Science Crimebusters 2010
B Division
Event Leader Instructions

This event contains NO WATER QUALITY. Points were redistributed to other areas of the test, as per the NC clarification.

Overview: This is a lab based event. Safety protocol must be followed by the teams at all times, anyone found not following safety protocol will be disqualified immediately. Upon entering the room teams will undergo an inspection to make sure they have all necessary safety apparel and have not brought any disallowed materials. Teams will be given a test book and an evidence pack. They will then perform tests, either at their tables (powders, metals, and liquids) or at a central location (chromatography test, conductivity test), and write a summary of their findings.

Setup:

- You will need to set up on opposite sides of the room ahead of time the chromatography stations (2) as per the directions included with them.

- Keep a candle and matches at the front of the room for SUPERVISED flame tests if a student decides it is necessary. (They *should* be able to figure it out without the flame tests, but you never know)

- Each table (or each team if there are enough) will need a wash bottle of distilled water, a bottle of KI, and a cup labeled "solid waste disposal". If there is not a sink at the table, you may also want to provide a cup for liquid waste.

- Each team will need a testing supply bag. (popsicle sticks, 2oz cups, HCl, vinegar, highlighter) Do not pass out the test books or evidence kits until just before they begin.

Running the event:

- If teams are lining up outside the door early, I recommend allowing them to enter and doing the material check as they come into the room. Use the enclosed printed material card to verify that they have all the proper safety equipment, and don't have any disallowed materials.
- When it is time to start the event, take role and check wristbands. Separate teams that are from the same school.
- Explain that the chromatography stations are set up in 2 locations
- Pass out the tests and evidence kits, tell them they have **45 minutes** to complete the test, and begin.
- Keep an eye out for students putting their goggles on top of their head. Warn them once, then disqualify them. If they have fogging problems, designate a safe area they may come to and remove their goggles until the fog subsides.

Scoring: Points have been pre-assigned to each question in the answer key. Ties will be broken by the better part 3 (analysis) score.

Please stress to the students not to contaminate the samples by double dipping or mixing in the lids. Tell them real forensic scientists would never do that. (Plus, we want to be able to reuse the parts of the samples that are left in the future)

Science Crimebusters Case# 2498253

School: _____ Circle one: V JV1 JV2 JV3

Detectives: _____ , _____

The Case of the Missing Kandinsky

Wassily Kandinsky
"Composition VII"
Oil on Canvas
Germany, 1913

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Case Details: On the evening of January 26th, Mr. Tomasevich returned home from his daily music lesson to discover his most prized possession, a 1913 oil on canvas by the German artist Wassily Kandinsky, missing. "It was my pride and joy! It hung above the fireplace, such a priceless work of art!" Upon searching the scene, crime scene investigators gathered the following evidence:

Fingerprint 1 found on the fireplace mantle
Fingerprint 2 found on the wrought iron fireplace poker
A partial shoeprint was found on the hearth
Unknown liquid L1 recovered from the rug
Unknown metal M1 recovered from beneath the sofa
Unknown powder P1 recovered from the coffee table
Unknown powder P2 recovered from the window sill
A note was found, stating "Serves you right!"

They also noted the following:
A dry chemical fire extinguisher containing baking soda had been discharged near the fireplace, the wool rug on the floor was cleaned recently with ammonia. The paint on the canvas is made with a pigment supplemented with calcium carbonate. Point of entry appears to be the window overlooking the rose garden.

DO NOT TURN PAGE UNTIL INSTRUCTED TO DO SO!!
YOUR SAFETY GOGGLES MUST REMAIN ON FROM THIS POINT FORWARD.

DO NOT DOUBLE DIP IN THE EVIDENCE SAMPLES! USE A NEW POPSICLE STICK (or whatever scoops you brought) EVERY TIME TO AVOID CONTAMINATION. IF YOU NEED MORE, GET THEM FROM THE FRONT OF THE ROOM.

SUSPECTS:

Alfred, Age 62. *Relationship to victim:* Butler

Motive: After working for Mr. Tomasevich for 30 years, Alfred was angry when he lost his Christmas bonus so Mr. Tomasevich could put in a new pool.
Alibi: Claims he had been doing chores all day, cleaning the sand from the bottom of the salt water aquarium and replacing the zinc tablet that keeps the filter motor from rusting. He also cleaned the fingerprints off the touch screen computer with isopropyl alcohol. After lunch he took a calcium carbonate antacid for his heartburn.
Processing Details: The butler was examined, powder P3, metal M2 and liquid L2 were recovered from his shoes which were also confiscated, and he was fingerprinted. Ink pen A was taken from his pocket.

