

شرح درس التنفس الخلوي



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المزيد من مادة
أحياء:

إعداد: GILGIL OMAR

التواصل الاجتماعي بحسب الصف الثاني عشر العام



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الثاني عشر العام والمادة أحياء في الفصل الأول

شرح درس ارتباط الجينات وتعدد المجموعات الكروموسومية

1

أسئلة على درس genetics mendelian - أنسباير

2

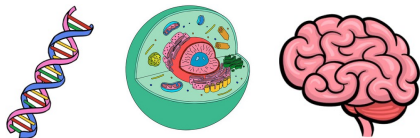
الجهاز التنفسي - عام بريدج

3

تحميل تطبيق المناهج للهواتف الذكية

تطبيق المناهج على Play Google (أندرويد)

تطبيق المناهج على Store App (آبل)



Term 3 – lesson 3

Cellular respiration

Overview of Cellular Respiration

Organisms obtain energy in a process called **cellular respiration**, during which the bonds of food and oxygen molecules are broken and energy transfers from one set of interacting molecules to another. New compounds (ATP) form that can transport energy to muscles.

Energy needed to maintain body temperature despite ongoing energy transfer to the environment is released. Cellular respiration is summarized in the equation and Figure 10.

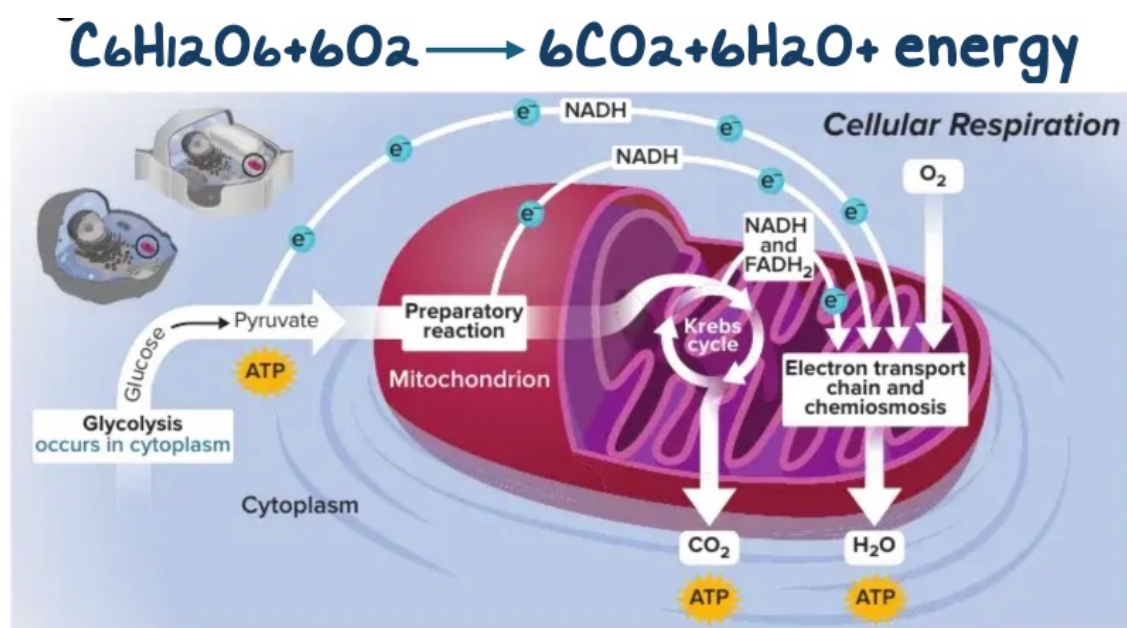


Figure 10 Cellular respiration occurs in the mitochondria, the energy powerhouse organelles of a cell.

Cellular respiration occurs in two main parts: (**glycolysis and aerobic respiration**).

