

2014-15 Forensics Run-off Test



Testing Rules and Guidelines!

1. You may use your 3-ring binder with resources and non-camera calculator, but nothing else. If you use information outside of this, sad job. Just... sad job. You will be disqualified.
2. Absolutely no cell phones, tablets, or computers, or other electronic devices explicitly or implicitly banned from Science Olympiad competitions will be visible during the testing period. Failure to comply with this rule will result in DISQUALIFICATION.
3. If you don't know an answer, please don't write a mocking answer. Write down your best intelligent guess. If you write a mocking answer, I have to read that and waste my time. It's ok to not know something, because believe it or not, you **do**

not have to know everything to be on the event. I care more for what you **do** know.

4. There may be more than one correct answer to a question. Please just write the correct amount. If it is indicated in the question that there is more than one answer necessary, all answers are necessary.

5. I will give partial credit for questions where there are multiple answers.

6. Each section's value in the test overall are as such:

Part a, Qualitative Analysis: 20%; Part b, Polymers: 20%; Part c,

Chromatography: 15%; Part d, Crime Scene Physical Evidence: 15%; and Part e, Analysis of the Crime as a whole: 30%.

7. The test will last 50 minutes. When time is called, put down the pencil **please**.

8. Hopefully, the questions on this test should be direct enough that it is not necessary. However, should you have any questions, just raise your hand. I will try to answer the questions quickly, but understand that other people have questions. If I am not there, my event co-supervisor or a different, designated authority will be there to try and help you. If no one is available, continue working and hopefully someone will be able to help.

9. Have fun, and don't stress too much. Remember, this is more of a learning experience than a stiff competition. Please learn from the mistakes you make on this test. HAVE FUN.

Name: _____ Date: _____

There has been a recent murder of a local Science O team's coach. As the newest member of the criminal investigation team in the local police department, you are along on the case with the other member of the team. You have been assigned to analyze primarily and give a brief report to your supervisor. During this analysis, please assume that if a person does not have a sample from that category that is found at the crime scene, consider this enough evidence to not put them at the crime scene. I know that is not necessarily true in real life, but this is just a test, and I am not great at writing situations from scratch.

The crime: Mr. Ren Dir, a coach of 7 years, was stabbed to death. He was not seen after he started his typical post-school-day run, which gave each of the suspects ample time and opportunity to commit this heinous crime. The body was discovered at about 1:30 pm and you arrived at about 2:30 pm the following

day. Below is information and evidence collected from each of the leading suspects.

a) Victor, the enraged (ex-) Science O team member

a. Motive: Victor was disbarred from the Science O team following the discovery of his cheating methods during the run-offs for his events in December.

Victor could have been angry enough to commit this crime, because Science O had been an extremely important for him and in his family.

b. Powder samples: calcium sulfate, magnesium sulfate, and sucrose

c. Hair/fiber samples: polyester, silk, and human hair

d. Plastics: PS and HDPE

b) Yaxely, the rival coach of the Resolute Science O team

a. Motive: As the Repulse Bay High School team, which Mr. Ren Dir coached, was finally rising to become competitive in the state, Yaxely became worried. His team was beginning to diminish from its former national level glories and he was in danger of losing his position following the loss of the conference championship to the Repulse Bay team. His only hope to redeem himself as coach was to win Regionals, and it seems that taking Mr. Ren Dir out of the picture could have been an option to help in that aspect.

b. Powder samples: lithium chloride, sucrose, and calcium nitrate

c. Hair/fiber samples: wool, polyester, and horse hair

- d. Plastics: PVC and LDPE
- c) Patrick, the jealous co-worker
 - a. Motive: As the team's ex-coach, he did not have success at all. His teams never placed very high and usually did terribly. When he saw that Mr. Ren Dir's team was beginning to go towards winning the state level competition, he likely became jealous. His hatred for Mr. Dir was widely known, and they had an argument in the Staff lunch room the previous day about the success of the Science Olympiad team. Killing Mr. Ren Dir might have been his way to try and get back the coaching position, and get back as well.
 - b. Powder samples: calcium sulfate, calcium nitrate, and lithium chloride
 - c. Hair/fiber samples: polyester, wool, and cat hair
 - d. Plastics: HDPE and PETE
- d) Mrs. Baxter, the frustrated and agitated mom
 - a. Motive: Mrs. Baxter is the mother of 2 of the team's members, Tara, sophomore, and Benjamin, senior. She felt that her son Ben should have been captain of the team in his senior year, but Mr. Ren Dir named juniors Christina and Jack as captains instead. This announcement was made two months previously, but she had appealed to the coach several times over the past few weeks. The last time she came, 2 days before the murder, she was visibly agitated and began yelling when Mr. Ren Dir took her into his room to talk with

her. This murder could have been her final statement about the captainship of the team.

b. Powder samples: Calcium nitrate, potassium chloride, calcium sulfate, and magnesium sulfate

c. Hair/fiber samples: cat hair, nylon, and silk

d. Plastics: PVC and LDPE

1. **Entomology:** Mr. Ren Dir's corpse is discovered with blowfly eggs and very few first stage-larvae, but nothing else was found during your analysis. How long has he been dead?

