



Paint Analysis Test No. 20-5451 Summary Report

Each sample set consisted of one item containing a known paint sample and two items containing questioned paint chips. Participants were requested to compare the items and report their findings. Data were returned from 69 participants and are compiled in the following tables:

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This report contains the data received from the participants in this test. Since these participants are located in many countries around the world, and it is their option how the samples are to be used (e.g., training exercise, known or blind proficiency testing, research and development of new techniques, etc.), the results compiled in the Summary Report are not intended to be an overview of the quality of work performed in the profession and cannot be interpreted as such. The Summary Comments are included for the benefit of participants to assist with maintaining or enhancing the quality of their results. These comments are not intended to reflect the general state of the art within the profession.

Participant results are reported using a randomly assigned "WebCode". This code maintains participant's anonymity, provides linking of the various report sections, and will change with every report.

Manufacturer's Information

Each sample set consisted of three items with layered paint and primer: one known sample (Item 1) and two questioned samples (Items 2 and 3) were cut from painted poplar wood plank substrates. Items 2 and 3 came from a plank with the same primer and topcoat. Item 1 was prepared with a different primer and topcoat. Participants were instructed to examine the questioned samples and determine if they could have originated from the known paint sample.

SAMPLE PREPARATION-

All planks used for this test were selected based on their limited defects and were wiped down to remove dust before painting. For the following preparations, each coat was allowed to dry overnight before applying the next coat.

ITEM 1 (KNOWN): The known Item 1 samples were prepared by applying two coats of primer (KILZ Original primer and sealer, white) to several poplar wood planks (each 4' x 3" x 1/2"). Then two layers of topcoat (Glidden Premium Paint and Primer, Base 3, Espresso Bean) were applied. The planks were cut into one inch wide strips using a miter saw. One 1" piece was packaged into a glassine bag and then into a pre-labeled Item 1 envelope.

ITEMS 2 and 3 (ELIMINATION): Items 2 and 3 were prepared by applying two coats of primer (Valspar All Weather Exterior Primer and Sealer, White) to several poplar wood planks. Then two layers of topcoat (BEHR Marquee, Deep Base, NO. 1453, Espresso Bean) were applied. The planks were scored into squares that were approximately 1/4" x 1/4" and were removed using a utility knife. Two 1/4" x 1/4" pieces were packaged into a glassine bag and then a pre-labeled Item 2 and Item 3 coin envelope. Items 2 and 3 were taken in close spatial proximity to one another, kept together as a group, and packaged into the sample sets as described below.

SAMPLE SET ASSEMBLY: For each sample set, Items 2 and 3 from the same batch were placed in a pre-labeled envelope along with an Item 1 sample. The sample pack was sealed with invisible tape. This process was repeated until all of the sample sets were prepared. Once verification was completed, all sample packs were further sealed with a piece of evidence tape and initialed "CTS".

VERIFICATION-

Laboratories that conducted predistribution examination of the completed sample sets reported the expected results. The methods employed by the predistribution laboratories included stereomicroscope, polarized light, and FTIR.

Summary Comments

This test was designed to allow participants to assess their proficiency in the examination, comparison, and interpretation of multi-layered architectural paint samples. Each sample set consisted of three items with layered paint and primer; one known sample (Item 1) and two questioned samples (Items 2 and 3) were cut from painted poplar wood plank substrates. Items 2 and 3 originated from a poplar wood plank substrate with the same primer and topcoat. Item 1 originated from a second poplar wood plank substrate that was prepared with a different primer and topcoat than what was used for Items 2 and 3. (Refer to Manufacturer's Information for preparation details.)

Of the 69 participants that reported examination results in Table 1, 69 (100%) reported that the Item 2 and Item 3 questioned paint chips could not have originated from the same source as the Item 1 known paint sample due to visual and chemical difference in the paint layers.

The most commonly reported methods of analysis were Stereomicroscope (96%), FTIR (86%), and SEM/EDX (28%).

Examination Results

Could the questioned paint chips recovered from the suspect's trunk (Item 2) and/or floorboard (Item 3) have originated from the damaged area of the victim's basement door as represented by Item 1?

TABLE 1

<u>WebCode</u>	<u>Item 1</u>		<u>WebCode</u>	<u>Item 1</u>		<u>WebCode</u>	<u>Item 1</u>	
	<u>Item 2</u>	<u>Item 3</u>		<u>Item 2</u>	<u>Item 3</u>		<u>Item 2</u>	<u>Item 3</u>
2MB9FV	No	No	EN3PYJ	No	No	RA3BCW	No	No
2MQRZT	No	No	F67PC7	No	No	RCAHQH	No	No
3N2TLR	No	No	F94ZHD	No	No	RD6CCT	No	No
3QGYEN	No	No	FCPZHU	No	No	TUGAZX	No	No
4AMULL	No	No	GNQZLH	No	No	TW99EW	No	No
4WGX3J	No	No	GXML64	No	No	V6THE2	No	No
6FZB77	No	No	H2Y3M7	No	No	V8JKKP	No	No
6HACBD	No	No	JFVGKE	No	No	VZH6W3	No	No
6KW6VV	No	No	JXQA7D	No	No	WEWQ3E	No	No
6L9M7D	No	No	KHW2LJ	No	No	WTU6UV	No	No
6Z6VXZ	No	No	KUPL3B	No	No	X2NAMW	No	No
77G8LD	No	No	LRLYJ6	No	No	XHDQGK	No	No
7DBDFE	No	No	M2XYXB	No	No	XJRTRZ	No	No
7UMQWC	No	No	MFHGRZ	No	No	XKJ39U	No	No
8MWUEF	No	No	MKVZAH	No	No	XQKE6R	No	No
9382XH	No	No	MNCML2	No	No	Y4PWFR	No	No
9DA3WG	No	No	N8LYQW	No	No	YFQ4NX	No	No
AQT4RE	No	No	PEG4KX	No	No	YNKC9N	No	No
B2NWDA	No	No	PUDHH7	No	No	ZDGGQJ	No	No
BB93GF	No	No	Q786DU	No	No	ZLHMXG	No	No
BKU4WP	No	No	QBGCP7	No	No	ZQ2WUJ	No	No
BZDURC	No	No	QEET2Z	No	No			
C6EKFA	No	No	QTJXKY	No	No			
E9PE7Q	No	No	QZUDX2	No	No			

