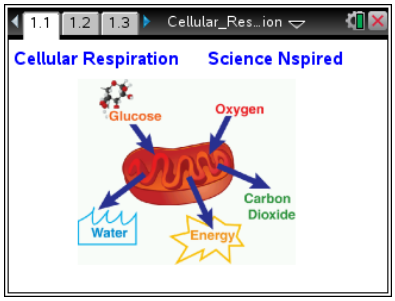
Cellular Respiration

Student Activity

Name _____

Class _____

Open the TI-Nspire document *Cellular_Respiration.tns.*



All living things require energy to stay alive. Most of this energy comes from food, often in the form of glucose. Cells share common pathways to metabolize food molecules like glucose into usable forms of energy, and these pathways are called Cell Respiration.

Cell respiration includes Glycolysis, the Krebs Cycle (sometimes called the "Citric Acid Cycle") and the Electron Transport System (ETS). These pathways convert energy-rich sugar molecules into molecules that represent smaller units of energy. In this lesson, you'll learn about the pathways of cellular respiration, and how these pathways convert sugar into usable energy for the cell.

Part 1: Glycolysis

Move to pages 1.2 – 1.4. Read the background information in the .tns file and/or below.

In this lesson, you will learn about the metabolic pathways that cells use to turn sugar into energy. For a cell, the most common currency for energy is in the molecule ATP, it can be used by a variety of enzymes. These pathways pair the catabolism (breakdown) of sugar with the anabolism (building) of new energy molecules. The carbon in glucose is actually released as CO_2 at the end! Much of the metabolism in the cell directs molecules to the major pathways you will learn about in this lesson.

Move to pages 1.5 – 1.7. Answer questions 1–3 here and/or in the .tns file.

Q1. Which molecule does a cell need to access the maximum chemical energy in glucose?

A. water
B. carbon dioxide
C. light
D. oxygen

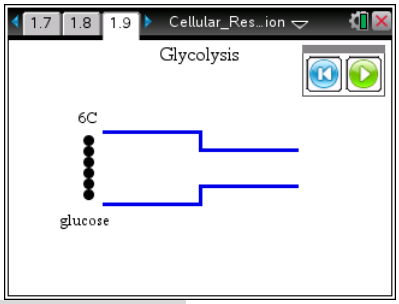
Q2. To catalyze the conversion of one glucose molecule into 38 ATP molecules, the cell uses many enzymes.

A. agree
B. disagree

Q3. Why does the cell convert glucose to ATP rather than use the energy directly from the sugar? Explain.

Move to pages 1.8 – 1.9.

1. Read the information on page 1.8. On page 1.9, you will see what glycolysis does to a molecule of glucose. Use the navigation buttons to watch the simulation multiple times.



Tech Tip: To access the Directions again, select menu or **Document Tools ( ) > Cellular Respiration > Directions.**

Tech Tip: To access the Directions again, select > **Cellular Respiration > Directions.**

Move to pages 1.10 – 1.11. Answer questions 4-5 here and/or in the .tns file.

Q4. Glycolysis starts with a 6-carbon sugar. What becomes of these 6-carbons at the end of this pathway?

A. 38 ATPs
B. ADP and NADH
C. 2 3-carbon pyruvic acids
D. 1 Glucose

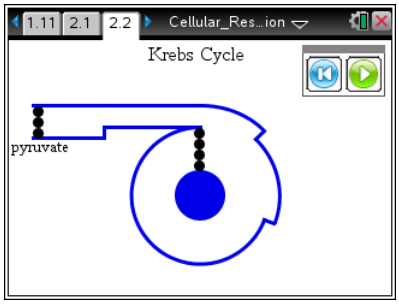
Q5. Glycolysis pairs the catabolism (breakdown) of glucose with the anabolism (formation) of which molecules?

A. 38 ATPs
B. ADP and NADH
C. 2 3-carbon pyruvic acids
D. 1 Glucose

Part 2: The Krebs Cycle

Move to pages 2.1 and 2.2.

