Science Olympiad Boyceville Invitational
Forensics : The Missing Million Dollars

Saturday, December 3, 2016

The Scenario:

This morning police received a phone call from Central High School reporting that the school's recently acquired $1,000,000 donation was missing. The donation was made by Rich Allison, the wealthiest alumnus of Central High School and was given to construct a new science wing for the high school. The police arrived promptly and started to work. They were able to collect fingerprints from the area where the money was being held in a safe and found a black marker and note that said "My Money Now!" A paper chromatogram was made of the ink. This chromatogram was developed in rubbing alcohol for 10 minutes. Eight powders (Samples A –H), four polymers (Samples I-L), two fibers (Samples M & N), and two hairs (samples O & P) were also collected at the scene. The safe holding the money was located in the weight room. **In addition, a DNA sample was taken at the scene with the results below, but this scene is in the main office of the school with easy access. Also, a whorl fingerprint was found at the scene.**

Six potential suspects have been identified:

Principal Jones: Principal Jones was not happy with the current science teacher and wanted the money to go towards building a new classroom for the social studies department.

Secretary Joe: Secretary Joe was dealing with financial troubles and needed money to pay the rent.

Coach Hardy: Coach was upset that the money was not being used to build a new weight room for the athletes at Central High School.

Athletic Casey: Athletic Casey was also upset that the money was not being used to build a new weight room for athletes. She thinks that the "smart kids" get everything nice while the athletes are left behind.

Smart Bob: Bob was excited that the money was donated for a new science wing of the high school, but he did not like the design that was proposed. Bob wanted the money to build his own science classroom at his house.

Rich Allison: The money donated was left in a will from Allison's wealthy husband Jerry. Allison was mad that the money was not left for her, as she was his loving wife for 48 years. She was very jealous of the science department at the school.

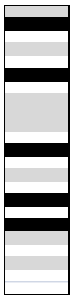
The samples have been provided to you. Police fingerprinted and interviewed each of the suspects. Your task, detectives, is to analyze the substances found at the crime scene, complete a chromatogram on the black marker, and determine which if any of the samples found at the scene belong to which of the suspects and determine who is most likely to have taken the money. You have 50 minutes. Good luck.

SUSPECT INTERVIEW SHEET

Fingerprint DNA

Name:	Principal Jones	**Age:**	55	**Pants:**	Wool
Pet:	None	**Eyes:**	Brown	**Pen:**	D

Additional info: Likes to eat salt and vinegar potato chips. Likes to collect plastic pop bottles.



Name:	Secretary Joe	**Age:**	32	**Pants:**	Cotton
Pet:	Bat	**Eyes:**	Hazel	**Pen:**	D

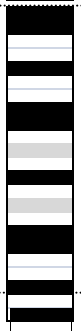
Additional info: Is a diabetic and uses glucose often. Was working yesterday to replace the PVC pipes in his basement and used a hack saw to cut the pipes, leaving bits of plastic behind. Putting new siding on house.

Name:	Coach Hardy	**Age:**	48	**Pants:**	Silk
Pet:	Horse	**Eyes:**	Green	**Pen:**	C

Additional info: Has been very busy cleaning and disinfecting the weight room for the past couple of days. He has also been putting up new sheetrock walls in the weight room at school.

Name:	Athletic Casey	**Age:**	17	**Pants:**	Polyester
Pet:	Squirrel	**Eyes:**	Blue	**Pen:**	B

Additional Info: Likes to volunteer in the garden center at her Grandpa's nursing home by spreading fertilizer. Busy making meals in styrofoam trays for the homeless lately.



Name:	Smart Bob	**Age:**	17	**Pants:**	Nylon
Pet:	Cow	**Eyes:**	Brown	**Pen:**	B

Additional Info: Has heartburn often and is currently working on an acid/base titration project for Chemistry. He was helping Principal Jones and Joe with a fireworks demonstration for town recently. He has a plastic bottle collection.

Name:	Rich Allison	**Age:**	72	**Pants:**	Spandex
Pet:	Horse	**Eyes:**	Green	**Pen:**	A

Additional Info: Likes to bake often. Spent the previous day making pickles and Jello Molds and likes to eat vinegar potato chips. Was working with her grandson to make lithium metal. Always eats on styrofoam plates and is diabetic.

