

# Raleigh Charter HS Science Olympiad Forensics Tryout Test

\_\_\_\_\_/150

Name: \_\_\_\_\_

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## Scenario

Hey ya'll, I'm Smriti from the RCHS Scioly Team, what's good. Unfortunately, someone's messed with my Detector Building device and COMPLETELY and utterly trashed it. Needless to say, I want bloody revenge. So far, I've found traces of a white powder on my circuit components, bits of plastic on the floor, an unknown scrap of fabric, and blood smears and fingerprints on my laptop. I've got six suspects, but not one of them will own up to the heinous crime. Find out whodunnit!

Powders 1 through 6 were collected from the suspects, along with their fingerprints and a blood sample. Samples A, B, and C, a fingerprint, and a blood sample were found at the crime scene. You have 50 minutes to complete this case. Good luck!

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## Suspects

Suspect 1: **Gobert**

Gobert does Ornithology and Wright Stuff, and claims that he doesn't know what a circuit is. His favorite hobby is making Plaster of Paris figurines of Robert De Niro and he wears thick glasses that constantly break. He wears one, and only one, woolen purple sweater.

Blood Type: A+

Fingerprint:



Suspect 2: **Yoshi**

Yoshi hates Dynamic Planet but does it anyways, and claims that she was throwing her binder off a cliff when the crime happened. Yoshi spends a lot of time drawing memes on the sidewalk with generic sidewalk chalk because Crayola is too bougie for her. She carries around a plastic plumbing pipe to terrorize people with, and on good days she wears a pretty silk top with flowers on it.

Blood Type: B-

Fingerprint:



Suspect 3: **Warko**

Warko does Protein Modeling and maybe Designer Genes, but nobody knows for sure. He claims that he was working on his protein model in the library. He eats copious amounts of salt and vinegar chips that he buys at Costco. Also, he never brings a reusable bag; talk about not eco-friendly! He wears his polyester Science Olympiad shirt pretty much every day.

Blood Type: O+

Fingerprint:

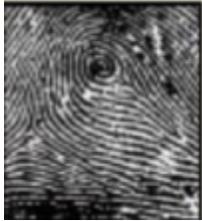


Suspect 4: **Sibi**

Sibi does Chem Lab and college apps, and claims she was at Officemax on the day of the crime. To relieve her stress, she bakes marshmallow fudge brownies, packs them in styrofoam boxes, and stores them in the SciOly closet in case of emergencies. She only wears cotton shirts, for some reason.

Blood Type: A-

Fingerprint:

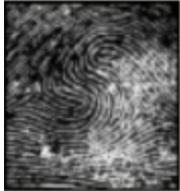


Suspect 5: **Kevin**

Kevin's an ambiguous entity that roams the Raleigh Charter hallways from time to time. He exclusively wears a spandex Spiderman suit, and for maximum stealth (and his perpetual cold), he takes lots of cough medicine on a daily basis. Kevin claims that ambiguous entities do not need alibis.

Blood Type: AB-

Fingerprint:

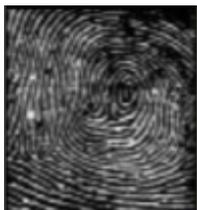


Suspect 6: **Arkansas**

Arkansas does everything BUT Science Olympiad, which is respected to some extent. He claims that, because he has nothing to do with Science Olympiad, he didn't know of the existence of my device. He buys a special cream for acne scars, and collects popular action figures as a hobby.

Blood Type: O-

Fingerprint:



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## **Powders**

1. Identify Sample 1 and its chemical formula. Which suspect is a match for sample 1?  
(2pts)

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2. Identify Sample 2 and its chemical formula. Which suspect is a match for sample 2?  
(2pts)

\_\_\_\_\_

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3. Identify Sample 3 and its chemical formula. Which suspect is a match for sample 3?  
(2pts)

\_\_\_\_\_

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4. Identify Sample 4 and its chemical formula. Which suspect is a match for sample 4?  
(2pts)

\_\_\_\_\_

\_\_\_\_\_

5. Identify Sample 5 and its chemical formula. Which suspect is a match for sample 5?  
(2pts)

\_\_\_\_\_

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6. Identify Sample 6. and its chemical formula. Which suspect is a match for sample 6?  
(2pts)

\_\_\_\_\_

- 
7. Sample A was found at the crime scene. What is Sample A? Which suspect matches sample A? (2pts)

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- 
8. What is the chemical makeup of Benedict's solution? What is Benedict's solution used For? (2pts)

- a. Write out the chemical reaction that occurs when a Benedict's test turns out positive. (2pts)

\_\_\_\_\_

9. Write out the chemical reaction between calcium carbonate and hydrochloric acid. (2pts)

\_\_\_\_\_

10. Write out the chemical reaction between ammonium nitrate and sodium hydroxide. (2pts)

\_\_\_\_\_

11. Which of the powders on the Forensics list is used in the lethal injection? Name the two other chemicals of the lethal injection. (2pts)

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## Plastics

Name the following plastics (full name AND abbreviation):

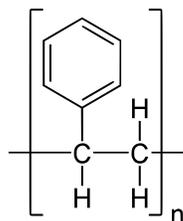
12. When burned, does not char; shrivels, drips. (2pts)

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13. When burned, does char; green flame. (2pts)

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14. (2pts)



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15. When burned, plastic drips, self-extinguishing, black smoke. (2pts)

