

Organic Compounds and Energy

Oct 4, 2013

Question of the Day

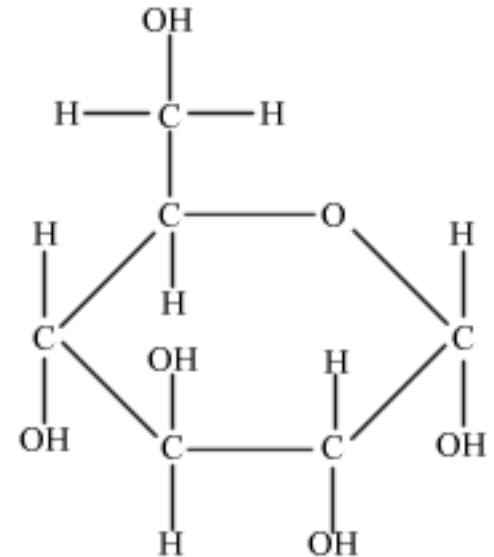
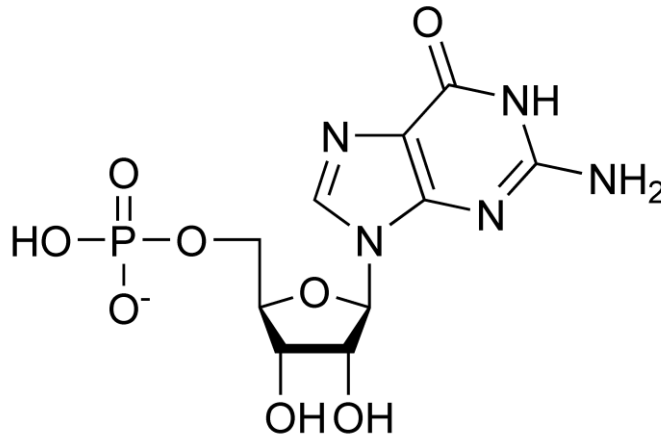
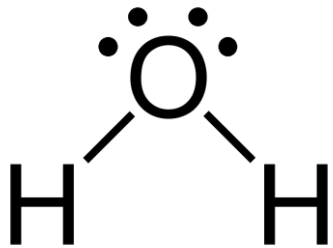
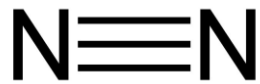
What gas do plants capture?

- A. Oxygen
- B. Carbon dioxide
- C. Oxygen and carbon dioxide
- D. None of the above



Organic Compounds

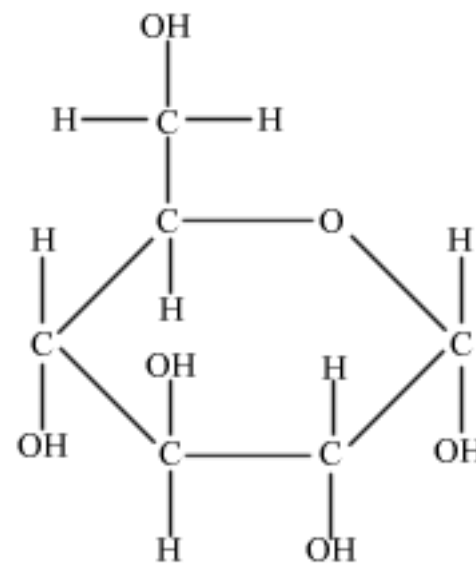
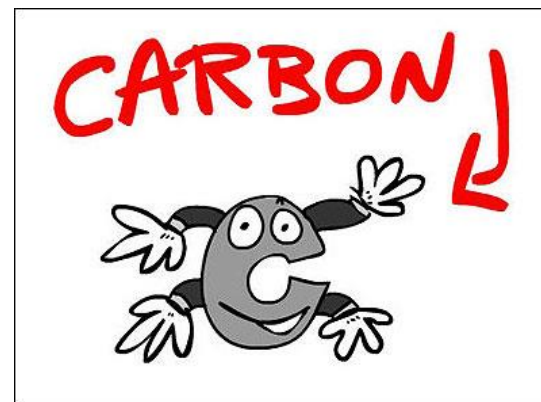
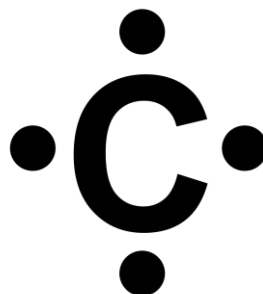
- ▶ The key elements in living organisms (C, H, O, N, P, S) bond to form very large molecules
 - ▶ Relatively simple molecules occur in the environment (CO_2 , H_2O , N_2)
- ▶ Ex. Sugars, starches, lipids and nucleic acids
- ▶ Some may contain millions of atoms; infinite diversity



Structural formula
for glucose

Organic Compounds

- ▶ Constructed mainly from carbon atoms bonded together into chains
- ▶ Carbon-carbon, carbon-oxygen or carbon-hydrogen bonding
- ▶ Assembly of organic compounds absorbs energy



Structural formula
for glucose

What is energy?

