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

Energy & Enzymes Quiz—34 points  
Note: By request, lines have been provided for short answer questions in order to guide you. Do not feel obligated to use all of the provided space.

1. Using the words **autotroph, heterotroph, sun, decomposer,** and **inorganic**, explain how energy cycles through ecosystems. (4 pts)  
   \_\_**Autotrophs use energy from inorganic sources, like the sun, to produce food. Heterotrophs eat other organisms to get energy, and decomposers break down dead organisms for energy.**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Why is the term “producer” somewhat misleading? (2 pts)  
   \_**Producers produce organic molecules but do not actually produce energy—they just convert energy from inorganic sources into chemical energy.**
3. Energy that is stored in molecules is known as \_\_**chemical**\_\_\_\_\_\_\_\_\_\_\_ energy, while energy that is available to be used for work is known as \_\_**free**\_\_\_\_\_\_\_\_ energy. (2 pts)
4. Fill in the following chart (6 pts):

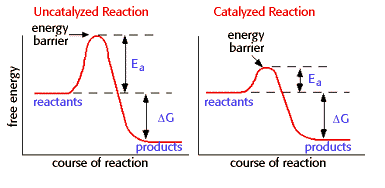
|  |  |  |
| --- | --- | --- |
| **Process** | **Does entropy increase or decrease?** | **Does this process require energy or does it release energy?** |
| Breaking peptide bonds to decompose proteins into individual amino acids | **Increase** | **Releases energy** |
| Building glycogen by forming bonds between individual glucose molecules | **Decrease** | **Requires energy** |
| Linking fatty acids to glycerol to form triglycerides | **Decrease** | **Requires energy** |

1. Organisms have highly ordered internal environments, but the Second Law of Thermodynamics tells us that systems tend towards disorder. What’s going on? (2 pts)  
   \_\_\_\_\_**Entropy can be decreased if energy is invested. Organisms use energy to maintain ordered environments. Since energy is being invested, the Second Law of Thermodynamics is not violated.**
2. We investigated the energy content of different foods by setting them on fire. How were we able to make claims about energy content by setting food on fire? (3 pts)  
   \_\_**A calorie is the amount of energy it takes to increase the temperature of 1 mL of water 1 degree Celsius. By measuring how much the temperature of the water increased, you can calculate how many calories were in the food.**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. How many calories would it take to increase the temperature of 500 mL of water 10 degrees Celsius? (2 pts)You are not required to show your work, but keep in mind that you cannot earn partial credit for a wrong answer if there is no work.

**Increasing the temperature of 500 mL of water 1 degree C would take 500 calories, so increasing the temperature of 500 mL of water 10 degrees C would take 5,000 calories.**

Use this diagram for questions 8-10. Both graphs depict the same chemical reaction:

Activation energy



Change in free energy

1. On each graph, label the **activation energy** and the **change in free energy.** (2 pts)
2. In which of these graphs is there an enzyme catalyzing the reaction and how can you tell? (2 pts)  
   **\_\_\_\_There is an enzyme catalyzing the reaction in the second graph because the activation energy is significantly lower in the second graph than in the first graph.**
3. Do you think the reaction shown in this diagram is a biosynthesis reaction or a decomposition reaction? Support your claim with evidence. (3 pts)  
   **\_\_\_This is a decomposition reaction because the products have less free energy than the reactants. This means that free energy was released during the course of the reaction. If it were a biosynthesis reaction, it would have required an investment in of energy and the products would have more energy than the reactants.**
4. Fill in the blanks. You might use the same word more than once (each blank is 0.5 pt for a total of 6 pts):  
   A \_\_**substrate**\_\_\_\_\_\_\_\_\_ binds to the \_\_\_\_\_\_\_\_**active site**\_\_\_\_\_\_\_\_\_\_ of an \_\_**enzyme**\_\_\_\_\_\_. When the \_\_\_\_**substrate**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ binds, the \_\_**enzyme**\_\_\_\_\_\_ changes shape. The \_\_\_**substrate**\_\_\_\_\_\_\_\_\_ and \_**enzyme**\_\_\_\_\_\_\_ bonded together form the \_\_**enzyme-substrate complex**\_\_\_\_\_\_\_\_. A chemical reaction takes place and the \_**product**\_\_\_\_\_\_\_ is formed. The \_\_**product**\_\_\_\_\_\_\_\_ dissociates from the \_**active site**\_\_\_\_\_\_\_ and the \_\_\_\_\_**enzyme**\_\_\_\_\_\_\_\_\_\_\_ can be re-used.