, NADPH, Oxygen
Calvin Cycle (Dark Rxn)	Stroma	ATP + NADPH + Carbon Dioxide	PGAL

5. In **Photosynthesis**, what is water used for? What is CO<sub>2</sub> used for?  
**Water is split apart and the Hydrogen is used to help make glucose. The Carbon dioxide is used to bond with the Hydrogen to make water.**
6. What is PGAL? How does this relate to Glucose? **PGAL is a carbohydrate= 1/2 of a glucose**
7. Why is the dark reaction described as a “Cycle”? How many CO<sub>2</sub>’s are required to make 1 PGAL? How many CO<sub>2</sub>’s are required for one glucose molecule? **It is a cycle because it needs to pick up 3 CO<sub>2</sub>’s and 6 Hydrogen for each PGAL. Therefore it needs to pick up 6 CO<sub>2</sub>’s for one glucose**

#### Cellular Respiration

8. Write the overall equation for **Cellular Respiration** (label the **reactants** and the **products**).



9. What is the purpose for cellular respiration in cells? What types of organism perform cellular respiration?

**MAKES ATP!!!!** All living things need ATP for cell energy.

10. What does **ATP** stand for? Why is it so important for all living things?

**Adenosine Triphosphate.** This is the energy molecule in all living things

11. Explain the differences between **aerobic** and **anaerobic respiration** by filling out the chart below:

	Location of Process in Cell	Oxygen Used? (yes or no)	Amount of ATP produced?	Organisms that do this process
<b>Anaerobic Respiration</b>	<b>Cytosol</b>	<b>NO</b>	<b>2</b>	<b>Some single-celled organisms</b>
<b>Aerobic Respiration</b>	<b>Mitochondria</b>	<b>YES</b>	<b>38</b>	<b>Most single-celled and ALL multi-celled</b>

12. What happens after **Glycolysis** if oxygen is not present? Does this help make more ATP?

**Pyruvic Acid** is the molecule that is left after **GLYCOLYSIS**. If no oxygen, then **FERMENTATION** occurs. Fermentation does not produce more ATP

13. Why does **Lactic Acid Fermentation** occur in your **muscle cells**? What type of **fermentation** occurs when making bread? Why? **When there is no oxygen our muscles do Lactic Acid Fermentation** because the Pyruvic Acid could damage our cells. **Alcohol Fermentation** is used in making bread, because the Carbon Dioxide makes our bread “airy”.

14. Why are anaerobic organisms usually always small and single-celled? Explain.

Since they do not need a lot of energy, the 2 ATP produced per glucose is enough for them.

15. Do plants perform cellular respiration? Why or why not?

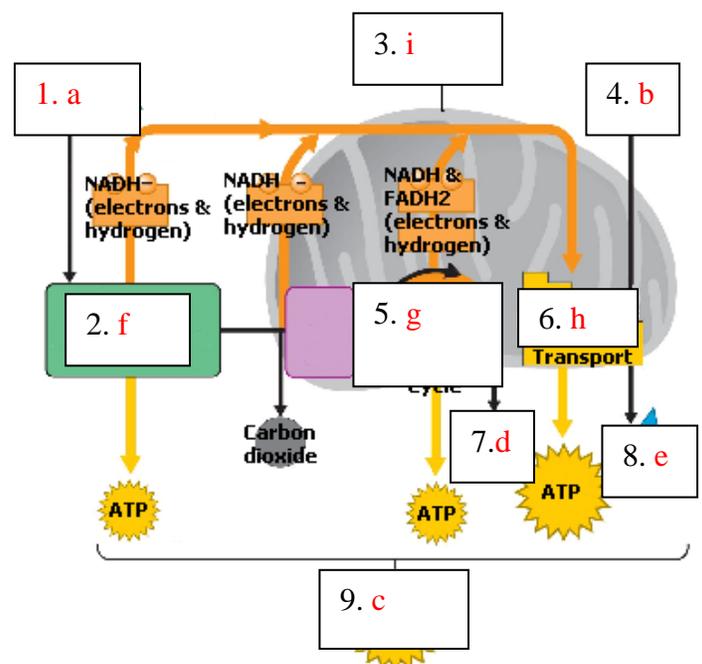
**YES.** Plants create glucose (stored energy) in photosynthesis, but must release this energy (into ATP) during respiration. Plants have chloroplasts and mitochondria.

16. Using your knowledge of cellular respiration, why does your heart rate and breathing rate increase during physical activity? Why do your muscles sometime burn when working out?

**More oxygen and glucose** are needed in your muscles during exercise, therefore your heart rate and breathing rate increase to help deliver these molecules faster. If low in oxygen, then lactic acid fermentation causes “burn”.

17. Label the diagram on the right with the letters of the following terms:

- a. Glucose
- b. Oxygen
- c. 38 ATP
- d. Carbon dioxide
- e. Water
- f. Glycolysis
- g. Krebs Cycle/Citric acid cycle
- h. Electron transport
- i. Mitochondria



18. Complete the following chart that summarizes the 3 steps of **aerobic respiration**:

Name of Stage	Location in cell	Oxygen Required?	# of ATP Produced
Glycolysis	<b>Cytosol</b>	<b>NO</b>	<b>2</b>
Krebs Cycle (Citric Acid Cycle)	<b>Mitochondrial Matrix</b>	<b>YES</b>	<b>2</b>
Electron Transport	<b>Inner Mitochondria Membrane/cristae</b>	<b>YES</b>	<b>34</b>

19. In **Respiration**, what is O<sub>2</sub> used for? How is water produced? Why is CO<sub>2</sub> released?

Oxygen “pulls” the electrons through electron transport and collects them. When oxygen collects electrons it also collects hydrogen, forming WATER. Carbon dioxide is released as electrons are “stripped” from glucose.

20. Why are plants considered “**Producers** or **Autotrophs**” and animals are “**Consumers** or **Heterotrophs**”?

Plants can make their own sugar, therefore they are producers. Animals must eat other organisms to get their sugar, therefore they are consumers.