- ▶ The universe is made of energy and matter
- ▶ Matter occupies space and has mass
- ▶ Forms of energy do not (light, heat, movement, electricity)
- ▶ Definition: Energy affects or moves matter (change its position or state)



Kinetic or Potential Energy

- ▶ Kinetic energy: energy in action or motion
- ▶ Potential energy: energy in storage
- ▶ A stretched rubber band has potential energy; releasing it will convert the energy to kinetic energy as it flies through the air



Chemical Energy

- ▶ Fuels, like gasoline, release kinetic energy when ignited
- ▶ They contain chemical energy, a form of potential energy
- ▶ Food sources also contain potential energy that we can turn into kinetic energy



Units of Energy

- ▶ Cannot use units of mass or volume to measure energy (has no mass, occupies no space)
- ▶ Most common unit of energy: the calorie
- ▶ Definition of calorie: the amount of heat required to raise the temperature of water one degree Celsius



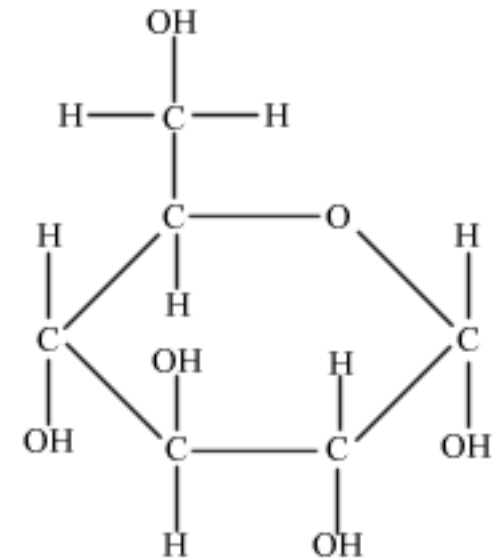
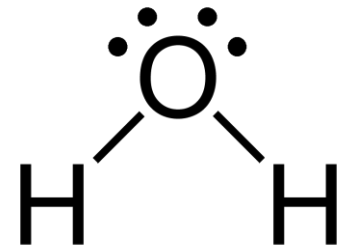
Laws of Thermodynamics

- ▶ **First LoT:** Energy is neither created nor destroyed, but may be converted from one form to another.
 - ▶ We can't "create" energy or turn matter into energy
- ▶ **Second LoT:** In any energy conversion, some usable energy is lost as heat energy.
 - ▶ The engine of a car becomes hot while converting chemical energy to kinetic, which is lost to the environment



Energy Changes in Organisms

- ▶ Organic compounds contain high potential energy
- ▶ Inorganic compounds contain low potential energy
- ▶ Assembling inorganic compounds into more complex, organic compounds requires an INPUT of energy

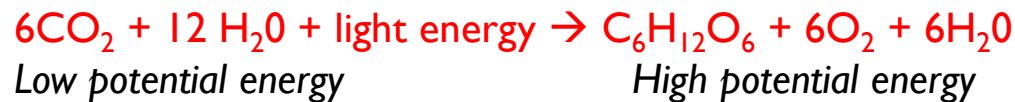
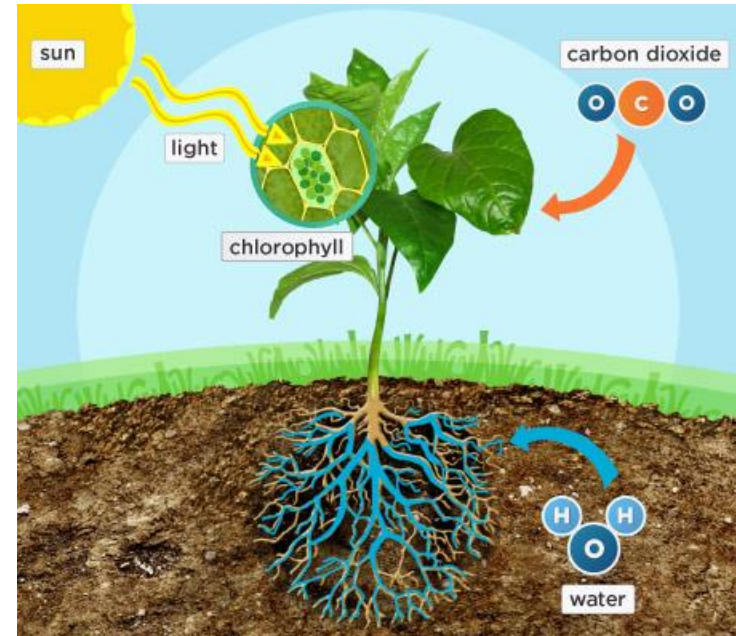


