CAN'T JUDGE A POWDER BY ITS COLOR

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

   A TEAM OF UP TO: 2 **EYE PROTECTION:** #4 **APPROX. TIME:** 50 min.

2. **EVENT PARAMETERS:**

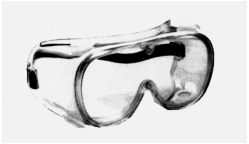
   a. **What students may not bring**: Reference materials, calculators, pens or pencils.

   b. **Students may bring**:

      i. pHydrion paper
      ii. Hand lens
      iii. Battery conductivity tester (no testers will be allowed that run on 120 volts.)
      iv. Beral pipettes or eye droppers
      v. Containers appropriate for testing conductivity and solubility (e.g., spot plates, beakers, etc.)
      vi. Test tube holder and test tube rack if using test tubes
      vii. Spatula
      viii. Stirring rod
      ix. 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.
      x. **Note:** Students not bringing these items will be at a disadvantage.

   c. **Event supervisors must provide**:

      i. 1.0 M HCl
      ii. 1.0 M NaOH
      iii. Distilled (deionized) water
      iv. Two different colored writing implements
      v. Paper toweling
      vi. The observation sheet
      vii. The questions/scoring sheet

   d. **Possible Equipment that may be provided:**

      i. Thermometer
      ii. Balance
      iii. Hot plate
      iv. 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.

   e. **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, **and** a **long** sleeved shirt **that reaches the wrists, and** a chemical apron or a lab coat that reaches the knees. **Chemical** 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 a **single** 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

   a. 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 the 1st colored writing implement provided by the event supervisor. It should be neat and organized.

b. During testing and observation of their substance, students must record their data and number it sequentially as it is collected. Any mistakes or changes should be crossed out (with one line).

c. A clean up time of ≅ 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. The 1st writing implement will be collected before the questions are given to the team.

d. Students will be given a 2nd different colored 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) recorded in 3.a. 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 ($NaHCO_3$), borax, Epsom salts, sugar, alum, chalk, non-iodized table salt (NaCl), sodium acetate ($NaC_2H_3O_2$), starch, talc, calcium carbonate, ammonium chloride, boric acid, copper (II) chloride, copper (II) sulfate, etc. Note: colored, as well as white salts are permissible.

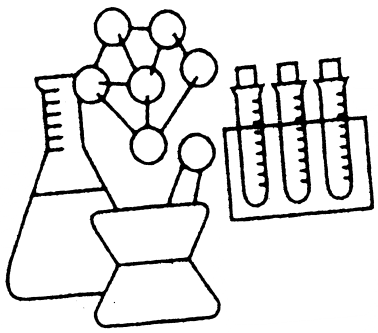
4. **SAMPLE QUESTIONS:**

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 **up to** 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.

b. Using the most answers that received 5, then 4, then 3, etc., will break ties. Time is not a tiebreaker! For instance if a student observes that when 0.1 g of the powder is put into 5 ml of water, the powder floats on the water until it is stirred, that observation would receive 5 points to the question of what happens when the substance is placed in water. But a 4 point answer might be that the substance floats on the water. If the student writes an inference instead of an observation, such as the density of the solid is less than water, the student would receive at most 3 points.



Recommended Resources: All reference, and training resources are available on the Official Science Olympiad Store and Website at http://www.soinc.org.