Density 2018 Trial Event Rules

(A.K.A Buoy Oh Buoy, Buoyancy)

Physics Rules Committee

1. **DESCRIPTION:** Competitors must compete in activities and answer questions about mass, density, number density, area density, concentration, pressure, and buoyancy.

   A TEAM OF UP TO: 2 **EYE PROTECTION:** B **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**
   a. Teams may bring writing utensils, any type of calculators, and one 3-ring binder (any size) containing pages of information in any form, from any source that can be used throughout the event.
   b. Event supervisors must provide any material and measurement devices required to complete the hands-on tasks. Teams must not utilize their own measurement devices.

3. **THE COMPETITION:**

   Part I: Written Test
   a. The written test consisting of multiple choice, true-false, completion, or calculation questions/problems will assess team's knowledge of mass, density, number density, area, density, concentration, temperature, pressure and buoyancy.
   b. Unless otherwise requested, answers must be in metric units with appropriate significant figures.
   c. The event supervisor may provide some mathematical relationships, but the participants are expected to demonstrate an understanding of the concepts outlined below.
   d. The test will consist of at least one question from each of the following areas:
      i. Density of solids, liquids, and gases
      ii. Determination of concentrations (limited to: mass/mass, mass/volume, volume/volume percentages, ppm, ppb and molarity)
      iii. Behavior of gases according to the ideal gas laws
      iv. Archimedes' Principle

   Part II: Hands-On Tasks
   a. The hands-on portion of the competition will consist of at least one task at a station(s) for the teams to complete.
   b. Some example tasks, or stations, are: (Note: this is not an exhaustive list of possible tasks or stations.)
      i. For a given container of gas, measure its volume and mass, and calculate the mass density.
      ii. Given a small bag of M&M's determine the number density of the brown M&M's in the bag.
      iii. Given a helium balloon and a balance determine the mass that the balloon could theoretically lift.
      iv. Determine the depth to which a solid object will sink when placed in water
      v. Determine the density of a material at different temperatures, e.g. air or water.

4. **SCORING:**
   a. High score wins.
   b. The written portion of the competition will account for 50-75% of each team's score. No single question will count for more than 10% of the total points possible on the written test.
   c. The hands-on portion of the competition will account for the remaining 25-50% of each teams score.
   d. Points will be awarded for correct answers, measurements, calculations, and data analysis. Supervisors are encouraged to provide a standard form for competitors to show measurements/calculations.
   e. Ties will be broken using pre-selected task(s)/question(s) that will be noted on the written test.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Density CD and Chem/Phy Science CD; other resources are on the event page at soinc.org.