Structural formula
for glucose



Energy in Ecosystems: Producers

- ▶ Producers (plants and other autotrophs) need an energy INPUT in order to assemble these high energy organic molecule
- ▶ How can they do this?
- ▶ Use chlorophyll to absorb light energy and conduct photosynthesis



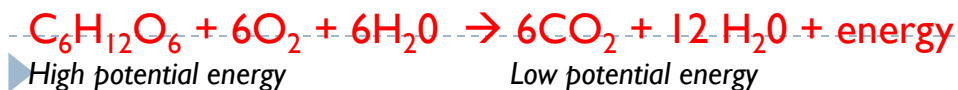
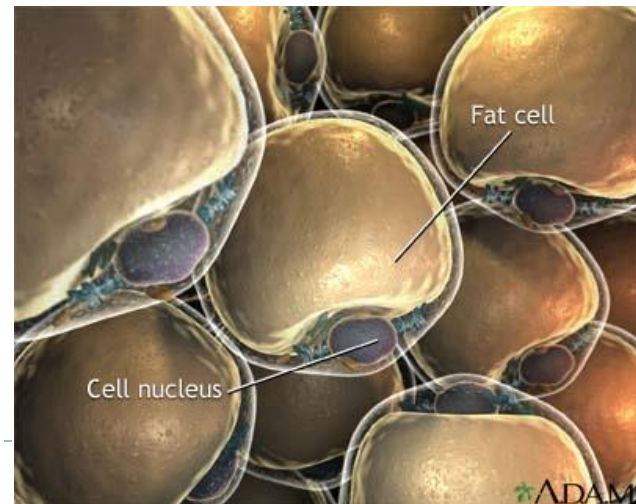
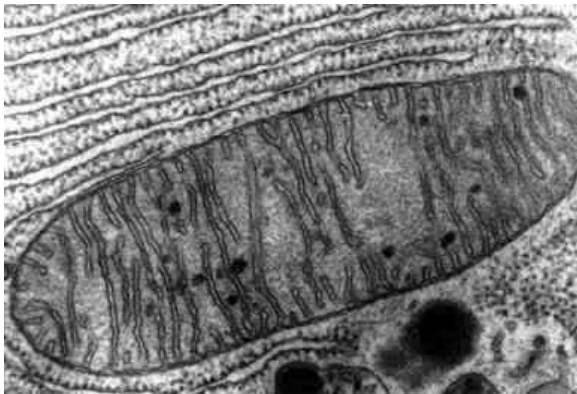
Glucose and Green Plants

- ▶ Used by plants to make their stems, roots, leaves, flowers and fruits (first converted into more complex molecules, like starches)
- ▶ The plant also breaks down a portion of the glucose to release its stored energy (respiration)
- ▶ Glucose may also be stored for future use by plants



Consumers

- ▶ First, consumers digest food (break down into simpler molecules) Ex. Starch → glucose
- ▶ Next, **respiration** takes place: breaking down organic molecules to release stored energy
 - ▶ Opposite reaction of photosynthesis
 - ▶ Occurs in mitochondria of our cells
- ▶ The rest is used in growth, repair, or storage (fat cells) or passes as waste



Decomposers

- ▶ Bacteria and fungus
- ▶ Some use oxygen to break down organic molecules just as composers do
- ▶ Many do not use oxygen
 - ▶ Fermentation, a different kind of respiration
 - ▶ Releases different gases (ex. Methane)



Homework

- ▶ Dennis says, “When I eat food, my body turns the food into energy so that I can move around.”
- ▶ Explain to Dennis why this statement is not completely correct, and how the process actually works.

