Practice Test

The PTA Meeting Gone Wrong

Mr. Doug Giles is a science teacher at a school in upstate New York. Mr. Doug Giles has a prized lab that he always keeps locked. During a PTA meeting, he left both the room and lab unlocked and unattended. One simple mistake quickly turned into grave misfortune. Mr. Doug Giles was absent from the lab and room for around thirty minutes. During those thirty minutes, someone had gone in and wreaked havoc amongst the clean lab. They had gone in and stolen all the chemicals used, broke equipment (the criminal had cut themselves on the broken equipment), and had left a note. The note left on the lab countertop read "Consider this a warning. You are not in charge of us but the other way around." Four people have been spotted passing by the lab and room. Your job is to identify all exhibits/evidence provided and answer the questions in order to help determine who committed the crime.

Information gathered about the Suspects:

Marcus Eden: 5' 3"; 89 lbs; dark brown hair; blue-grey eyes

- Likes dogs and hates cats
- Wears cotton and silk
- Has a metal iron-plated bottle
- Gets caught cheating frequently
- Likes making dessert and favorite dish is jello and fruit

David Bramble: 5' 5"; 95 lbs; dirty blonde hair; green eyes

- Likes to wear warm wool sweaters
- Likes sculpting
- Brings Aquafina water bottles to school
- Has a pet rat
- Always look stressed and upset in science class
- Hates science class but loves science

Nina McCoy: 5' 4"; 98 lbs; brown hair; hazel brown eyes

- Loves to eat seaweed
- Has a rayon backpack
- In the evenings she takes strolls along the beach and goes to her favorite cafe
- Allergy to cats
- Has a Poland Spring water bottle
- Constantly compared to other students by teachers

Christine Lee: 5’ 2”; 91 lbs; black hair; dark brown eyes
- Wears nylon
- Likes KFC chicken and mashed potatoes with gravy
- Has an aluminum plated bottle
- Outcast and disliked by teachers for her quiet demeanor
- Doesn’t participate in class due to her shyness

Evidence Recovered

Powder A: from the lab cabinets
Powder B: from the lab counter
Powder C: found on the floor
Powder D: from Marcus’ sneakers
Powder E: from Nina’s clothing
Powder F: from the kitchen counter
Powder G: found next to the broken equipment
Powder I: found next to the entrance/exit to the lab

Metal A: from the kitchen table
Metal B: on the front lawn
Metal C: on the doorstep

Hair A: found on edge of the front door
Hair B: found on the floor next to the cabinet of chemicals

Fiber A: found on the broken equipment
Fiber B: found on a chair in the lab
Fiber C: under the doormat in front of the lab's entrance

Plastic A: found by the classroom entrance
Plastic B: found on David’s clothes

Pen 1: Crime Scene
Pen 2: Marcus
Pen 3: David
Pen 4: Nina
Pen 5: Christine

Fingerprint A: found on some broken glassware
Fingerprint B: found on some broken glasswarE

Powder Identification:

Identify exhibits A through H and determine which suspect each one implicates. Powders H and I could possibly be mixtures(Note: iodine stains yellow in water)

A. Turns clear in I2, soluble in water, and no HCl reaction

B. Soluble but lumpy, stains dark purple in I2, and no HCl reaction

C. Uniform square crystals, soluble in water, no HCl or I2 reaction

D. Soluble with bubbles, turns hard in water, no HCl reaction, stain yellow in I2

E. Soluble and smooth, stains bluish-purple in I2, and no HCl reaction

F. Absorbs water, completely soluble, no I2 or HCl reaction, has a snow-like texture

G. Insoluble and foggy, stains yellow in I2, and fizzes in HCl

H. Soluble but fizzes, fizzes in everything but extremely strongly in HCl for a long time, also has a few fine crystals but is still a powder

I. Uniform square crystals, partly soluble in water, has parts of sediments, and no HCl or I2 reaction

1. What are the three uses of Powder E?
2. What is a common use of Powder F in the food flavoring industry?
3. Limestone, marble, chalk are rocks that primarily consist of?
4. What is the pH of Powder A?
5. What is the chemical formula of Powder D?

