

## Lesson Plan Lab: Alcohol and Flies

<b>Class:</b> Biology	<b>Date:</b>
<b>Essential Question (EQ):</b> 1.) Develop a laboratory experiment observing the effect of alcohol on fruit flies (or other insect). 2.) Demonstrate and understand how observational data (qualitative) can be scored for quantitative data for analysis 3.) Describe the metabolism of alcohol.	<b>NC Standard Course of Study Goals:</b>
<b>Key Vocab/Concepts:</b> Alcohol Metabolism, quantitative and qualitative data, alcohol, alcoholism, fruit flies,	<b>Formative/Summative Strategies:</b> Lab report written in lab notebook.

<p><b>Class Opener: Activate Prior Experience &amp; Knowledge /Pique Interest/Preview Vocab</b> (3-5 min)</p> <p>Discuss with students that fruit flies are attracted to the alcohol created from the decaying food. Students can be given the article titled Drunken Drosophila by Karen Hopkin. Also, discuss/review with students how alcohol is metabolized with the aid of a special enzyme ADH which is created from a specific gene.</p>
<p><b>Process/Debrief/Reflect/Share Out:</b></p> <p>Have students discuss with their neighbor and/or teacher what would happen if flies could not properly oxidize alcohol? What are the implications in human beings who can't oxidize alcohol?</p>

<p><b>First Activity</b> (Whole-Class/ Group Work/Individual Work; Before-During-After framework) (Day 1)</p> <p>Students will develop an experiment to observe the effects of alcohol on flies. Students will be developing an experiment in which they can observe qualitative data and then graph it in quantitative data.</p> <p>Students will be given access to cotton balls, alcohol (white wine), Fruit fly bottles, covers, pipettes, fruit flies, ice bucket (chilling the flies)</p> <p>Students will be instructed to work with a partner/group to develop an experiment to observe how different concentrations of alcohol will affect the flies behavior. Students will discuss with their groups (2-4 students) and write a lab procedure in their lab notebooks. Students will make an "observation statement" such as: I have observed that alcohol has intoxicating properties. In which students will make an "inference statement" such as: Therefore, I infer that flies can become intoxicated too. And students will make/write a hypothesis for their experiment.</p> <p>Next in their group students will create a lab procedure for the experiment. They must include each section:</p> <p><b>-Hypothesis:</b> What they students think will happen based on previously tested and/or known data.</p>
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**-Materials:** What did the student used.

**-Methods:** How did the students conduct their experiment? What are their justifications for setting up the experiment the way they did? This is the section I want student to create a method to quantify observational data. I also want student to think about how many times they will make observations and at what time intervals. Students will keep in mind they have a 24 hour period but must observations should be made in the 2 hour class block.

**-Procedure:** This is a step by step break down of what the students did in the experiment.

**-Conclusion:** What do the results of the experiment mean.

**Process/Debrief Activity** (Connect to EQ; Higher Order Thinking Question → Analyze/Reason/Apply)

Students should develop an appropriate control (water) and think about what appropriate concentrations of alcohol are. Keeping in mind students don't want to kill the flies out right in the beginning so what are some good concentrations. The teacher will give guidance to the class regarding the appropriate concentrations. For example, students could have 4 fruit fly bottles one bottle with water as a control, bottle 2 could be 1ml drop of wine, bottle 3 could be 2.5ml and bottle four 5ml drop of wine. Students should discuss these concentrations but must be given approval from the teacher before setting up their alcohol concentrations for their experiment. However, if students choose to try drops they must make all the cotton balls a uniform "wetness" or there could be additional source of error. Students could add 4ml of water to bottle 2 and 2.5ml of water to bottle 3 in order to soak each cotton ball with 5ml of liquid. However, another method students could utilize in this experiment is to dilute the concentrations. For example, if the wine is 12% alcohol, bottle one could be 10ml of alcohol, bottle two could be 5ml alcohol and 5ml water, bottle three could be 2.5ml wine and 7.5ml water ect. For a varying degree of concentrations.

\*\*The teacher will then set up the concentrations of the bottles for each lab group but label the tubes anonymously in order to protect students from biases. The teacher will keep record of each groups alcohol concentrations and after the experiment has been conducted the teacher will reveal to the group what concertation each bottle was in order for students to write their conclusion section.

Students should develop a scoring mechanism in which to describe the flies movement and/or behavior. The teacher will give students an example such as the table to the right. But students will be given the chance to think of different ways to measure fly behavior. Most importantly, what ever behavioral observation students choose must be continuous in order for students to plot the observational data in a quantitative way to plot in a graph such as a line graph. In this possible scenario students could plot on a line graph how increasing alcohol concentrations causes reduced movement in flies.

Behavior score	Behavior
1	Flying around
2	Some movement
3	Little movement
4	No movement but alive
5	Dead

Students should think about what kinds of behaviors will they be scoring with their flies? Will it be a 1-5 score based on movement? Will it be based on flying behavior? Ect.