Examination Response Summary		Participants: 69	
		Item 1	
		Item 2	Item 3
Responses	Yes	0 (0%)	0 (0%)
	No	69 (100%)	69 (100%)
	Inc	0 (0%)	0 (0%)

Examination Methods

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/Chemical	Microspectrophotometry	XRS / XRF	SEM / EDX	Other
2MB9FV	✓				✓					
2MQRZT	✓				✓			✓		Raman spectroscopy
3N2TLR	✓				✓		✓			
3QGYEN	✓				✓					
4AMULL	✓	✓			✓					
4WGX3J	✓				✓					
6FZB77	✓	✓			✓					
6HACBD	✓				✓				✓	
6KW6VW	✓				✓		✓			
6L9M7D	✓		✓	✓	✓			✓		
6Z6VXZ	✓				✓					
77G8LD	✓	✓	✓		✓					Pyrolysis GC-MS
7DBDFE	✓	✓			✓				✓	
7UMQWC	✓			✓	✓	✓		✓		
8MWUEF	✓				✓				✓	
9382XH	✓				✓					
9DA3WG	✓				✓					
AQT4RE	✓		✓		✓					
B2NWDA	✓	✓								
BB93GF		✓			✓				✓	
BKU4WP	✓				✓				✓	Pyrolysis GC/MS
BZDURC	✓				✓				✓	
C6EKFA	✓				✓		✓			
E9PE7Q	✓								✓	
EN3PYJ	✓				✓					
F67PC7	✓				✓					
F94ZHD	✓		✓		✓					
FCPZHU	✓		✓							

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/Chemical	Microspectrophotometry	XRS / XRF	SEM / EDX	Other
GNQZLH	✓				✓					
GXML64	✓					✓				
H2Y3M7	✓	✓								
JFVGKE	✓				✓					
JXQA7D	✓				✓			✓		
KHW2LJ	✓				✓					
KUPL3B	✓				✓					
LRLYJ6	✓	✓			✓		✓			
M2XYXB	✓				✓			✓		
MFHGRZ	✓	✓	✓		✓					
MKVZAH	✓				✓					Raman
MNCML2	✓				✓					
N8LYQW	✓		✓		✓					
PEG4KX	✓	✓			✓					
PUDHH7	✓				✓	✓				
Q786DU			✓		✓		✓			
QBGCP7	✓	✓								
QEET2Z	✓	✓			✓					
QTJXKY	✓				✓					
QZUDX2	✓	✓			✓					RAMAN
RA3BCW	✓	✓			✓					
RCAHQH	✓				✓					
RD6CCT	✓				✓					
TUGAZX	✓		✓		✓			✓		
TW99EW	✓				✓					
V6THE2	✓				✓					
V8JKKP	✓	✓			✓			✓		
VZH6W3	✓				✓			✓		
WEWQ3E	✓					✓		✓		

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	Microspectrophotometry	XRS / XRF	SEM / EDX	Other
WTU6UV	✓	✓						✓		Reflected light microscopy, comparison microscopy
X2NAMW	✓	✓			✓			✓		Raman spectroscopy
XHDQGK	✓				✓					
XJRTRZ	✓				✓					
XKJ39U	✓				✓					
XQKE6R	✓				✓					
Y4PWFR				✓	✓					
YFQ4NX	✓	✓			✓					
YNKC9N	✓							✓		
ZDGGQJ	✓	✓	✓						✓	
ZLHMXG	✓				✓					
ZQ2WUJ	✓	✓		✓	✓	✓		✓	✓	

Response Summary										Total Participants: 69
	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	Microspectrophotometry	XRF/XRS	SEM/EDX	
Participants	66	16	11	6	59	4	1	8	19	
Percent	96%	23%	16%	9%	86%	12%	6%	1%	28%	

Conclusions

TABLE 3

WebCode	Conclusions
2MB9FV	Item 2, Questioned paint chips recovered from the prybar in the suspect's trunk, could not have originated from Item 1, Known paint sample representative of the damaged area of the basement door. Item 3, Questioned paint chips recovered from the suspect's floorboard near the pedals, could not have originated from Item 1, Known paint sample representative of the damaged area of the basement door.
2MQRZT	The questioned paints marked "Item 2" and "Item 3" did not originate from the same source as the control paint marked "Item 1".
3N2TLR	The paint Chips of all 3 Items (samples) consist of 2 layers: a black (top) and a White layer. The paint chip from the victims damaged Basement door (Item1) and both samples from the suspect (prybar=Item2, floorboard near the pedals=Item3) Show different IR spectra in both layers and they have different concentrations of inorganic Elements. It is highly improbable that the questioned paint Chips from the suspect (Item 2 and 3) have originated from the damaged area of the victims Basement door.
3QGYEN	The dark brown paint in Items 2 and 3 was different from the dark brown paint in Item 1 (Elimination). This means that the paint chips recovered from the prybar in the suspect's trunk and the paint chips recovered from the suspect's floorboard near the pedals did not originate from the damaged area of the basement door.
4AMULL	The following results only apply to the items tested. The paint from Exhibit 2 and Exhibit 3 was analyzed and compared to the paint in Exhibit 1. The Exhibit 1 paint consisted of at least two layers (brown paint over white) on a wooden block substrate. Exhibits 2 and 3 also consisted of at least two layers of paint (brown paint over white) on a wooden substrate. The paint from Exhibit 2 and 3 were consistent with each other in physical characteristics, including layer construction and color, and in chemical composition. The Exhibit 1 paint was different from the Exhibit 2 and Exhibit 3 paint in chemical composition in both layers and exhibited slight dissimilarities in physical characteristics, including color. Therefore, the Exhibit 2 and Exhibit 3 paints were not consistent with having originated from the same source as the paint of Exhibit 1.
4WGX3J	The paint chips in Items 2 and 3, though visibly similar in color and layer structure (black top layer, white bottom layer), are different in chemical composition (FTIR) from the known paint in Item 1. Therefore, the paints in Items 2 and 3 did not come from the same source as the Item 1 known paint (Exclusion).
6FZB77	The questioned paint chips from the prybar (Item 2) are dissimilar in microscopic characteristics and paint type to known paint from the basement door (Item 1). It is my opinion that these questioned paint chips did not originate from the sampled area of the basement door. The questioned paint chips from the suspect's floorboard (Item 3) are dissimilar in microscopic characteristics and paint type to known paint from the basement door (Item 1). It is my opinion that these questioned paint chips did not originate from the sampled area of the basement door.
6HACBD	I formed the opinion based on the techniques used, that the paint recovered from the pry bar in the suspect's trunk (item 2) had a chemical and elemental composition that was different to the known paint representative of the damaged area of the basement door (item 1) and could not have come from it. I also formed the opinion based on the techniques used, that the paint recovered from the suspect's floorboards near the pedals (item 3) had a chemical and elemental composition that was different to the known paint representative of the damaged area of the basement door (item 1) and could not have come from it.