Metal Identification:

Identify exhibits A through C and determine which suspect each one implicates

A. Gray, density of 2.7 g/cm3, delayed HCl reaction, no reaction with water

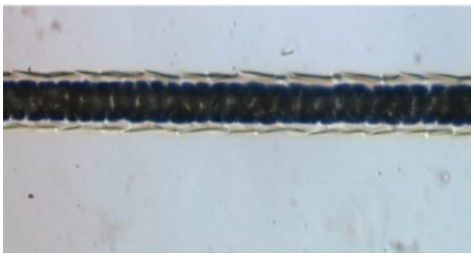
B. Gray, density of 7.31 g/cm3, small HCl reaction, yellow tint, no reaction with water

C. Gray, density of 7.13 g/cm3, quickly fizzes in HCl, no reaction with water

Polymer Testing

Hairs:

1. Identify A and B and determine which suspect each one implicates

a. 

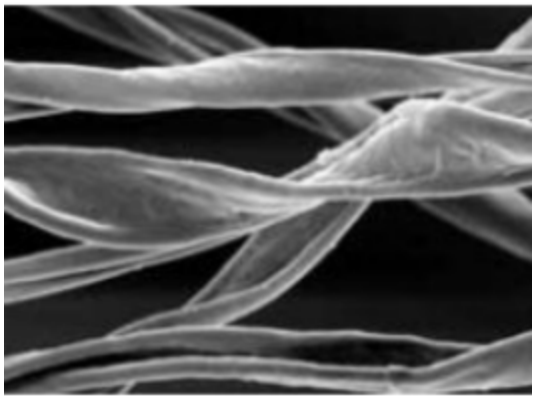
b. 

2. What is the medullary index of cat hair?

3. How do you distinguish between cat and dog hair? Please provide two reasons.

Fibers:

Identify exhibits A through C and determine which suspect each one implicates

A. 

B. It burns without flame or melting and may flare-up. Doesn't leave any bead. It smells like burning paper and leaves soft, gray ash. What type of fiber is this?

C. It is a protein fiber that burns slowly. It sizzles and curls away from the flame. It leaves beads that are brittle, dark, and easily crushed. It is self-extinguishing and leaves harsh ash from the crushed bead. It smells like burning hair. What type of fiber is this?

Chromatography:

1. Which chromatography matches the one above?
   a. Marcus - 
   b. David - 
   c. Nina - 
   d. Christine - 
2. What is the mobile phase and the stationary phase in paper chromatography?

3. Calculate the Rf of each chromatogram. These are not the chromatograms above. These are just additional questions to test your knowledge of Rf. D1 is the distance the solute traveled and D2 is the distance traveled by the solvent
   a. A chromatogram has a D1 of 5 cm and a D2 of 15 cm:
   b. A chromatogram has a D1 of 7 cm and a D2 of 20 cm:
   c. A chromatogram has a D1 of 2.5 cm and a D2 of 10 cm:

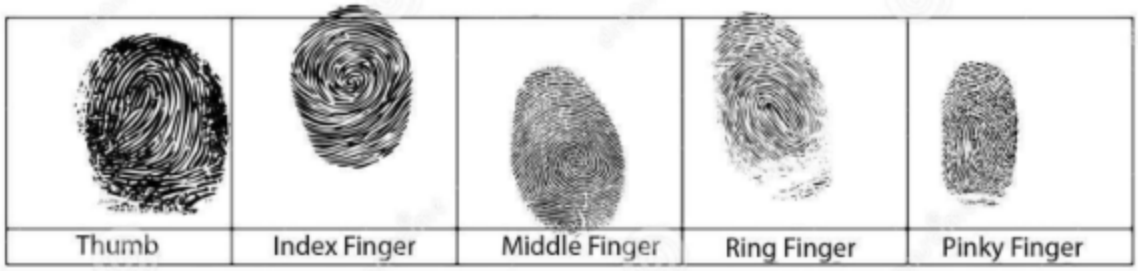
Physical Evidence

Fingerprints:

