

University of Texas at Austin  
Virtual Invitational 2020

# Forensics

Division C



## TEST PACKET

School/Team Name \_\_\_\_\_

Team Number \_\_\_\_\_ Name(s) \_\_\_\_\_

### Instructions:

**\*\*INSERT INSTRUCTIONS\*\***

## Scenario:

After years of being on the run, Peter Burke has finally tracked his former partner and conman Neal Caffrey through dozens of European cities to a startlingly unusual location: Neal is now on American soil, in Austin, Texas. After making remote contact with Neal, Peter learns that Neal is under pressure by a third party to recover something from UT Austin's Blanton Museum of Art, but the Bolivian fabric sculpture he was planning to steal had already been taken by someone else. Peter is distrustful, but decides to believe Neal, asking, "Then who could have done this, Neal?"

"All I know is that when I went to scope out the sculpture *recently*, the sculpture on display was clearly a forgery, with shape lines inconsistent with that of Valdés' work during that time period," Neal replied.

"And that's all you know for certain? Neal?"

"Okay, at that point, someone passed me a message saying 'Good luck delivering now. This is for the charges...'"

Peter and Neal have now come to the conclusion that their main suspects must be someone they've (tried to) put someone away in the past. After a night-long conversation, they come up with the following short-list:

1. **Vincent Adler:** An eccentric conman who the FBI finally put away for his conspiracy to steal Nazi treasure, Adler used to be Neal's former boss until he pulled off a large Ponzi scheme and Neal was left with nothing. Adler was thought to be dead when he threatened Neal's life and Peter shot him, but new intel arises he may have survived and he's back for revenge.
  - a. Blood type: AB-
  - b. Pets: None
  - c. Hair Color: Reddish-brown
  - d. Attire: dusty gray linen suit, with a couple of motor oil stains
  - e. Other: Carries hot packs often since he is sensitive to the winter cold. He also loves coming to Austin and visiting the bat colonies that parts of the city are famous for. He claims he doesn't like Neal enough to be wasting his time on "petty paybacks." He seemed to be in a rush however; the water filter in his house broke and they were coming to fix it the day of questioning, and he is "sick and tired of drinking out of bottles."
2. **Dr. Mara Summers:** Possibly one of the more scarier antagonists on the show, Dr. Summers is a professor of psychology who worked with convicted ex-cons and conspired to mentally trick them into robbing banks, and even gets into Neal's inner conscious once and tells him he can never reform from his sneaky methods. Being put away, she's been waiting to play mind games with Neal. Since being released, she now teaches as a professor at UT.
  - a. Blood type: B-
  - b. Pets: None
  - c. Hair Color: Brown
  - d. Attire: Her usual silk neck scarf and cerise woolen dress.
  - e. Other: Has a fear of squirrels after being attacked by the campus rodents numerous times (she had a bag of walnuts with her). She also developed migraines over the years, and regularly takes meds in an attempt to alleviate her headaches. She also said she had left the past behind a long time ago, as she no longer found it fun or amusing.
3. **Henry Dobbs:** Also known as Robert Macleish, one of FBI's Most Wanted Fugitives, Henry originally owned the island Neal and Mozzie fled to and then later couldn't escape. He's a man with rich taste and is usually a "go-lucky guy" as others would describe him, except he has been holding a grudge against Peter and Neal ever since they crashed his house-warming party and tried to arrest him. The fiasco caused panic and a dent in Dobbs' record in the criminal world, a reputation he had worked hard for.
  - a. Blood type: AB+
  - b. Pets: owns a ranch offshore
  - c. Hair Color: light brown

- d. Attire: Loves Hawaiian polyester shirts
  - e. Other: Has been suffering from heart burns and is taking anti-acid medications for it. Has recently also taken up 3D printing as a hobby to make more boats in bottles.
4. **Alex Hunter**: Alex is one of Neal's allies though she's double crossed him quite a few times. Though it seems like they left on good terms, she can be volatile and there's a good chance she'd place their friendship second to any large swindles or scores. However, stealing and gambling with relics was her muse only when Neal was involved in the game; otherwise, she claimed to have grown bored of the chase and has moved on to other things. Maybe having Neal involved again has changed that ...?
- a. Blood type: A+
  - b. Pets: A cat
  - c. Hair Color: Brown
  - d. Attire: Polyester open-back dress
  - e. Other: Alex has been prioritizing self-care after many years of running and hiding. She enjoys eating sugary foods as a destressor, particularly macarons. She also loves to garden and spends most of her time outside tending to her tulips - her favorite.
5. **James Bennett**: Neal's long lost father and fugitive who goes on the run after killing a senator who he posited was framing him. It's evident he'll prioritize his own liberties over anything too.
- a. Blood type: A-
  - b. Pets: Technically none, but enjoys going horseback riding at the local stable.
  - c. Hair Color: originally brown but now gray/white
  - d. Attire: flannel and rough jeans
  - e. Other: He is rather embarrassed about his acne and has been staying in to avoid being seen. Only recently he started using new acne medication when leaving the house, only to get Chinese takeout too often a week.

