CHEMISTRY LAB

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 aqueous solutions **and oxidation/reduction.**
   A TEAM OF UP TO: 2 **EYE PROTECTION:** #4 **APPROX. TIME:** 50 min.
2. **EVENT PARAMETERS:**

   a. **Students: must bring goggles and a writing implement and may bring a non-programmable, non-graphing calculator**, but no reference materials are allowed.
   b. **Supervisors:** must provide whatever other reagents/glassware are appropriate for the tasks students are asked to do (e.g., Periodic Table, table of standard reduction potentials, any constants needed, etc.)
   c. **Safety Requirements**: Students must wear the following or they will not be allowed to participate: closed-toed shoes, ANSI Z87 indirect vent chemical splash goggles (see http://soinc.org), pants or skirts that cover the legs to the ankles, **and** a **long** sleeved shirt **that reaches the wrists, and** a chemical apron or a lab coat that reaches the knees. **Chemical** gloves are optional. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) will be disqualified from the event.
3. **THE COMPETITION**: 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 (graphs, diagrams, etc.), and/or observation of an experiment set up & running. Supervisors are encouraged to use computer or calculators with sensors/probes. Students may be asked to collect data using probeware that has been set-up & demonstrated by the Supervisor. Or the supervisor 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 & students will be expected to interpret the data. Students should be aware that nomenclature, formula writing, & stoichiometry are essential tools of chemistry & may always be included in the event. Stoichiometry includes mole conversions & percentage yield. For purposes of nomenclature & formula writing, students are expected to know the symbols & charges for the following ions: nitrate, carbonate, phosphate, acetate, sulfate, ammonium, bicarbonate, & hydroxide. Students should know how to use the "ite" form of an ion (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^{+}, S^{2-}).
4. **SAMPLE QUESTIONS**
   a. Aqueous Solutions: Students will demonstrate an understanding of the principals & properties of aqueous solutions. They must be able to calculate solution concentrations given quantities of solute & solvent, & calculate quantities of material required to produce a solution of specified concentration. Molarity, molality, mass percentage, & parts per million may be required. At the state & national levels, conversions between concentration units may be required. Tasks will be chosen from the following: 1) Use density to experimentally determine the concentration of a solution. 2) Determine solution concentration using a series of standard absorbencies & Beer's Law. 3) Use freezing point depression to determine the molar mass of a solute. 4) Use titration to determine an unknown concentration. 5) Identify & explain factors that effect solution formation or construct a solubility curve. 6) Determine whether a solution is saturated, unsaturated or supersaturated.
   b. **Oxidation/Reduction:** Students must be able to write oxidation & reduction half reactions, assign oxidation numbers, balance redox reactions in neutral, acidic, & basic solutions, & calculate standard cell potentials using a table of standard reduction potentials. Tasks will be chosen from the following 1) Use a sequence of redox reactions to construct an activity series. 2) Construct a simple voltaic cell & measure its potential. 3) Stoichiometry & electrochemical processes (such as electrochemical deposition). 4) Construct simple electrolytic cells. 5) At state & national levels, knowledge of fuel cells, knowledge & application of the Nernst equation & common storage batteries may be included.
5. **SCORING**: **Oxidation/Reduction: 50% &** Aqueous Solutions: 50%**.** Time may be limited at each task, but will not be used as a tiebreaker or for scoring. All ties will be broken by selected questions chosen by the supervisor that may or may not be identified to the students.

Recommended Resources: All reference and training resources including the **Chem/Phy Sci CD Rev. 2011** are available on the Official Science Olympiad Store or Website at http://www.soinc.org