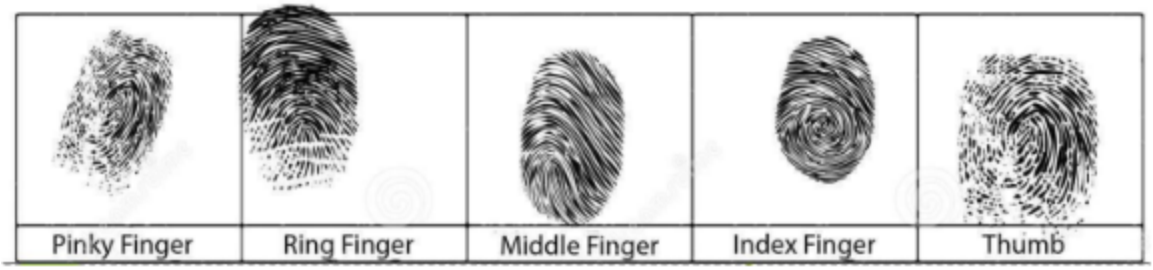
Fingerprints of each suspect were collected and are provided below:

Marcus-

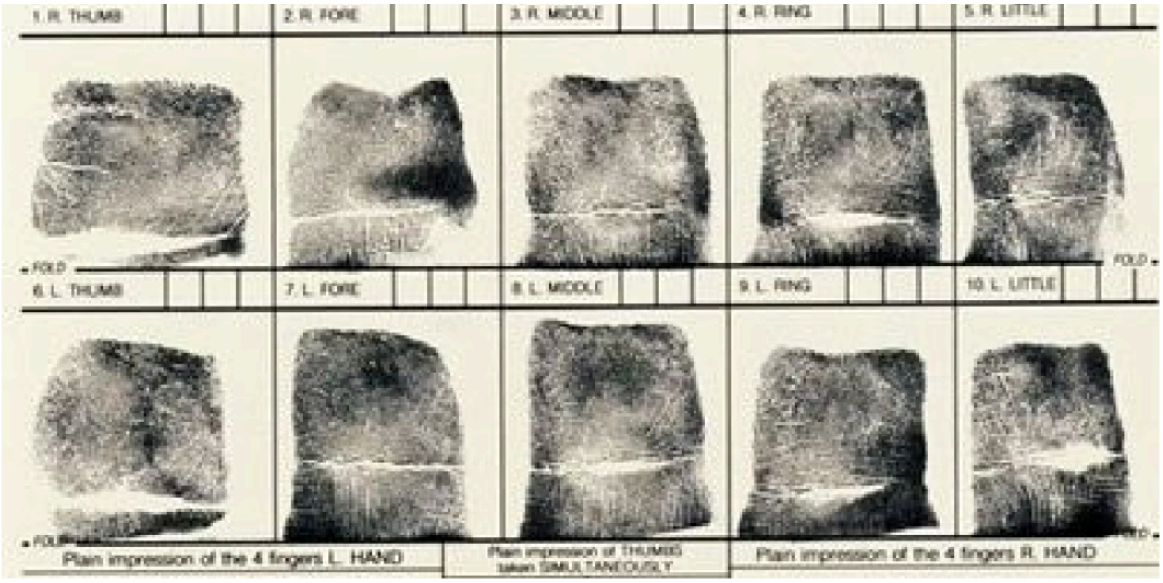
Right Hand



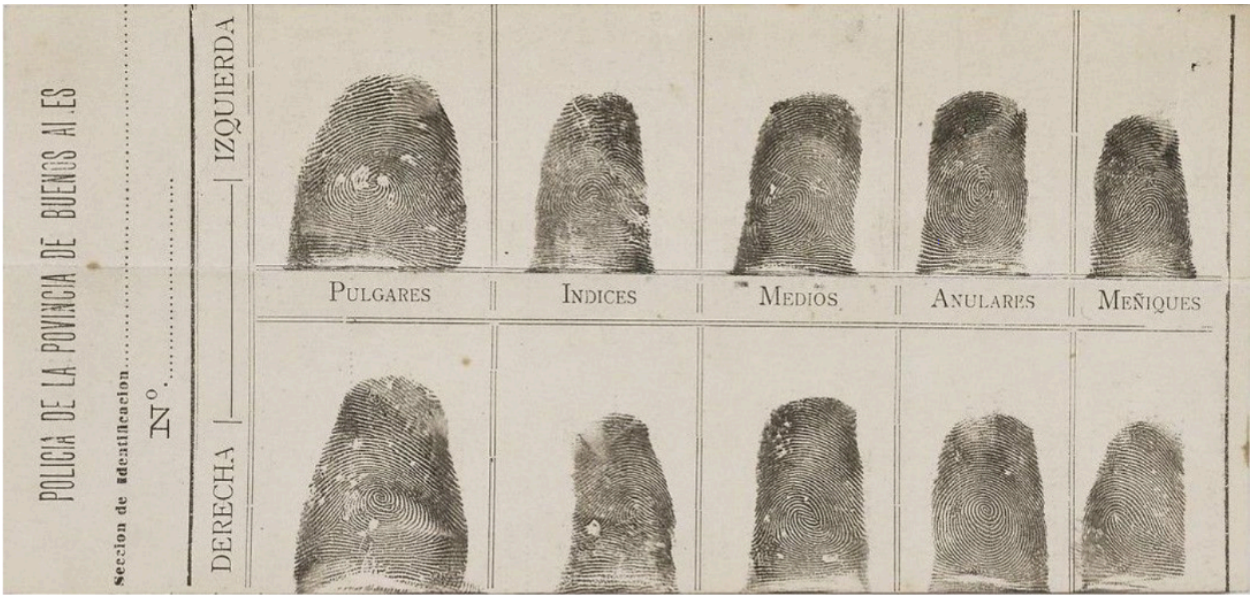
Left Hand



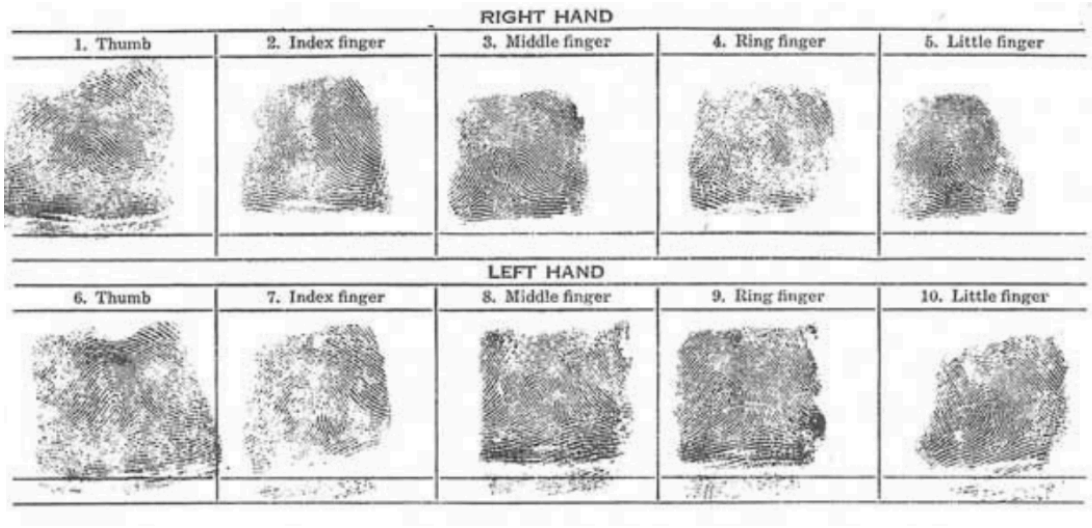
David-



Nina-(derecha is right and izquierda is left)



Christine-



Fingerprint A: 

Fingerprint B: 

1. What kind of fingerprint is Fingerprint A?

2. Who does Fingerprint A belong to?

3. What kind of fingerprint is Fingerprint B?

4. Who does Fingerprint B belong to?

5. What type of fingerprint does the owner of Fingerprint A have the most and how many?(Ex: 3 tented arches)

6. What type of fingerprint does the owner of Fingerprint A have the most and how many?(Ex: 3 tented arches)