Students will also need to think about how many observations they will make on the fly behavior. The teacher will inform students that they will be given the following day to conduct the experiment which they write up. Meaning students will have a 2hour class period to set up, perform and write their observations on the experiment they wrote up the previous day. Therefore, students need to think about how many observations they will make and at what time interval. The teacher could give students an example such as making observations every 5 minutes for 45 minutes.

Students will be given a 2hour long class period to develop their experiment.

Students will need to discuss what factors could cause errors in their experiment? Such as hurting a fly due to mishandling or having residue liquid/alcohol on the sides of the flask which flies could get stuck in and die.

Students should think about what ways are to reduce these possible points of error.

**Formative Assessment of Activity** *(What will you be looking for/listening for; how will students self-evaluate, process, reflect; Connect this assessment to EQ or Standard)*

I will be reading and grading the student's lab notebooks, the data and observations they collect and the tables/graphs they create as a graded assessment.

**Grading Rubric:**

**Hypothesis:** What do students hypothesis will happen based upon knowledge they already posses. 5pts

**Materials:** List of what students used 2pts.

**Methods:** How did the students conduct their experiment? What are their justifications for setting up the experiment the way they did? 10pts

**Procedure:** This is a step by step break down of what the students did in the experiment. 5pts.

**Conclusion:** What do the results mean? 8pts

**Graph of data:** Students should plot fly behavior vs alcohol concentration. 10pts.

Total 40pts.

**Second Activity** *(Whole-Class/ Group Work/Individual Work; Before-During-After framework) (Day 2)*

The second part of class students will conduct their experiments. Students will set up their experiment based on how they brainstormed and constructed their experiment from the previous day (See Activity one above). Students will have a 2 hour class period to conduct their experiment, make their observations, and construct their graph/s base don the information they obtain. (Students should have already written their Hypothesis, Materials and Methods section from the

previous day). Students should focus on writing their procedure and conclusion sections in this class period.

**Multiple Forms of Representation** *(Visual/Audio/Multiple modes for directions and content)*

Labs are hands on experiments therefore great forms of representation with multiple modes.

**Process/Debrief Activity** *(Connect to EQ; Higher Order Thinking Question → Analyze/Reason/Apply)*

The teacher will walk around the classroom helping students with their experiments and guiding students with more critical thinking and higher order thinking questions.

After the experiments have been conducted, data collected, and observations made. Students will be guided by the teacher's prompting to extrapolate these observations to real world and/or human consequences. Did they see similarities to how alcohol effected the flies to how humans behave? What are the consequences to humans who receive too much alcohol? How does this relate to the walk the line test vs breathelizer

**Formative Assessment of Activity** *(What will you be looking for/listening for; how will students self-evaluate, process, reflect; Connect this assessment to EQ or Standard)*

The teacher will collect students lab books either at the end of class or the following day and grade students work based on the grading rubric. (see activity one above for detailed rubric grading.)

**End-of-Class: Debrief/Review/Process/Reflection opportunity***(Connect to Standard/EQ) (3-5 min)*

**Plan to reach/accommodate ALL students**

**Student 1 (pseudo)Name:**

**Student 2 (pseudo)Name**

**Student 3 (pseudo)Name:**

**After the Lesson: Reflection Quick Notes**

**What went well:**

**Things to reconsider / do-over for next time:**

**Questions/Discussion Points**

1.) Types of alcohol that could be used? – wine seems to be the best fit for this experiment

2.) What are recommended insects if I can't get fruit flies? - Carolina Biological Supply. Venders in Asia (do a little google searching)

3.) What are possible alternative qualitative observations students can make in which to score on a scale for quantitative data? – flask of flies before treated and observe normal flying behavior and write down some observations and thing they see. The scale needs to be a **continuous scale**...need to have order to the experiment. Think about what they are seeing and observing before they make their qualitative scale.

4.) what are some tips and advice on getting students to think about controls? Appropriate differing concentrations of alcohol and what is an appropriate length of time/how frequently they should be making observations? – ask the students how do we know what the wine is doing do we need to compare the flies to something else? How do you know if they stop moving they aren't just tired. How do you know they just don't like to sit on the bottom on the tube. To avoid any misinterpretation we really need a control! Ask student what do I mean by control? What could we do to make the control more “wine” like.

Tubes – should be about 1inch wide about 4inches tall. **Fruit fly bottles.**

Group of two has 4 vials and labeled A,B,C,D coded by the teachers. Keep the students “blind” to the treatment conditions. The entire experiment is subjective.

5.) what do you think of having each lab group come up with their own version of a behavior score methodology? Instead of one big class? Pros and Cons here? – Go for similar in a sense! In theory should get the same results. Subjectivity creates variability.

6.) I would like to give students a 24 hour time frame in which to conduct this experiment....too long too short? Or many day 1 set up/write their experiment making sure their experiments are thorough then day two students can conduct their experiments.

1<sup>st</sup> day – design experiment

2<sup>nd</sup> day – conduct experiment

\*\* they can use flies with gene mutations, study behavior to understand ways to predict addiction, flies genetics are quite similar to humans, good test subject. We don't do this to just watch flies get drunk.