

Science Olympiad

Feb 25, 2017

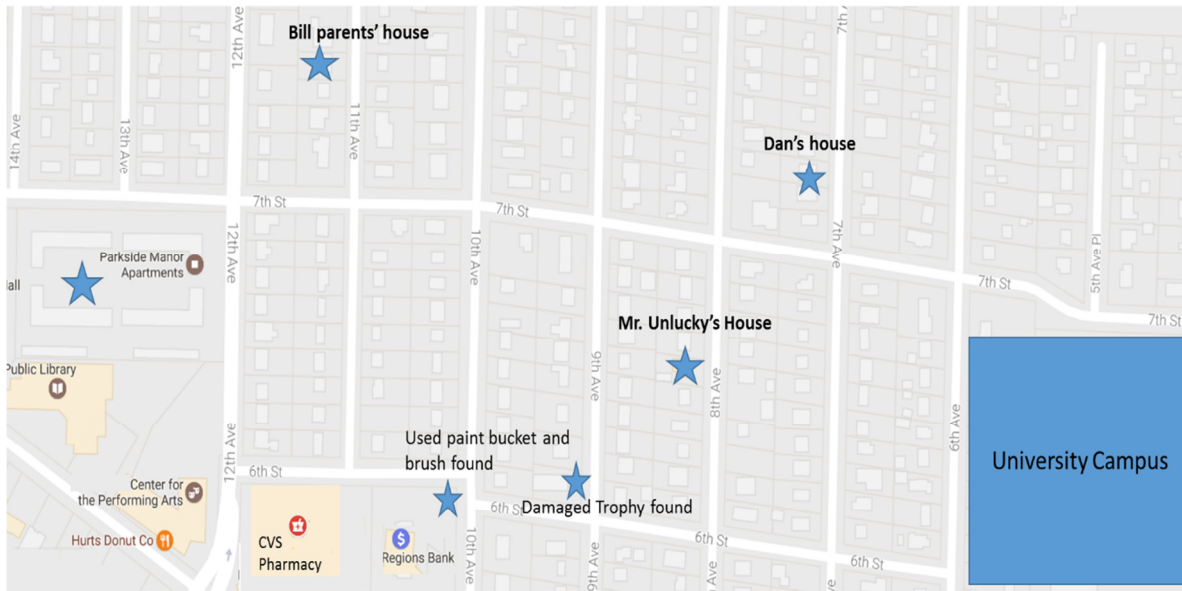
Holt, Michigan

Crime Busters

Please use the answer sheet provided to answer all questions.

- The scoring is composed of these elements:
- Identification of Unknowns (50% of total score) (Second Tiebreaker)
- Paper Chromatography (5%)
- Fiber, hair, and plastic (10%)
- DNA, finger printing, tire treads (10%)
- Crime Solution Essay (25%) (First Tiebreaker)

Crime Scene Scenario: Mr. Unlucky's home break-in



Mr. Unlucky is head coach of the Bulldogs, the football team of Winning University. Mr. Unlucky lives alone and has no pets. This year has been a disastrous season for Mr. Unlucky and his team, since the Bulldogs have lost all six games they've played so far.

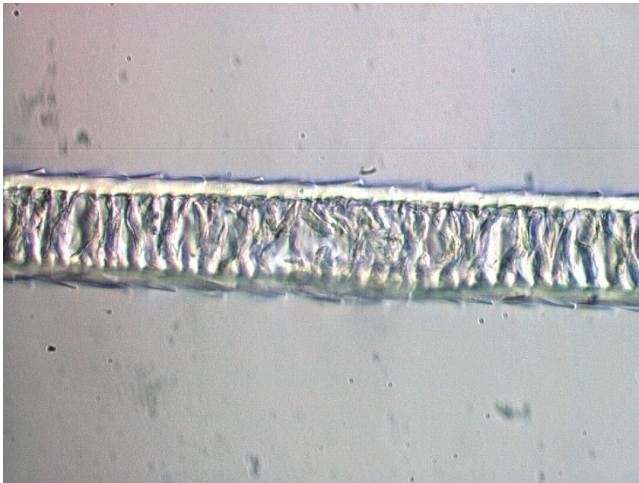
Sunday morning, Mr. Unlucky woke up in his second floor bedroom and went downstairs. He found out someone had broken into his house during the night and painted "Fire Unlucky" in his living room, in his kitchen, and on several windows. Also his "Best Coach" trophy for the 2015 season had been stolen.

