FORENSICS C

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

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

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

EYE PROTECTION: C **CALCULATOR:** Class III

2. **EVENT PARAMETERS:**
   a. Each participant may bring writing utensils.
   b. Each participant may bring a Class III 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 C 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.
   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 in KI solution or 2% tincture of Iodine**)
      ii. 1M HCl
      iii. 1M NaOH
      iv. Benedict's solution
      v. a hot water bath
      vi. a Bunsen burner or equivalent BTU heat source to perform flame tests
      vii. a waste container
      viii. chromatography materials (e.g., beakers, Petri dishes, etc.)
      ix. a wash bottle with distilled water
   g. The Supervisor may provide:
      i. other equipment (e.g., a microscope, probes, 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 other tests

3. **THE COMPETITION:**
   a. The competition will consist of evidence from Parts 3.b. - e. and analysis of the evidence in Part 3.f. Analysis or questions can only be on the evidence topics included in the competition. The collected evidence and other data given may be used in a mock crime scene. The amount of evidence included will be according to the following table:

Level	Part b. # of samples	Part c. # of samples	Part d. # of chromatograms	Part e. # of topics	Part f.
Regional	3-8	5-9	1 type + Mass Spectra	1-2	Required
State	6-10	6-12	1-2 types + Mass Spectra	1-3	Required
National	10-14	10-18	1-3 types + Mass Spectra	3-5	Required

   b. Qualitative Analysis: Participants may be asked to identify the following substances: 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). All teams will have the same set of solids to identify.
   c. Polymers: Participants may be asked to identify:
      i. Plastics: PETE, HDPE, non-expanded PS, LDPE, PP, PVC, PMMA, PC – Participants will not perform any burn tests on these plastics, but the Supervisor may provide burn test results on them.

ii. Fibers: cotton, wool, silk, linen, nylon, spandex, polyester - burn tests will be permitted on the fibers.
iii. Hair: human, bat, cow, squirrel, and horse - participants will need to know hair structure including medulla, cortex, cuticle, root and hair scale classification.

d. Chromatography/Spectroscopy: Participants will be expected to separate components using paper chromatography, TLC, and/or analyze mass spectra. Participants may be expected to measure Rfs.
e. Crime Scene Physical Evidence:
   i. Fingerprint Analysis: Participants will be expected to know the 8 specific fingerprint patterns (plain arch, tented arch, radial loop, ulnar loop, plain whorl, central pocket whorl, accidental whorl, and double loop whorl). Participants should also be familiar with the common fingerprint development techniques of dusting, iodine fuming, ninhydrin, and cyanoacrylate fuming. Participants should understand terminology such as bifurcation, ridges, island, enclosure, loop, eye, spur, trifurcation, delta, and double bifurcation. Participants should be able to answer questions about skin layers and how fingerprints are formed. Participants may be asked questions on the different methods of detecting fingerprints and the chemistry behind each of these methods.
   ii. DNA: Participants may be asked to compare DNA chromatograms/electropherograms from materials found at the scene to those of the suspects. Participants will be expected to know how DNA is copied. See http://educationalgames.nobelprize.org/educational/chemistry/pcr/
   iii. Glass analysis: Participants may be asked to use index of refraction to determine the type of a glass found broken at a crime scene. They may be asked to analyze which hole or fractures occurred before others based on a piece of glass available for examination or a picture of a piece of glass.
   iv. Entomology: Participants may be asked to identify how long an animal has been dead based on the type of insects found on the body at the scene.
   v. Spatters: Participants may be asked to analyze actual spatters or photographs of spatters to determine the angle and velocity with which the liquid approached the solid object bearing the spatter & the spatter origin direction.
   vi. Seeds and Pollen: Participants may be asked to compare pictures of seeds/pollen found at the scene with either seeds/pollen found on the suspects or seeds/pollen from different country regions.
   vii. Tracks and Soil: Participants may be asked to match tire tracks or footprints found at the scene to tires or shoes of the suspects. 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.
   viii. Blood: Participants may be asked to identify the ABO blood type using artificial blood (Event Supervisor required to provide instructions on how the typing system works) or participants may be asked to identify if a blood sample, either prepared microscope slide or pictures of microscope slide, is human, avian, mammalian, or reptilian/amphibian.
   ix. Bullet striations: Participants may be asked to match the striations on bullets or casings found at the crime scene and fired from a given gun.
f. Analysis of the Crime: Participants will be asked to write an analysis of the crime scene explaining not only which pieces of evidence implicate which suspect(s) 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.
g. 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): Part 3.b. ≈ 20%, Part 3.c. ≈ 20%, Part 3.d. ≈ 15%, Part 3.e. ≈ 15%, and 3.f. ≈ 30%.
c. Ties will be broken by the highest score on the analysis of the crime scene, which includes the reasons why certain suspects have been eliminated or others remain in the pool of possible criminals.
d. A 10% penalty may be given if the area is not cleaned up as designated by the Event Supervisor.
e. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.