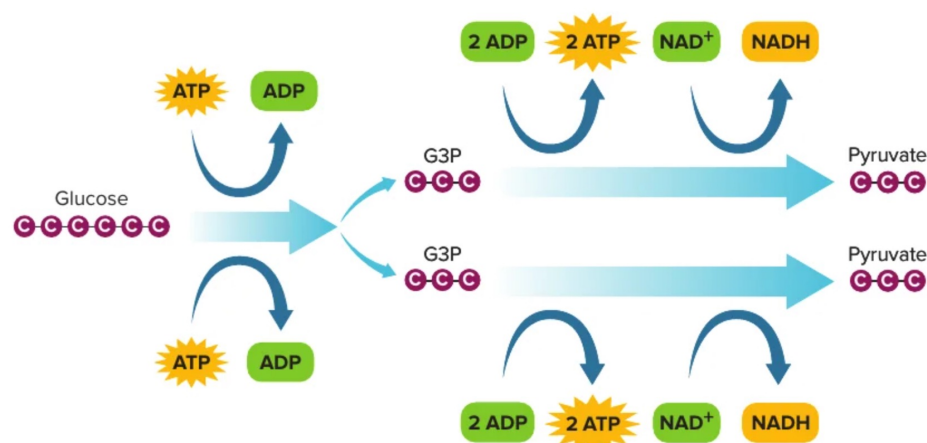
- Glycolysis is an anaerobic process, meaning it **does not require oxygen**. / Cytoplasm
- Aerobic respiration involves the Krebs cycle and electron transport. Aerobic processes **require oxygen**. / Mitochondria of eukaryotes





Glycolysis

- Glucose is broken down in the cytoplasm through a process called **glycolysis**. For each glucose molecule, two ATP and two NADH molecules are produced.
- First**, two phosphate groups (from two ATP molecules) are added to glucose. This requires an initial energy input of two ATP to start the reactions.
- Next**, the 6-carbon glucose molecule is split into two 3-carbon compounds.
- Then**, additional phosphate groups are added, and electrons and hydrogen ions (H^+) combine with two NAD^+ molecules to form two NADH molecules. NAD^+ is similar to NADP, which is an electron carrier used in photosynthesis.
- Finally**, the two 3-carbon compounds are converted into two molecules of pyruvate. At the same time, four ATP molecules are produced.



Results of Glycolysis	
Product	Amount
ATP	+ 2 ATP
NADH	+ 2 NADH
Pyruvate	+ 2 Pyruvate

Figure 11 Glucose is broken down during glycolysis inside the cytoplasm of cells.

Krebs Cycle

- Glycolysis has a net result of two ATP and two pyruvate. Most of the energy from the glucose is still contained in the pyruvate.
- The series of reactions in which pyruvate is broken down into carbon dioxide is called the Krebs cycle, which is also known as the tricarboxylic acid (TCA) cycle.





Preparatory Reaction

- Before the Krebs cycle, each 3-carbon pyruvate reacts with coenzyme A (CoA). This forms a 2-carbon molecule called **acetyl CoA** and releases **carbon dioxide (CO₂)**.
- During this process, **NAD⁺** is converted into **NADH**, and CO₂ is released from the cell. Since one glucose produces two pyruvate molecules, this stage produces:
 - 2 acetyl CoA
 - 2 CO₂
 - 2 NADH
- Finally**, acetyl CoA moves into the mitochondrial matrix to enter the Krebs cycle.

Steps of the Krebs Cycle

- The cycle starts when acetyl CoA (2C) combines with a 4-carbon compound to form a 6-carbon compound called **citric acid**.
- Citric acid is then broken down through a series of reactions. This releases:
 - 6 CO₂
 - 1 ATP
 - 3 NADH
 - 1 FADH₂
 FAD is an electron carrier similar to NAD⁺ and NADP⁺.

