

Chapter 6;

Biochemical Pathways - Part 1

Energy basics...

- All living things require _____
- Animals get this energy by breaking the chemical bonds in _____ molecules.
- Plants get this energy from the _____.
- Plants store energy from the sun in the form of _____ **bonds** (their tissues).
- The process of converting sunlight into chemical bond energy is called _____

Respiration

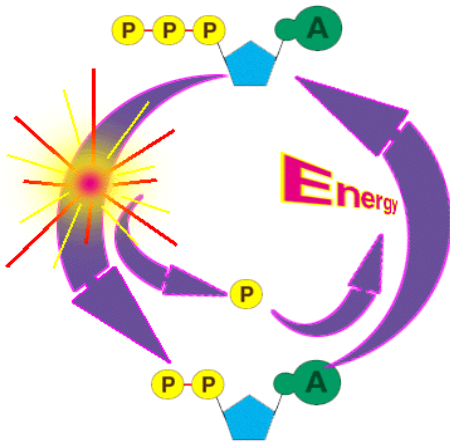
- All living organisms must carry out _____.
- _____ is the breakdown of large food _____ to produce ATP energy
- Even _____ break down the food they store for energy.
- **Essay: Why do plants make and store food?**

- Organisms that make their own food from CO₂, water, and the sun are called _____.
- One group of autotrophs are _____
- Organisms that must eat food to get energy are called _____.
- One group of heterotrophs are _____

Making Usable Energy: ATP

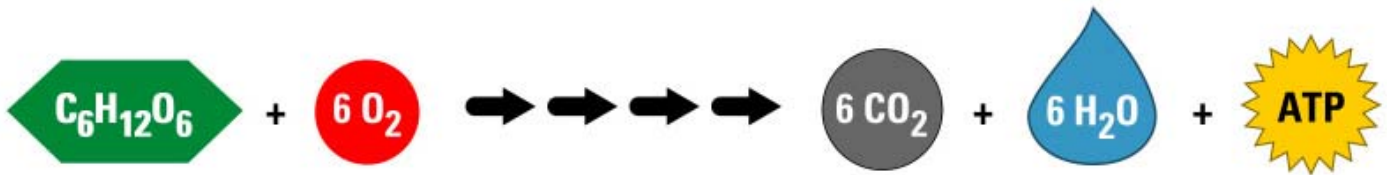
- Although energy is stored in the bonds inside food molecules, this energy is _____ for work.
- _____ is a form of energy that cells can use to do work.
- ATP stands for _____ (= 3 phosphates)
- When ATP does work in the cell, one of the phosphates comes off making the ATP into _____
(_____ = 2)
- When food is broken down, the phosphate is _____, energy is stored, and ATP is ready to do cellular _____.

● Label the Figure below. Be able to describe it in detail for the quiz and test →



The Overall Equation for Cellular Respiration

- A common fuel molecule for cellular respiration is _____
- This is the overall equation for what happens to _____ during cellular _____



Breaking down sugar: the chemistry

The formula for glucose (sugar) is _____

- When sugar is broken down, the energy in the molecule's bonds are converted into _____ energy
- The **by-products** of the reaction are _____ and _____
- $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$ (+ ATP energy)
- In words: sugar (_____) plus oxygen (_____) is converted into (→) carbon dioxide (_____) and water **with ATP (energy) as the main product.**

The Relationship Between Cellular Respiration and Breathing

- Cellular respiration and breathing are closely related
- Cellular _____ requires a cell to exchange _____ with its surroundings
- _____ exchanges these gases between the _____ and outside _____

Respiration; two ways

- _____ respiration occurs in the _____ - of cells and does not require oxygen (called _____ = sugar splitting)
- (An- means _____ and -aerobic means _____)

Example: sprinting is an _____ activity

•**Benefit:** You don't need _____ to get your energy

•**Problem:** You only earn 2 ATP molecules per sugar molecule, and you can build up _____ acid in muscles (burning sensation)

•**Aerobic** respiration occurs in the _____ and requires oxygen (called **Kreb's cycle** and **Electron Transport System**)

•**Example:** When you _____, you are burning sugar aerobically

•**Benefit:** You earn 32 ATP molecules per _____ molecule.

•**Problem:** You have to have _____ in your cells.

Fermentation in Human Muscle Cells

•They have enough _____ to support activities such as quick _____ for about ____ seconds

•A secondary supply of energy (_____ phosphate) can keep muscle cells going for another ____

•To keep running, your muscles must generate _____ by the anaerobic process of _____; the production of _____ acid is _____ in humans and other _____.

Fermentation in Microorganisms

•Various types of _____ perform _____

•_____ cells carry out a slightly different type of _____ pathway

•This pathway produces _____ and ethyl _____

Review Questions (not in order)

1. What are the 2 main problems or drawbacks of anaerobic respiration?
 - A. Requires oxygen and very little ATP generated
 - B. Does not require oxygen and generates a lot of ATP
 - C. Only produces 2 ATP per glucose and can generate lactic acid
 - D. Requires oxygen and produces 32 ATP
 - E. None of the above are correct
 2. Are you burning sugar aerobically or anaerobically right now?
 - A. Aerobically
 - B. Anaerobically
 - C. Both
 - D. Neither
 - E. None of the above are correct
 3. The autotrophs that we are most familiar with are the;
 - A. Animals
 - B. Bacteria
 - C. Fungi
 - D. Protists
 - E. None of the above are correct
 4. What is the only form of energy that the cells can **directly** use for cellular work?
 - A. Food
 - B. Protein
 - C. ATP
 - D. DNA
 - E. None of the above are correct
 5. What is the abbreviation of Adenine TriPhosphate?
 - A. AT
 - B. ADP
 - C. ATP
 - D. DNA
 - E. None of the above are correct
 6. What happens to ATP when it is used for cellular work?
 - A. It disappears
 - B. It becomes adenosine quadraphosphate
 - C. It becomes ADP + phosphate
 - D. It does not change when used for work
 - E. None of the above are correct
- over →

