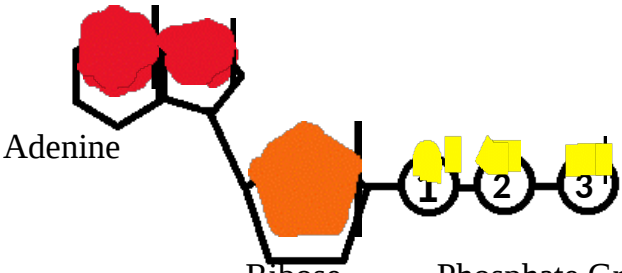
Biology I - ATP/ADP Energy Cycle Name __Emily M._____

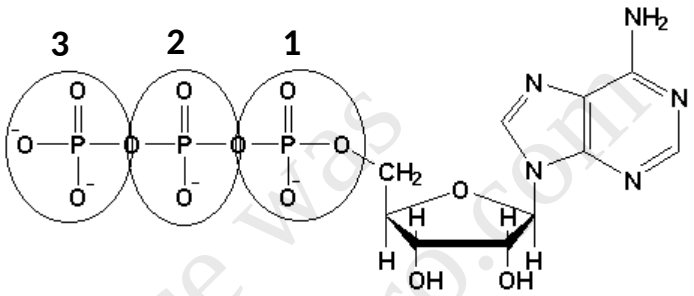
Your cells require energy to carry out many different functions (active transport across the membrane, protein synthesis, and cell division). The fuel for these functions comes from a molecule called adenosine triphosphate (ATP). ATP stores energy until a cell needs it. When a cell requires energy, it breaks part of the ATP molecule apart which releases energy.

Part 1: The structure of ATP

ATP consists of 3 parts: 1 adenine molecule, 1 ribose sugar molecule, and 3 phosphate molecules. Energy is stored in the bond that is found between the 2nd and 3rd phosphate groups.

- COLOR & LABEL the following in the ATP molecules below: adenine – red, ribose – orange, 3 phosphate groups – yellow.
- Circle the area that represents the HIGH ENERGY bond.

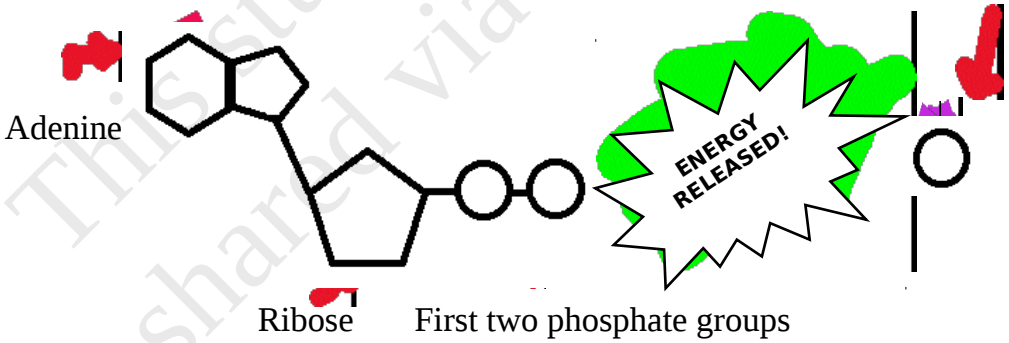




Part 2: ATP Decomposition

When a cell requires energy, it breaks off the last (3rd) phosphate group from the ATP molecule, which releases energy. The molecule that is left over is called adenosine diphosphate (ADP) which consists of adenine, ribose sugar, and **TWO** phosphate groups. ADP contains less energy than ATP.

- COLOR & LABEL the following in the energy molecule below: adenine – red, ribose – orange, first two phosphate groups – yellow, lone phosphate group – purple. COLOR the energy released – green.
- Circle the part of the image that makes up one molecule of ADP. Lone phosphate group

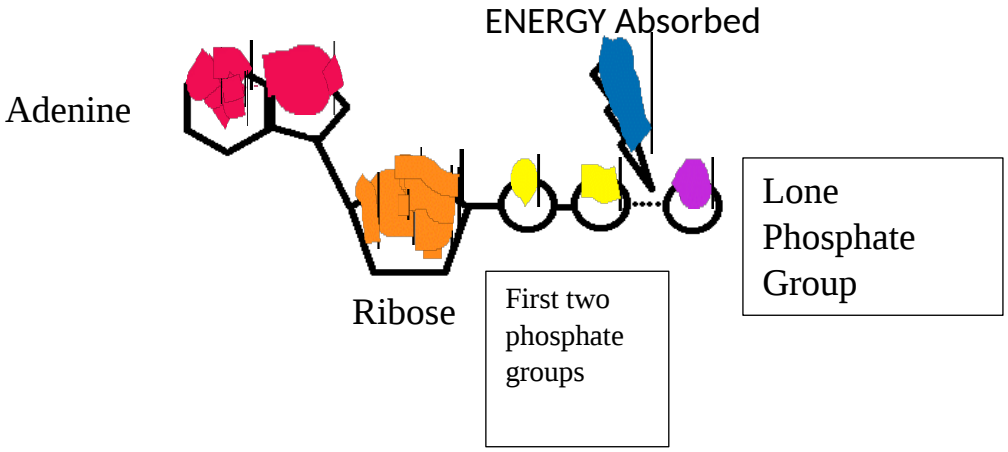


Part 3: ATP Synthesis

ATP molecules are constantly being rebuilt from ADP and lone phosphate groups. This ensures that cells always have a source of energy. However, it takes energy to make ATP. The energy to make ATP comes from a carbohydrate called GLUCOSE. Glucose is a monosaccharide, or simple sugar. Its chemical formula is $C_6H_{12}O_6$. Plants produce glucose during photosynthesis.

- COLOR & LABEL the following in the energy molecule below: adenine – red, ribose – orange, first two phosphate groups – yellow, lone phosphate group – purple. COLOR the energy absorbed – blue.
- Is the ENTIRE energy molecule called ATP or ADP? Be sure to LABEL the name below!

ADP



USE your NOTES to answer the following questions:

1. What is energy?
   Energy is the ability to do work, or a property of objects which can be transferred to other objects or converted into different forms but cannot be created or destroyed. Organisms use energy to survive, grow, respond to stimuli, reproduce, and for every type of biological process.

2. (T/F) Organisms need a constant supply of energy to survive.

   True, all organisms need a constant supply of energy to stay alive.

3. What is the structural difference between ATP and ADP? Compare/contrast structure of ATP & ADP.
   The structural difference between ATP and ADP is that ATP has three phosphate groups, hence the name with "tri-" and ADP, has only two phosphate groups, and so has the prefix "di-". So, ATP has one extra phosphate group than ADP.

4. Which structure, ATP or ADP, contains more stored energy? Where is the energy stored?

ATP is the higher energy form, while ADP is the lower energy form. When the terminal (third) phosphate is cut loose, ATP becomes ADP (Adenosine diphosphate; di= two), and the stored energy is released for some biological process to utilize. The energy is stored in the covalent bonds between the phosphate groups.

5. Which type of macromolecule (protein, carb, nucleic acid, or lipid) is ATP & ADP?

ATP & ADP are nucleic acids, and they are macromolecules of nucleic acids as they are made up of structures similar to DNA.