

## CHEMISTRY LAB DRAFT RULES 17

1. DESCRIPTION: Teams will complete one or more tasks and answer a series of questions involving the science processes of chemistry focused in the areas of Physical Properties and thermodynamics.

A TEAM OF UP TO: 2

EYE PROTECTION: C

APPROX. TIME: 50 mins

2. EVENT PARAMETERS:

- a. Each student may bring safety equipment (e.g. goggles, lab coat, apron) and a writing implement. Each team may bring two dedicated calculators of any type and five 8.5" x 11" sheets of paper that contain information on both sides in any form and from any source. The sheets may not be contained in a sheet protector or have any annotations affixed but they may be laminated.
- b. Students must wear goggles, an apron, or a lab coat, and have skin covered from the neck down to the wrist and toes. Gloves are optional; but if a host requires a specific type they must notify teams. Shoulder length hair, or longer, must be tied back. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in an unsafe manner will be penalized or disqualified from the event.
- c. Supervisors must provide reagents/glassware/references that are needed for the tasks (e.g., Periodic Table, table of standard reduction potentials, and constants needed).

3. THE COMPETITION:

- a. The competition will consist of a series of tasks similar to those in first year high school courses. These tasks could include hands-on activities, questions about each topic, interpretation of experimental data (i.e., graphs, diagrams), or observation of an already set-up experiment. Approximately 50% of the questions/activities will relate to Physical Properties and 50% will relate to Thermodynamics.
- b. Supervisors are encouraged to use computers or calculators with sensors/probes. Teams may be asked to collect data using probe ware that has been set up and demonstrated by the Supervisor or they may provide students with data sets collected by such sensors/probes following demonstration of the data collection. Data will be presented in a tabular and/or graphic format and students will be expected to interpret the data.
- c. Students should be aware of nomenclature, formula writing, and stoichiometry are essential tools of chemistry and may be included in the event. Stoichiometry includes mole conversions and percentage yield. For purposes of nomenclature and formula writing, students are expected to know the symbols and charges for the following ions: nitrate, carbonate, phosphate, acetate, sulfate, ammonium, bicarbonate, and hydroxide. Students should know how to use "ite" form of anion (one less oxygen than the "ate" form). Students should be able to use the periodic table to obtain the charge for monatomic ions. (e.g. Na<sup>+</sup>, S<sup>2-</sup>)
- d. Students should understand the following Physical Property concepts: density; color; conductivity; boiling and melting points; electrical resistance; elasticity/brittle, not brittle; heat capacity; specific heat; solubility; magnetism; extensive (amount of matter) & intensive (type of matter) properties.
- e. Students should understand the following Thermodynamic concepts: direction of heat flow; endothermic and exothermic processes; units of heat measurement (joules, calories, etc.); heat capacity; calorimetry; enthalpy change; thermochemical equations; heat of fusions and solidification; heat of vaporization & condensation; phase diagrams; heat of solution; heat of combustion; heats of reaction; standard heat of formation and heat of reaction; and associated calculations. Concepts that may only be addressed at the State or National level include: Gibbs free energy and entropy and Hess' s Law (calorimetry adding hydrate and non-hydrate)

4. SAMPLE QUESTIONS/ACTIVIITES

- a. Use density to identify an unknown metal

- b. Determine the density of a liquid using a pycnometer
  - c. Separate a mixture by physical properties (e.g., magnetism, solubility)
  - d. Determine a specific heat of a metal (coffee cup calorimeter)
  - e. Determine  $\Delta H$  of an acid/base or endothermic/exothermic reaction.
  - f. Determine specific heat of liquid based on heat exchange between water samples.
5. SCORING: Highest score will determine the winner. Time may be limited at each task, but will not be used as a tiebreaker or for scoring. Selected questions may be used as tiebreakers.