2. Read the information on page 2.1. On page 2.2, you will see a simulation of the Krebs cycle. Use the navigation buttons to watch the simulation multiple times.



Move to pages 2.3 – 2.5. Answer questions 6-8 here and/or in the .tns file.

Q6. Two substrates combine to make a 6 carbon substrate that loses 2 carbons during the cycle. What becomes of these carbons?

A. CO_2
B. NADH
C. ATP
D. $FADH_2$

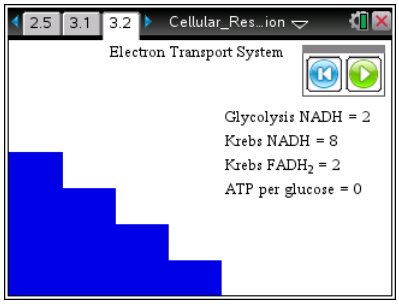
Q7. Based on your observations, which of these releases more energy?

A. glycolysis
B. Krebs Cycle
C. They are the same.

Q8. Where does the 2 carbon substrate that starts the Krebs Cycle come from?

A. protein in food
B. oxygen
C. anabolism of lipids
D. glucose

Part 3:Electron Transport System (ETS)



Move to pages 3.1 – 3.2.

3. Read the information about the Electron Transport System (ETS) on page 3.1. On page 3.2, use the navigation buttons to view the simulation.

Move to pages 3.3 – 3.6. Answer questions 9-12 here and/or in the .tns file.

Q9. Based on your observations, which molecule has the most energy?

A. ATP
B. NADH
C. $FADH_2$
D. H_20

Q10. The simulation refers to oxidative phosphorylation, which is similar to respiration in that both require which molecule?

A. oxygen
B. H_20
C. CO_2
D. light

Q11. FADH2 can be converted into how many ATPs?

A. 0
B. 1
C. 2
D. 3

Q12. NADH can be converted into how many ATP molecules?

A. 0
B. 1
C. 2
D. 3

Assessment

Move to pages 4.1 – 4.3. Answer questions 13–15 here and/or in the .tns file.

Q13. Which of the following is a major source of energy for cellular respiration?

A. DNA
B. water
C. the cell membrane
D. glucose

Q14. Without oxygen, glycolysis cannot complete the pathway, and only one pyruvate is produced per glucose. This is more efficient.

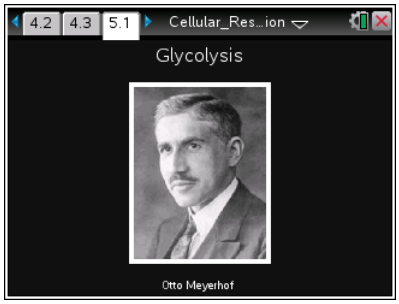
A. True
B. False

Q15. Imagine an enzyme that needs 2 ATP to unwind each base pair of DNA. How many glucose molecules would it take to unwind 108 base pairs of DNA ?

A. 1
B. 6
C. 38
D. 216

Extension

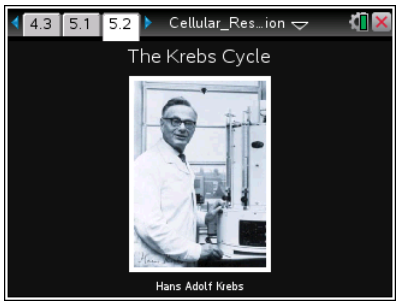
Move to page 5.1.



Otis Meyerhof

Dr. Meyerhof studied how cells use the energy in sugar, and was able to show that the process yeast use to metabolize sugar is that same that mammals use. He was awarded the 1922 Nobel Prize for this work.

Move to page 5.2.



Hans Adolf Krebs

Dr. Krebs described the energy creating reactions in all living matter, including the Krebs cycle (or Citric Acid Cycle). He was able to piece together an enzymatic pathway for creating where the product of the last reaction is the substrate of the first. He won the Nobel Prize in 1953 for this discovery.

Assessment

Move to page 5.3. Answer question 16 here and/or in the .tns file.

Q16. Meyerhof's work found that glycolysis happens in which organisms?