Part A: Qualitative Analysis (20%)

You have eight samples (labeled A-H) to identify. Provided materials include: Iodine reagent, 2 M HCl, 2M NaOH, waste beaker, and a wash bottle with distilled water. Place all wastes into the waste beakers provided.

There are also several questions to answer regarding the substances and their properties. NOTE: When answering the questions, be sure to consider all the possible substances, not just those identified.

Part B: Polymers and Fibers (15%)

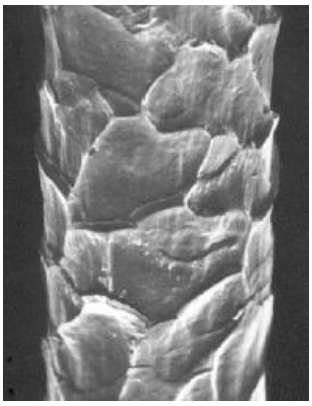
You have four polymers (I, J, K, L) to identify. You don't actually have samples, just the information below.

Substance	Density (g/mL)
Corn Oil	0.717
46% Isopropyl Alcohol	0.950
Distilled Water	1.00
10% NaCl	1.07
25% NaCl	1.19
Saturated NaCl	1.25

Additionally:

Sample I has the second highest density of any of the possible plastics
Sample J burns with a green flame
Sample K sinks in distilled water but floats in 10% NaCl
Sample L sinks in the 10% NaCl but floats in the 25% NaCl

Fiber M under an Electron microscope

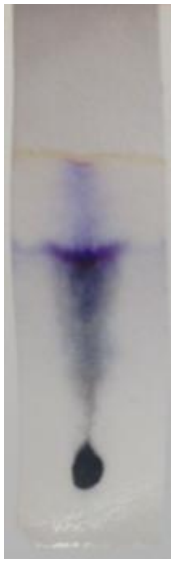


Fiber N under the Electron Microscope

Hair O Photomicrograph

Hair P Photomicrograph

Part C: Chromatography/Spectroscopy (15%)



Pen A

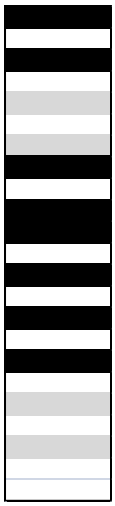
Pen B

Pen C

Pen D

Part D: Crime Scene Physical Evidence (15%)

DNA Found at the Scene



Part E: Analysis of the Crime (30%)

Write an analysis of the crime that explains which pieces of evidence implicate the suspect you selected. Also provide reasons why the other suspects were not chosen. ***You must limit your analysis to the one side of the answer sheet only – be concise!***

WI Boyceville Invitational 2016
Forensics Event – Answer Sheet

Saturday, Dec 3, 2016

Team Name: _____ Team Number: _____

Names of Participants: _____

Part A: Qualitative Analysis (20%) – 40 Total Points

	Point value	Answer	Question
1.	3		**Identity of Sample A**
2.	1		On what basis did you make the ID?
3.	1		Which suspect(s), if any, does this piece of evidence implicate?
4.	3		**Identity of Sample B**
5.	1		On what basis did you make the ID?
6.	1		Which suspect(s), if any, does this piece of evidence implicate?
7.	3		**Identity of Sample C**
8.	1		On what basis did you make the ID?
9.	1		Which suspect(s), if any, does this piece of evidence implicate?
10.	3		**Identity of Sample D**
11.	1		On what basis did you make the ID?
12.	1		Which suspect(s), if any, does this piece of evidence implicate?
13.	3		**Identity of Sample E**
14.	1		On what basis did you make the ID?
15.	1		Which suspect(s), if any, does this evidence implicate?
16.	3		**Identity of Sample F**
17.	1		On what basis did you make the ID?
18.	1		Which suspect(s), if any, does this evidence implicate?
19.	3		**Identity of Sample G**

20.	1		On what basis did you make the ID?
21.	1		Which suspect(s), if any, does this evidence implicate?
22.	3		**Identity of Sample H**
23.	1		On what basis did you make the ID?
24.	1		Which suspect(s), if any, does this evidence implicate?