At this point, Peter comes to Austin with his trusted colleagues, Diana and Jones, along with Mozzie, to help Neal break into the Museum and recover any forensic evidence from the forgery/surrounding exhibit. Here's what they found:

- Exhibit A and B (powders) found at the scene
- Plastics A-E
- Fibers A-D
- Ink sample from note
- Mystery compound at scene
- Fingerprints A-C
- Glass
- DNA
- Blood sample on glass

## A. Powders

Mozzie was able to recover 8 unusual powders from the exhibit, but senses they may have been contaminated due to the delay in getting samples. Thus, he tells you that 7 of these properties are erroneous, but that you should be able to nonetheless recover the identities (since, at most one property per row is erroneous). Some powders may appear more than once.

Powder	Reaction with Benedict's (A)	Flame Test (B)	Reaction with NaOH (C)	Reaction with HCl (D)	Crystalline shape (E)	pH (F)
Evidence A	N	Red	N	N	Monoclinic (trihydrate)	8-9
Evidence B	N	Boils off hydration	N	N	Triclinic (pentahydrate)	~10
Powder C	Orange	Boils off hydration	N	N	monoclinic	6-7
Powder D	N	Green	Y	N	triclinic	5-6
Powder E	N	Boils off hydration	N	Y	Triclinic	~6
Powder F	N	Purple	Y	Y	circular	7
Powder G	Brown	Orange	N	N	cubic	7
Powder H	N	Yellow	N	N	anhydrous	8-9

- Identify the powders. Provide the full name (1 pt) and chemical formula (1 pt):
  - Evidence A:  $\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$  (1 bpt), Sodium acetate (trihydrate - 1 bpt)
  - Evidence B:  $\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$  (1 bpt), Magnesium sulfate (pentahydrate - 1 bpt)
  - Powder C:  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , sucrose
  - Powder D:  $\text{H}_3\text{BO}_3$ , boric acid
  - Powder E:  $\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$  (1 bpt), Magnesium sulfate (pentahydrate - 1 bpt)
  - Powder F:  $\text{CaCO}_3$ , calcium carbonate
  - Powder G:  $\text{Ca}(\text{NO}_3)_2$ , calcium nitrate
  - Powder H:  $\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$  (1 bpt), Sodium acetate (trihydrate - 1 bpt)
- Identify the seven errors by putting the column letter (A-F) in which there's an error. There can be none! (1 pt each, explanation not required)
  - Evidence A: B
    - Flame test is yellow, not red - LiCl is the only forensics powder that burns red, it is cubic and pH is closer to neutral.

- b. Evidence B: **F**
  - i. So the pH is ~6, not 10 - Only  $\text{Na}_2\text{CO}_3$  has a pH that high, and does not boil off hydration or have no reaction with HCl (it fizzes). The only one that boils off hydration is  $\text{MgSO}_4$ .
- c. Powder C: **NONE**
- d. Powder D: **C**
  - i. The powder doesn't react with NaOH - the only powder that does react with NaOH is ammonium chloride, which doesn't burn green and is cubic, not triclinic. The powder that burns green is  $\text{H}_3\text{BO}_3$ , which doesn't react with NaOH.
- e. Powder E: **D**
  - i. Does not react with HCl - The only powders that do are the carbonates, which either burn orange ( $\text{CaCO}_3$ ) or are basic and burn yellow (sodium carbonate/bicarbonate). The only powder that boils off hydration is  $\text{MgSO}_4$ , which doesn't react with HCl.
- f. Powder F: **B**
  - i. Flame burns orange, not purple -  $\text{CaCO}_3$  is the only powder with a circular crystalline structure, and burns orange.
- g. Powder G: **A**
  - i. No reaction with benedicts - No powders precipitate with benedicts and burn a color of a metal ion. The only one that precipitates brick red (close to brown) is glucose, which doesn't burn orange nor is cubic.  $\text{Ca}(\text{NO}_3)_2$  burns orange and does not react with HCl nor benedicts.
- h. Powder H: **E**
  - i. It is crystalline (triclinic) and not anhydrous - The basic powders in forensics are found in crystalline form.

