Lesson 3.7 Anaerobic Respiration

Name

Date

Period

Key Terms	
alcoholic fermentation	lactic acid fermentation

Engage

Each class member will compete in the Lactic Acid Sit out. Find an empty space against a wall and wait for further instructions.

1. Why is it so difficult to support yourself sitting against a wall?

2. Where do you think the burn in your legs comes from?

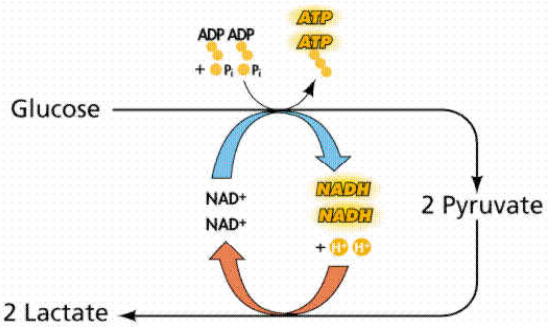
Explore I *Fermentation Investigation*

Fermentation - an Alternative to Cellular Respiration

While some steps do not require oxygen, cellular respiration, as a whole, can only take place when oxygen is present. For organisms living in anaerobic conditions, complete cellular respiration is not possible. These organisms undergo fermentation; in fermentation, glycolysis proceeds normally, as in aerobic conditions, producing a net gain of 2 ATP, but the Krebs cycle and the electron transport chain do not take place. The pyruvates from glycolysis are then broken down into either ethanol and CO_2 or lactic acid. This allows NADH to be recycled so that fermentation can continue in the cytoplasm.

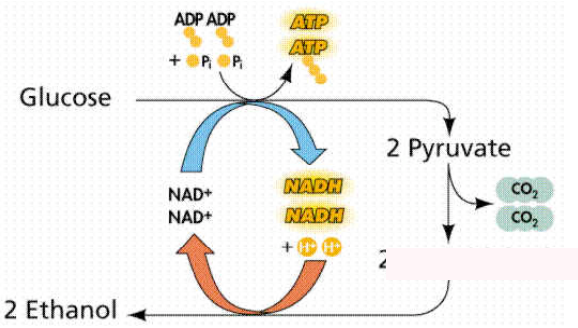
Lactic Acid Fermentation

$C_6H_{12}O_6 \rightarrow$ 2ATP + 2 Lactate (lactic acid)



Alcoholic Fermentation

$C_6H_{12}O_6 \rightarrow$ 2ATP + 2CO_2 + 2 Ethanol



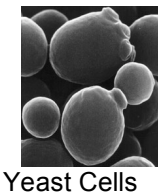
3. Where does fermentation occur?

4. Why do some organisms only undergo fermentation instead of cellular respiration?

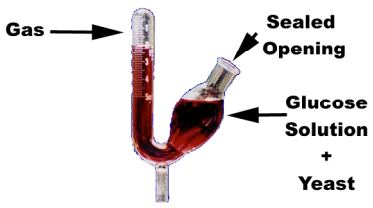
5. Which produces more energy: cellular respiration or fermentation?

Use the information below to answer questions 6 – 8.

Glucose solution and yeast are placed in the tube shown on the right at 20°C. The tube is sealed. After several hours gas is formed in the collection tube.



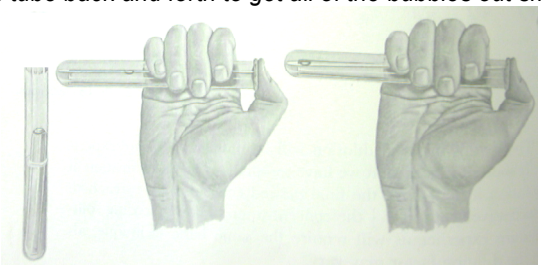
Yeast Cells



6. What process has occurred to produce this gas?

7. What gas is produced?

8. Predict which of the following conditions will provide the most gas: hot, warm or cold temperature. Explain.

Materials	**Protocol**
4 Test Tubes (20x150mm) 4 Test Tubes (12x75mm) 10% Molasses (glucose) solution Dry yeast Hot water bath Metric ruler	1. Label one 20x150mm test tube with your group number, and ***experimental condition***. 2. Place 20mL of molasses solution into the labeled 20x150mm test tube. 3. The teacher will add a few mL of yeast solution to the test tube. 4. Invert and place the small test tube inside of the larger test tube. 5. Allow the small tube to fill with the molasses solution by holding the larger tube on its side. *You may need to rock the tube back and forth to get all of the bubbles out smaller tube (see diagram).*  6. Once all of the bubbles are removed from the smaller tube, place your test tube in the appropriate location. 7. Repeat 1-5 for tubes labeled with ***cold***, ***warm***, and ***hot***. 8. Wait for 24-48 hours and measure the amount of gas produced in millimeters.

Data

	Refrigerator Test Tube gas height (mm) (*with yeast*)	**Room Temperature Water Bath Test Tube gas height (mm) (*with yeast*)**	**Room Temperature Water Bath Test Tube gas height (mm) (*without yeast*)**	**Warm Water Bath Test Tube gas height (mm) (*with yeast*)**	**Incubator Test Tube gas height (mm) (with yeast)**
Group 1					
Group 2					

Explain I

9. Compare the results to your prediction from question #8 (previous page). Does the data support your initial thinking, or has your thinking changed?

10. What other material is present in the test tube at the end of the experiment beside CO_2, glucose, yeast, and water? How do you know?

11. For every molecule of glucose broken down by the yeast, what is the net gain in ATP?

12. What is the process of glucose breakdown by yeast called?

13. What kind of condition (aerobic or anaerobic) is required for this process to occur?

14. Would the CO_2 be produced if the small test tube were upright instead of inverted? Explain your answer.

15. In the Engage (wall sit activity), what process occurred in your muscles?

16. Why do we make bread with yeast? Explain your reasoning.

17. Why does the alcohol content in sparkling wines only get to 14%? Explain.

18. Summarize the key differences between aerobic and anaerobic respiration in the table below.

	Does it require the presence of oxygen?	How much ATP does the total process produce?	List the key steps of each process.
Aerobic respiration			
Anaerobic respiration			