ATP and Photosynthesis Summary & Study Guide

Directions: Answer the following questions the BEST you can without any help. After you have finished, notice what you don’t know and make note of this by highlighting the question. Now use notes, etc to finish.

**ATP**

Adenosine triphosphate is the energy molecule used by all cells to do work and function. Organisms break down carbon-based molecules (food you eat) to produce ATP. It is a nucleotide (adenine base, sugar, phosphate), but with 3 phosphate groups. ATP stores and transports chemical energy within cells. The last two phosphate groups (PO₄) are joined by a HIGH ENERGY bond. When this bond is broken, energy is released for cells to use; ADP is left over. Enzymes help to break and reform these high energy bonds.

1. What is the energy molecule of the cell called? ATP
2. What does ATP stand for? Adenosine triphosphate
3. What three main things make up an ATP molecule?
   a. adenine
   b. sugar
   c. 3 phosphate groups
4. Where is there a high energy bond found in ATP? Between the last two phosphates
5. What helps to break the bonds in ATP and reform bonds between ADP + P? Enzymes
6. When ATP loses a phosphate group, energy is released for cells and a molecule of ADP remains.
7. Fill in the diagram below

8. The prefix tri- means “three” and the prefix di- means “two”. How do these prefixes tell you the difference between ATP & ADP? ATP has three phosphate groups, ADP only has two. ATP is a higher energy molecule than ADP.
9. Fill in the table below.

<table>
<thead>
<tr>
<th>Type of Molecule</th>
<th>Role in ATP Production</th>
</tr>
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<tbody>
<tr>
<td>Carbohydrates</td>
<td>Most common molecule broken by cells to make ATP. 36 ATP made from 1 glucose</td>
</tr>
<tr>
<td>Lipids</td>
<td>146 ATP made from 1 triglyceride. Stores most energy in people. Broken down after carbs have been used.</td>
</tr>
<tr>
<td>Proteins</td>
<td>Rarely used by cells to make ATP. The amino acids/protein are used for other functions in the cell</td>
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10. What product of photosynthesis is used in cellular respiration? Glucose

11. The process that breaks down carbohydrates to produce ATP is called Cellular Respiration. Because some cells require more energy than others, some cells will contain a far greater supply of mitochondria. This way, the cell can produce a greater amount of ATP to suit the cell’s needs. How would the number of mitochondria in an insect’s wing compare to the amount found in the rest of an insect’s body? Explain your answer.

   The cells in the wings would have more mitochondria because they require more energy (because they used for movement) than the cells in the rest of the body.

Photosynthesis

Plant cells and some Algae contain an organelle called the chloroplast. The chloroplast allows plants to harvest energy from sunlight to carry on a process known as Photosynthesis. Specialized pigments in the chloroplast (including the common green pigment chlorophyll) absorb sunlight and use this energy to combine carbon dioxide and water and make GLUCOSE and OXYGEN. The complete the chemical reaction for Photosynthesis is:

\[
6 \text{ CO}_2 + 6 \text{ H}_2\text{O} + \text{energy (from sunlight)} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2
\]

In this way, plant cells manufacture glucose and other carbohydrates that they can store for later use. Photosynthetic cells found mainly in the leaves may have thousands of chloroplasts.

1. Why are some organisms called producers? They are called producers because they produce their own source of food. Another name for them is autotrophs.
2. What type of cells contains chloroplasts? Plant cells. Some protists (algae) and bacteria do too.
3. What is the energy autotrophs use to make their own food? Solar energy (the sun)
4. The food making process is called photosynthesis.
5. What are the raw materials for photosynthesis? 6 CO₂ & 6 H₂O (carbon dioxide and water)
6. What simple sugar is produced? Glucose
7. What gas is USED? CO₂ RELEASED? O₂
8. Where are most photosynthetic cells in plants found? The leaves (the greenest parts)

9. About how many chloroplasts can be found in photosynthetic cells? Thousands

Chloroplasts are double membrane organelles with a smooth outer membrane and an inner membrane folded into disc-shaped sacs called thylakoids. Color and label the outer membrane light green. Thylakoids, contain chlorophyll which is a green pigment that absorbs sunlight energy. Other accessory pigments (red, orange, yellow, brown) are in stacks called granum (grana, plural). Color and label the grana (STACK) dark green in Figure 1. Grana are connected to each other by membranes, and they are surrounded by a gel-like material called stroma. Color and label the stroma light blue in Figure 1. FIGURE 1-CHLOROPLAST

10. How many membranes surround a chloroplast? 2

11. The INDIVIDUAL SACS formed by the inner membrane are called thylakoids and are arranged in stacks like pancakes.

12. What pigment is found inside a thylakoid? chlorophyll
   a. What color will it be? green

13. STACKS of thylakoids are called grana (plural) or GRANUM (singular).

Photosynthesis is broken up into two sets of reactions: the Light Dependent (light) Reactions and the Light Independent (dark) Reactions. The light reactions occur across the thylakoid membrane, while the dark reactions occur in the stroma. If necessary, use your notes to answer the last few questions.

14. What are the reactants of the light reactions? H₂O (& sunlight)
    The products? O₂ (ATP & H₂ also)

15. What are the reactants of the dark reactions? CO₂ (ATP & H are also used)
    The products? Glucose

16. What product from the light reactions is necessary for the dark reactions to function? Energy (ATP & H)