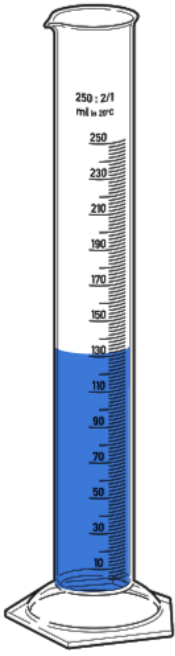
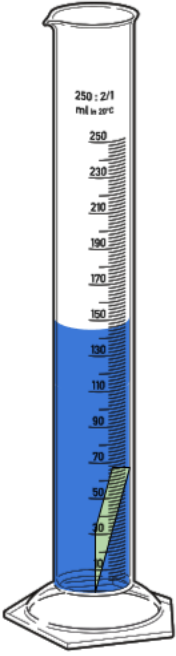
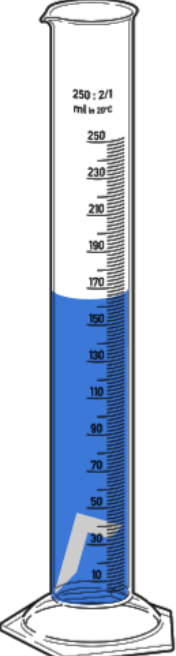
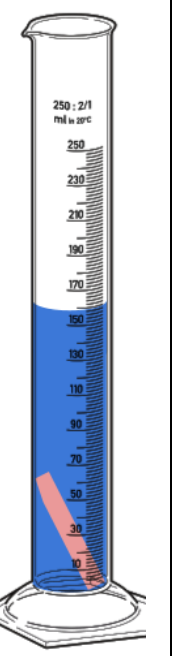
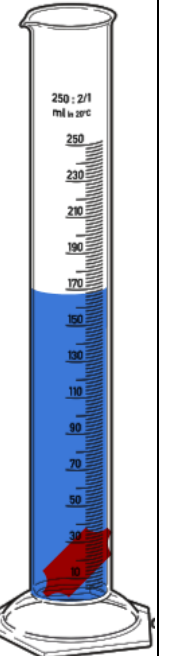
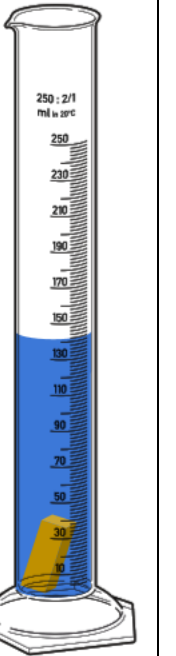
- 3. Relate each of the powders to their suspect(s), if any, and describe how they were used (suspect = 1 pt, use = 1 pt):
  - a. Powder C: **Alex Hunter** - she has a sweet tooth and enjoys sugary foods high in sucrose.
  - b. Powder D: **James Bennett** - acne medication, antibacterial
  - c. Powder E: **Dr. Mara Summers** - has been suffering migraines, takes medication for them.
  - d. Powder F: **Henry Dobbs** - heartburn medications
  - e. Powder G: **Alex Hunter** - she loves gardening, fertilizers
  - f. Powder H: **Vincent Adler** - Is sensitive to the cold, uses heat packs.
- 4. Based on your answers in #3, which suspect(s) do Evidence A and B incriminate? How were the powders used? (suspect = 1 pt, use = 1 pt)
  - a. Evidence A: **Vincent Adler** - Is sensitive to the cold, uses heat packs. (May have used it in preservation of the stolen textiles, heavily used in textile industry - 1 bpt)
  - b. Evidence B: **Dr. Mara Summers** - has been suffering from migraines, takes medication for them.

## B. Polymers (Plastics & Fibers)

In addition to some of the fibers that made up the sculpture, Diana also found some plastics and fibers in the exhibit.

### Plastics:

Diana finds 5 plastics, one of which was likely used in the making of the sculpture. Two of these plastics (A, B) were found near the sculpture while three (C-E) were found slightly further away. Since the samples are large enough, you decide to run flame and water displacement tests to determine what the identity of each plastic might be. For each plastic, determine its identity.

Starting water level:	Plastic A:	Plastic B:	Plastic C:	Plastic D:	Plastic E:
					
mass of tested plastic >	20.7g	46.92g	29.40g	35.89g	15.18g
flame test >	yellow	greenish-yellow	yellow	Bluish, yellow tip	Yellow, green

1. Identify the 5 plastics (give abbreviation ONLY) (2 pt each):

- A: PETE
- B: PVC
- C: PS

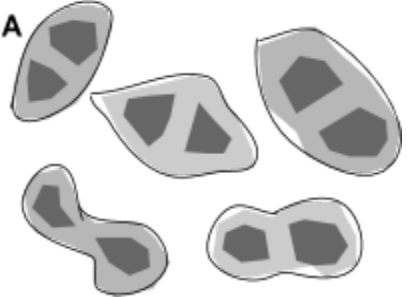
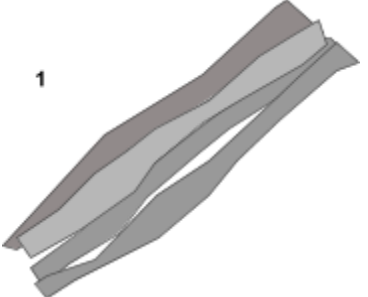

