

Southern Utah University Practical Guide to Science Olympiad CRIMEBUSTERS Division B Event 2019

Disclaimer: The information in this guide is designed to provide a helpful breakdown of the Science Olympiad Event Manual. This guide is not meant to replace the official Science Olympiad Event Manual. Rather, it is intended to aid user comprehension of the official manual. Event staff and competitors are responsible for familiarizing themselves with the official Science Olympiad Event Manual and event manual updates prior to the SUU Science Olympiad. The SUU Science Olympiad will defer to the official Science Olympiad Event Manual and event updates during competition.

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

DESCRIPTION: Given a scenario, a collection of evidence, and possible suspects, students will perform a series of tests. The test results along with other evidence will be used to solve a crime.

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

EVENT PARAMETERS:

1. Each participant may bring
 - a. 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 annotations or labels affixed.
 - b. Recommended Lab Equipment for [Division B Chemistry Events](#)
 - i. Note: Teams not bringing these items will be at a disadvantage. The Supervisor will not provide them.
 - c. Teams may bring only specified items. Other items not listed, including calculators, 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.
 - 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.
2. The Supervisor will provide:
 - a. Iodine reagent (KI solution)
 - b. 1M HCl
 - c. Chromatography materials plus containers
 - d. Waste container(s)
 - e. Wash bottle with distilled water (no more than 250 mL)
3. The Supervisor may provide:
 - a. Other equipment (e.g., microscope, probes, calculator, etc.)

- b. Candle & matches if fibers given
- c. Differential density solutions or other method of determining density of polymers if plastics given
- d. Reagents to perform additional tests

THE COMPETITION:

1. 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 type	2-3 topics	Required
National	14-20	2-6 of 2-3 solids with *	10-15	1-3 types	2-4 topics	Required

2. The collected evidence and other data given may be used in a mock crime scene.
3. **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.
 - a. Solids: Anhydrous sodium acetate, yeast, vitamin C (ascorbic acid), *calcium carbonate (powdered limestone), *baking soda, *table *powdered salt (NaCl), gelatin, *sugar *powdered (crystal), Alka-Seltzer®, *flour, *calcium *sand sulfate (white). 2H₂O (gypsum), *cornstarch,
 - b. Non-Powdered Metals: aluminum, iron, zinc, magnesium, copper, tin.
 - c. Liquids: lemon juice, rubbing alcohol (isopropyl), household ammonia (3%), water, vinegar, hydrogen peroxide (3%).

4. **Polymer Testing/Natural and Man-made Substances:** Participants will demonstrate their skills in analyzing evidence from a variety of sources such as:
 - a. Hair - the difference between human, dog, and cat; not specific kinds of hair.
 - b. Fibers - the difference between animal, vegetable, and synthetic; not specific kinds of fibers.
 - c. Recyclable Plastics - PETE, HDPE, non-expanded PS, LDPE, PP, PVC, PMMA. Burn tests will not be conducted but burn results may be provided.
5. **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. No calculations are expected to be performed.
6. **Crime Scene Physical Evidence:** Participants will also demonstrate their skill in analyzing evidence from a variety of other sources such as:
 - a. Fingerprints: Participants may be asked to identify different patterns on fingerprint evidence such as the difference between whorls, loops, and arches.
 - b. DNA evidence: Participants may be asked to compare DNA chromatograms/electropherograms from materials found at the scene to those of the suspects.
 - c. 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.
 - d. 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.
 - e. Spatters: Analyze spatter patterns for speed and direction of impact. No calculations are expected to be performed.
7. **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.
8. Teams will dispose of waste as directed by the Event Supervisor.

SCORING:

1. The team with the highest score wins. Time will not be used for scoring. The score will be composed of the following elements (percentages given are approximate):
 - a. 3.c. = 50%
 - b. 3.d. = 10%
 - c. 3.e. = 5%
 - d. 3.f. = 10%

- e. 3.g. = 25%
- f. Actual point values will be shown at each question.
- 2. The tiebreakers in order are the score from:
 - a. Part 3.g.
 - b. Part 3.c.
 - c. Part 3.d.
- 3. A penalty of up to 10% may be given if the area is not cleaned up as instructed by the Event Supervisor.
- 4. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.

Recommended Resources:

- 1. The [Science Olympiad Store](#) carries the Science Crime Busters CD and Science Crime Busters Manual;
- 2. Other resources are on the [event page](#) at soinc.org
 - a. [Event Info for Science Crime Busters and tips for Event Supervisors](#)
 - b. [Recommended Lab Equipment List](#)
 - c. [Science Crime Busters Notes](#)
 - d. American Chemistry Council - [Plastics 101](#) and [Teaching Plastics](#)
 - e. [Faces in Polymers: Polymer Chemists and Their Work](#)
 - f. [FBI Laboratory - Latent Fingerprint Unit](#)
 - g. [FBI - Forensic Science Communications](#)
 - h. [Hands On Plastics Videos - Identifying Polymers by Differential Density](#)
 - i. [Macrogalleria](#)
 - j. [Polymer Science Learning Center](#)
 - k. [Society for Plastics Engineering Education Resources](#)
 - l. [Spinning the Elements: Wallace Carothers and the Nylon Legacy](#)
 - m. [The Story of Rubber](#)