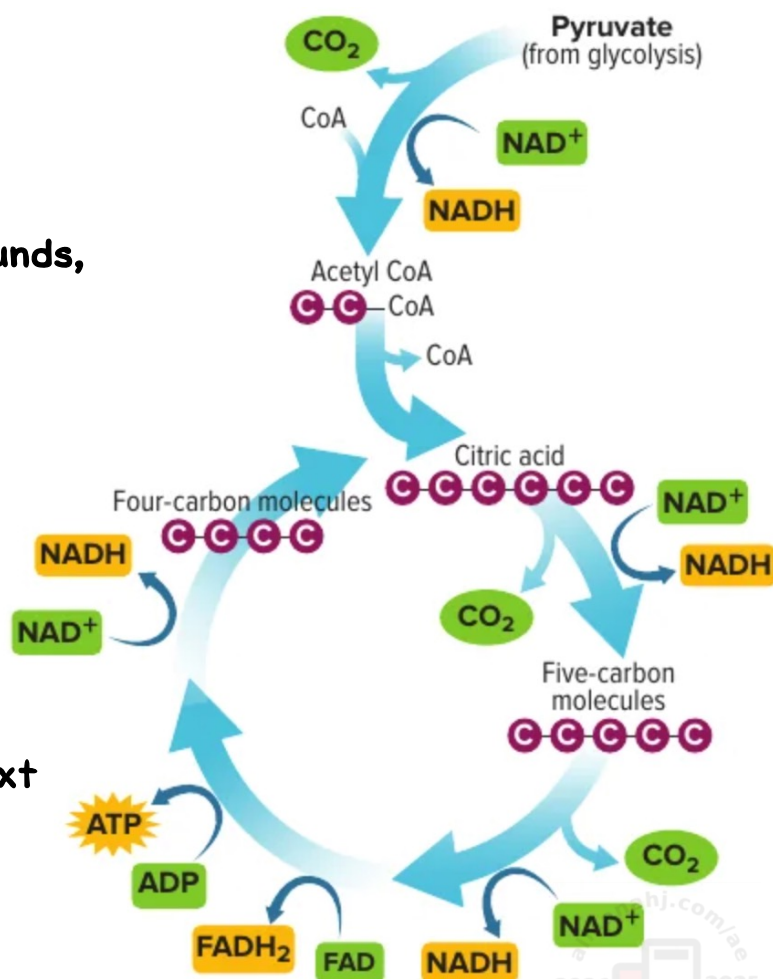
The cycle regenerates the starting compounds, allowing it to continue.

Since one glucose produces **two pyruvate**, the **Krebs cycle runs twice per glucose**.

Net results per glucose:

- 3 CO₂
- 2 ATP
- 8 NADH
- 2 FADH₂

Finally, 10 NADH and 2 FADH₂ move to the next stage of aerobic respiration



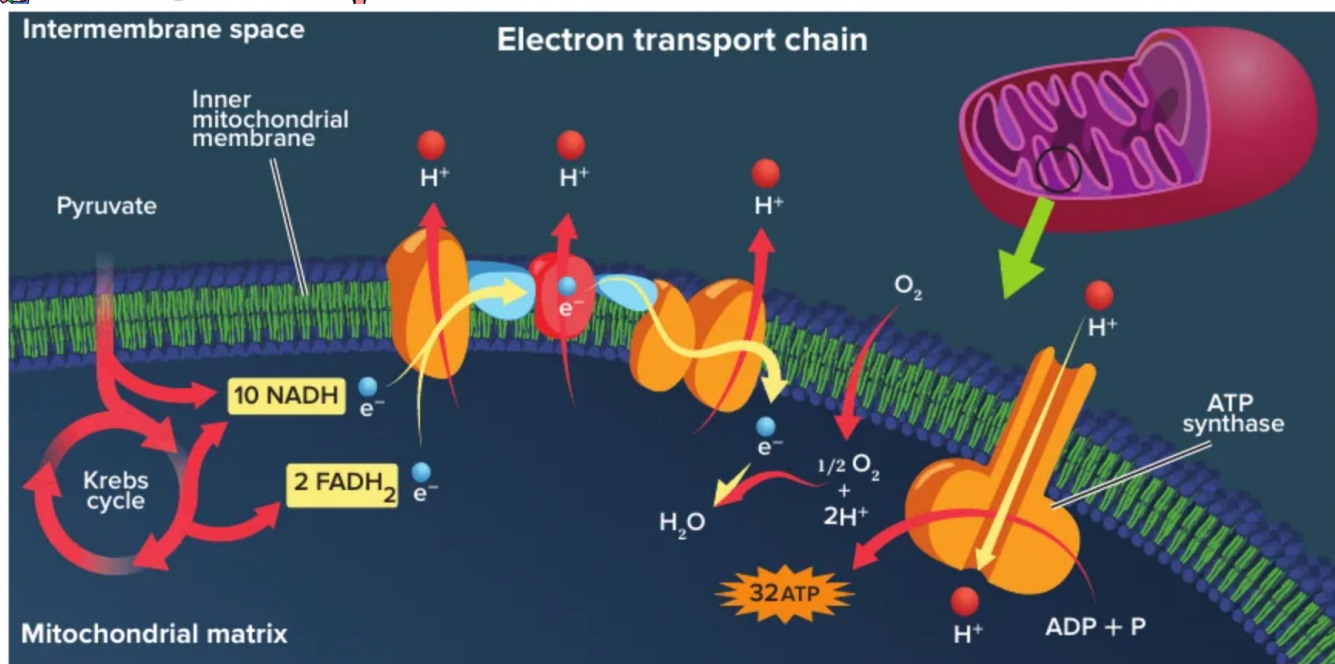
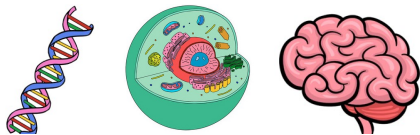