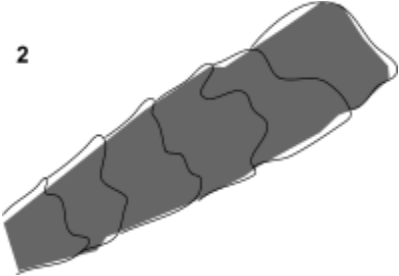

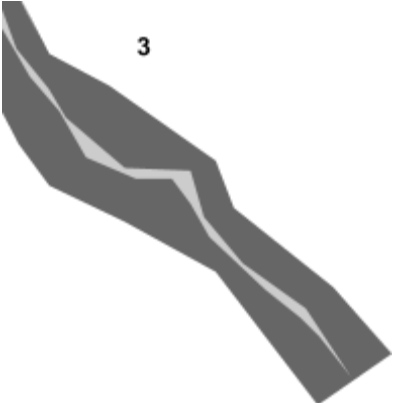
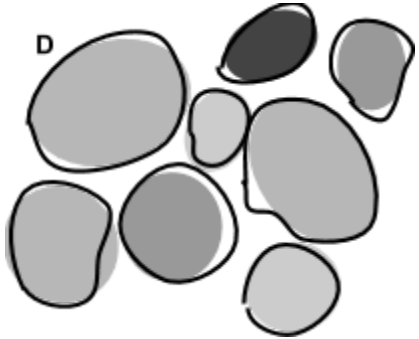
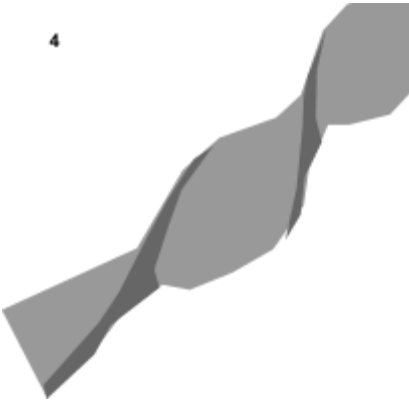
- d. D: **HDPE**
- e. E: **PVC**

2. Which plastic(s) do you think came from the structure of the sculpture? No explanation needed, only list the plastic codes separated by a comma (e.g. A, B, C) [2 pt]
  - a. Answer: **B, E**
3. For each of the following plastics, fill in the blanks [1 pt per entry] :
  - a. Plastic A likely incriminates **\_Adler\_** because **\_has to\_** **\_**.
  - b. Plastic B likely incriminates **\_no one\_** because **\_likely part of the sculpture\_**.
  - c. Plastic C likely incriminates **\_James Bennett\_** because **\_came from styrofoam takeout\_**.
  - d. Plastic D likely incriminates **\_Henry Dobbs\_** because **\_likes to 3D print stuff\_**.
  - e. Plastic E likely incriminates **\_no one\_** because **\_likely part of the sculpture\_**.
4. As you do the burn tests, you realize you've actually added too much heat to the plastics and their chemical structure/makeup may have changed. Did any plastics char? If so, which ones (list sample letters)? [2 pt]
  - a. **No**
5. If a plastic chars, what kind of plastic is it? [1 pt]
  - a. **Thermoset**

### Fibers:

Diana finds 4 fibers, but thinks it's possible that some of the fibers came from the sculpture, which was made out of sateen and gabardine.

1. Match the cross sections of the different fibers to their view under the microscope (1 pt each):

Cross Section	Longitudinal View
<b>A</b> 	<b>1</b> 
<b>B</b> 	<b>2</b> 
<b>C</b> 	<b>3</b> 
<b>D</b> 	<b>4</b> 