TABLE 3

WebCode	Conclusions
6KW6W	Three paint samples (Item 1, Item 2 and 3) are similar in color and morphology. Item 1 sample was different with those of Item 2 and Item 3 sample in component from Infrared spectrum and Pyrolysis chromatogram.
6L9M7D	Examination of the known paint sample representative of the damaged area of the basement door (Item 1). Item 1 comprised a paint sample with the layer sequence: black topcoat/white undercoat. The black topcoat was identified as a polyvinyl acetate type paint with calcite. Bulk elemental composition of the topcoat principally comprised calcium, silicon, magnesium, and titanium. The white undercoat layer was identified as a styrene-modified polymer with calcite and talc. Bulk elemental composition of the undercoat principally comprised calcium, titanium, silicon, aluminium and magnesium. Examination of the questioned paint chips recovered from the prybar in the suspect's trunk (Item 2). Item 2 comprised a paint sample with the layer sequence: black topcoat/white undercoat. The black topcoat was identified as an acrylic type paint with kaolinite. The composition of the black topcoat did not correspond to the composition of the black topcoat from item 1. The white undercoat was identified as a styrene-modified acrylic type paint with talc and kaolinite. The composition of the white undercoat did not correspond with the white undercoat from item 1. Therefore, the results do not support the proposition that the paint recovered from the suspect's trunk (Item 2) originated from the damaged area of the basement door (Item 1). Examination of the questioned paint chips recovered from the suspect's floorboard near the pedals (Item 3). Item 3 comprised a paint sample with the layer sequence: black topcoat/white undercoat. The black topcoat was identified as an acrylic type paint with kaolinite. The composition of the black topcoat did not correspond to the composition of the black topcoat from item 1. The white undercoat was identified as a styrene-modified acrylic type paint with talc and kaolinite. The composition of the white undercoat did not correspond with the white undercoat from item 1. Therefore, the results do not support the proposition that the paint recovered from the suspect's floorboard near the pedals (Item 3) originated from the damaged area of the basement door (Item 1).
6Z6VXZ	Items 1, 2 and 3 each consisted of a black paint layer over a white paint layer over wood. The chemical composition of the Item #2 and Item #3 black and white paint layers were different than the chemical composition of the Item #1 black and white paint layers and did not originate from this source (elimination). Terminology Key for Associative Evidence: The following descriptions are meant to provide context to the levels of opinions reached in this report. Every level of conclusion may not be applicable in every case nor for every material type. Level I Association: A physical match; items physically fit back to one another, indicating that the items were once from the same source. Level II Association: An association in which items are consistent in observed and measured physical properties and/or chemical composition and share atypical characteristic(s) that would not be expected to be readily available in the population of this evidence type. Level III Association: An association in which items are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. Because other items have been manufactured that would also be indistinguishable from the submitted evidence, an individual source cannot be determined. Level IV Association: An association in which items are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. As compared to a Level III association, items categorized within a Level IV share characteristics that are more common amongst these kinds of manufactured products. Alternatively, an association between items would be categorized as a Level IV if a limited analysis was performed due to characteristics or size of the specimen(s). Level V Association: An association in which items are consistent in some, but not all, physical properties and/or chemical composition. Some minor variation(s) exists between