Figure 13 Electron transport occurs along the mitochondrial membrane.

Electron Transport Chain (ETC)

- Electrons move along the mitochondrial membrane from one protein to another.
- The process begins when 10 NADH and 2 FADH₂ release electrons. These electrons move along the inner mitochondrial membrane through a series of proteins. NADH and FADH₂ are converted back to NAD⁺ and FAD, and H⁺ ions are released into the matrix.
- The energy from moving electrons is used to pump H⁺ ions into the intermembrane space, increasing their concentration outside the matrix.
- Because of the high concentration of H⁺ in the intermembrane space and low concentration in the matrix, H⁺ ions move back into the matrix through ATP synthase. This process is called **chemiosmosis**.
- As H⁺ ions pass through ATP synthase, ADP is converted into ATP in the mitochondrial matrix.
- Oxygen (O₂) is the final electron acceptor. It combines with electrons and H⁺ ions to form water (H₂O).

Energy yield:

Electron transport produces **32 ATP**

Each NADH → **3 ATP**

Each FADH₂ → **2 ATP**

Total per glucose (eukaryotes): **36 ATP**





Prokaryotic Cellular Respiration

- Some prokaryotes also undergo aerobic respiration. They do not have **mitochondria**, so the electron transport chain occurs on the cell membrane instead of the mitochondrial membrane.
- In eukaryotic cells, pyruvate must be transported into the mitochondria, but in prokaryotes this step is not needed. Because no energy is used for transport, prokaryotes save energy.

Result:

Total ATP in prokaryotes $\approx$ 38 ATP

Anaerobic Respiration

- Some cells can work for a short time when oxygen is low. Some prokaryotes also live without oxygen, so they are anaerobic. In these cases, cells still produce ATP using glycolysis.
- However, glycolysis alone is not enough. It produces only **2 ATP per glucose**, and the cell has a limited amount of NAD^+ . When NAD^+ runs out, glycolysis stops.
- To solve this, cells use **fermentation**. Fermentation happens **in the cytoplasm** and helps regenerate NAD^+ , so glycolysis can continue. It also produces a small amount of ATP.