- a. Matchings:  
i. A, 3

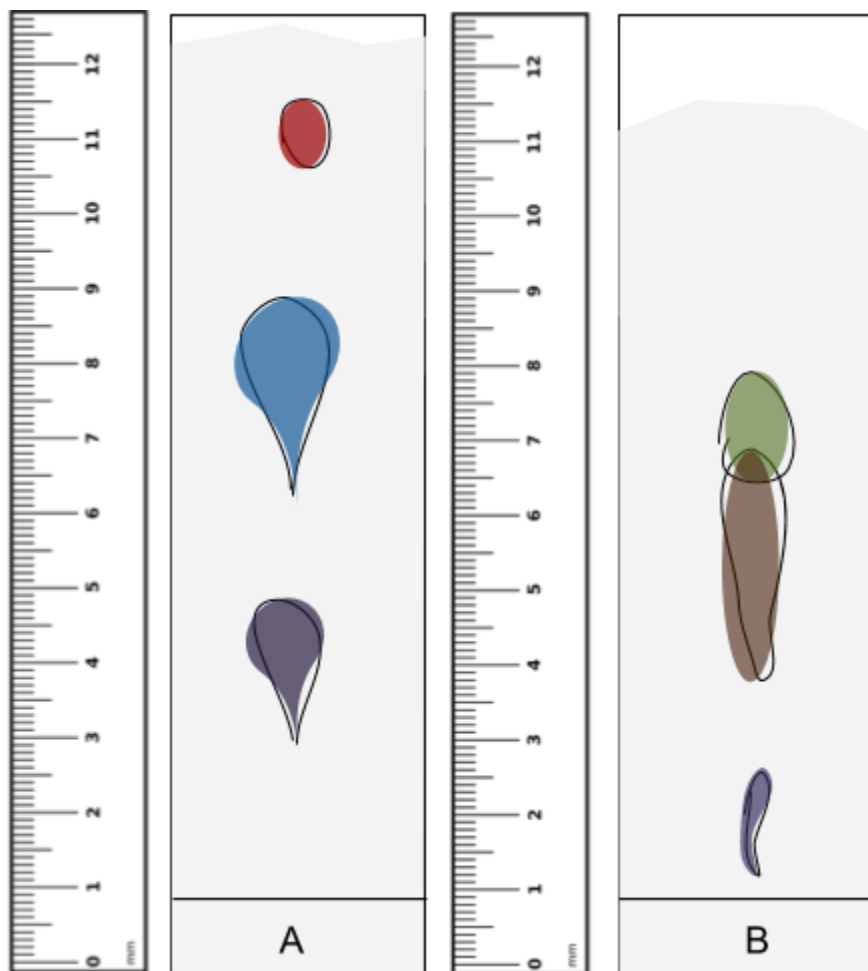


- ii. B, 4
- iii. C, 1
- iv. D, 2

2. Identify the fiber presented in ... (1 pt each)
  - a. Cross Section A: **silk**
  - b. Cross Section B: **cotton**
  - c. Cross Section C: **spandex**
  - d. Cross Section D: **wool**
3. What main fiber is involved in the making of sateen? (1 pt) **cotton**
4. What main fiber is involved in the making of gabardine? (1 pt) **cotton**
5. Based on the above information, which fibers appear to be incriminating, and who does each one incriminate? [1 pt per entry]
  - a. Fiber/Cross Section A appears to incriminate **Dr. Summers** because **silk scarf**.
  - b. Fiber/Cross Section B appears to incriminate **no one** because **is part of the sculpture**.
  - c. Fiber/Cross Section C appears to incriminate **no one** because **no one was wearing spandex**.
  - d. Fiber/Cross Section D appears to incriminate **Dr. Summers** because **her dress**.

### **C. Chromatography**

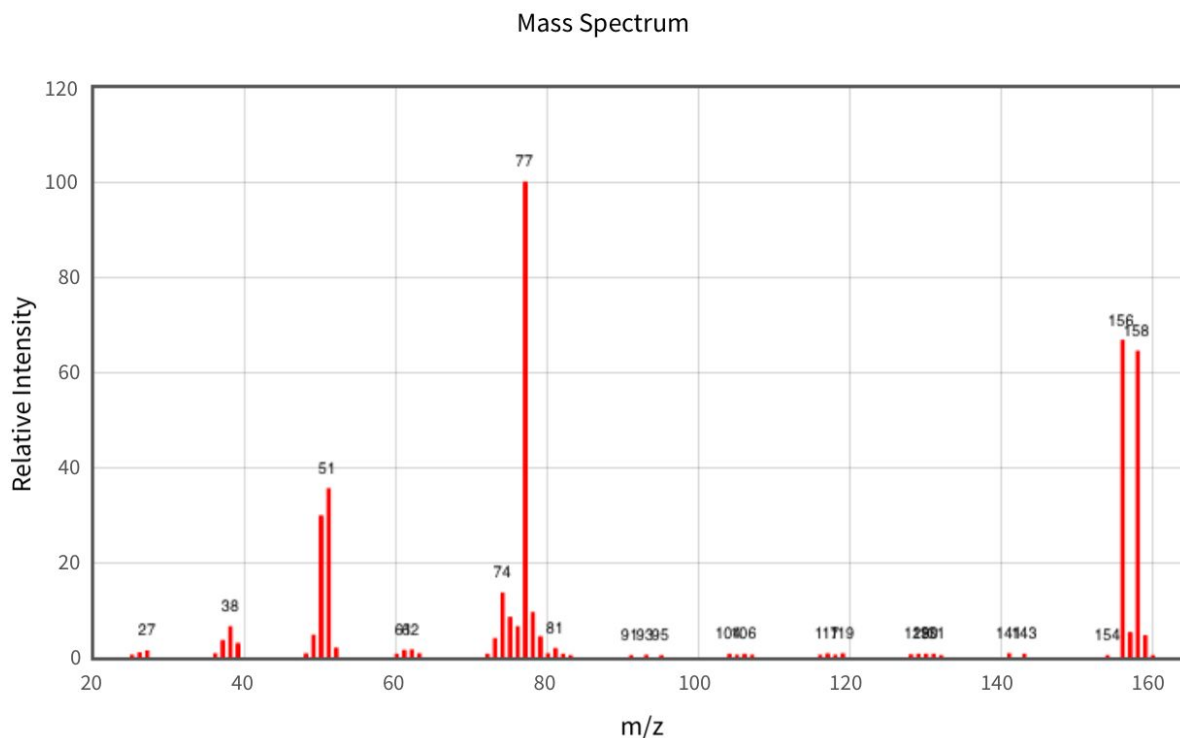
From inspection of the note Neal found, it looks like there are two different types of running/bleeding in the ink, suggesting that two different inks/pens were used. Answer the questions about these two chromatograms below, with rulers provided for your convenience:



1. To two decimal places, calculate the Rf of all 6 spots on both chromatograms. (need to give  $\pm 0.05$ ) [0.5 pt each]
  - a. A:
    - i. Red: **0.91**
    - ii. Blue: **0.64**
    - iii. Purple: **0.31**
  - b. B:
    - i. Green: **0.61**
    - ii. Brown: **0.44**
    - iii. Purple: **0.10**
2. Pens are collected from 3 of the suspects: Mara Summers, Alex Hunter, and Henry Dobbs. Mara's pen had an Rf of 0.34, Alex's pen had an Rf of 0.70, and Henry's pen had an Rf of 0.80. Even though these might not be comprehensive Rfs, which pens might match up most to either of the A/B ink samples? [2 pt] **Mara and Alex**

## D. Mass Spectrometry

Peter notices a sweet smell coming from what seems to be a bit of clear liquid on the ground. Taking a sample of this, he decides to run it through UT's mass spectrometer and asks for your help in deciphering the data. Here is the plot:



1. What is the molecular weight of this compound? [1 pt] **157g/mol**
2. There seem to be 5 intermittent bits (at roughly 91, 103, 117, 129, 141 are the intermittent fragments, completion at ~153) that suggest there's one atom or fragment of the same mass that keeps getting added to form the larger product. What atom is this? [2 pt] **Carbon**
3. How many of those atoms are in the compound? [1pt] **6**
4. Based on the sweet smell, you think you have an aromatic compound of some kind. Using this information, what kind of fragment is present at the M peak? Write its chemical formula, with overall charge if any at the end. [3 pt] **C<sub>6</sub>H<sub>5</sub>-**
5. We now have one of the main fragments! Based on the lack of fragmentation between the M peak and M+1/M+2 peaks, we think it might be safe to assume only one additional atom might be added to the structure. What atom is this? [2 pt] **Br**
6. Put everything together! What is the chemical formula of this compound: [3 pt] **C<sub>6</sub>H<sub>5</sub>Br**
7. Mozzie pointedly notes that acetates with that kind of sweet smell usually show up in industrial pesticides while benzylic compounds are really common in motor oil and gasoline. Where did this compound originate? [1 pt] **Motor oil/gasoline (car!!)**





## **E. Fingerprints**





You tag along with Mozzie to the exhibit to help him pick up some fingerprints to analyze. Neal suggests that the ideal break-in route would have been through the service entrance, a door with a simple exit metal push bar. Then, the culprit would have to remove some greasy screws from underneath the sculpture's stand to unfasten it, remove the sculpture, and escape going through the alley exit on the bottom floor, where the thief might have brushed up against a new layer of paint that hadn't dried yet.

1. Pick one valid option of picking up fingerprints for each of these three locations:

Location	Options (2 pts each)
Metal push bar, service door	a. <b>Dusting</b> b. Peroxidase-reaction chemicals/phenolphthalein c. Silver nitrate
Greasy underside/screws of stand	a. Ninhydrin b. Cyanoacrylate c. <b>Sudan Black</b>
Layer of paint, undried	a. Kastle-Meyer Test b. <b>Small particle reagent</b> c. Ninhydrin

2. Prints A-C were collected from the crime scene using the above specified methods. Further analysis revealed that the prints were from the left hand, so prints of the suspects' left hands were taken as well. Identify each fingerprint (be as specific as possible):

Source	Print	Type of Print (1 pt)
Print A - Crime Scene		<b>Central pocket loop (whorl)</b>
Print B - Crime Scene		<b>Plain whorl</b>
Print C - Crime Scene		<b>Plain arch</b>
Print D - Henry Dobbs		<b>Ulnar Loop</b>