Camille, Age 41. *Relationship to victim*: Wife

Motive: The relationship with her husband was strained, saying that he spent more time with his beloved art and music than he did with her ever since she turned 40.
Alibi: Claims to have spent most of the day working on her photography in the darkroom, developing her gelatin based film in ascorbic acid while sipping on lemonade.
Processing Details: The wife was found with alka seltzer in her pocket, which she claims she takes for her frequent indigestion. Powder P4 and powder P5 were recovered from her shoes which were also confiscated. She was fingerprinted, and ink pen B was recovered from her purse.

Charles "Chuck", Male, Age 19. *Relationship to victim*: Nephew

Motive: Is angry at his Uncle for cutting him out of the will after refusing to take a painting class, opting for an auto class instead at the local community college.
Alibi: Claims he was working on his '66 Shelby GT 350 in the garage, using tin solder to repair some wiring and a vinegar based cleaner to clean spots out of the upholstery.
Processing Details: The Nephew was found with an isopropyl alcohol cleaning pad in his pocket, which he said he used to keep his iPhone clean. He has a broken wrist, set with a gypsum cast. Powder P6 and metal M3 were recovered from his shoe, which was also confiscated. He was fingerprinted, and ink pen C was found tucked into his cast.

Mario, Male, Age 56. *Relationship to victim*: Cook

Motive: Is angry at Mr. Tomasevich for having a recent dinner party catered by a local restaurant instead of using the cook's usual menu.
Alibi: Claims to have been working in the kitchen all day, perfecting a recipe for a yeast bread, with a sugar frosting on top thickened with cornstarch. Several loaves were found in the kitchen, wrapped in aluminum foil and dusted with flour to keep them from sticking. He also descaled the cappuccino maker with vinegar.
Processing Details: The Cook was found with powder P7 on his hat, powder P8 and liquid L3 on his shoe, which was also confiscated. He was fingerprinted, and ink pen D was recovered from his apron.

PART 1 – Qualitative Analysis (50%) (____ / 40)

Unknown Substances- Fill in the chart, use the examples as a guide

Substance	From	What is it?	How did you test/observe it and what was the result?
Example	*Pool*	*Limestone*	*Water soluble, Hydrochloric acid fizzed, powder structure, white*
Example	*Pool*	*Chlorine*	*very distinct smell, clear*
P1	Scene		
P2	Scene		
P3	Butler		
P4	Wife		
P5	Wife		
P6	Nephew		
P7	Cook		
P8	Cook		
M1	Scene		
M2	Butler		
M3	Nephew		
L1	Scene		
L2	Butler		
L3	Cook		

Part 2 – Paper Chromatography (10%) (____ / 8)

Filter paper is available at the Chromatography station. Identify each ink as A, B, C, or D on the strips in pencil. When you are done, attach the strip(s) that match the ink found at the scene. You may throw the others away.

Attach your chromatography sample(s) here:

Questions:

1. Which sample matches the ink recovered at the scene?

2. Which suspect does this implicate?

3. Is the sample water soluble? _____ How can you tell?

4. How many separate components can you see in the ink?

PART 3 – Physical Evidence (10%) (____ / 8)

Compare the fingerprints found at the scene to the fingerprints taken from each suspect:

Which suspect matches fingerprint 1? _____

What characteristics did you find in the fingerprint to make you believe it was a match? Use the highlighter to mark the identifying parts of the fingerprint that you discuss.

Fingerprint 1

Which suspect matches fingerprint 2? _____

What characteristics did you find in the fingerprint to make you believe it was a match? Use the highlighter to mark the identifying parts of the fingerprint that you discuss.

Fingerprint 2

Questions:

Which suspect matches fingerprint 1? _____

What characteristics did you find in the fingerprint to make you believe it was a match? _____