TABLE 3

WebCode	Conclusions
	the known and questioned items and could be due to factors such as sample heterogeneity, contamination of the sample(s), or having a sample of insufficient size to adequately assess homogeneity of the entity from which it was derived. Inconclusive: No conclusion could be reached regarding an association/elimination between the items. Elimination: The items were dissimilar in physical properties and/or chemical composition, indicating that they did not originate from the same source.
77G8LD	The questioned paint sample (Item 2) recovered from the prybar in the suspect's trunk and the questioned paint sample (Item 3) recovered from the suspect's floorboard near the pedals were not similar and could not have come from the paint sample (Item 1) recovered from the damaged area of the victim's basement door.
7DBDFE	The paint from the known sample from the damaged area of the victim's basement door is comprised of two layers. Item 2 and item 3 could not have originated from the damaged area of the victim's basement door. The paints from item 2 and item 3 are each comprised of two layers, with both layers microscopically, optically, and chemically different from the corresponding layers of the damaged area of the victim's basement door.
7UMQWC	CONCLUSIONS: The questioned paint identified as recovered from the prybar and the floorboard of the vehicle (Items 2 and 3) did not originate from the area of the basement door represented by Item 1. RESULTS: Questioned paint chips identified as recovered from the prybar and the floorboard of the vehicle (Items 2 and 3) were examined for the purpose of determining whether or not they are like known paint from the basement door (Item 1). The paint standard from the basement door has the following layer structure: 1. Black polyvinyl acetate latex enamel topcoat. 2. White enamel primer. This paint exhibits characteristics typical of an architectural finish and was used for comparison with questioned paint identified as recovered from the prybar and vehicle (Items 2 and 3). The questioned paint recovered from the prybar and vehicle (Items 2 and 3) has the following layer structure: 1. Black acrylic latex enamel topcoat. 2. White acrylic latex enamel primer. Examination and comparison of the questioned paint (Items 2 and 3) with Item 1 revealed they are dissimilar with respect to general binder types and pigment characteristics. It is therefore concluded that the questioned paint (Items 2 and 3) did not originate from the area of the basement door represented by Item 1. METHODS OF ANALYSIS: Examinations were performed visually, by stereo microscopy, comparison microscopy, microchemical tests, Fourier transform infrared microspectroscopy, pyrolysis gas chromatography/mass spectrometry, and scanning electron microscopy/energy dispersive x-ray analysis.
8MWUEF	The physical and chemical properties of items #2 and #3 were compared to item #1. It is concluded that the paint recovered from the prybar (item #2) and the paint recovered from the floorboard (item #3) could not have originated from the damaged area of the basement door (item #1).
9382XH	1. Exhibit 1 (known paint standard from the damaged area of the basement door) consists of a dual paint layer system, including a dark brown topcoat over a white primer on an apparent wood substrate. 2. Exhibit 2 (questioned paint from the pry bar in the suspect's trunk) consists of two dual-layered paint chips. The paint layer system consists of a dark brown topcoat over a white primer on apparent wood substrate. 3. Exhibit 3 (questioned paint from the suspect's floorboard near the pedals) consists of two dual-layered paint chips. The paint layer system consists of a dark brown topcoat over a white primer on apparent wood substrate. 4. Comparative examinations of the paint in Exhibits 2 and 3 with Exhibit 1 disclosed them to be inconsistent in their physical characteristics and chemical compositions. As a result of these findings, the paint from the pry bar in the suspect's trunk and the paint from the suspect's

TABLE 3

WebCode	Conclusions
	floorboard near the pedals could not have originated from the damaged basement door.
9DA3WG	The two-layer paint sampled from Item 1 (Known sample from basement door) and Item 2 (Questioned chips from prybar in suspect's truck) were found to be dissimilar in chemical composition (FTIR). The damaged area on the basement door is not the source of the paint chips removed from the prybar. The two-layer paint sampled from Item 1 (Known sample from basement door) and Item 3 (Questioned chips from suspect's floorboard near pedals) were found to be dissimilar in chemical composition (FTIR). The damaged area on the basement door is not the source of the paint chips recovered from the suspect's floorboard.
AQT4RE	The following methodologies were used in the examination of this case: visual examination, microscopy, fluorescence, and FTIR. Examination of Item #1 (Known paint sample representative of the damaged area of the basement door) revealed the presence a piece of wood painted black on one side. The black paint has the following layer structure: black and white. Examination of Item #2 (Questioned paint chips recovered from the prybar in the suspect's trunk) and Item #3 (Questioned paint chips recovered from the suspect's floorboard near the pedals) each revealed the presence of two small wooden fragments painted black on one side. The black paint has the following layer structure: black and white. The black paint from Items #2 and #3 was not consistent with the black paint from Item #1. Therefore, the black paint from Items #2 and #3 did not originate from the same source as the black paint from Item #1.
B2NWDA	The basement door (as represented by item 1) was eliminated as a possible source of the paint chips recovered from the suspect's prybar and vehicle (items 2 and 3, respectively).
BB93GF	Given the samples provided, Items 2 and 3 are visually, texturally, and compositionally similar to each other but are distinctly different than Item 1. Therefore, Items 2 and 3 could not have originated from Item 1.
BKU4WP	[No Conclusions Reported.]
BZDURC	The known paint sample and both questioned paint chips consisted of 2-layered paint structures, with a black upper layer and a white lower layer on a wooden substrate. Both questioned paint chips were found to agree in colour but differed in chemical compositions with the known paint sample in their respective paint layers. Furthermore, the white layer of the known sample differed texturally with the respective layer of both questioned samples when examined under the microscope. These findings suggest that the questioned paint chips recovered from the prybar in the suspect's trunk and from the suspect's floorboard near the pedals did not share a common source with the known paint sample from the damaged area of the basement door.
C6EKFA	It was determined utilizing Stereomicroscopic, Fourier Transform Infrared Spectroscopy and X-Ray Fluorescence Spectroscopy that the brown layer and white layer from item 2 and questioned paint samples from item 3 exhibit dissimilar characteristics than the brown layer and white layer paint sample from item 1. Therefore, the known paint can be eliminated as being the source of the questioned paint samples.
E9PE7Q	The chemical element compositions of Items 2 and 3 are inconsistent with the chemical element composition of Item 1. Therefore, Item 1 does not appear to be the source of Item 2 or 3.
EN3PYJ	Exemplar item 1 is excluded as a possible source of unknown items 2 and 3, based on class characteristics. The class characteristics include chemical and manufacturing properties.
F67PC7	Paint samples collected from the damaged area of the basement door (Item 1), the prybar in the suspect's trunk (Item 2) and the suspect's floorboard near the pedals (Item 3) all comprised

