

Learning Outcomes

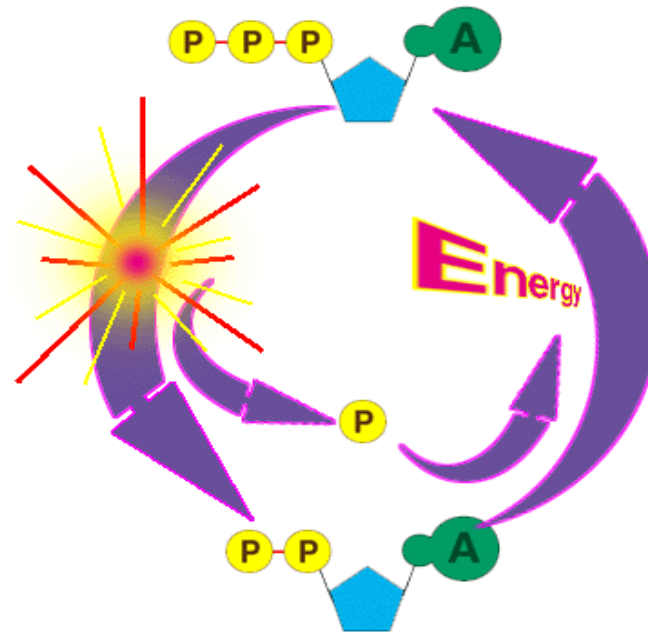
At the end of this topic, you should be able to:

- Summarize how glucose is broken down in glycolysis.
- Describe how ATP is made in cellular respiration.
- Identify the role of fermentation in cellular respiration.
- Evaluate the importance of oxygen in aerobic respiration.
- Compare and contrast aerobic and anaerobic respiration.

ATP

How is ATP used?

- As ATP is broken down, it gives off usable energy to power chemical work and gives off some nonusable energy as heat.



ATP

How is ATP used?

- ATP powers cellular work. Three main kinds of work are:

Chemical Work

- Synthesizing molecules for growth and reproduction.

Transport Work

- Active transport, endocytosis, and exocytosis.

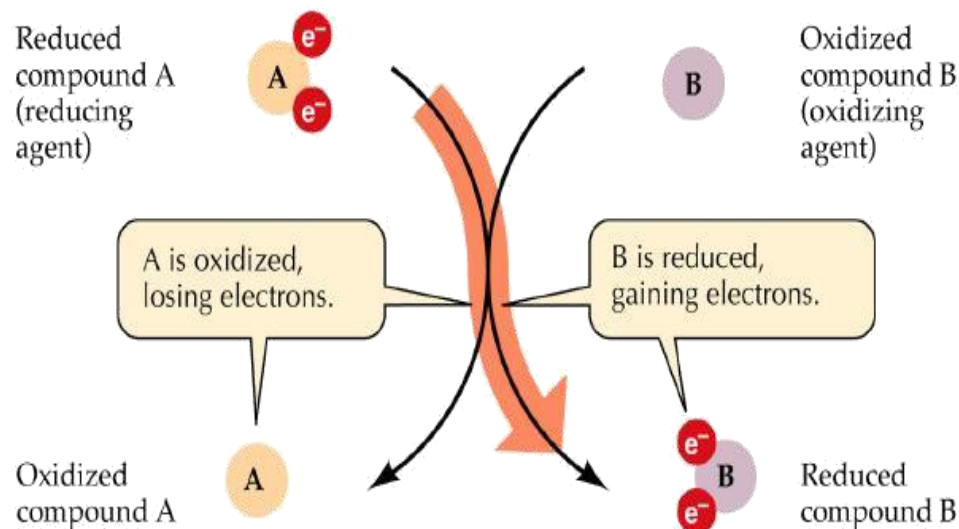
Mechanical Work

- Muscle contraction, cilia and flagella movement, organelle movement.

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Redox Reaction

- Cellular Respiration is a redox reaction.
- Redox reactions** is a transfer of one or more electrons (e^-) from one reactant to another occurs in many chemical reactions.