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16. Branching structure of this plastic: (2pts)



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17. If you recall, a plastic (Sample B) was found at the crime scene. It floats in water, sinks in 46% isopropyl alcohol. What is Sample B? (2pts)

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18. Which suspect is a match for Sample B? (2pts)

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19. Describe the difference between condensation and addition polymerization. (2pts)

20. Describe the properties of a plastic that cause it to be acetone reactant. (2pts)

21. Match the plastic with its resin code (2pts)

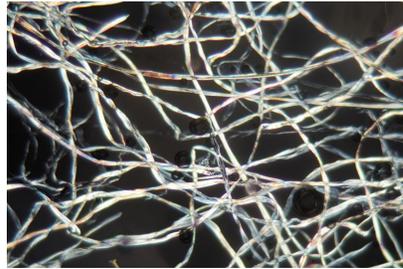
- |         |   |
|---------|---|
| A. PETE | 1 |
| B. PVC  | 2 |
| C. PS   | 3 |
| D. PC   | 4 |
| E. HDPE | 5 |
| F. LDPE | 6 |
| G. PP   | 7 |
| H. PMMA |   |

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## Fibers

Identify these fibers and their suspects (2pts each, 1 pt for each identification):

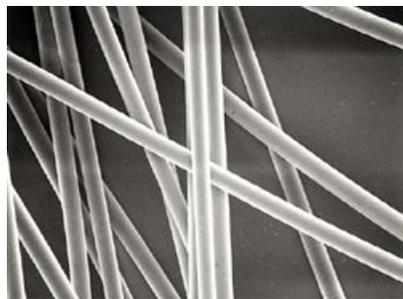
22. (2pts)



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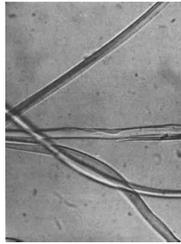
23. (2pts)



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24. (2pts)



25. (2pts)



26. (2pts)



27. Sample C (#23) was found at the crime scene. Which suspect matches sample C? (2pts)

28. What's your favorite color? (I messed up the numbering). (0pts)  
29. What test can you do to differentiate a synthetic fiber, a plant-based fiber, and an animal based fiber? (2pts)

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30. Describe the reactions of each fiber for the test above. (2pts)

31. What are synthetic fibers made of? (2pts)

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## Fingerprints

32. Identify the indicated parts of this fingerprint: (7pts, one for each identification)



Figure 1

33. What fingerprint lifting technique results in a purple stain? (2pts)

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34. What fingerprint lifting technique results in an orange-ish stain? (2pts)

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35. Describe how silver nitrate lifting works. (2pts)

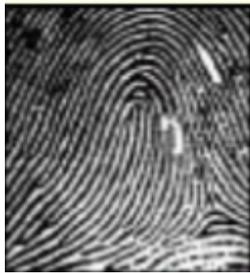
36. What is the difference between latent and patent prints? (2pts)

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37. What does AFIS stand for? (2pts)

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38. This print was found at the crime scene. What shape is it? Which suspect matches this print? (2pts, 1 pt for each identification)



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## DNA

39. What is the full form of PCR? (2pts)

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40. Name the three steps of PCR. (2pts)

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41. Name the main enzyme used in PCR. (2pts)

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42. Which bacteria provides the main enzyme used in PCR? Why this bacteria? (2pts)

43. What is the main purpose of PCR? (2pts)

## Blood

44. How does blood typing work (reaction-wise)? (2pts)

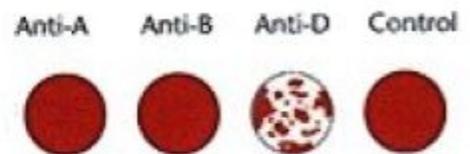
45. Consider someone with an A- blood type. What antigens does this person have? What antibodies? (2pts)

46. Blood type is considered what kind of hereditary gene? (2pts)

47. The plus and minus in blood typing refers to the presence of what (full-form)? (2pts)

48. Which blood types are more prone to vascular disorders? (2pts)

49. The following analysis of the blood found at the crime scene had these results. What is the blood type? Which suspect is a match for the blood sample? (2pts, one for each identification)



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**Miscellaneous:** The following are to test your abilities as a forensic scientist.

50. Complete a chromatography strip with the marker and items you've been provided. Staple it to your test once completed. (7 pts)

51. Name these alkanes: (1 pt each)

$\text{CH}_4$  \_\_\_\_\_

$\text{C}_2\text{H}_6$  \_\_\_\_\_

$\text{C}_3\text{H}_8$  \_\_\_\_\_

$\text{C}_4\text{H}_{10}$  \_\_\_\_\_

$\text{C}_5\text{H}_{12}$  \_\_\_\_\_

$\text{C}_6\text{H}_{14}$  \_\_\_\_\_

52. Name the 4 stages of mass spectrometry (2 pts)

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53. Describe the results of mass spectrometry run on a substance that contains one bromine atom. Use a diagram if necessary. (2 pts)

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Analysis: Answer the following questions in a written analysis. Be sure to include details and observations based on the suspect descriptions. (30 pts)

- Who's the culprit?
- What evidence points to said culprit? What evidence does not?
- What additional testing would confirm your suspicions?

Please write your analysis on a separate sheet of paper, neatly written, and staple it to your answer sheet.