Part B: Polymers and Fibers (20%) – 40 Total Points

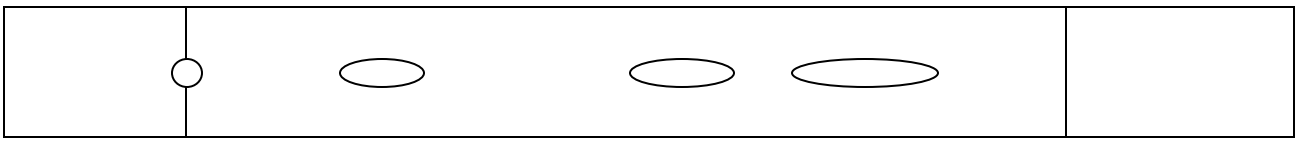
	Point value	Answer	Question
25.	3		**Identity of Polymer I**
26.	1		What type of polymerization is used to make this polymer?
27.	1		Which suspect(s), if any, does this evidence implicate?
28.	3		**Identity of Polymer J**
29.	1		What type of polymerization is used to make this polymer?
30.	1		Which suspect(s), if any, does this evidence implicate?
31.	3		**Identity of Polymer K**
32.	1		What type of polymerization is used to make this polymer?
33.	1		Which suspect(s), if any, does this evidence implicate?
34.	3		**Identity of Polymer L**
35.	1		What type of polymerization is used to make this polymer?
36.	1		Which suspect(s), if any, does this evidence implicate?
37.	3		**Identity of Fiber M**
38.	1		Which suspect(s), if any, does this evidence implicate?
39.	3		**Identity of Fiber N**
40.	1		Which suspect(s), if any, does this evidence implicate?

41.	3		**Identity of Hair O**
42.	1		Which suspect(s), if any, does this evidence implicate?
43.	3		**Identity of Hair P**
44.	1		Which suspect(s), if any, does this evidence implicate?
45.	1		Which polymer is used in peanut butter jars?
46.	1		What polymer is used in produce bags?
47.	1		Which polymer is used in water pipes?
48.	1		Which polymer is used in bottle caps?

Part C: Chromatography/Spectroscopy (15%) – 30 Total Points

49.	10		Attach your completed chromatograph above.
50.	5		Which suspect(s) does this evidence implicate?

Determine the R_f values for the three components in the following chromatogram: (4 pts each)



R_f __(51)__ __(52)__ __(53)___

51.	4		Calculate the Rf above for (51).
52.	4		Calculate the Rf above for (52).
53.	4		Calculate the Rf above for (53).
54.	3		What does Rf stand for?

Part D: Crime Scene Physical Evidence (15%) – 30 Total Points

	Point value	Answer	Question
55.	4		Which suspect's DNA was found at the scene?
56.	2		Which suspects have arches in their fingerprints?
57.	2		Which suspects have loops in their fingerprints?
58.	2		Which suspects have whorls in their fingerprints?
59.	4		Which suspect(s) are implicated by the fingerprint evidence?
60.	2		What does AFIS stand for?
61.	2		What approximate percentage of the population has arch fingerprints?
62.	2		What approximate percentage of the population has loop fingerprints?
63.	2		What approximate percentage of the population has whorl fingerprints?
64.	2		How many ridges does the average fingerprint have?
65.	2		Prints on a porous surface such as paper could be obtained using which type of process?
66.	2		What are the three main ways to lift fingerprints?
67.	2		What is the name given to the 10 to 16 points of a fingerprint used to compare to a database?

Part E: Analysis of the Crime Scene (30%) – 60 Total Points

Write an analysis of the crime that explains which pieces of evidence implicate the suspect you selected. Also provide reasons why the other suspects were not chosen. ***You must limit your analysis to this side of the answer sheet only – be concise!***

Start by filling out the table below. Mark a check mark if the evidence implicates the suspect. Don't forget to write the analysis after the table!

Suspect	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	CH	DNA	FP
Principal Jones																			
Secretary Joe																			
Coach Hardy																			
Athletic Casey																			
Smart Bob																			
Rich Allison																			