_____

_____

Which suspect matches fingerprint 2? _____

Name: Alfred the Butler

ID# 31789

Ref. Case # _____

FINGERPRINT CARD

For Police Department Use Only

1. RIGHT THUMB	2. RIGHT INDEX	3. RIGHT MIDDLE	4. RIGHT RING	5. RIGHT LITTLE
				
6. LEFT THUMB	**7. LEFT INDEX**	**8. LEFT MIDDLE**	**9. LEFT RING**	**10. LEFT LITTLE**
				

Name: **Camille, the Wife**

ID# 13497

Ref. Case # _____

FINGERPRINT CARD

For Police Department Use Only

1. RIGHT THUMB	2. RIGHT INDEX	3. RIGHT MIDDLE	4. RIGHT RING	5. RIGHT LITTLE
				
6. LEFT THUMB	**7. LEFT INDEX**	**8. LEFT MIDDLE**	**9. LEFT RING**	**10. LEFT LITTLE**
				

Name: Chuck, the Nephew

ID# 61457

Ref. Case # _____

FINGERPRINT CARD

For Police Department Use Only

1. RIGHT THUMB	2. RIGHT INDEX	3. RIGHT MIDDLE	4. RIGHT RING	5. RIGHT LITTLE
				
6. LEFT THUMB	**7. LEFT INDEX**	**8. LEFT MIDDLE**	**9. LEFT RING**	**10. LEFT LITTLE**
				

Name: Mario the Cook

ID# 87439

Ref. Case # _____

FINGERPRINT CARD

For Police Department Use Only

1. RIGHT THUMB	2. RIGHT INDEX	3. RIGHT MIDDLE	4. RIGHT RING	5. RIGHT LITTLE
				
6. LEFT THUMB	**7. LEFT INDEX**	**8. LEFT MIDDLE**	**9. LEFT RING**	**10. LEFT LITTLE**
				

SHOEPRINTS:
Compare the shoeprint found at the scene of the crime to the shoe taken from each suspect:

Crime scene:

Compare to:

Alfred, the Butler

Camille, the Wife

Chuck, the Nephew

Mario, the Cook

Questions:

Which suspect matches the print found at the scene? _____

PART 4 – Analysis (30%) (____ / 24)

1. Based on the evidence you analyzed, who stole the painting? _____

2. What evidence **found at the scene** could have been left by this suspect, and why? _____

3. What evidence **found on the suspect** could have come from the scene, and why? _____

4. How would you explain any evidence found **on other suspects**? _____

When you are done, please clean up!! Reseal your evidence containers (**do not** put used evidence back in them!) and dispose of all waste. Solids should go in the trash can, liquids can go down the sink. **Safety goggles must remain on until you leave the room.**

ANSWER KEY

PART 1 – Qualitative Analysis (50%) (____ / 40)

Unknown Substances- Fill in the chart, use the examples as a guide

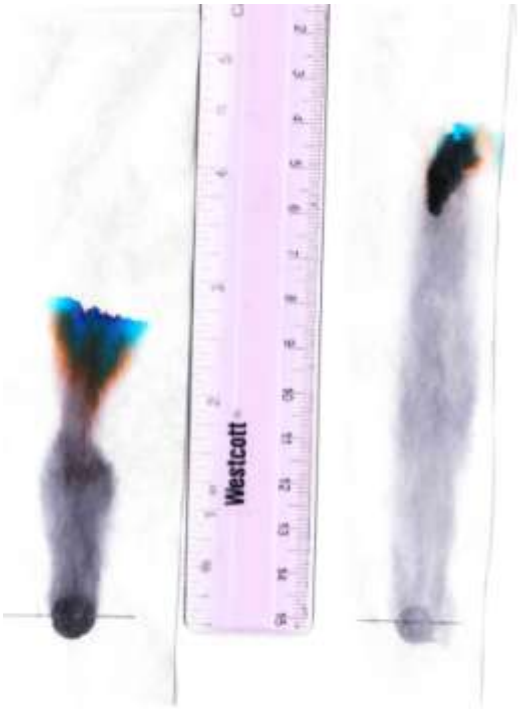
Substance	Found on	What is it? (2 points each, name or formula acceptable)	How did you test/observe it and what was the result? (1 point for each test listed, up to 3 points per substance)
Example	*Pool*	*Calcium carbonate*	*Water soluble, Hydrochloric acid fizzed, powder structure*
Example	*Pool*	*Chlorine*	*very distinct smell, appeared clear*
P1	Scene	**Flour**	**Examples: water soluble, HCl no fizz, powder structure, iodine turns black, highly flammable**
P2	Scene	**Sugar**	**Examples: water soluble, HCl no fizz, crystalline, iodine turns black, melts/blackens in flame**
P3	Butler	**Salt (NaCl)**	**Examples: water soluble, insoluble in HCl, HCl no fizz, crystalline, pH=acidic, non-flammable**
P4	Wife	**Ascorbic acid (Vitamin C)**	**Examples: water soluble, HCl no fizz, crystalline, iodine turns blue/black, pH=acidic, melts in flame**
P5	Wife	**Alka seltzer**	**Examples: water soluble, water =fizz, powder, no iodine reaction, vinegar fizz**
P6	Nephew	**Gypsum ($CaSO_4$) (calcium sulfate)**	**Examples: water insoluble, HCl no reaction, powder structure, non-flammable, odorless, white, pH= acidic**
P7	Cook	**Calcium Carbonate ($CaCO_3$)**	**Examples: water insoluble, HCl fizz reaction, powder structure, non-flammable, pH=acidic**
P8	Cook	**Baking Soda ($CHNaO_3$) (Sodium Bicarbonate)**	**Examples: water insoluble, vinegar fizz, HCl violent fizz, fine crystal structure (looks like powder), iodine no reaction, odorless, pH= acidic**
M1	Scene	**Aluminum**	**Examples: non-magnetic, conducts electricity, shiny**
M2	Butler	**Zinc**	**Examples: White ash when burned, repels magnet (diamagnetic), conducts electricity, dull**
M3	Nephew	**Tin**	**Examples: Non-magnetic, does not conduct electricity, does not react to flame, shiny**
L1	Scene	**Vinegar**	**Examples: distinct smell, pH 2-3, clear**
L2	Butler	**Isopropyl alcohol**	**Examples: distinct smell, pH 5-6, clear, rapid evaporation**
L3	Cook	**Ammonia (NH_4)**	**Examples: distinct smell, pH 12, clear**

