

QUALITATIVE ANALYSIS

DESCRIPTION: This event consists of two parts. Part I is designed to use simple chemical and physical tests to identify 13 solids. In addition to identifying the 13 solids individually, a mixture of 2 or 3 of the solids could be given to the team to identify the solids in the mixture. Part II consists of a written test on the chemistry of the reactions of the 13 powdered solids.

Safety Requirements: Students must bring and wear aprons or lab coats and OSHA approved chemical splash goggles with indirect vents. Tasting and touching the solids are forbidden. Solids may only be heated in a hot water bath. No open toed shoes may be worn. Books, notes and calculators are not allowed in the competition.

Students Must Bring: The team is to bring test tubes and test tube racks and holders or any devices in which they can perform the tests, droppers, funnel(s), filter paper, pHHydrion or litmus paper, and spatulas, plastic spoons or stirring rods. The team may bring NOTHING else. NOTE: Violation of the rules on equipment brought to the competition by the team or the tasting or touching of the chemical species will result in disqualification from the event.

Supervisor Will Provide: 70% isopropyl alcohol, phenolphthalein, iodine (iodine dissolved in KI solution), vinegar, distilled neutralized water (no more than 250 mL of), 50 mL of 2M NaOH, and a source of copper (II) ions (e.g., copper (II) sulfate crystals, Benedict's test solution, etc.), a hot water bath and a copy of this page of rules or a list of the names of the all possible unknowns. No more than 50 mL of any reagent, except water, will be allowed.

A TEAM OF UP TO: 2

THE COMPETITION: PART I

SOLIDS TO IDENTIFY: sodium acetate, sodium chloride, sodium bicarbonate, sodium carbonate, boric acid, calcium nitrate, calcium sulfate, calcium carbonate, cornstarch, fructose, sucrose, magnesium sulfate, ammonium chloride.

1. The team will be presented with as many of the 13 solids as the event supervisor decides. All teams will have the same set of solids to identify. The team is to identify the solids using the tests they have learned. No more than about 1 tablespoon of any solid should be provided. Be prepared for less. No more solid should be given a team once they have received the original samples.

2. In addition, a team may be provided a mixture of 2 or 3 of the solids. This mixture will contain solids that are separable using the tests that are common for these 13 solids. The team will be told how many of the 13 solids are in the mixture, and all teams will have the same mixture with about equal masses. The mixture will contain an equal amount of each solid. The team should expect a mixture at the state level and will have a mixture at the national level. The container with the mixture will be clearly identified by the event supervisor.

THE COMPETITION: PART II

1. The team should be prepared to write balanced equations and net equations to represent the reaction taking place in any test for any of the 13 solids. The event supervisor may request such information OR ask the team to explain why a test gives the observation it does (e.g., why does fructose result in a red precipitate when tested with copper (II) sulfate or Benedict's test solution?).

2. These questions can be about any of the 13 solids, NOT just ones provided as unknowns in this event.

APPROXIMATE TIME: 50 Minutes

SCORING: The scoring of the event will be 75% on identifying the white solids (Part I) and 25% on answering questions based on #1 in the description of the competition (Part II). If a mixture is used, the 75% should include points for the mixture. TIME is NOT to be used in the scoring or as a tiebreaker. All ties will be broken by selected questions chosen at the discretion of the event supervisor. These questions may or may not be identified to the students.

Reference: For excellent help in preparing for this event, check the Journal of Chemical Education, pages 328 and 329, April 1991. *Go to http://www.ncsu.edu/science_olympiad/leaderinfo/ and click on Qualitative Analysis for information about easy ways to neutralize water. NOTE: This event is scheduled to be replaced in 05.