

## CHEMISTRY LAB

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.



1. **DESCRIPTION:** Teams will complete one or more tasks and answer a series of questions involving the scientific processes of chemistry focused in the areas of Periodicity and Equilibrium.

#### **A TEAM OF UP TO: 2**

**EYE PROTECTION:** C **APPROXIMATE TIME:** 50 minutes

## 2. EVENT PARAMETERS:

- a. Each participant must bring safety equipment (e.g., goggles, lab coat, apron), a writing implement, and may bring a stand-alone calculator of any type.
- b. Each participant may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, with information on both sides in any form and from any source.
- c. Teams should bring any or all of the items listed on the Division C Chemistry Events Lab Equipment List, posted on soinc.org. Teams not bringing these items will be at a disadvantage, as they are not provided.
- d. Participants 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 the host requires a specific type they will notify teams. Pants should be loose fitting; if the host has more specific guidelines they will notify teams in advance of the tournament. Shoulder length or longer hair must be tied back. Participants removing safety clothing/ goggles or unsafely handling materials or equipment will be penalized or disqualified.
- e. Supervisors will provide any required reagents, additional glassware, and/or references that are needed for the tasks (e.g., Periodic Table, table of standard reduction potentials, any constants needed).

#### 3. THE COMPETITION:

- a. The competition will consist of a series of tasks focused in the areas of Periodicity and Equilibrium. These tasks could include hands-on activities, questions on listed topics, interpretation of data (e.g., graphs, diagrams, tables), or observation of an established and running experiment.
- b. Teams may be asked to collect data using a probeware set-up demonstrated by the Supervisor(s). Following a demonstration of the sensors/probes, participants may be given data sets to interpret.
- c. Nomenclature, formula writing, & stoichiometry (mole conversions & percentage yield) are essential tools of chemistry & may be included in the event. Participants are expected to know the symbols & charges for: nitrate, carbonate, phosphate, acetate, sulfate, ammonium, bicarbonate, & hydroxide. Participants should know how to use the "ite" form of anion (one less oxygen than the "ate" form). With a periodic table, participants should be able to obtain charges for monatomic ions (e.g., Na<sup>+</sup>, S<sup>2-</sup>).
- d. Equilibrium: Students must be able to write equilibrium reactions, predict the direction of a reaction using Le Châtelier's Principle, calculate an equilibrium constant, & use equilibrium constants to determine concentrations. Tasks will be chosen from the following:
  - Use a titration or data of a weak acid/base with a strong acid/base to calculate an equilibrium i. constant.
  - Investigate an equilibrium reaction and determine what happens when it is stressed. <u>ii</u>.
  - iii. Stoichiometry of equilibrium reactions.
  - iv. Construct/use a standard absorption curve to determine an equilibrium constant.
  - Use a calorimeter to predict a curve. v.
  - vi. State & Nationals: knowledge/application of equilibrium to separate chemicals may be included.
- e. Participants should understand the following about Periodicity
  - Physical Properties (e.g., atomic & ionic radii, ionization energy, melting point, electro-negativity, 1. etc.)

  - ii. Electronic structure and bonding formation (e.g., ionic vs. covalent, charges on ions) iii. Chemical properties (e.g., precipitate formation  $K_{sp}$  calculations, solubilities, reactions with acids)

## 4. SAMPLE TASKS:

- a. Use freezing point depression to determine the molar mass of a solute.
- b. Identify and explain factors that affect solution formation.
- c. Determine whether a solution is saturated, unsaturated, or supersaturated.
- d. Given the concentration of the reactants and products at equilibrium, calculate the equilibrium constant
- e. Construct and ICE chart given the original concentration of the reagents.



# **CHEMISTRY LAB (CONT.)**





#### 5. SCORING:

- a. High score wins. Points will be divided evenly between Periodicity and Equilibrium.
- b. Time may be limited at each task but will not be used as a tiebreaker or for scoring.
- c. Ties will be broken by pre-selected questions.
- d. A penalty of up to 10% may be given if the area is not cleaned up as instructed.
- e. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.

**<u>Recommended Resources</u>**: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase for this event; other resources can be found on the Event Pages at sonic.org.