TABLE 3

WebCode	Conclusions
	two layers of paint over what appeared to be a wood substrate: Layer 1 - Black (or very dark brown). Layer 2 - White. No significant differences in chemical composition were observed in the black paint (Layer 1) and the white paint (Layer 2) respectively between the suspect's paint chips (Items 2 and 3). Significant differences in chemical composition were observed in the black paint (Layer 1) and the white paint (Layer 2) respectively between the basement door sample (Item 1) and the suspect's paint chips (Items 2 and 3). It is my opinion that the paint chips from the prybar and floorboard (Items 2 and 3) do not share a common origin with paint from the basement door (Item 1).
F94ZHD	Item 1, Item 2 and Item 3 have been analysed. The used analytical methods show that Item 1 is different to Item 2 and Item 3. So, we conclude that neither the paint chips recovered from the suspect's prybar in the trunk nor the one recovered from the suspect's floorboard near the pedals, comes from the damaged area of the victim's basement door.
FCPZHU	Items 1, 2, and 3 were examined visually and using stereomicroscopy. Samples from Items 1, 2, and 3 were examined using fluorescence microscopy. Based on the particles examined, the Item 1 two-layered black paint could not be associated with the Item 2 or 3 two-layered black paint due to differences in fluorescence.
GNQZLH	[No Conclusions Reported.]
GXML64	Exhibit 1_01 (control) was a 2-layer paint - dark grey on white. Exhibits 1_02 and 1_03 were each 2-layer paints - dark brown on white. The dark brown layer of each was significantly thicker than the dark grey layer of 1_01. The visible colour difference between 1_01 and 1_02/1_03 was confirmed by analysis. Exhibit 1_01 is eliminated as a source for either of 1_02 or 1_03.
H2Y3M7	Paint from Items 2 and 3 could not have originated from the basement door as represented by the Item 1 sample.
JFVGKE	The spectrum of the topcoat of item #1 was not similar or consistent with the spectra of the topcoats of items #2 or #3. The topcoat paints of items #2 and #3 were not the same as the topcoat paint of item #1. Therefore, items #2 and #3 could not have originated from the basement door (item #1).
JXQA7D	Upon analysis, I found that the FTIR spectra and SEM elemental composition of the questioned paint chips recovered from the prybar in suspect's trunk (Item 2) and from suspect's floorboard near the pedals (Item 3) is not consistent with the FTIR spectra and SEM elemental composition of the known paint chip sample from the damaged area of basement door (Item 1). Therefore, paint chips recovered from the prybar (Item 2) and floorboard (Item 3) could not have originated from the damaged area of the victim's basement door.
KHW2LJ	Comparative examination of the paint chips from samples Item 1 and Item 2 found chemical and visual differences in the paint layers. Item 2 could not have originated from Item 1. Comparative examination of the paint chips from samples Item 1 and Item 3 found chemical and visual differences in the paint layers. Item 3 could not have originated from Item 1.
KUPL3B	Item #3 and Item #2 cannot be originated from Item #1 (known paint sample) due to different layers chemistry and physical properties.
LRLYJ6	The questioned paint samples in Items 1.2 and 1.3 were found to be dissimilar to the known paint sample in Item 1.1. Therefore, the paint in Items 1.2 and 1.3 could not have originated from the same source as the paint in Item 1.1.
M2XYXB	Item 2: neither the top or bottom layers of this item match the known sample (item 1). Item 3:

TABLE 3

WebCode	Conclusions
	neither the top or bottom layers of this item match the known sample (item 1).
MFHGRZ	Questioned brown paint chips reportedly collected from a prybar (Item 2) and the floorboard of a vehicle (Item 3) were observed to be composed of two layers: brown over white. A known brown paint chip collected from a door (Item 1) was also observed to be composed of two layers: brown over white. Samples of each layer of each item were analyzed and compared using microscopy, fluorescence, and infrared spectroscopy. Layers of Items 2 and 3 were dissimilar to layers of Item 1 by all methods. Items 2 and 3 did not originate from the door as represented by Item 1 (Elimination).
MKVZAH	1. Visual and microscopic examinations: Item 1, Item 2 and Item 3 are the solid paint distinguishable in their appearance; microscope examinations all three Items have similar in physical appearance. 2. Chemical analysis and comparisons: 2.1 The pigment compositions of Item 2 and Item 3 are same type with Item 1 in Raman technique. 2.2 The binder composition of all Item in FTIR technique are same type but difference in chemical structure, by Item 2 and Item 3 are same type but not same as Item 1. 3. Conclusions: Item 2 and Item 3 couldn't have originated from known paint sample Item 1.
MNCML2	Items 1, 2 and 3 were examined visually, using stereo microscopy and FTIR (dark brown layers of Items 1, 2 and 3). The dark brown layers of the paint on Items 2 and 3 are different in chemical composition from the dark brown layer of the paint on Item 1. Therefore, the painted wood chips recovered from the pry bar in the suspect's trunk, Item 2, and the painted wood chips recovered from the suspect's floorboard near pedals, Item 3, did not originate from the damaged area of the basement door, as represented by Item 1.
N8LYQW	The questioned paint chips recovered from the prybar in the suspect's trunk (item 2) and the known paint sample representative of the damaged area of the victim's basement door (item 1) were inconsistent in terms of chemical composition. The item 2 could not have originated from the same source as represented by the item 1. The questioned paint chip recovered from the suspect's floorboard (item 3) and the known paint sample (item 1) were inconsistent in terms of chemical composition. The item 3 could not have originated from the same source as represented by the item 1. The questioned paint chips recovered from the suspect (items 2 and 3) are, however, consistent in terms of color, layering and chemical composition and could have originated from the same source.
PEG4KX	Each of the submitted exhibits in items 2 and 3 were examined microscopically and found to be consistent in layer structure with item 1 (2 layers). Each exhibit from items 2 and 3 and item 1 were analyzed using polarized light microscopy, visible microscopy and fourier transform infrared spectroscopy (FTIR). The FTIR results reveal discriminating differences between both layers of items 2 and 3 and item 1. In addition, microscopy results reveal discriminating differences in the physical properties of the white layer from items 2 and 3 and item 1. Thus, neither item 2 nor item 3 could have originated from item 1 as received.
PUDHH7	On analysis, I found that Item 2 and Item 3 were not similar to Item 1. Hence, I am of the opinion that the questioned paint chips recovered from the suspect's trunk (Item 2) and floorboard (Item 3) could not originated from the damaged area of the victim's basement door (Item 1).
Q786DU	1. I have considered the following propositions to evaluate my findings: a. The paint chips recovered from the prybar and the suspect's floorboard near the pedal originated from the damaged area of the basement door. b. The paint chips recovered from the prybar and the suspect's floorboard near the pedal originated from an unrelated source and are present due to chance. 2. Given the results it is my opinion that the recovered paint chips from the prybar