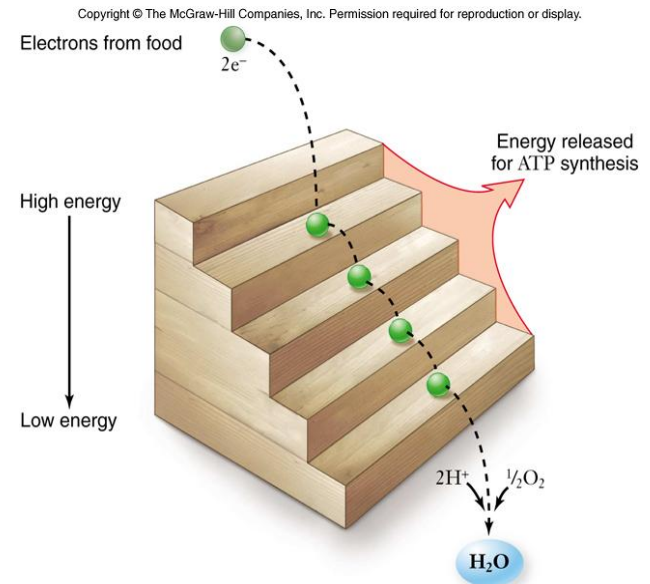


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Redox Reaction

- Glucose is oxidized when electrons and H^+ are passed to coenzymes NAD⁺ and FAD before reducing or passing them to oxygen.
- Glucose is oxidized by a **series of smaller steps** so that smaller packets of energy are released to make ATP, rather than one large explosion of energy.

[Click on hypertext for more details.]



Types of Cellular Respiration

- There are two types of cellular respiration:

Aerobic Respiration

- Requires oxygen in order to generate energy (ATP).
- Consist four process:
 - Glycolysis
 - Transition Reaction
 - The Kerbs Cycle
 - The Electron Transport Chain and Chemiosmotic Phonsphorylatio
- This takes place in the mitochondria of the cells.

Anaerobic Respiration

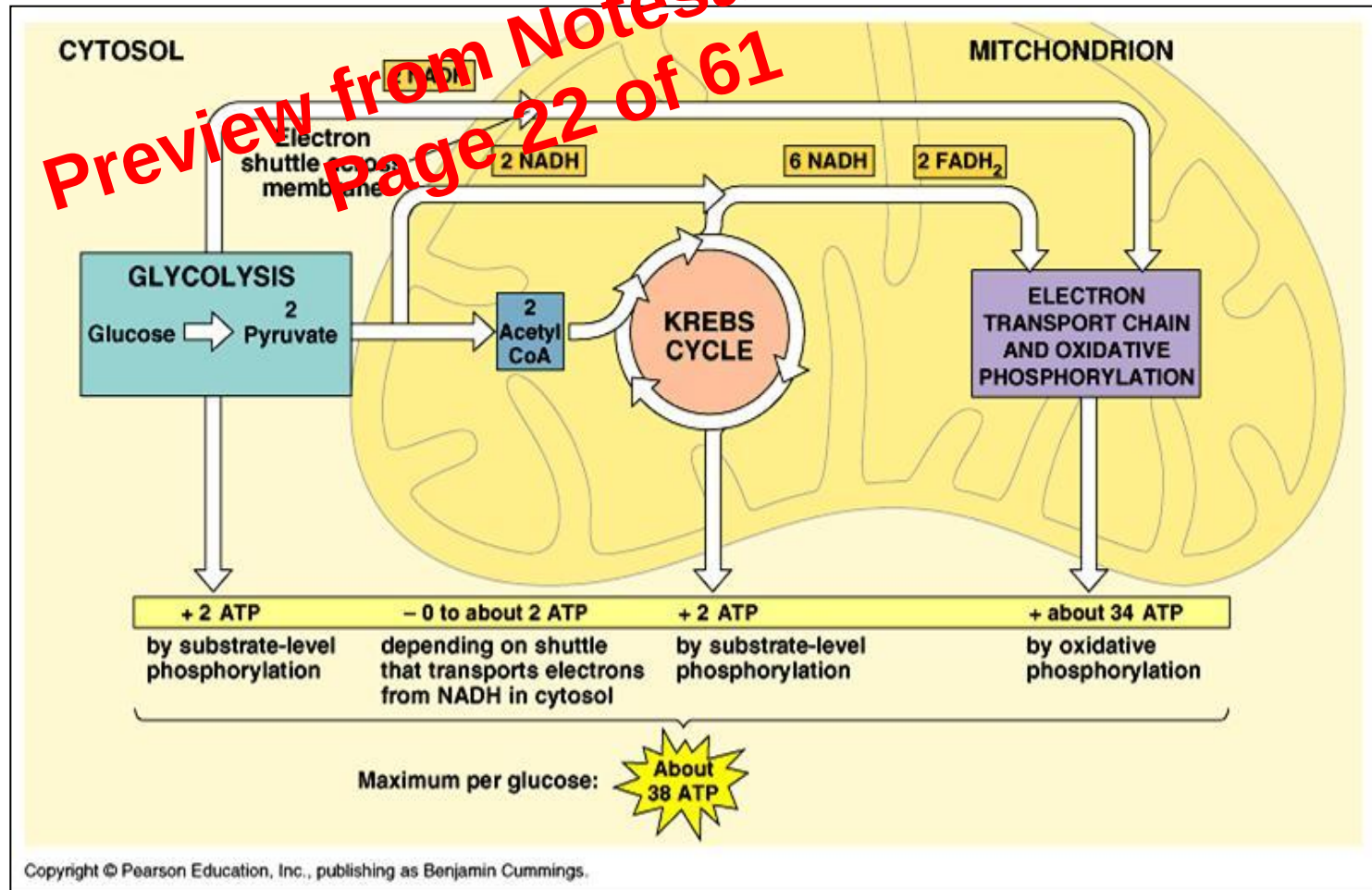
- A form of respiration that can function without oxygen.
- Example of anaerobic is fermentation.
- This takes place in the cytoplasm.

