Additional Resources

Learning to Identify Birds Using a Field Guide (PDF format)

Grape Observation Lab (Grades K-12)

Objectives: This activity introduces students to using their observational skills, which is an important part of scientific practice. This practice includes data collecting, organization of data, and communication skills. Students will also generate questions and testable hypotheses.

Materials (per group):

- 4 grapes
- 2 150ml beakers
- 2 paper towel sections
- ginger ale
- pencil and notebook
- 1 forceps (optional)
- 1 metric ruler
- 1 100ml graduated cylinder
- 1 timer

Procedure:

1. Prior to the day of the lab, refrigerate one-half of the grapes. *(K-6 teachers skip this step.)*
2. Set out one bunch of grapes at room temperature on a paper towel labeled "group A." Set a bunch of grapes from the refrigerator on a paper towel labeled "group B." *(K-6 teachers only use one bunch of grapes.)*
3. Each can of ginger ale contains 355 ml volume; each student group will need 100ml.

Student Protocol:

1. Obtain the materials listed above and set them up at your work station.

2. Label one side of the paper towel “A” and set two grapes from bunch “A” on it, then label the other side of the paper towel “B” and place two grapes from bunch “B” on it.
3. Using the forceps (or fingernails) peel one grape from group “A” and peel one grape from group “B.”
4. Use the graduated cylinder to measure out 100ml of ginger ale and pour it into each beaker.
5. Place the peeled and unpeeled grapes from bunch “A” into one beaker, and the peeled and unpeeled grapes from bunch “B” into the second beaker.
6. Start the timer and observe what is happening in both beakers. Record your observations at one-minute intervals for 10 minutes.
7. When finished, stop the timer, pour the ginger ale down the sink, throw the grapes into the trash, and clean up your area.
8. Organize your observations into a data table, remembering to use the metric system.

In your group: Generate five to six questions from your observations.
With your class: Discuss what questions from the groups can be used to make testable hypotheses.

Answer the following questions using complete sentences:

1. What were the major differences in the behaviors of the two grapes in the same beaker?
2. What were the major differences in the behaviors of the grapes between the two beakers?
3. Do you think the grapes would behave the same way using a liquid different than ginger ale? Explain your answer.
4. What purpose does the grape skin (membrane) serve?
5. Do you think the tiny bubbles released by the peeled grapes has the same gases in it as the larger bubbles on the outside of the grape?

Extension: *(Teachers: leave this out if you wish)*

1. What are the ingredients in ginger ale?
2. Which of these ingredients may be responsible for the behavior of the grapes in the ginger ale?
3. What is a logical test for your hypothesis from #2 above?

**Teacher Notes*
Students can test the grapes in water, club soda, water with alka seltzer, ice water, and warm water. The carbonation is the primary factor for driving the activity. The membrane prevents absorption of the ginger ale, keeping the grape buoyant, and will collect the larger carbonation (CO_2) bubbles on one side. After a minute or so the grape will spin or turn and start collecting bubbles again. Cold grapes behave differently due to changes in density. As the grapes warm, they start to behave similarly to the room temperature grapes.

Invention Take Apart (suggested grade levels 5-12)

Materials: Provide students an assortment of mechanical item(s) to disassemble. Non-digital items with gears, buttons, etc., such as tape recorders, radios, toy cars, work the best. In addition, provide a variety of tools with which to disassemble, such as screwdrivers, tweezers, a hammer (for the teacher to use), etc. Keeping safety in mind, remember to also provide safety goggles. Display the items using heavy duty cardboard (boxes cut open to lie flat), clear packing tape and markers.

Procedure:

Begin by introducing the item(s) to students. This may require some background knowledge as to what the item is/does. In their science notebooks, have them diagram what they see on the exterior, and label known parts with a caption the includes the function of the part.

Next, have the students create an additional page in their student notebooks predicting what they will find inside, as well as a paragraph of how they think the item works. Begin disassembling by removing the outside case; older students can do this step themselves.

In a third science notebook page, have students diagram what they see on the inside, labeling with captions the various parts. Continue disassembling by removing each individual part, and taping the parts onto the display cardboard with a label and function.

The extension of this activity can tie into *Core Idea ETS 1 – Engineering Design* by communicating not only the function of the design, but the research of the "next generation" and optimization of the design. A final piece can be brainstorming and/or creating inventions with accompanying diagrams and communication tools (e.g., Prezi).

Dissection Observation (Life science or biology)

Objectives: Integrate obtaining, evaluating, and communicating into a dissection lab. Students will use these practices as a platform for discovery and understanding of deep anatomy in the object being dissected.

Materials: Dissection equipment, dissection object (e.g., frog, fish, tomato)

Procedure:

Use this toolkit activity during a normal lab dissection. During the lab portion when transitioning from superficial to deep, do not provide information about the internal anatomy. Once the internal anatomy is exposed, students will draw and diagram in their science notebook what they observe of the internal anatomy.

The students should identify the different organs or parts

even if they do not know the names. Differentiation can occur by having the upper grades justify why they have assigned a name to an organ (justification by observation). Lower grades can assign a fictional name and fictional purpose to the organs they do not know.

Continuation of this activity is to give enough information to the students for them to discover what the actual name and function of the organs are. Have them reconstruct their drawing and diagram with the correct names and functions with an explanation as to what they got wrong and why. Include their explanations in their lab write up.

Classification: Dichotomous Key Activity

Students create a dichotomous key of sturgeon using the Sturgeon Classification – Dichotomous Keys Lesson Plan (PDF format) from author Rob Yeomans.

Genetics & Environmental Science Activity

Toothpick Fish Genetics Activity for Middle School (PDF format)

Online Resources:

- Encyclopedia of Life
- Frog Guts (virtual frog dissection)
- Science World Magazine's online resources
- Science News for Students
- Wonderopolis: A great site for explanations of wonderings. Can search by subject and grade level. Would be a great prompt for science notebooking and predictions with diagrams and labeling. Research the "wonder" and evaluate findings via notebooks, discussions, etc.

TED Videos:

- "The Wacky History of Cell Theory"

- “The ABC’s of Gas: Avogadro, Boyle, Charles” – Brian Bennett
- “How to Think About Gravity”
- “The Simple Story of Photosynthesis”