TABLE 3

WebCode	Conclusions
	(item 2) and the suspect's floorboard near the pedal (item 3) can be excluded from having originated from the damaged area of the basement door (item 1) based on chemical and elemental differences.
QBGCP7	In my opinion, the findings provide conclusive support for the proposition that the questioned paint chips recovered from the prybar, in the suspect's trunk, and those recovered from the suspect's floorboard, near the pedals, have not originated from the damaged area of the basement door.
QEET2Z	The known paint sample representative of the damaged area of the basement door (Item 1), the questioned paint chips recovered from the prybar in the suspect's trunk (Item 2) and the questioned paint chips recovered from the suspect's floorboard near the pedals (Item 3) show the different layers with black and white layer. All layers of three samples were analyzed by stereomicroscopy and Fourier transform-infrared-spectroscopy. As a result, the questioned paint samples such as Item 2 and 3 could not have originated from the damaged area of the basement door (Item 1).
QTJXKY	Items 1, 2, and 3 were examined using stereomicroscopy and infra-red spectroscopy. Black paint chips in Items 2 and 3 were different from the black paint in Item 1 (Elimination). This means that the paint chips recovered from the prybar in the suspect's trunk and from the suspect's floorboard near the pedals did not originate from the damaged area of the basement door. Trace Interpretation Scale Type 1 Association: Physical Match—The compared items exhibit physical features that demonstrate they were once part of the same object. Type 2 Association: Association with Distinctive characteristics—Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore, could have originated from the same source. The items further share distinctive characteristics that would not be typically encountered in the relevant population. Type 3 Association: Association with Conventional characteristics—Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. Because other items have been manufactured or are naturally occurring that would also be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Association with limited characteristics and/or examination (1) Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. This type of evidence may be commonly encountered in the environment or may have limited comparative value. Or (2) The comparison between items may be categorized as a Type 4 Association if the association is limited by the inability to perform a complete analysis or if minor variations are observed in the examination results. Inconclusive—No conclusion could be reached regarding an association or an elimination between the items. Elimination—Items exhibit differences in one or more of the following: physical properties, chemical composition, or microscopic characteristics and therefore did not originate from the same source. Non-Association—The items were different in physical properties, chemical composition, and/or microscopic characteristics, indicating that the items did not originate from the same source. However, these differences were insufficient for a definitive elimination.
QZUDX2	ITEM 1 HAS A DIFFERENT CHEMICAL COMPOSITION THAN ITEM 2 AND ITEM 3.
RA3BCW	The examined portions of the black and white layers from the two paint chips from Trace item, Questioned paint chips recovered from the pry bar in the suspect's trunk (Item 1-2), were found to be different in instrumental properties from the examined portions of the black and white layers from the paint from Trace item, Known paint sample representative of the damaged area

TABLE 3

WebCode	Conclusions
	of the basement door (Item 1-1). Accordingly, the examined portions of the two paint chips from Trace item, Questioned paint chips recovered from the pry bar in the suspect's trunk, could not have originated from the examined portions of the paint from Trace item, Known paint sample representative of the damaged area of the basement door. The examined portions of the black and white layers from the two paint chips from Trace item, Questioned paint chips recovered from the suspect's floorboard near the pedals (Item 1-3), were found to be different in instrumental properties from the examined portions of the black and white layers from the paint from Trace item, Known paint sample representative of the damaged area of the basement door (Item 1-1). Accordingly, the examined portions of the two paint chips from Trace item, Questioned paint chips recovered from the suspect's floorboard near the pedals, could not have originated from the examined portions of the paint from Trace item, Known paint sample representative of the damaged area of the basement door.
RCAHQH	The basement door as represented by item 1 is excluded as the source of the paint chips in items 2 and 3.
RD6CCT	Item 2 and item 3 could not be distinguished from each other based on their visual appearance and their chemical compositions. Therefore, in my opinion, the paint chips recovered from the prybar and the floorboard could have come from the same source of paint containing the same two layers of paint. An elemental analysis and comparison has not been undertaken. Items 2 and 3 can be distinguished from Item 1 based on the chemical composition of the black and white layers. Therefore, in my opinion, the paint chips recovered from the prybar in the suspect's trunk and from the suspect's floorboard near the pedals could not have come from the basement door.
TUGAZX	Each item has two layers; The first is brown and the second is white. FT-IR, Pyrolysis GC and SEM/EDX show that ITEM2 and ITEM3 are not same as ITEM1 in their chemical composition.
TW99EW	Description of Evidence: Item 1A Known paint sample, labeled as item 1. Item 1B Questioned paint chips from prybar, labeled as item 2. Item 1C Questioned paint chips from suspect's floorboard, labeled as item 3. Results and Conclusions: The following instruments and microscopes were utilized in the analysis of this case: Stereomicroscope and Fourier Transform Infrared Microscope (FTIR). Neither items 1B nor 1C could have originated from item 1A.
V6THE2	1. The paint in Exhibits 2 and 3 did not originate from the source of Exhibit 1.
V8JKKP	The known paint sample (Item 1) as well as the both questioned paint samples (Item 2 and Item 3) show the same paint layers: a brown top layer and a white layer. All layers of the three samples were analyzed by microscopy, light microscopy, infrared spectroscopy and SEM/EDX. Item 2 cannot be differentiated from the Item 3 by the used methods. Item 1 shows differences to Item 2 and Item 3. Both questioned paint samples (Item 2 and Item 3) could not have originated from Item 1.
VZH6W3	The questioned paint chips recovered from the prybar in the suspect's trunk (Item 2) may not be originated from the damaged area of the victim's basement door (Item 1). The questioned paint chips recovered from the suspect's floorboard near the pedals (Item 3) may not be originated from the damaged area of the victim's basement door (Item 1).
WEWQ3E	Items 1 through 3 were examined visually, microscopically, by chemical spot tests and by scanning electron microscopy with energy dispersive x-ray analysis. Known paint (Item 1), reportedly from the door, was examined and found to have the following layer sequence: black over white. Questioned paints (Items 2 and 3), reportedly from the prybar and floorboard respectively, were examined and found to have the following layer sequence: black over white. The known paint (Item 1), was found to be inconsistent with the questioned paints (Items 2 and

