Ethanol and Fermentation Midterm Unit Objectives: by the end of this unit, students will be able to…

- Summarize the origins, history, and purpose of the Energy Independence and Security Act of 2007, including the impacts of OPEC, 1973 Oil Embargo, Arab-Israeli War, 1990 Clean Air Act Amendments, 9/11 Terrorist Attacks, Brazilian ethanol, and the Renewable Fuel Standard.
- Summarize how ethanol is produced.
- Compare the primary sources of ethanol in the US vs. Brazil.
- Explain why Brazil has successfully implemented ethanol use throughout the country.
- Summarize the goal of the Renewable Fuel Standard component of EISA.
- Explain what is meant by the terms E10, E15, and E85.
- Define each of the following: a. Feedstock b. Biomass c. Distillers Dried Grains d. Octane Number e. Fodder
- Summarize the history of ethanol use in the US beginning with the American Civil War though WWII.
- Describe the relationship between octane rating and engine knocking, and explain the impact that ethanol use has on the octane rating of a fuel.
- Compare and contrast the energy balance of ethanol vs. gasoline.
- Compare and contrast the benefits and drawbacks of ethanol made from corn vs. cellulosic ethanol.
- Summarize the benefits of ethanol use, specifically in regards to octane rating, energy balance, carbon neutrality, economic benefits, likelihood of complete combustion, and in regards to creating additional markets for American agriculture.
- Explain the kinds of vehicles in which E10, E15, and E85 can be used.
- Summarize problems associated with the production and use of ethanol.
- Identify and explain problems specific to corn ethanol that could be addressed by using cellulosic ethanol instead.
- Summarize the main benefits of cellulosic ethanol in comparison to other fuel sources.
- Identify and outline problems specific to cellulosic ethanol that are currently preventing a more widespread use of this fuel.
- Identify cellulose, hemicellulose, and lignin molecules based on images and descriptions.
- Explain how the molecular structure of cellulose differs from starch and how they are similar.
- Define pretreatment and hydrolysis.
- Identify steps of cellulosic ethanol production using pictures and descriptions.
- Draft a position statement in which students take a stance either for or against the proposal to expand the use of cellulosic ethanol in the future and back this position with evidence and facts in regards to this source of fuel (essay format on quiz).
- Explain the role of ATP in the cell and explain how it is produced from ADP and P_i.

- Explain how a cell can use ATP Synthase to produce ATP.
- Explain how a cell can use pyruvate to produce ATP.
- Explain the role that oxygen plays in the production of ATP.
- Explain the difference between a prokaryotic cell and a eukaryotic cell.
- Compare and contrast cellular respiration and fermentation.
- Explain how glycolysis relates to cellular respiration and fermentation.
- Compare and contrast prokaryotic and eukaryotic organisms.
- Explain why it is necessary for yeast cells to convert pyruvate into acetaldehyde and then ethanol.
- Summarize the role played by NAD+ in glycolysis and fermentation.
- Diagram the conversion of sugar into ethanol by showing each intermediary molecule that is created in order to produce ethanol.
- List the benefits of fermenting food.
- Identify and list fermented products.
- Compare and contrast wet milling and dry milling and explain how each can be used to produce ethanol.
- Summarize the organs, steps, and processes used by the body to break down alcohol that has been consumed.
- Explain how fast alcohol can be processed by the body.
- Identify the class of drugs in which alcohol is categorized through the impact that it has on the body.
- Explain the connection between alcohol consumption and the risk of sexual assault through statistics and a comparison between how alcohol affects men and women differently.
- Define each of the following: a. Binge drinking b. Alcohol abuse c. Substance dependence d. Tolerance e. Withdrawal
- Describe the outcome that occurs as a result of the impact of alcohol on each of the following structures: parietal lobe, cerebellum, amygdala, hippocampus, primary motor cortex, premotor cortex, and endolymph/semicircular canals.
- Summarize three ways in which alcohol consumption results in increased urination and water loss.
- Explain how alcohol's inhibition of the production of glutamine, a natural stimulant, results in increased fatigue.
- Identify and list chronic problems associated with long-term alcohol abuse.