

1. **DESCRIPTION:** Given a scenario and some possible suspects, students will perform a series of tests which, along with other evidence or test results will be used to solve a crime

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes



2. **EVENT PARAMETERS:**

- a. Students may bring only these items:

- i. Test tubes and test tube holders or any devices in which they can perform the tests, droppers, funnel (s), filter paper, pH or litmus paper, spatulas, plastic spoons or stirring rods, 9-volt conductivity tester (no testers will be allowed that run on AC current), thermometer, flame test equipment (nichrome wire, cobalt blue glass, etc.), slides, ruler, hand lens, writing instruments, a pencil (for chromatograms), paper towels, and metal tongs. (Students not bringing these items will be at a disadvantage. The event supervisor will not provide them.)
- ii. Each team member may bring one 8.5 X 11 sheet of paper with hand written notes on either or both sides, and a non-programmable calculator.

- b. Supervisor will provide: Iodine reagent (Iodine dissolved in KI solution), 2M HCl, 2M NaOH, Benedict's solution, (no more than 50 mL of each of the solutions) a hot water bath, a **Bunsen burner or equivalent BTU** heat source to perform flame tests, a method that may be used for differential density tests on plastics, a waste container, chromatography materials, and a wash bottle with distilled water (no more than 250 mL). The supervisor will provide a candle and matches for burn tests on the fiber samples. Flame tests may not be done on the polymers. The supervisor may provide other equipment (such as a microscope) or reagents to perform additional tests.

c. **Safety Requirements:**

Students must wear pants or skirts that cover the legs to the ankles. In addition, students must bring and wear a lab coat or apron that reaches below the knees. Students must wear closed toed shoes and OSHA approved non-vented or indirect vented chemical splash goggles. Students who fail to meet any of the above safety requirements will not be allowed to participate. Tasting or touching the chemicals will result in disqualification. Gloves are optional. Students who unsafely remove their safety clothing/glasses will be disqualified from the event. Anyone observed handling any of the material or equipment in a hazardous manner will be disqualified.

3. **THE COMPETITION:** There will be 4 parts and then the Analysis of the Crime. The event will consist of evidence from the first three parts and up to 2 parts from Crime Scene Physical Evidence at Regional, 3 parts from Crime Scene Physical Evidence at State and 4 parts of Crime Scene Physical Evidence at National.

- a. **Qualitative Analysis:** Substances to identify: sodium acetate, sodium chloride, sodium hydrogen carbonate, sodium carbonate, lithium chloride, potassium chloride, calcium nitrate, calcium sulfate, calcium carbonate, cornstarch, glucose, sucrose, magnesium sulfate, boric acid, and ammonium chloride (there will be no mixtures). The team will be provided with 3-5 powders at Regional (4-8 at State and 6-8 at National) of the 15 substances listed above. All teams will have the same set of solids to identify. No more than 15 g of each substance will be given to the team.

- b. **Polymer Testing/Natural & Man-made Substances to identify:** PETE, HDPE, non-expanded (slide 7) PS, LDPE, PP, PVC, PMMA, PC, cotton, wool, silk, linen, nylon, spandex, polyester, human hair, dog hair, and cat hair. Students may not perform any burn tests on the PETE, HDPE, PS, LDPE, PP, PVC, PMMA or PC (burn test results on these plastics may be provided by the event supervisor). Burn tests will be permitted on the fibers. Students may use density tests, their senses, or other characterizations of the samples to identify them. Students will be given 4-7 samples at Regional, 7-10 at State, and 10-13 at National competitions.

- c. **Chromatography/Spectroscopy:** Students may be expected to separate components using chromatography and/or analyze mass spectra. Students may be expected to do paper or thin layer chromatography and measure R_f (rate of flow). Students will be expected to do chromatograms on 1 type of material at Regional, 1-2 at State, and 2-3 at National.

d. **Crime Scene Physical Evidence:**

- i. **Fingerprint Analysis:** Students will be expected to know the 8 NCIC classifications (arch, tented arch, radial loop, ulnar loop, plain whorl, central pocket whorl, accidental, and double loop). Students should also be familiar with the common fingerprint development techniques of dusting, iodine fuming, ninhydrin, and cyanoacrylate fuming. Students should understand terminology such as bifurcation, ridges, island, enclosure, loop, whorl, and arch. Students should be able to answer questions about skin layers and how fingerprints are formed.