TABLE 3

WebCode	Conclusions
	3) with respect to chemical and physical properties and composition.
WTU6UV	Item 2, the brown paint chips labeled recovered from the prybar in the suspect's trunk, displays differences in physical characteristics and elemental composition as compared to item 1, the brown paint chip labeled representative of the damaged area of the basement door. Elimination. Item 3, the brown paint chips labeled recovered from the suspect's floorboard near the pedals, displays differences in physical characteristics and elemental composition as compared to item 1, the brown paint chip labeled representative of the damaged area of the basement door. Elimination.
X2NAMW	The paint chips recovered from the suspect's trunk (Item 2) and floorboard (Item 3) couldn't have originated from the damaged area of the victim's basement door as represented by Item 1.
XHDQ GK	The paint sample from the basement door (item 1) consisted of a dark brown top coat and white second coat on a wooden substrate. The paint chip from the prybar (item 2) consisted of a dark brown top coat and white second coat. The chemical composition of each of these coats was found to be different to the corresponding coats from the basement door (item 1). Therefore, the paint present on the prybar could not have originated from the basement door. The paint chip from the floorboard (item 3) consisted of a dark brown top coat and white second coat. The chemical composition of each of these coats was found to be different to the corresponding coats from the basement door (item 1). Therefore, the paint from the floorboard could not have originated from the basement door.
XJRTRZ	1. A two layer, matte black paint standard was analyzed for comparison to items 2 and 3. 2. Two small, two layer, matte black paint chips were found. In the sample analyzed, the unknown paint and the standard paint (item #1) are not the same in physical and chemical characteristics. The unknown paint could not have originated from the standard. 3. Two small, two layer, matte black paint chips were found. In the sample analyzed, the unknown paint and the standard paint (item #1) are not the same in physical and chemical characteristics. The unknown paint could not have originated from the standard.
XKJ39U	The paint in items 2 and 3 is similar in color to the paint in item 1; however, it is dissimilar in infra-red spectra. Therefore, the paint in items 1, 2, and 3 could not have originated from the same source.
XQKE6R	The questioned paint samples reportedly recovered from a vehicle (Items 2 and 3) were examined and compared to a known paint sample reportedly recovered from the damaged area of a basement door (Item 1) using stereomicroscopy and infrared spectroscopy. Although the submitted paint samples were consistent in layer sequence (dark brown over white), the chemistry of each layer of the known paint (Item 1) was dissimilar to the chemistry of each layer of the questioned paint (Items 2 and 3). In the opinion of the examiner, the questioned paint from the pry bar and the questioned paint from the vehicle floorboard did not originate from the damaged area of the basement door, as represented by Item 1 (Elimination/Non-association).
Y4PWFR	Item 1, 2 and 3 consist of two layers, dark and white colors. As results of chemical analysis on the surface layer from three items, Item 1 showed the different chemical composition compared to Item 2 and Item 3. Therefore, Item 2 and Item 3 could have not originated from the same source as Item 1.
YFQ4NX	The following methodologies were used in the examination of this case: visual examination, microscopy, fluorescence, and FTIR. KNOWN STANDARDS: Examination of Item 1 revealed the presence of one rectangular piece of wood with black paint on one side. The black paint

TABLE 3

WebCode	Conclusions
	<p>had the following layer structure: black, white. QUESTIONED SAMPLES: Examination of Item 2 revealed black paint chips with the following layer structure: black, white. Each paint chip was on a wood substrate. The questioned paint chips recovered from the prybar in the suspect's trunk (Item 2), were not consistent with the known paint sample representative of the damaged area of the basement door (Item 1). Therefore, the paint chips from Item 2 did not originate from the same source as the paint in Item 1. Examination of Item 3 revealed black paint chips with the following layer structure: black, white. Each paint chip was on a wood substrate. The questioned paint chips recovered from the suspect's floorboard near the pedals (Item 3), were not consistent with the known paint sample representative of the damaged area of the basement door (Item 1). Therefore, the paint chips from Item 3 did not originate from the same source as the paint in Item 1.</p>
YNKC9N	<p>In the opinion of this examiner: The paint samples from both the prybar in the suspect's trunk (Item 2) and from the suspect's floorboard near the pedals (Item 3) are disassociated from the paint standard from the damaged area of the basement door (Item 1) and are eliminated as having originated from the basement door (Elimination).</p>
ZDGGQJ	<p>Physical, microscopic and chemical differences were observed between the known paint sample from the damaged area of the basement door (item 1) and the questioned paint chips from the prybar in the suspect's trunk (item 2) and the questioned paint chips from the suspect's floorboard near the pedals (item 3); therefore item 1 does not share the same source as either item 2 or item 3.</p>
ZLHMXG	<p>Through physical study and chemical analysis practiced to the submitted evidence, it was determined Items 1, 2 and 3: 1. Do not have physical match with each other. 2. Consists of two layers (dark brown and white) which are consistent in color and sequence. 3. Item 1 does not have similar infrared spectra with Item 2 and Item 3, so they do not come from a common origin. 4. Unknown Items 2 and 3 have similar infrared spectra. 5. Item 1 was used as a reference sample.</p>
ZQ2WUJ	<p>CONCLUSIONS: The questioned paint chips recovered from both the prybar (item 2) and the floorboard (item 3) did not originate from the damaged area of the basement door represented by item 1. RESULTS: The questioned paint chips recovered from both the prybar (item 2) and the floorboard (item 3) were examined for the purpose of determining whether or not there is any paint present like that on the damaged area of the basement door (item 1). The paint standard from the damaged area of the basement door (item 1) has the following layer structure: 1. Black polyvinyl acetate latex enamel topcoat. 2. White primer. This paint exhibits characteristics typical of an architectural finish and was used for comparison with questioned paint chips recovered from the prybar (item 2) and the floorboard (item 3). The questioned paint chips recovered from both the prybar (item 2) and the floorboard (item 3) have the following layer structure: 1. Dark brown acrylic latex enamel topcoat. 2. White acrylic latex primer. Examination and comparison of the questioned paint chips (items 2 and 3) with item 1 revealed they are dissimilar with respect to layer structure, layer colors, binder types, and pigment characteristics. It is therefore concluded that the questioned paint chips recovered from both the prybar (item 2) and the floorboard (item 3) did not originate from the damaged area of the basement door represented by item 1. METHODS OF ANALYSIS: Examinations were performed visually, by stereo microscopy, brightfield/polarized light comparison microscopy, microchemical tests, Fourier transform infrared microspectroscopy, pyrolysis gas chromatography, scanning electron microscopy/energy dispersive x-ray analysis and x-ray fluorescence spectroscopy.</p>