2. **Powder Samples:** You have 3 powders that could place the suspects at the scene of the murder. These are the results of the three powders from the crime scene:

Test	1	2	3
Flame Test	red	yellow-red	light purple
Solubility	dissolves	dissolves	dissolves
Conductivity	conductive	conductive	conductive
Rxn w/ NaOH?	no	yes	no
Rxn w/ HCl?	no	no	no
Rxn w/ Iodine?	no	no	no

Benedict's Sol'n?	no	no	no
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What are the identities of the three powders?

#1:

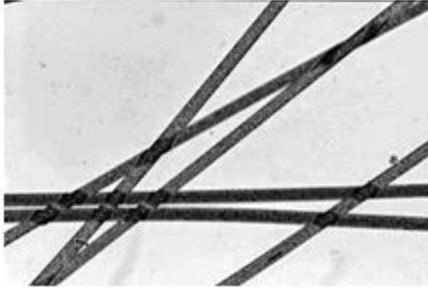
#2:

#3:

Based on this evidence, which suspect can you eliminate?

What is your reasoning behind this?

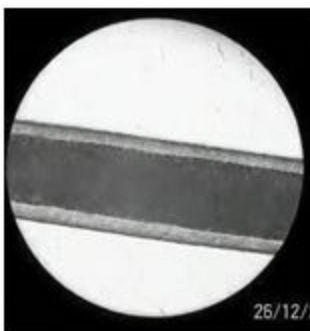
- Fibers and Hairs:** You find two fiber samples and one hair sample on Mr. Ren Dir's clothing. You perform burn tests on each of the two fibers and take a microscopic view at all three samples.



This is Fiber A. During the burn test, Fiber A melted and dripped, and also produced a slightly sweet aroma. What is its identity?



This is Fiber B. During the burn test, Fiber B shriveled up, leaving behind a dark grey or black residue. It also produced a smell like burning hair. What is its identity? _____



This is the hair sample from the crime scene. Based upon this microscopic

image, what type of hair is this sample? _____

Based upon this new evidence, can you eliminate any more suspects?

_____ (2)

What is your reasoning for this?

4. **Plastics:** You find three plastic samples on the body of Mr. Ren Dir. You put the samples into various solutions to test the density, and also perform a burn test on each of the plastics to see if the Plastic A does not float in any of the liquids you used to test. In the burn test, Plastic A burns the color green and produces a white smoke as it is burning.

Plastic B floats in 1.30 g/cm³ salt water, 1.10g/cm³ salt water, floats in distilled water, floats in .95 g/cm³ castor oil, but sinks in ethyl alcohol. In the burn test, Plastic B melted and dripped. It also burns extremely quickly, at a rate of more than 3 inches per minute.

Plastic C floats in 1.30 g/cm³ salt water, 1.10g/cm³ salt water, but sinks in

distilled water, sinks in $.95 \text{ g/cm}^3$ castor oil, and sinks in ethyl alcohol.

Plastic C burns yellow and produces a dense smoke during the burn analysis.

What are the identities of these plastics? A _____ B _____

C _____ (1+1+1)

Based on this evidence, which suspect, if any, can you

eliminate? _____ What is your reasoning? (2, 3)

5. Given the evidence above, can you identify the culprit? If, so, who is it?

Please provide your reasoning. (8)

Eaststroudsburg13's General Knowledge Section :D

1. What would a cobalt blue glass be used for in qualitative analysis? (2 pts)

2. What is HCl used to identify in quantitative analysis?

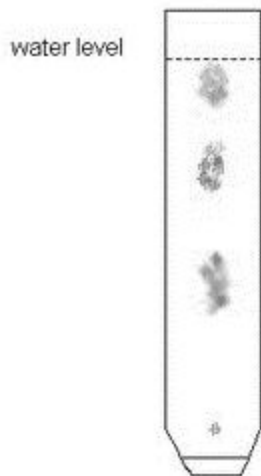
3. Choose a powder listed in the Forensics rules that reacts with HCl and write the chemical reaction that occurs. (2 pts)

4. What is the main **structural** difference between LDPE and HDPE?

5. Draw the chemical structure for PP. (2 pts)

6. What is the stationary phase in paper chromatography?

7. Calculate the R_f values of the mixture components indicated on the paper chromatography sample. (3 pts)

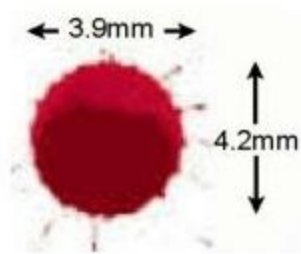


8. What does PCR stand for and what is it? (2 pts)

9. In a mass spectrometry graph, what does the m/z ratio represent?

10. Name two uses for PVC. (2 pts)

11. You find the following blood spatter at a crime scene. At what angle did the spatter strike the ground? (2 pts)



12. Identify the type of fingerprint for each print below. Be as specific as you can. (1 pt each)

a.



b.



c.



13. Ninhydrin is sometimes used to develop latent prints. With what component of the print does ninhydrin react?