

# 2022 Forensics Exam KEY

University of Maryland Science Olympiad Invitational



Instructions:

- This is the ANSWER KEY, for proctors and those grading the exam ONLY.

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

Team Number: \_\_\_\_\_

## I. Qualitative Analysis (40 points)

Identify these powders, using any method available to you, then complete the following table, indicating each unknown's name and chemical formula. (3 points for each powder and formula, 42 possible points)

Powder	Name of Powder	Chemical Formula
A	Sodium Hydrogen Carbonate	$\text{NaHCO}_3$
B	Calcium Carbonate	$\text{CaCO}_3$
C	Calcium Sulfate	$\text{CaSO}_4$
D	Sodium Acetate	$\text{C}_2\text{H}_3\text{NaO}_2$
E	Sodium Chloride	$\text{NaCl}$
F	Lithium Chloride	$\text{LiCl}$
G	Glucose	$\text{C}_6\text{H}_{12}\text{O}_6$

## II. Polymers (40 points)

Identify these polymers. Burn tests are NOT allowed for the plastics. (3 points each)

### a. Fibers

Fiber A identity: Cotton

Fiber B identity: Silk

Fiber C identity: Polyester

Fiber D identity: Spandex

### b. Plastics (recycling number and abbreviation) (3 points for each number, 1 additional point for proper abbreviation, bonus point in B for both abbreviations)

Plastic A identity: #2, HDPE

Plastic B identity: #1, PET/PETE

Plastic C identity: #5, PP

### c. Hair

Hair A identity: Cow

Hair B identity: Horse

Question 1: Cuticle

Question 2: Mostly straight, maybe wavy

Question 3: Cuticle, Cortex, Medulla**III. Chromatography/Spectroscopy (30 points)**

You are given a sample of the ink found at the crime scene, as well as three possible suspect pens. Describe how you would go about developing a chromatogram of these inks. Describe in detail what the results of your chromatography look like, and how you would calculate the R<sub>f</sub> value of each of them (show your calculations). Describe how you would determine which pen was found at the crime scene.

**IV. Crime Scene Evidence (30 points)****a. Fingerprint analysis (2 points each)**

Identify the fingerprint pattern of each of the fingerprints provided.

Fingerprint A: Double Loop Whorl

Fingerprint B: Tented Arch

Fingerprint C: Plain Whorl

Fingerprint D: Radial Loop Double

Fingerprint E: Central Pocket Whorl

Identify the fingerprint minutiae.

Minutia A: Eye

Minutia B: Fork

Minutia C: Spur

Minutia D: Delta

**b. Blood analysis (3 points each)**

Identify the blood type.

Blood sample A: O+

Blood sample B: A-

Blood sample C: AB+

## Evidence List

### Powders:

- Powder A- treats poison ivy
- Powder B- chalkdust
- Powder C- in drywall
- Powder D- salt and vinegar chips
- Powder E- salt for food
- Powder F- used as desiccant
- Powder G- candy
- Unknown- powders C and E

### Fibers:

- Fiber A- cotton lab coat
- Fiber B- silk handkerchief
- Fiber C- polyester scrubs
- Fiber D- spandex
- Unknown- Fiber D

### Plastics:

- Plastic A- bottle for powders
- Plastic B- Gatorade bottle (suspect 3) and recycling water bottle (suspect 1)
- Plastic C- yogurt container
- Unknown- Plastic B

### Hair:

- Hair A- from working at the barn
- Hair B- from riding

### Fingerprints:

- Fingerprint A- Suspect 2
- Fingerprint B- Suspect 4
- Fingerprint C- Suspect 1
- Fingerprint D- Suspect 2
- Fingerprint E- Suspect 3
- Unknown: central pocket loop

### Blood:

- Blood Sample A- Suspect 4
- Blood Sample B- Suspect 1
- Blood Sample C- Suspect 2 and Suspect 3

## V. Analysis of the Crime (60 points)

- 46 points: points for identification of evidence (2 points each)
- 4 points for correct identification of suspect (Suspect 3, Cyan)
- 10 points for evidence supporting suspect

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