Police found some evidence in Mr. Unlucky's home, including some powders, hair, and fiber, plus a bike tire track in his backyard. One neighbor living in the next block found the damaged trophy. The police successfully collected samples of DNA (from blood) from the damaged trophy. Later that day, the police found one used paintbrush and a bucket abandoned two blocks away, from which the police collected some paint for the paper chromatography test. All of the crime scene evidence is listed in Table 1.

The security camera at a nearby CVS pharmacy helped police identify four suspects for the crime. Details about these four suspects are shown in the next few pages.

Table 1—Evidence collected from the crime scene

| Crime Scene Evidence (CSE) | Description | Collected from | Note |
|----------------------------|-----------------|-------------------------------|-----------|
| CSE-1 | Mixture | Mr. Unlucky's kitchen | |
| CSE-2 | Mixture | Mr. Unlucky's kitchen | |
| CSE-3 | Powder | Mr. Unlucky's kitchen | |
| CSE-4 | powder | Mr. Unlucky's kitchen | |
| CSE-5 | powder | Mr. Unlucky's living room | |
| CSE-6 | powder | Mr. Unlucky's living room | |
| CSE-7 | hair | Mr. Unlucky's kitchen | Picture 1 |
| CSE-8 | ink | Mr. Unlucky's living room | Picture 6 |
| CSE-9 | fiber | Mr. Unlucky's living room | |
| CSE-10 | fiber | Mr. Unlucky's deck door frame | |
| CSE-11 | Bike tire track | Mr. Unlucky's backyard | Picture 2 |
| CSE-12 | DNA | Damaged trophy | Picture 7 |



Picture 1: Animal hair under microscope (CSE-7)



Picture 2: Bike tire track (CSE-11)

Suspect A



Adam is a freshman at Winning University and lives at Parkside Manor Apartments. He has a pet dog in his apartment. Adam is a quarterback for the football team. However, he was on the bench and did not get a chance to play in any games this season. Adam has a part-time job at a bakery near campus, and his major duty is to move/transport the baking raw materials.

It was reported that Adam had quarreled with Mr. Unlucky during Friday's training, and that he did not show up at the game on Saturday afternoon.

He was found on the CVS security camera at around 12:15 AM wearing a light colored T-jersey and biking to his apartment. Adam claims that he was in the school library the whole day until midnight working on a report that was due Monday.

Some evidence collected from Adam is listed in Table 2.

Table 2—Evidence collected from Adam

| Suspect Evidence A (SEA) | Description | Collected from | Note |
|--------------------------|-----------------|---------------------|--------------------|
| SEA-1 | Powder | Adam's pants pocket | |
| SEA-2 | Powder | Adam's pants | |
| SEA-3 | Ink | Adam's jersey | |
| SEA-4 | Hair | Adam's pet dog | |
| SEA-5 | Fiber | Adam's jersey | Nylon |
| SEA-6 | Bike tire tread | Adam's bike | Shown in picture 3 |
| SEA-7 | DNA | Adam | Shown in picture 7 |



Picture 3: Adam's bike tire (SEA-6)

Suspect B



Bill, an alumnus of Winning University, is a big Bulldogs fan. He is now working at a construction company in another city. He was in town on Saturday and went to the university stadium for the Bulldog game Saturday afternoon. After that, he had dinner at his parents' home and helped his dad to replace a few pieces of drywall in the basement due to damage from his parents' cat.

Mr. Unlucky told police that Bill had come to his house and yelled at him and criticized him for the losing the game.

Bill was shown on the security camera around 1:20 AM wearing a light colored pullover. Bill left his parents' home early Sunday morning to go back to work. The police found the cotton pullover Bill had worn last night and there were some ink marks on it. In the phone interview, Bill claimed that he went to Regions Bank to withdraw some cash.

Some evidence collected from Bill's parents' house is listed in Table 3.

Table 2 Evidence collected from Bill

| Suspect Evidence B (SEB) | Description | Collected from | Note |
|--------------------------|-------------|-----------------|--------------------|
| SEB-1 | Powder | Bill's pullover | |
| SEB-2 | Powder | Bill's pullover | |
| SEB-3 | Ink | Bill's pullover | |
| SEB-4 | Fiber | Bill's pullover | cotton |
| SEB-5 | DNA | Bill's mom | Shown in picture 7 |
| SEB-6 | DNA | Bill's dad | Shown in picture 7 |

Suspect C



Charles, a senior at Winning University, and a friend of Bill's, also lives at Parkside Manor Apartments with no pets. Charles is a research assistant in the Chemistry Department. He does lots of lab tests on food seasoning/analysis.

