CRIME BUSTERS B

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

1. **DESCRIPTION:** Given a scenario, a collection of evidence, and possible suspects, students will perform a series of tests. Test results along with other evidence will be used to solve a crime and answer questions.

   A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes

   EYE PROTECTION: C **CALCULATOR:** Class II

2. **EVENT PARAMETERS:**
   a. Each participant may bring writing utensils.
   b. Each Participant may bring a Class II calculator.
   c. Each Participant may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any affixed labels.
   d. Each team may bring any or all of the items listed on the Division B Chemistry Events Lab Equipment List, posted on soinc.org. Teams not bringing these items may be at a disadvantage. The Supervisor will not provide them. Items not listed are prohibited. The Event Supervisors will check each team's equipment, confiscate non-allowed items, and have the right to penalize the team up to 10% if additional equipment is brought to the event.
   e. 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, up to and including potential disqualification.
   f. The Supervisor will provide:
      i. Iodine reagent (**I_2 dissolved KI solution or 2% tincture of iodine)**
      ii. 1M HCl
      iii. Chromatography materials plus containers
      iv. Waste container(s)
      v. Wash bottle with distilled water (no more than 250 mL)
   g. The Supervisor may provide:
      i. Other equipment (e.g., microscope, probes, calculator, etc.)
      ii. Candle & matches if fibers given
      iii. Differential density solutions or other method of determining density of polymers if plastics given
      iv. Reagents to perform additional tests

3. **THE COMPETITION:**
   a. The competition will consist of evidence from Parts 3.c.-f. and analysis of the evidence in Part 3.g. Analysis or questions can only be on the evidence topics included in the competition. The amount of evidence included will be according to the following table:

Level	Part 3.c. (i-iii)	Limit on Mixtures from Part 3.c.i only	Part 3.d.	Part 3.e.	Part 3.f.	Part 3.g.
Regional	6-15	Up to 2 of 2 solids with *	5-7	1 type	1-2 topics	Required
State	10-18	2-4 of 2-3 solids with *	7-10	1-2 types	2-3 topics	Required
National	14-20	2-6 of 2-3 solids with *	10-15	1-3 types	2-4 topics	Required

   b. The collected evidence and other data given may be used in a mock crime scene.
   c. Qualitative Analysis: Participants will identify evidence (unknowns) by performing tests such as solubility, acidity, magnetic property, color, density, and odor. Every team will have the same set of unknowns (evidence). The scenario will identify which containers hold mixtures and if the mixtures are made of two or three materials. The unknown common materials will be taken from the following lists.
      i. Solids: Anhydrous sodium acetate, yeast, vitamin C (ascorbic acid), *calcium carbonate (powdered limestone), *table salt (NaCl), *sugar (crystal), *flour, *calcium sulfate dihydrate (gypsum), *cornstarch, *baking soda, *powdered gelatin, *powdered Alka-Seltzer®, *sand (white).

ii. Non-Powdered Metals: aluminum, iron, zinc, magnesium, copper, tin.
iii. Liquids: lemon juice, rubbing alcohol (isopropyl), household ammonia (3%), water, vinegar, hydrogen peroxide (3%).

d. Polymer Testing/Natural and Man-made Substances: Participants will demonstrate their skill in analyzing evidence from a variety of sources such as:
   i. Hair - the difference between human, dog, and cat; not specific kinds of hair like guard.
   ii. Fibers - the difference between animal, vegetable, and synthetic; not specific kinds of fibers like silk.
   iii. Recyclable Plastics - PETE, HDPE, non-expanded PS, LDPE, PP, PVC, PMMA. Burn tests will not be conducted but burn results may be provided.
e. Paper Chromatography: Participants will analyze evidence from paper chromatography (ink pens, juices, Kool-Aid®, etc.). The paper chromatogram(s) will be collected with the score sheet. Rfs will be performed.
f. Crime Scene Physical Evidence: Participants will also demonstrate their skill in analyzing evidence from a variety of other sources such as:
   i. Fingerprints: Participants may be asked to identify different patterns on fingerprint evidence such as the difference between whorls, loops, and arches.
   ii. DNA evidence: Participants may be asked to compare DNA chromatograms/electropherograms from materials found at the scene to those of the suspects.
   iii. Shoeprints & tire treads: Participants may be asked to compare prints and make conclusions such as direction and speed of travel. No calculations are expected to be performed.
   iv. Soil: Participants may be given the composition of soil found at the scene or on the suspects and asked to determine if this implicates any of the suspects.
   v. Spatters: Analyze spatter patterns for speed and direction of impact. No calculations are expected to be performed.
g. Analysis: Participants will be asked to write an analysis of the crime scene explaining not only which pieces of evidence implicate which suspect and why the suspect(s) was (were) chosen as the culprit(s), but also why the other suspects were not chosen. They will also answer any other crime scene analysis questions posed by the Event Supervisor.
h. Teams will dispose of waste as directed by the Event Supervisor.

4. **SCORING:**
   a. High Score wins (Time will not be used for scoring)
   b. The score will be composed of the following elements (percentages given are approximate):
      i. 3.c. = 50%
      ii. 3.d. = 10%
      iii. 3.e. = 5%
      iv. 3.f. = 10%
      v. 3.g. = 25%
      vi. Actual point values may be shown at each question.
   c. The tiebreakers in order are the score from:
      i. Part 3.g.
      ii. Part 3.c.
      iii. Part 3.d.
   d. A penalty of up to 10% may be given if the area is not cleaned up as instructed by the Event Supervisor.
   e. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.