

POTIONS AND POISONS

1. **DESCRIPTION:** Students will demonstrate an understanding and knowledge of the chemical properties and effects of specified toxic and therapeutic chemical substances, with a focus on common household and environmental toxins or poisons.

A TEAM OF UP TO: 2 EYE PROTECTION: #4 APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Students should bring: two 8.5" x 11" pages of notes containing information in any form from any source, a writing implement, any kind of non-graphing calculator, test tubes and racks, spot plates, well plates, reaction plates, beakers or similar small containers for mixing, 10- or 25-ml graduated cylinder, something for scooping and stirring, pH or Hydrion paper, hand lens(es), Beral pipettes, 9-Volt or less conductivity tester, paper towels and test tube brush.
- b. Event supervisors will provide for each team: all required reagents and test solutions, any needed probes or other instrumentation, chromatography materials, and the answer sheet. The event supervisor may provide any other items or instructions deemed necessary.
- c. Safety requirements: During the lab portion of the event, students must wear the following or they will not be allowed to participate: closed-toe shoes, ANSI Z87 indirect vent chemical splash goggles (Eye protection #4, see <http://soinc.org>), pants or skirts that cover the legs to the ankles, and additionally a long-sleeved lab coat reaches the wrists and the knees, or a long-sleeved shirt with a chemical apron 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) will be penalized and/or disqualified from the event.

3. **THE COMPETITION:** The competition will be conducted in two parts.

- a. Part 1--Exam: This part will be a multiple-choice and short answer test covering the following subject areas: Students should understand ionic and covalent bonds, and the difference between mixtures, solutions and compounds. Students may be asked to separate components of a mixture. Students will distinguish between physical and chemical changes. Students may be asked to balance a simple chemical equation. Students may be asked to identify common poisonous plants and animals, and their toxic effects. Students may be given a map and be asked to analyze the potential patterns of spread of toxic spills in the environment via water, wind or gravity. Students will understand the effects and chemistry of common household toxins. Students should understand the effect of dilution on toxicity.

The test may include information on the following specific toxins:

- i. Household chemicals: ammonia, hydrogen peroxide, rubbing alcohol, bleach, Epsom salts, vinegar, nutritional supplements containing calcium and iron.
- ii. Toxic living organisms: Poison ivy (*Toxicodendron radicans*), jequity bean (*Abrus precatorius*), deadly nightshade (*Atropa belladonna*), foxglove (*Digitalis purpurea*), Giant hogweed (*Heracleum mantegazzianum*), rattlesnakes (*Crotalus sp*), cottonmouth

snakes (*Agkistrodon piscivorus*), black widow spiders (*Latrodectus sp.*) and brown recluse spiders (*Loxosceles reclusa*).

iii. Environmental toxins: lead, mercury, arsenic

- b. Part 2--Lab: Students will be asked to perform at least one lab task themselves. Other lab exercises may be performed as a demonstration, at the discretion of the event supervisor.

Lab activities may include: chromatography, mixtures of reagents, separation of a mixture, serial dilutions, determination of pH, and conductivity testing. Reagents may be mixed by students or the event supervisor with subsequent observation of changes in temperature or color, production of a gas or a precipitate, the rate of a chemical reaction or other parameters. Students may be asked if a particular change is a physical or chemical change.

4. **SAMPLE EXAM QUESTIONS:**

- What hazardous chemical may be produced if you mix household bleach and ammonia?
- What are the major sources of lead which cause lead poisoning?
- What should you do if you find a giant hogweed plant? Why is it dangerous?
- Categorize each as a physical or chemical change: 1) iron forms rust when exposed to oxygen, 2) copper melts at 1085° C 3) apple slices turn brown in the air 4) a sheet of aluminum foil is crumpled into a ball.
- You stir together sand and salt. Is this a mixture, a solution or a compound? How might you separate the sand and salt again?

5. **SCORING:**

- Part 1: Test questions are worth 60% of the competition
- Part 2: Lab questions are worth 40% of the score.
- Selected questions or quality of free response answers will be used to break ties.

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