

Energy Review Questions

1. Explain potential energy.
2. In the food we eat, where is the energy found?
3. What is the difference between Exergonic (exothermic) and (endothermic) reactions?
4. Yesterday I consumed 2,500,000 actual “scientific calories”. Is that reasonable? How many “food” Calories did I actually consume? Explain.
5. Write the chemical equations for both photosynthesis and cellular respiration.
6. In what ways are photosynthesis and cellular respiration complementary or opposite processes?

Enzymes Review Sheet

1. Explain the relationship between an **enzyme** and a **catalyst**. What is the **role of each**?
2. Define **substrate**.
3. Describe **activation energy** and explain how an enzyme operates.
4. Explain how **pH and temperature** affect enzyme action.
5. Explain **how** competitive inhibition affects reaction rates.
6. Explain **how** feedback inhibition affects reaction rates.
7. Explain **how** precursor activation affects reaction rates.

Energy Storage and Transformation Review

1. What does ATP and ADP represent?
2. What is the primary function of ATP in the cell?
3. Explain how energy is released from ATP.
4. Write the chemical equation for the hydrolysis of ATP.
5. Is energy is released or consumed when ATP is converted to ADP?
6. How much energy is released or consumed when ATP is converted to ADP?
7. Explain phosphorylation.
8. Is energy is released or consumed when ADP is converted to ATP?
9. How much energy is released or consumed when ADP is converted to ATP?
10. Write the chemical equation for the synthesis of ATP.
11. Most chemical reactions in the cell are powered by ATP. Give 3 examples of such reactions.
12. Give 4 examples of other cell functions that are powered by ATP.

Energy Review Questions

1. Explain potential energy.
Potential energy is the energy something has based on its position in the universe.
2. In the food we eat, where is the energy found?
The energy is actually found within a few types of high energy bonds that make up the carbs, lipids, and proteins we eat.
3. What is the difference between Exergonic (exothermic) and (endothermic) reactions?
Exothermic (Exergonic) reactions release energy (high energy reactants converted to low energy products). Examples include burning wood or glucose.
Endothermic (Endergonic) reactions require energy (low energy reactants converted to high energy products). Examples include electrolysis (splitting) of water, and making glucose.
4. Yesterday I consumed 2,500,000 actual “scientific calories”. Is that reasonable? How many “food” Calories did I actually consume? Explain.
Yes, that is reasonable; it is the same as 2,500 Calories.
5. Write the chemical equations for both photosynthesis and cellular respiration.
cellular respiration : $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O = -686 \text{ kcal}$
photosynthesis: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2 = +686 \text{ kcal}$
6. In what ways are photosynthesis and cellular respiration complementary or opposite processes?
Products of one are the reactants of the other.

Enzymes Review Sheet

1. Explain the relationship between an **enzyme** and a **catalyst**. What is the **role of each**?
Catalysts are chemicals that control the speed of reactions without changing the products formed by the reaction. **Enzymes** are special **protein catalysts** that control the rates of reactions that occur in living cells.
2. Define **substrate**.
The substrate is the molecule the enzyme binds to and changes.
3. Describe **activation energy** and explain how an enzyme operates.
The **activation energy** is the energy required to initiate a chemical reaction. Enzymes bind temporarily to one or more of the reactants of the reaction they catalyze. In doing so, they lower the amount of **activation energy** needed and thus speed up the reaction.
4. Explain how **pH and temperature** affect enzyme action.
The activity of enzymes is strongly affected by changes in **pH** and **temperature**. Each enzyme works best at a certain pH and temperature, its activity decreasing at values above and below that point.
5. Explain **how** competitive inhibition affects reaction rates.
Competitive inhibitors have shapes very similar to that of the substrate. They “compete” with the substrate for the activation sites of enzymes and thus “get in the way” of the reaction, slowing it down.
6. Explain **how** feedback inhibition affects reaction rates.
When enzyme activity is regulated by a molecule which is **not** its substrate, the regulator molecule binds to the enzyme at a different site than the one to which the substrate binds. This alters the shape of the enzyme so that it no longer fits the substrate at the active site, and therefore inhibition the enzyme from doing its job.
7. Explain **how** precursor activation affects reaction rates.
When enzyme activity is regulated by a molecule which is **not** its substrate, the regulator molecule binds to the enzyme at a different site than the one to which the substrate binds. This alters the shape of the enzyme to improve the fit between it and the substrate at the active site, and therefore activates the enzyme increasing its rate of activity.

Energy Storage and Transformation Review

1. What does ATP and ADP represent?
Adenosine Triphosphate
Adenosine Diphosphate
2. What is the primary function of ATP in the cell?
Major energy currency of the cell providing the energy for most of the energy consuming activities of the cell.
3. Explain how energy is released from ATP.
When the 3rd phosphate group of ATP is released by hydrolysis, a substantial amount of free energy is released (7.3 kcal).
4. Write the chemical equation for the hydrolysis of ATP.
$$\text{ATP} + \text{H}_2\text{O} \rightarrow \text{ADP} + \text{P}_i$$
5. Is energy is released or consumed when ATP is converted to ADP?
Energy is released.
6. How much energy is released or consumed when ATP is converted to ADP?
7.3 Kcal/mole is released.
7. Explain phosphorylation.
Is the addition of 1 or more phosphate groups to a molecule (usually ADT)
$$\text{ADP} + \text{P}_i + \text{energy} \rightarrow \text{ATP} + \text{H}_2\text{O}$$
8. Is energy is released or consumed when ADP is converted to ATP?
Energy is consumed
9. How much energy is released or consumed when ADP is converted to ATP?
7.3 Kcal/mole is consumed.
10. Write the chemical equation for the synthesis of ATP.
$$\text{ADP} + \text{P}_i + \text{energy} \rightarrow \text{ATP} + \text{H}_2\text{O}$$
11. Most chemical reactions in the cell are powered by ATP. Give 3 examples of such reactions.
assembly of amino acids into proteins
assembly of nucleotides into DNA and RNA
assembly of fats
assembly of polysaccharides
12. Give 4 examples of other cell functions that are powered by ATP.
Active transport of molecules and ions
nerve impulses
maintenance of cell volumes by osmosis
contraction of muscles