

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 team's 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.