In the past few weeks, Charles has posted "Fire Unlucky" several times on Facebook and Twitter, and has mentioned that he will take some action to punish the "stupid coach".

Charles was recorded on the security camera at 1:55 AM wearing a light gray coat. He claims that he had lost his wallet at the football game. He went to the police station to pick up his wallet that night.

The University Police record shows that someone turned the wallet in after 9:00 PM. The police called Charles around 10:00 PM, and Charles left the police station around 12:30 AM with his wallet.

Some evidence collected from Charles is listed in Table 4.

Table 4 Evidence collected from Charles

| Suspect Evidence C (SEC) | Description | Collected from | Note |
|--------------------------|-----------------|-----------------------|--------------------|
| SEC-1 | Powder | Charles's coat pocket | |
| SEC-2 | Powder | Charles's coat pocket | |
| SEC-3 | Ink | Charles's coat | |
| SEC-4 | Fiber | Charles's coat | PE |
| SEC-5 | Bike tire tread | Charles's bike | Shown in picture 4 |
| SEC-6 | DNA | Charles | Shown in picture 7 |



Picture 4: Charles's bike tire (SEC-5)

Suspect D



Dan lives with his wife and their dog just one block from Mr. Unlucky's house. Dan is the owner of a local sport shop that sells lots of Bulldogs stuff, and he is a Bulldogs fan. Because of the Bulldogs' disappointing performance, Dan's shop's business has been down more than 70% for the past few weeks.

Witnesses saw Dan hang a banner in his shop this weekend that said "Fire Unlucky", and his shop had a huge discount sale on all the Bulldogs items.

Dan was caught on the security camera at 2:25 AM wearing a light colored sweater and on bike. Dan explained that he had a terrible cold and he biked to CVS pharmacy for some medicine.

Some evidence collected from Dan is listed in Table 5.

Table 5 Evidence collected from Dan

| Suspect Evidence D (SED) | Description | Collected from | Note |
|--------------------------|-----------------|--------------------|-----------|
| SED-1 | Powder | Dan's sweater | |
| SED-2 | Powder | Dan's jeans pocket | |
| SED-3 | Ink | Dan's jeans | |
| SED-4 | Fiber | Dan's sweater | wool |
| SED-5 | Bike tire tread | Dan's bike | Picture 5 |
| SED-6 | DNA | Dan | picture 7 |



Picture 5: Dan's bike tire (SED-5)

Please insert the file “Holt Crime Busters Pictures 6 and 7” here.

Answer Sheet

School Name: _____

Team Number: _____ **Station Number:** _____

1. Identify unknown powders—The list of possibilities is on the next page

| Item | Material name | Brief explanation |
|-------------|----------------------|--------------------------|
| CSE-1 | | |
| CSE-2 | | |
| CSE-3 | | |
| CSE-4 | | |
| CSE-5 | | |
| CSE-6 | | |
| SEA-1 | | |
| SEA-2 | | |
| SEB-1 | | |
| SEB-2 | | |
| SEC-1 | | |
| SEC-2 | | |
| SED-1 | | |
| SED-2 | | |

List of possibilities for identifying unknown powders on the previous page:

Keep in mind that some of these may not be present in your test samples!

Alka-Seltzer
Corn starch
Gypsum
Sodium acetate

Baking soda
Flour
Salt
Vitamin C

Calcium carbonate
Gelatin
Sugar
Yeast

2. Paper chromatography

Please do paper chromatography for all the ink samples and attach your chromatography papers to this page and label them.

3. Fiber, hair, and plastic

| Item | Material name |
|--------|---------------|
| CSE-7 | |
| CSE-9 | |
| CSE-10 | |

Please circle the one that is the most suitable material for the paint bucket.

- A) PMMA B) LDPE C) HDPE D) Nylon-66

Please circle the one that is the most suitable material for the paintbrush.

- A) Silk B) polyester C) asbestos D) Rayon

Please circle the one that can be easily identified by putting it into water.

- A) LDPE B) HDPE C) PP D) PS E) PVC

Please circle the one that is least likely to be used for a warm winter coat.

- A) Cotton B) linen C) polyester D) wool

For HDPE and LDPE, which is stronger and why?

4. DNA and tire tread

Identify whose DNA matches the sample collected from the trophy and give a brief explanation.

Which of the following does NOT contain DNA? ()

- A) blood B) Nail C) sweat D) saliva

Identify whose bike tire matches the track in Mr. Unlucky's backyard and give a brief explanation.

5. Crime solution essay