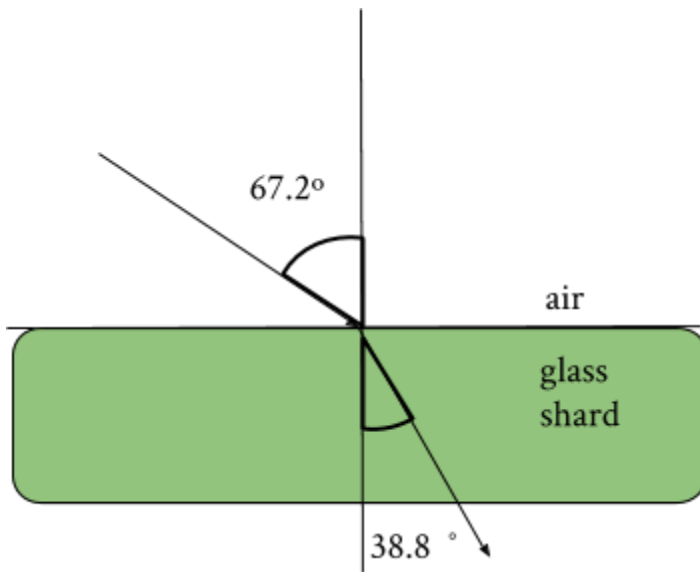
Print E - Vincent Adler		Central pocket loop (whorl)
Print F - Alex Hunter		Twinned Loop/Double Loop
Print G - Dr. Mara Summers		Plain arch
Print H - James Bennett		Accidental

3. Who do Prints A and B incriminate, if anyone? [3 pt, 1 pt per print]
- Print A: **Vincent Adler**
  - Print B: **No one**
  - Print C: **Dr. Mara Summers**

## **F. Glass:**

Neal shows Jones some samples of glass shards he found where the exhibit had lay, noting how weird this was given the fact that that the sculpture was purely made of plastic trusses and fabric. Jones notes there had been some unusual crimes around the city, with no suspects so far in any of the three cases:

1. Some plants were stolen from the local garden; the breakin occurred on the south side of the garden's greenhouse, and it's possible that toxic chemicals could be extracted from the plants that were stolen.
2. A stolen car found by the university, with some taillights broken
3. Two blocks from the museum, a residential house has its sliding doors broken after someone forcibly entered their home for what appears to be a quick steal.



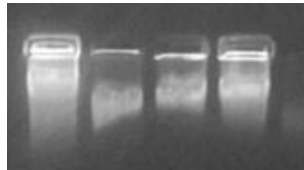
1. Calculate the index of refraction. (2pts)  $1.47 = n$
2. What is the speed of light through the glass shard's medium? (1pt)  $2.04 \cdot 10^8 \text{ m/s}$
3. Based on where this glass type might be used, where do you think we could place the criminal: (2 pts)
  - By the car burglary
  - The greenhouse
  - The residential house

## G. DNA

It turns out that this crime is connected to other similar crimes that have occurred recently. Jones visited the previous crime scene (as chosen in the Glass section) and found shards of the same type of glass at the scene, but with blood and DNA left on them.

1. What type of electrophoresis is typically used in DNA profiling (1 pt)?
  - a. Polyacrylamide gel electrophoresis
  - b. Capillary electrophoresis
  - c. Pulsed field electrophoresis
  - d. High resolution electrophoresis
2. Mozzie extracted the DNA samples from the scene and returned to the lab to perform PCR. However, during the run he decided to increase the duration of elongation, and increase the temperature during the annealing phase. How would these adjustments affect his final yield (2 pts)?
  - a. Yield increased, but precision decreased
  - b. Precision increased, but yield decreased
  - c. Precision and yield both increased
  - d. Precision and yield both decreased

3. Poor Mozzie; he also tried to run DNA electrophoresis, only to find smears in his DNA fragments' bands. Below is what he sees:



He has concluded that biochemistry techniques are not his forte. What could be the reason for the smears below the DNA bands? (1 pt)

- a. DNA began to degrade as it moved through the gel
  - b. Proteins were accidentally present in the sample
  - c. Contamination of RNA
  - d. The voltage was too high and tried forcing DNA through the gel.
4. He was also confused that he added 4 endonucleases to digest the DNA at specific spots to produce 5 fragments, but only saw 4. What could be the reason? (2 pts)

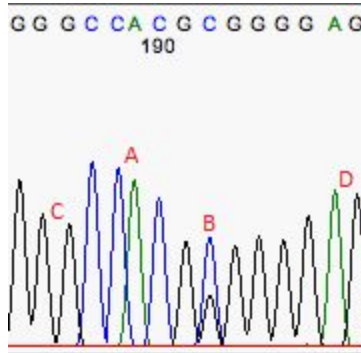
Two of the fragments were the same size, and showed up as one band on the gel.
  5. Give the complementary strand of RNA for the template strand of DNA listed below. (1 pt)

3' AAACCACGGACGCGG 5' DNA template

    - a. A. 3' TTTGGTGCCUCGCGG 5' mRNA
    - b. B. 3' UUUGGUGCCUGCGCC 5' mRNA
    - c. C. 5' TTTGGTGCCUCGCGG 3' mRNA

d. D. 5' UUUGGUGCCUGCGCC 3' mRNA

6. In the chromatogram below, indicate the location of the heterozygous SNP (1 pt):



- a. A  
b. B  
c. C  
d. D

7. Based on the electrophoresis performed by someone *other* than Mozzie, which suspect(s) is incriminated, if anyone? (2 pt)