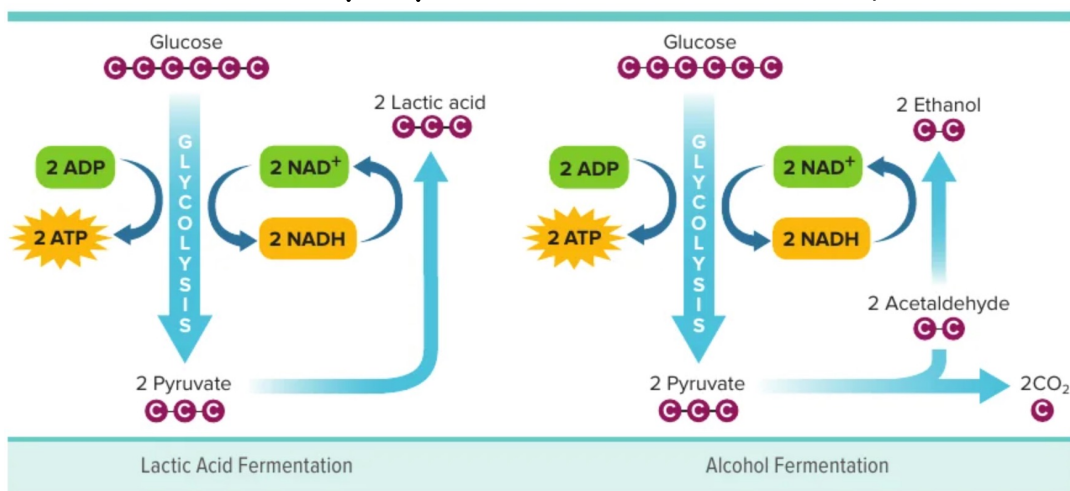


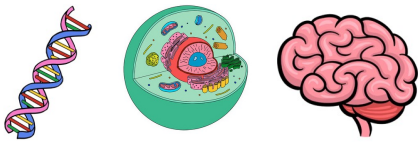
Figure 14 When oxygen is absent or in limited supply, fermentation can occur.

There are two types of fermentation.

Lactic Acid Fermentation

- Enzymes convert the pyruvate made during glycolysis into lactic acid.
- Skeletal muscles produce lactic acid when the body cannot supply enough oxygen, such as during periods of strenuous exercise.





Alcohol Fermentation

- This process occurs in yeast and some bacteria.
- It converts pyruvate into ethyl alcohol and carbon dioxide.

Photosynthesis and Cellular Respiration

- Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy needed for life. These two processes are connected in a cycle. Figure 15 shows the interrelated, cyclical relationship between these two processes.
- Photosynthesis produces oxygen and glucose, which are needed for cellular respiration.
- Cellular respiration produces carbon dioxide and water, which are needed for photosynthesis.

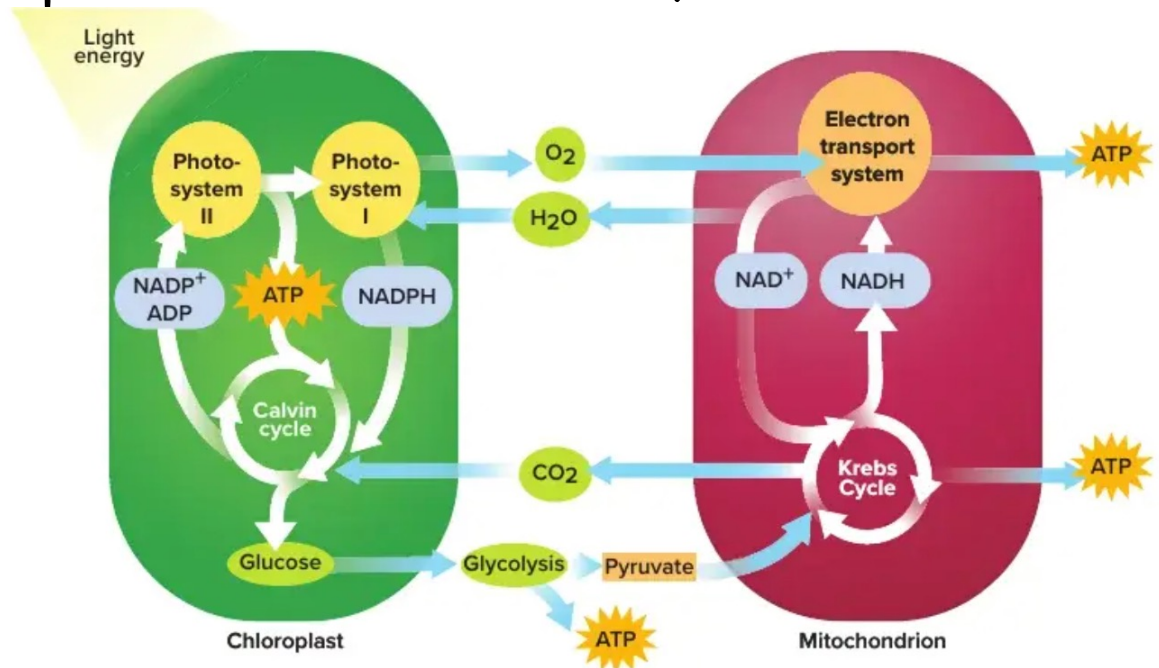


Figure 15 Photosynthesis and cellular respiration form a cycle.

Thank you

