How do cells acquire and use energy?

Cellular respiration and photosynthesis
Changing forms of energy

An automobile engine changes chemical energy to mechanical and heat energy.

A tree changes radiant energy to chemical energy.

Hammering a nail changes mechanical energy to deformation and heat energy.

A thermonuclear reaction changes nuclear energy to radiant and heat energy.

An electric mixer changes electrical energy to mechanical and heat energy.

A lamp changes electrical energy to radiant and heat energy.

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Chemical reactions: atoms change partners

By breaking existing bonds and forming new ones

\[ 2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{energy} \]

Reactants                      Products

Was matter created?

Was energy created?

*Law of physics: energy can not be created nor destroyed only transformed*

Energy is required to form a covalent bond and energy is released when a covalent bond is broken

Are there any oxygen molecules after the reaction is complete?
ATP, NADH and NADPH: High energy molecules
Where do threes get their mass from?

\[ 6 \text{CO}_2 + 6 \text{H}_2\text{O} \xrightarrow{\text{Light energy}} \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 \]

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The Overall reaction of Photosynthesis

Series of reactions that stores the light energy (sun) into chemical energy (organic molecules) and converts inorganic molecules into organic ones (glucose) that can make up living things.

What reactants need to be present for photosynthesis to occur?

Which is the source the matter and energy in the glucose molecule?

What is produced during photosynthesis?

Which organisms carry out photosynthesis?
Photosynthesis stores light energy into organic molecules.
Photosynthesis takes place in chloroplasts

Chlorophyll and other pigments are in charge of capturing light energy

These pigments are found in the **thylakoid membranes**

*Stroma* is the space between the inner membrane and the thylakoids
Photosynthesis occurs in two stages linked by ATP and NADPH

For each step:

Where does it take place?

Energy transformation?

What goes in?

What comes out?

Fill out chart
Why do plants carry out photosynthesis?

A. To produce oxygen so that we animals can breath
B. To produce food for humans
C. To produce organic molecules so that they can be use for the plant growth
D. To convert solar energy into chemical energy that the plant can use to power some of its process
E. To counterbalance the amount of carbon dioxide in the atmosphere
What happens to the glucose produced by photosynthesis?

Sugar used for:
- Cellular respiration
- Cellulose
- Starch
- Other organic compounds
The connection between photosynthesis and cellular respiration

Life requires energy

Your energy ultimately comes from …

Life requires matter

Your matter ultimately comes from …
Photosynthesis Lab:

Procedure 1: relationship of photosynthesis to chlorophyll

Procedure 2: relationship of photosynthesis to carbon dioxide
Iodine is an indicator of starch (polymer of glucose)
Phenol Red is an indicator of amount of Carbon Dioxide in a solution.

If we add CO₂ to the phenol red, what will be the color of “phenol red”?

If we remove CO₂ from the phenol, what will be the color?
Procedure 1:

Sketch your leaf before on page 37
And after on page 38, answer question
Procedure 2:

Reaction of photosynthesis:

Elodea plants live in freshwater
When elodea is photosynthesizing,

What does it consume from the surrounding liquid?

What does it produce into the surrounding liquid?

How can we detect if the elodea is photosynthesizing?

Answer questions in page 39