

Top Fuel: Ethanol Project

James Burk's Sample Schedule

Provided is a sample 2-3 week schedule for 50 minute class periods. James tends to use this schedule at the beginning of the year as it introduces many concepts that can be referred to later in the year and these labs help students learn many lab procedures and techniques. Students enjoy competing with other groups to produce the most efficient fuel producing process. These labs also provide a great way to show the relevance of what is being learned in the class.

Concepts

Science

- Experimental Design
- Measurement and data collection
- Forms of Energy

Biology

- Enzyme function
- Fermentation
- Macronutrients
- Ecology – impact of abiotic factors on metabolism of yeast

Chemistry

- Determining Density
- Concentration of solutions
- pH
- Distillation
- Balancing equations
- Gas Stoichiometry
- Calorimetry
- Combustion

Sample Schedule

- Day 1 Introduce ethanol production, fermentation, uses and importance.
- Day 2 Prepare samples and weigh out yeast for fermenting fuel.
- Day 3 Run Fermenting Fuel assigned experimental procedures.
- Day 4 Report out results and students design Fermenting Fuel experiment and prepare samples.
- Day 5 Run student designed Fermenting Fuel experiments.
- Day 6 Report out results and design a scaled-up fermentation protocol for larger scale fermentation.
- Day 7 Prepare samples for large scale fermentation and set up gas collection. Start fermentation and let run at least overnight.
- Day 8 Set up distillation apparatus and estimate the amount of ethanol produced using gas collection or density.

- Day 9 Run initial distillation and use density to determine the concentration and amount of ethanol produced.
- Day 10 (Optional) Run a second distillation while setting up calorimetry for Top Fuel. Determine final concentration of ethanol and total amount collected.
- Day 11 Analyze fuel burning characteristics using Top Fuel procedures.
- Day 12 “Sell” the fuel produced at current ethanol prices substituting milliliters for gallons. Determine the profitability of the student developed protocol by subtracting the cost of the protocol from the sale price of the ethanol product.
- Day 13 Introduce the concept of DDGs and other value added products that can be used to increase profitability. Have students prepare another mash sample using the same protocol excluding the yeast.
- Day 14 Compare nutrients in DDGs and initial mash sample.
- Optional exploration of more value-added product labs: More Fuel, Corn Plastics, etc.
- Culminating Experience-Take a tour of an ethanol plant or have an ethanol expert as a speaker.