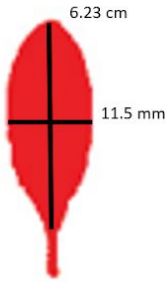
Crime Scene	Vincent Adler	Alex Hunter	Henry Dobbs	Dr. Mara Summers	James Bennett
			✓		
✓				✓	✓
✓	✓	✓	✓		
		✓			✓
			✓		
✓	✓	✓		✓	✓
✓	✓				
✓				✓	✓

Vincent Adler & Dr. Mara Summers



## H. Blood

1. Calculate the angle of impact found on the piece of glass. Include any formulas used. (answer = 1 pt, work = 1 pt).



$$\theta = \arcsin(w/l) = \arcsin(11.5/62.3) = 10.64 \text{ degrees}$$

2. Based on where the sample was found, and the angle you've just calculated, is it possible to determine whether the blood dripped first or the glass broke first? (1 pt)  
(obviously, no -- would need actual image of blood on glass to make better conclusions)
3. You decide to do some blood typing on this sample and find the following results (spotty is agglutinated, contiguous is not agglutinated):



Anti-A



Anti-B



Anti-Rh

What is the blood type of the sample? (1pt) **B-**

4. Who does this sample incriminate? (1 pt) **Mara Summers**
5. Which broad class of macromolecule on the surface of red blood cells is responsible for the behavior shown in question 3? (1pt) **Proteins/Peptides**
6. Occasionally it is possible for a developing fetus to have a mismatched blood type with the mother
  - a. What is the primary physiological consequence of this mismatch? (1pt) **Maternal blood antibodies attack fetal blood cells, destroying them (if fetal blood cells somehow cross the placenta; not necessary but of note)**
  - b. How would you prevent this consequence? No need to go into detail here; a hypothetical answer is acceptable (1pt) **Preventing the maternal immune system from being sensitized to fetal blood (actually done for Rh mismatch), destruction of maternal antibodies, any other reasonable answer**
7. Is it possible for blood with a different blood type than that identified in (3) to be mixed with another blood type to produce the above results? (2 pt) **True (take for instance, B- with O-)**

## **I. Analysis**

Describe who Peter and Neal should pursue and which suspects are likely not to be behind the crime. Be sure to mention any auxiliary details along with any evidence that would rule out a suspect or contribute to their potential involvement.

### **10 pts: Vincent Adler is a main suspect**

- **2 pts:** Powder C matched with Evidence A
  - **1 pt:** Sodium acetate used for heat packs, since he's sensitive to cold
  - **1 pt:** possibly used for preservation of stolen textiles
- **2 pts:** Plastic A incriminates Adler
  - **1 pt:** he's heavily relying on water bottles at the moment
- **2 pts:** Print E matches with Print A
  - **1 pt:** only suspect with central pocket whorl print
- **2 pts:** DNA from crime scene contained fragments that matched Adler's

### **10 pts: Dr. Mara Summers is a main suspect**

- **2 pts:** Powder E matched with Evidence B
  - **1 pt:** magnesium sulfate is characteristically used in medications to treat migraines.
- **2 pts:** Fiber A incriminates Dr. Summers
  - **1 pt:** Silk from her scarf
- **2 pts:** Fiber D incriminates Dr. Summers
  - **1 pt:** wool from her dress
- **2 pts:** Print G matches with Print C
  - **1 pt:** only suspect with plain arch prints
- **2 pts:** DNA from crime scene contained fragments that matched Summers'
- **2 pts:** Blood type of crime scene sample matched Summers'
  - **1 pt:** only suspect with B- blood type

### **5 pts: Henry Dobbs is NOT a suspect**

- **2 pts:** Not enough evidence to incriminate him
- **2 pts:** Plastic D incriminates Henry
  - **1 pt:** too general of a plastic to solely incriminate him, HDPE has many other uses as well

### **5 pts: Alex Hunter is NOT a suspect**

- **2 pts:** Not enough evidence to incriminate her
- **2 pts:** Dye from pen used on note matched Rf with dye in Alex's pen
  - **1 pt:** Pens are general and cannot be solely used to incriminate someone

### **5 pts: James Bennett is NOT a suspect**

- **2 pts:** Not enough evidence to incriminate him
- **2 pts:** Plastic C incriminates James
  - **1 pt:** PS is commonly used and so is styrofoam, cannot be solely used to incriminate someone

### **General Evidence**

- **2 pts:** A car was stolen and used as the method of transportation for the crime
  - **1 pt:** Glass shards matched that of tail-light glass
  - **1 pt:** Blood on glass, Summers broke the taillights

- **1 pt:** Bromobenzene (found in motor oil) was found at the scene, indicating a car of some sort was used

TOTAL ANALYSIS POINTS: 85 points