

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 **Acids & Bases**.

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 non-programmable, non-graphing calculator**.
- b. Each team may bring **one 8.5" x 11"** sheet of paper, **in a sheet protector or laminated**, with information on both sides in any form and from any source **along with any or all of the items listed as Recommended Lab Equipment for Division C Chemistry Events, posted on soinc.org**. **Teams not bringing these items will be at a disadvantage, as they are not provided.**
- c. 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, the host will notify teams if a specific type is required). 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 from the event.
- d. 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 similar to those in first year high school courses. 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^+ , S^{2-}).
- d. Participants should understand the following **Acid-Base Chemistry concepts**:
 - i. **Properties & Uses of Common Acids and Bases**
 - (1) **Acids - (HCl , HNO_3 , H_2SO_4 , H_3PO_4 , H_2CO_3 , acetic, and ascorbic acid)**
 - (2) **Bases - (NaOH , KOH , $\text{Ca}(\text{OH})_2$, $\text{Mg}(\text{OH})_2$, and $\text{NH}_3(\text{aq})$)**
 - (3) **Acid/Base indicators and how they are used; pH ranges and color changes will be provided. Questions will not address theories of how indicators work.**
 - ii. **Titrations to determine percent composition, molarity, and/or molecular mass.**
 - iii. **Additional calculations will be limited to K_a , K_b , pH, pOH, and dilution.**
 - iv. **Acid & Base reactions will be limited to metals, carbonates, bicarbonates, sulfites, bisulfites, oxides, & neutralizations.**
 - v. **State and Nationals only: calculations or questions about buffers.**
- e. Participants should understand the following Physical Property concepts: density; color; conductivity; boiling & melting points; electrical resistance; elasticity/brittleness; heat capacity; specific heat; solubility; magnetism; extensive (amount of matter) & intensive (type of matter) properties.

4. **SAMPLE QUESTIONS/ACTIVITIES:**

- a. **Determination of the density of a liquid using a pycnometer.**
- b. **Separate a mixture by physical properties (magnetism, solubility, etc.).**
- c. **Titrations to determine percent composition, molarity, and/or molecular mass.**
- d. **Given a pH indicator and the results of a test determine the pH of a solution.**
- e. **Identify the pH indicator that should be used to monitor the pH change in a given experiment.**

5. **SCORING:**

- a. High score wins. **Points will be divided evenly between Physical Properties and Acids & Bases.**
- 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.**

Recommended Resources: The Science Olympiad store (store.soinc.org) carries the Chem/Phy Sci CD (CPCD); other resources are on the event page at soinc.org.