7. How do plants store solar energy?
 A. As ATP
 B. As chemical bond energy in food molecules
 C. As light
 D. They don't store it
 E. None of the above are correct
8. How are the phosphates of ATP reattached to the ADP after they are removed?
 A. By magic
 B. By synthesizing food molecules
 C. By breaking down food molecules during respiration
 D. By destroying ADP
 E. None of the above are correct
9. What is the scientific name for organisms that photosynthesize?
 A. Autotrophs
 B. Heterotrophs
 C. Bacteria
 D. Animals
 E. None of the above are correct
10. What is $C_6H_{12}O_6$?
 A. An enzyme
 B. A sugar
 C. Sucrose
 D. Glucose
 E. Both B and D above are correct
11. After aerobic respiration is over, how do human muscles continue to generate ATP when running?
 A. By breaking down oxygen molecules
 B. By using creatine phosphate
 C. By converting to anaerobic respiration
 D. By using the process of fermentation
 E. All of the above are correct, except A
12. When sugar is broken down, what happens to the energy that was in the sugar?
 A. It disappears
 B. It is used to do work
 C. It is transferred into the bonds of ATP
 D. It is transferred into the bonds of ADP
 E. None of the above are correct
13. What is the main benefit of aerobic respiration?
 A. Requires oxygen
 B. Does not require oxygen
 C. Only produces 2 ATP per glucose
 D. Produces 32 ATP per glucose
 E. None of the above are correct
14. What name is given to the process that plants use to store sunlight energy in food molecules?
 A. Respiration
 B. Metabolism
 C. Storing
 D. Photosynthesis
 E. None of the above are correct
15. What is the scientific name for any organism that must eat food for energy? (like us)
 A. Plants
 B. Heterotrophs
 C. Bacteria
 D. Animals
 E. None of the above are correct
16. What is the overall (unbalanced) equation for cellular respiration?
 A. $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$ (+ ATP energy)
 B. $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$
 C. $A + B \rightarrow C$
 D. $C_6H_{12}O_6 \rightarrow ATP$
 E. None of the above are correct
17. Where in the cell does aerobic respiration occur?
 A. In the nucleus
 B. In the cytoplasm
 C. In the mitochondria
 D. In the golgi body/apparatus
 E. None of the above are correct
18. How do animals get the energy they need?
 A. From laying in the sun
 B. From photosynthesizing
 C. From eating the products of photosynthesis or other food molecules
 D. From ATP
 E. None of the above are correct
19. Only some living organisms carry out respiration
 TRUE (A) OR FALSE (B);
20. Microorganisms (like yeast) carry out fermentation in exactly the same way as human muscles do, with the same waste products; TRUE (A) OR FALSE (B);
21. Cellular respiration and breathing have nothing to do with each other; TRUE (A) OR FALSE (B);
22. How are cellular respiration and breathing related?
 A. Opposites
 B. Unrelated
 C. Very different
 D. One is dependant on the other to occur
 E. None of the above are correct
23. What is the main benefit of **anaerobic** respiration?
 A. Requires oxygen
 B. Does not require oxygen
 C. Only produces 2 ATP per glucose
 D. Produces 32 ATP per glucose
 E. None of the above are correct

24. What is the main **problem** or drawback of **aerobic** respiration?
- A. Requires oxygen
 - B. Does not require oxygen
 - C. Only produces 2 ATP per glucose
 - D. Produces 32 ATP per glucose
 - E. None of the above are correct
25. How is fermentation in yeast cells different from fermentation in human muscles?
- A. Animals produce lactic acid
 - B. Yeast cells produce ethyl alcohol
 - C. Yeast cells produce carbon dioxide
 - D. All of the above are correct
 - E. None of the above are correct
26. What are the two basic forms of respiration?
- A. Fast and slow
 - B. In and out
 - C. Aerobics and kickboxing
 - D. Aerobic and anaerobic
 - E. None of the above are correct
27. Where in the cell does anaerobic respiration occur?
- A. In the nucleus
 - B. In the cytoplasm
 - C. In the mitochondria
 - D. In the golgi body/apparatus
 - E. None of the above are correct
28. What molecule does aerobic respiration require that is not necessary for anaerobic respiration?
- A. Water
 - B. Oxygen
 - C. ATP
 - D. Mitochondria
 - E. None of the above are correct
29. What are the 2 main by products of microorganism fermentation?
- A. Water and carbon dioxide
 - B. ATP and oxygen
 - C. Ethyl alcohol and water
 - D. Ethyl alcohol and carbon dioxide
 - E. None of the above are correct
30. What does aerobic mean?
- A. It makes you sweat
 - B. It does not require oxygen
 - C. It does require oxygen
 - D. It happens in the cytoplasm
 - E. None of the above are correct
31. What do all living things require?
- A. Energy
 - B. Sunlight
 - C. A mate
 - D. Oxygen
 - E. None of the above are correct
32. What is the breakdown of large food molecules inside of cells to produce ATP energy?
- A. Photosynthesis
 - B. Respiration
 - C. Digestion
 - D. Evacuation
 - E. None of the above are correct
33. Plants do not need to carry out respiration TRUE (A) OR FALSE (B);
34. How do plants get the energy they need?
- A. From the food they eat
 - B. From ATP
 - C. From the sun
 - D. From animals
 - E. None of the above are correct