Part 2 – Paper Chromatography (10%) (____ / 8)

You have been given filter paper. Identify each ink as A, B, C, or D on the strip in pencil. When you are done, attach the strip(s) that match the ink found at the scene. You may throw the others away.

Attach your chromatography sample(s) here: **(2 points)**

If they have attached a sample that approximately matches the one pictured here, give 1 point. If they have attached the same sample both in DI and in ISO, give 1 more point.



Chromatography found on note at crime scence

Questions:

1. Which sample matches the ink recovered at the scene?

   D (1 points)

2. Which suspect does this implicate?

   Mario, the cook (1 points)

3. Is the sample water soluble? _____ How can you tell?

   Yes. (1 point). The components separated when placed in water. (1 points)

4. How many separate components can you see in the ink?

   If they list:
   1= 0 points
   2= 1 points
   3= 2 points
   4= 1 points
   5 or more = 0 points

PART 3 – Physical Evidence (10%) (_____/7)

Compare the fingerprints in your evidence kit to the fingerprints taken from each suspect:

Questions:

Which suspect matches fingerprint 1? **Mario, the cook (1/2 point)**
What characteristics did you find in the fingerprint to make you believe it was a match**?**

Identification of loop (1 point)

Labeling loop as left slant (1/2 point)

Identification of delta (1/2 point)

Identification of any minutiae- can be any spot where a ridge line comes together or ends, a few are shown (1 point)

Which suspect matches fingerprint 2? **Camille, the wife (1/2 point)**

What characteristics did you find in the fingerprint to make you believe it was a match**?**

Identification of whorl (1 point)

Identification of deltas (1/2 point each)

Identification of any minutiae- can be any spot where a ridge line comes together or ends, a few are shown (1 point)

SHOEPRINTS: **(_____/1)**

Compare the shoeprint found at the scene of the crime to the shoe taken from each suspect:

Questions:

Which suspect matches the print found at the scene? **Mario the cook (1 point)**

PART 4 – Analysis (30%) (_____/24)

1. Based on the evidence you analyzed, who stole the painting? **Mario, the cook (5 points)**

2. What evidence **found at the scene** could have been left by this suspect, and why? **(2 points each)**
   - **Fingerprint 1 implicates the suspect, there is no other reason for it to be there**
   - **Shoeprint implicates the suspect, there is no other reason for it to be there**
   - **Powder 1 (Flour) could have been transferred after baking bread**
   - **Powder 2 (Sugar) could have been transferred after making frosting with it**
   - **Metal 1 (Aluminum) could have been transferred after wrapping bread loaves in it**
   - **Liquid 1 (Vinegar) could have been transferred after using it to clean the cappuccino machine**
   - **Ink on the note matched the pen found on him**

3. What evidence **found on the suspect** could have come from the scene, and why? **(1 point each)**
   - **Powder 7 (calcium carbonate) could have transferred to the suspect from handling the painting, which had calcium carbonate in the paint**
   - **Powder 8 (Sodium bicarbonate) could have transferred to him from the fire extinguisher contents**
   - **Liquid 3 (Ammonia) could have transferred to his shoes when he walked across the ammonia treated rug at the scene**

4. How would you explain any evidence that implicated **other suspects**? **(1 point each)**
   - **The butler could have left fingerprint 2 at the scene while cleaning**
   - **All other evidence is accounted for by the other suspect's actions that day and do not place them at the scene. (students may also have listed items individually, still only 1 point)**