Stages of Cellular Respiration

- Cell Respiration can be divided into 4 stages:



Stages of Cellular Respiration



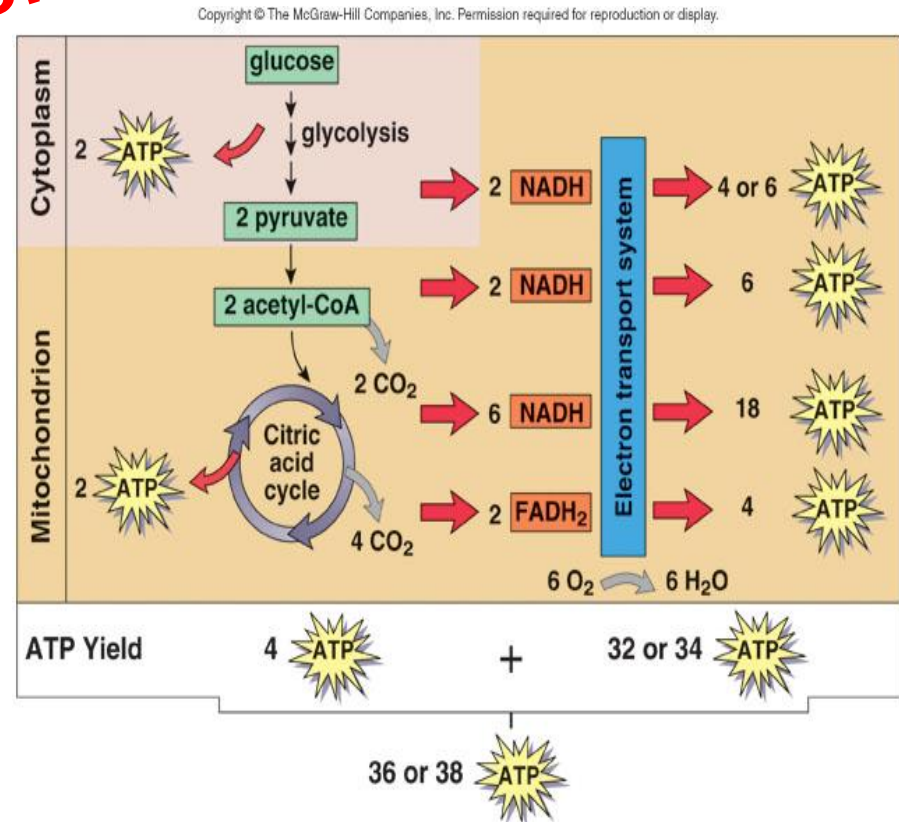
Energy Yield of Respiration

Accounting of Energy Yield per Glucose Molecule Breakdown

- Glycolysis → 4 ATP
- Oxidation of Pyruvate → No ATP
- The Krebs Cycle → 2 ATP
- The Electron Transport Chain and Chemiosmotic Phosphorylation:

- Each NADH produces 2-3 ATP
so 10 NADH → 28 ATP
- Each FADH_2 produces 2 ATP
so 2 FADH_2 → 4 ATP

Total Net ATP YIELD = 36 ATP



Key Terms

Term	Definition
Substrate-level phosphorylation	The process when an enzyme (eg: a kinase) transfers a phosphate group from a substrate molecule to ADP.
Glycolysis	The process of breaking a glucose molecule into two pyruvic acid molecules.
Krebs cycle	The process of breaking down pyruvic acid into carbon dioxide.
Electron Transport Chain	High energy electrons are used to convert ADP to ATP.
Mitochondria	The organelle in which cellular respiration takes place.
Fermentation	The release of energy from food without the presence of oxygen.

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