

Solutions, Density and Floating

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This event will consist of two parts, a paper and pencil event and a hands-on event. Each part of the event will be worth 50 points, for a total of 100 points. There will be time limits on both parts of the event.

The paper and pencil event will consist of a series of questions mostly on solution chemistry. Topics included here are density calculations, types of solutions, the solution process, saturation, factors affecting solubility, ways of expressing concentration, and boiling point elevation and freezing point depression. A very small part will be devoted to questions on density and about what makes objects float in a liquid. Questions may be multiple choice, short answer, and/or include calculations. Students will be allowed to bring a scientific calculator to the event, and will be furnished with a reference sheet containing all relevant equations and constants. No books or other support materials will be allowed during the event. The duration of this part of the event will be communicated to the students at the beginning of it, probably not to exceed 30 minutes.

For the hands-on part of the event, students will be given at least two known and different kinds of powder and/or granulated solids, and a small, hard, single solid object (henceforth, The Object). They will also be told the name and density of a certain liquid (which will be used later in the event), but they will not be given samples of it. The Object will be such that it would sink when put into the liquid. The students' job is to use a pre-determined volume of liquid (which they will be told at the beginning of this part of the event) and the powder and/or granulated solids to prepare a solution in which The Object will float. Students will have a limited amount of time (probably 10 minutes) to decide the kind and amount (by weight) of powdered and/or granulated solid they will need to add and dissolve into the pre-determined volume of liquid to make The Object float.

Once students have determined and measured the kind and amount of powder and/or granulated solid they will use, they will take it to the testing area, where an event runner will use it together with the pre-determined volume of liquid to prepare a solution

in some sort of vessel, probably a beaker or a graduated cylinder. If The Object ends up floating in the solution, the team shall receive 50 points. Floating is defined as the case in which The Object will not touch the bottom of the vessel containing it while the liquid is not moving or spinning, and no other person or object (with the possible exception of the walls of the vessel) is touching The Object. If The Object sinks, the team shall receive 0 points. *Note that the students will not be allowed to make a trial to see if their measurement is correct. They must decide in advance which is the measure that they think will do the job, and prepare it accurately.*

Note that the solution prepared cannot reach the saturation point. If the solution becomes saturated, students will receive 0 points for the hands-on part of the event, even if the object ends up floating in the solution. For this event's purposes, we will define saturation as a case in which the powder or granulated solid covers more than 50% of the bottom of the vessel where the solution is, or shows a height equal to or greater than 2 mm on any area of the bottom of the vessel. *Note that it will be acceptable if a little powder or solid ends up at the bottom of the vessel, as long as it does not exceed these measures.*

For this part of the event, students will have access to a triple beam balance, and plastic boats for weighing. They will be allowed to bring a scientific calculator, but no books or other reference materials will be allowed.

Students must bring their own goggles and aprons to participate in the event. No students will be allowed in the hands-on part of the event without them; if a team does not have them, they will receive 0 points for this part of the event.