Additional Comments

TABLE 4

WebCode	Additional Comments
2MQRZT	a. "Item 1" to "Item 3" were each found to consist of two layers of paint, an outermost dark brown layer and a white layer. b. The examined two layers from "Item 2" and "Item 3" were each found: (i) To be different from "Item 1" in terms of chemical composition. (ii) To have no significant differences with each other in terms of layer sequence, colour and chemical composition.
3QGYEN	methods used and our trace interpretation scale would also be included on my report
GXML64	Levels of association range from Level 1 (highest) to Level 5 (lowest), Inconclusive, and Elimination
QBGC7	The above results/findings predicated upon the submitted paint sample from the damaged basement door being representative of all the paint on the door. The questioned paint chips (items 2 & 3) were found to be microscopically indistinguishable from one another. The three submitted paint samples (items 1-3) each consisted of two-layer paint system on a substrate. It was found that the undercoat associated with item 1 was clearly distinguishable, in the results of fluorescence microscopy, from items 2 and 3.
QZUDX2	IT IS RECOMMENDED TO CONTINUE MAKING THIS TYPE OF REPORTS
V6THE2	RESULTS 1. Exhibit 1 contained a block of wood painted on one surface with the paint layer sequence: brown-black / white. 2. Exhibits 2 and 3 each contained two wood shavings, each painted on one surface with the paint layer sequence: dark brown / white. These paint layers were physically and chemically different from the paint layers in Exhibit 1.
XQKE6R	An Association Scale would be included at the end of the report.
YNKC9N	Methodology: A stereomicroscope was utilized in the general examination of evidence. An EDAX Orbis PC micro X-ray fluorescence spectrometer (micro-XRF) is utilized to analyze and compare the elemental characteristics of various types of trace evidence including glass, paint, tape, metals, and unknown materials. The elements sodium to berkelium on the periodic table can be detected. Glass is also amenable to semi-quantitative elemental ratio analysis and comparisons. Comparisons of glass elemental ratios increase the discrimination power of the method. Furthermore, ratios of certain elements may be utilized to classify glass as sheet or container.

-End of Report-
(Appendix may follow)

Test No. 20-5451: Paint Analysis

DATA MUST BE SUBMITTED BY **May 25, 2020, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234J

WebCode: XHX8WN

The Accreditation Release section can be accessed by using the "Continue to Final Submission" button above. This information can be entered at any time prior to submitting to CTS.

Scenario:

Police are investigating a break-in of a residence where damage was rendered to the basement door and personal items were stolen. The police have a suspect in custody and have collected paint chips from the prybar in the suspect's trunk and on the floorboard near the pedals. A known paint sample has been collected from the damaged area of the basement door. Police are requesting that you examine the recovered paint chips from the suspect's prybar in the trunk and floorboard near the pedals and determine if either of them could have originated from the damaged area of the basement door.

Please Note:

-Samples contained within each individual item are representative of a single source.

-The purpose of this test is the examination of paint; please ignore the wood substrate.

CTS will not reproduce Interpretation Scales, Scale of Conclusions or Terminology Keys in the final report, please do not submit with the participant's data sheet.

Items Submitted (Sample Pack P1):

Item 1: Known paint sample representative of the damaged area of the basement door.

Item 2: Questioned paint chips recovered from the prybar in the suspect's trunk.

Item 3: Questioned paint chips recovered from the suspect's floorboard near the pedals.

1.) Could the questioned paint chips recovered from the suspect's trunk (Item 2) and/or floorboard (Item 3) have originated from the damaged area of the victim's basement door as represented by Item 1?

	Yes	No	Inconclusive
Item 2:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Item 3:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2.) Indicate the procedure(s) used to examine the submitted items:

Please check all that apply.

Microscopic Exams:	<input type="checkbox"/> Stereomicroscope	<input type="checkbox"/> Polarized Light
	<input type="checkbox"/> Fluorescence	
<input type="checkbox"/> Pyrolysis GC	<input type="checkbox"/> FTIR	<input type="checkbox"/> Solubility/Chemical
<input type="checkbox"/> XRS/XRF	<input type="checkbox"/> SEM/EDX	<input type="checkbox"/> Microspectrophotometry

Other (specify):

Please note: Any additional formatting applied in the free form space below will not transfer to the Summary Report and may cause your information to be illegible. This includes additional spacing and returns that present your responses in lists and tabular formats.

3.) What would be the wording of the Conclusions in your report?

4.) Additional Comments

RELEASE OF DATA TO ACCREDITATION BODIES

The Accreditation Release is accessed by pressing the "Continue to Final Submission" button online and can be completed at any time prior to submission to CTS.

CTS submits external proficiency test data directly to ASCLD/LAB, ANAB, and/or A2LA. Please select one of the following statements to ensure your data is handled appropriately.

- This participant's data is intended for submission to ASCLD/LAB, ANAB, and/or A2LA. (Accreditation Release section below must be completed.)
- This participant's data is **not** intended for submission to ASCLD/LAB, ANAB, and/or A2LA.

Have the laboratory's designated individual complete the following steps **only if your laboratory is accredited in this testing/calibration discipline** by one or more of the following Accreditation Bodies.

Step 1: Provide the applicable Accreditation Certificate Number(s) for your laboratory.

ANAB Certificate No.
(Include ASCLD/LAB Certificate here)

A2LA Certificate No.

Step 2: Complete the Laboratory Identifying Information in its entirety.

Authorized Contact Person and Title

Laboratory Name

Location (City/State)