Name: \_\_\_\_\_Ms. F’s Answer Key\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_\_

**Cell Energy**

**Biology GT Test—70 Points**

1. Write the balanced chemical equation that summarizes photosynthesis. (2 pts)  
   6CO2 + 6H2O + light 🡪 C6H12O6 + 6O2
2. Write the balanced chemical equation that summarizes cellular respiration. (2 pts)  
   C6H12O6 + 6O2 🡪 6CO2 + 6H2O + ATP
3. What is the relationship between the equations you wrote for #1 and #2? (2 pts)  
   \_\_**The inputs for photosynthesis are the outputs of cellular respiration and the reactants for cellular respiration are the products of photosynthesis.**
4. Draw a diagram or write an equation that demonstrates how energy is released from a molecule of ATP. (Note: You do not need to include detailed molecular structures.) (3 pts)  
     
   ATP ADP + P + energy

hydrolysis

1. True or **false**: Chlorophyll absorbs green light.  
   Explain: (3 pts) **\_\_\_Chlorophyll reflects green light. This is why plants are green—the reflected green wavelengths are what we see. If chlorophyll absorbed green light, then plants would not be green. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
2. True or **false**: The Calvin Cycle does not require light.  
   Explain: (3 pts) \_\_**The Calvin Cycle does not directly require light energy but it depends on the products of the light reactions.**
3. During the \_\_\_**light reactions [or hydrolysis]**\_\_\_\_ of photosynthesis, \_\_**H2O**\_\_\_\_\_\_\_\_\_\_\_ gets split into protons, \_\_**electrons**\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_**O2**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (2 pts)
4. Put a circle around the products of the light reactions of photosynthesis in the following list: (1.5 pts)

FADH2, ADP, **NADPH**, CO2, **O2**, glucose, lactate, pyruvate, **ATP**, H2O, NAD+

1. What is this a diagram of? \_\_\_\_\_**chloroplast**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1 pt)

**Lumen**

**Thylakoid**

**Stroma**

1. Fill in the blank boxes of the diagram in question #9. (1.5 pts)
2. Plants have adapted to close their stomates when their cells have a low concentration of water. Explain why this is an advantageous adaptation. (3 pts)  
   \_\_**Water vapor evaporates from stomates during transpiration. If a plant does not have much water, then closing the stomates is advantageous because it prevents further water loss.** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. During the light reactions, the proton concentration is higher in the \_\_\_\_**lumen**\_\_\_\_\_\_\_\_\_\_\_\_\_ than it is in the \_\_**stroma**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (1 pt)
4. How does the enzyme ATP synthetase work? (2 pts)  
   \_\_\_**ATP synthetase uses the movement of protons down their concentration gradient to power the phosphorylation of ADP. This generates ATP.**
5. Give one example of a reduced electron carrier and one example of an oxidized electron carrier. Clearly indicate which one is reduced and which one is oxidized. (2 pts)  
   **Reduced electron carriers: NADH, NADPH, FADH2Oxidized electron carriers:** **NAD+, NADP+, FAD**
6. Fill in the boxes of the diagram below. (3 pts)

**NADP+**

**NADPH**

**ADP**

**ATP**

**C6H12O6**

**CO2**

1. Where in a plant cell is glucose produced? \_\_\_**chloroplast [or stroma]**\_\_\_\_\_\_\_ (1 pt)
2. In plants, the \_\_\_**xylem**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ transports water and the \_\_**phloem**\_\_\_\_\_\_\_\_\_\_\_\_ transports sugar. (1 pt)
3. Fill in the table below for cellular respiration (12 pts):

|  |  |  |  |
| --- | --- | --- | --- |
| **Process** | **Location** | **Inputs** | **Outputs** |
| Glycolysis | **cytoplasm** | **Glucose, ATP, NAD+** | **ATP, pyruvate, NADH** |
| Krebs Cycle | **mitochondria** | **pyruvate, FAD, NAD+** | **CO2, FADH2, NADH, ATP** |
| Electron Transport Chain | **Inner mitochondrial membrane** | **FADH2, NADH, O2** | **ATP, H2O, FAD, NAD+** |
| Fermentation | **Cytoplasm** | **Pyruvate, NADH** | **Lactic acid, NAD+** |

1. How is fermentation able to keep glycolysis going in the absence of oxygen? (2 pts)  
   \_\_\_**Fermentation regenerates the NAD+ that is necessary for glycolysis.**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is the fate of the carbon atoms in pyruvate when there is oxygen in the cell? (2 pts)  
   \_**When there is oxygen, the carbon in pyruvate gets converted in carbon dioxide and released as waste.** \_\_
3. **True** or false: The Krebs Cycle is aerobic.   
   Explain: (3 pts) \_**The Krebs cycle is aerobic because if there is no oxygen in the cell, then the Krebs cycle will not function.**
4. What is the advantage for cells to use aerobic respiration instead of fermentation? (1 pt)  
   A) Aerobic respiration consumes oxygen  
   B) Aerobic respiration is done in the mitochondria  
   C) Aerobic respiration produces water  
   **D) Aerobic respiration produces more ATP**
5. What is the difference (besides quantity) between the ATP produced during glycolysis and the ATP produced by the electron transport chain? (2 pts)  
   \_\_**The ATP during glycolysis is produced by substrate-level phosphorylation and the ATP produced by the electron transport chain is produced by oxidative phosphorylation.**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Compare and contrast the electron transport chain of the light reaction with the electron transport chain of aerobic respiration. Provide one similarity (besides that they both move electrons!) and one difference (besides location). (4 pts)  
   \_**The light reactions reduce electron carriers while the electron transport chain oxidizes electron carriers. In addition, the light reactions produce oxygen while the electron transport chain produces water. Both of them produce ATP, and both are found in membranes.**
7. Why do your muscles ache during intense exercise? (4 pts)  
   \_**During intense exercise, muscles do not get all of the oxygen they need. As a a result, fermentation increases in the cells. Fermentation produces lactic acid, and lactic acid causes muscle aches.**
8. Explain how cellular respiration links the respiratory system, the digestive system, and the circulatory system. (6 pts)

\_**The respiratory system brings in the oxygen needed for aerobic respiration and releases the carbon dioxide produced by the Krebs Cycle. The circulatory system transports oxygen from the respiratory system to the cells and carries the carbon dioxide away from cells. The digestive system breaks down food into glucose and the circulatory system transports the glucose to the cells.**