

## Can't Judge a Powder by its Color

1. **DESCRIPTION:** Students will test and characterize one pure substance and then, based only on data they collect, answer a series of questions about that substance

**A TEAM OF UP TO: 2**

**APPROXIMATE TIME: 50 minutes**

2. **EVENT PARAMETERS/CONSTRUCTION:**

- a. What students may bring
- No reference materials or calculators are allowed. Do not bring pens or pencils into this event.
  - Students should bring
    - pHydrion paper
    - hand lens
    - 9 volt conductivity tester (no testers will be allowed that run on 120 volts.)
    - Beral pipettes or eye droppers
    - Containers appropriate for testing conductivity and solubility (spot plates, beakers, etc. are fine)
    - Test tube holder and test tube rack if using test tubes
    - Spatula
    - Stirring rod
  - The team may bring no other items. Supervisors will check the equipment a team brings and have the right to rank the team below the first tier for bringing equipment not on the list

b. Event supervisors will provide

- 1.0 M NaOH
- 1.0 M HCl
- Distilled (deionized) water
- Two different colored writing implements
- Paper Toweling
- The observation sheet
- The questions/scoring sheet

Possible Equipment that MAY be provided

- Thermometer
- Balance
- Hot plate
- Anything else the supervisor decides to distribute. If the supervisor feels instructions are needed in order to use something provided, the instructions will be available.

- c. **Safety Requirements:** Students must wear the following or they will not be allowed to participate: closed-toed shoes, ANSI Z87 indirect vent chemical splash goggles (see <http://soinc.org>), pants or skirts that cover the legs to the ankles, a sleeved shirt, and a lab coat or chemical apron that reaches below the knees. Gloves are optional. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) will be disqualified from the event.

3. **THE COMPETITION:**

The intent of this event is for students to make and record observations. Contestants will be given a sample of one pure substance. Equipment and test chemicals listed will be provided. The supervisor will make the selection of equipment and chemicals. Students and teachers ARE NOT to know what substance has been selected before the event. Students will be expected to perform relevant tests using the materials provided. Emphasis in scoring is placed on careful and organized observations. Students WILL NOT be asked to identify the solid. Emphasis of this event is on the quality of data collected, answering questions about the substance and providing data to support their answers.

- Teams will use various tests to characterize the substance. These tests are to be determined by the students, not the supervisor. It is recommended that students be given 25-35 minutes to do these tests. Data is to be recorded on a data sheet with a writing implement provided by the event supervisor. It should be neat and organized.
- During testing and observation of their substance, students must record their data. Any mistakes or changes should be crossed out (with one line). The data should be numbered sequentially as it is collected. The writing implement will be collected before the questions are given to the team.

- c. A clean up time of  $\approx$  10 minutes will follow. The supervisor will collect all samples and announce the appropriate clean up procedures. A scoring deduction may be incurred for improper clean up procedures.
- d. Students will be given a writing implement and a list of questions about the characteristics of their substance. The ability to answer these questions will depend on the quality and thoroughness of their investigations. Questions will have answers that derive from student observations. If the team has sufficient data and/or observations to support the answer to a question, they are to simply place the data number(s) beside the question. Place a number for all data that supports your answer to the question. (15 minutes) Questions will not be asked about melting point.
- e. **Examples of Possible Substances:** baking soda ( $\text{NaHCO}_3$ ), borax, Epsom salts, sugar, alum, chalk, non-iodized table salt ( $\text{NaCl}$ ), sodium acetate ( $\text{NaC}_2\text{H}_3\text{O}_2$ ), starch, talc, calcium carbonate, ammonium chloride, boric acid, copper (II) chloride, copper (II) sulfate, etc. Note: Colored, as well as white salts are permissible.

4. **SAMPLE QUESTIONS:**

- a. Is the substance soluble in water?
- b. If soluble in water, is the solution capable of conducting a current?
- c. Does the substance react with an acid to produce a gas?
- d. If soluble in water, what is the approximate pH of the solution?
- e. If soluble in water; does the substance dissolve endothermically or exothermically?
- f. Using a hand lens, what is the shape of the individual particles or are they too small to see?

5. **SCORING:**

- a. Each question is worth 5 points. The number of points awarded will depend on the quality of the data and/or observations. If the team remembers an answer to a question but does NOT have the supporting data and/or observations, they may write the answer to the question with their writing implement and receive a maximum of 2 points. Ties will be broken by using the most answers that received 5, then 4, then 3, etc. Time is not a tiebreaker! For instance if a student observes that when .5 g of the powder is dissolved in 5 ml of water, the temperature of the solution goes down .7 degrees, that observation would receive 5 points to the question of what happens when the substance is dissolved in water. But a 4 point answer might be that the temperature goes down when the substance is dissolved in water. If the student writes an inference instead of an observation, such as the dissolving is an endothermic process, the student would only receive 3 points.