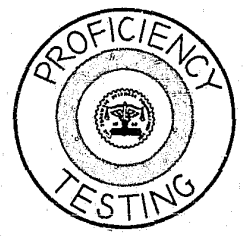
LABORATORY PROFICIENCY TESTING PROGRAM

REPORT NO. 9

GLASS EXAMINATION



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Points of view or opinions stated in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Justice.

FOREWORD

The analysis summarized in this report is the ninth of a series that will be made in conjunction with this proficiency testing research project.

In the course of this testing program participating laboratories will have analyzed and identified ten different samples of physical evidence similar in nature to the types of evidence normally submitted to them for analysis.

The results of Test Number Nine are reflected in the charts and graphs which follow.

The citing of any product or method in this report is done solely for reporting purposes and does not constitute an endorsement by the project sponsors.

Comments or suggestions relating to any portion of this report or of the program in general will be appreciated.

February 1976

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BACKGROUND

This laboratory proficiency testing research project, one phase which is summarized in this report, was initiated in the fall of 1974.

This a research study of how to prepare and distribute specific samples; how to analyze laboratory results; and how to report those results in a meaningful manner. The research will be conducted in two cycles, each of which will include five samples: a controlled substance; firearms evidence; blood; glass; and paint.

Participation in the program is voluntary. Accordingly, invitations have been extended to 235 laboratories to share in the research. It is recognized that all laboratories do not perform analyses of all possible types of physical evidence. Thus, in the data summaries included in this report, space opposite some Code Numbers (representing specific laboratories) may be blank, or marked "No Data Returned."

Additional evaluations of individual tests will be published in a separate report.

The Project is under the direct control of the Project Advisory Committee whose members' names are listed on the Title Page. Each is a nationally known criminalistic laboratory authority.

Supporting the Project Advisory Committee in their efforts is the Forensic Sciences Foundation with additional support from the National Bureau of Standards in the areas of the sample evaluation and data analysis and interpretation.

SUMMARY

Test Sample #9 consisted of glass samples A, B, and C packaged in a plastic box. The samples were mailed on September 4, 1975 with instructions to handle the sample in a manner similar to like evidence and submitted for analysis.

The basic roster of 189 laboratories was reduced to 173 by removing those laboratories who previously indicated that they do not do glass examination.

In the accompanying data summaries, 112 laboratories responded with completed data sheets, 16 responded they do not do glass examination and no response was received from 61 laboratories. This represents a participation rate of 65%.

No effort was made in this report to highlight areas wherein laboratory improvements might be instigated.

ANNEX A

LAB CODE A - _____

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM GLASS EXAMINATION

DATE RECEIVED IN LAB _____
DATE PROCESSED IN LAB _____

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #9
GLASS EXAMINATION

Item A and B represent glass samples removed from the clothing of two hit and run victims found in different locations. Item C represents glass removed from a suspect vehicle.

1. Could Item A and B have common origin with Item C?

	Item A	Item B
Yes	☐	☐
No	☐	☐
Inconclusive	☐	☐

2. What information (qualitative and quantitative) did you develop to arrive at your conclusions in Question 1? (Please check all appropriate boxes and provide values where applicable.)

	Item A	Item B	Item C
a. Color			
b. Density			
c. Dispersion Curves			
d. Elemental Analysis			
e. Physical Match			
f. Refractive Index			
g. Thickness			
h. U.V. Light			
i. X-ray Fluorescence			
j. Other (Specify)			

3. Please specify the methods and/or instructions which were used for those methods checked in Question 2. (Example: Refractive Index using Cargille liquids, hot stage; Density gradient tubes with mixture of bromobenzene and bromoform, etc. Attach additional sheets if necessary.)

Method:

Method:

Method:

Method:

DATA SHEETS MUST BE RECEIVED AT THE FOUNDATION OFFICE BY OCTOBER 6, 1975

ANNEX B

National Bureau of Standards Analysis

LABORATORY TESTING PROGRAM

Test No. 9 - Glass Examination

In test No. 9, 189 laboratories were sent three pieces of glass referred to as A, B, and C. Participants were asked three questions: (1) Could Item A and B have common origin with Item C? (2) What information did you develop to arrive at your conclusions to Question 1? (3) Specify the methods and/or instructions which were used for those methods checked in Question 2.

Of the 189 laboratories, 112 responded with data, 16 indicated they do not do glass analysis, and 61 did not respond. A tabulation of the codes for laboratories in each of these last two categories is given in Table 1.

The information in Tables 2 and 3 shows that the three glass samples were the same. Table 4 lists the responses to Question 1. As shown in Table 4a, 77.7% of the laboratories reported that Items A and C were the same and 76.8% reported Item B and C were the same. However, only 68.8% reported both A and B were the same as C. Table 5 lists the frequency of use of the methods used to answer Question 2. Table 6 summarizes the responses to Question 2 for the nine most frequently reported methods. Table 7 tabulates the responses to Question 2 from each participating laboratory. Table 8 is a summary of responses to Question 3 for the nine most frequently reported methods, and Table 9 tabulates all of the responses to Question 3.

This annex was prepared by the Law Enforcement Standards Laboratory (LESL) of NBS. The test results anonymously reported by participating forensic laboratories were analyzed and tabulated by James McLeod, research associate in the Laboratory Evaluation Technology Section and Alvin Lewis of the Hazards Analysis Section, NBS. This work was supported by the National Institute of Law Enforcement and Criminal Justice, Department of Justice.

Table 1

Code Numbers of Non-responding Laboratories

THE FOLLOWING LABS INDICATED THEY DO NOT DO GLASS ANALYSIS:

708	780	850	998
734	803	852	
736	816	864	
764	824	942	
774	828	944	

Total Labs = 16

THE FOLLOWING LABS DID NOT RESPOND:

703	737	792	834	889	938	999
707	738	795	858	892	946	
709	762	796	861	895	964	
710	766	809	865	898	966	
719	770	811	867	902	972	
722	773	814	869	905	973	
723	777	817	871	912	984	
728	781	820	879	914	985	
732	782	822	880	917	988	
733	783	825	887	931	989	

Total Labs = 61

Samples were not sent to laboratories which indicated in Test No. 4 that they do not do glass analysis.

Table 2

Supplier's Characterization of Samples

The glass samples were all prepared from a single headlight lens (Corning) with a refractive index of 1.47777. When pieces from different locations on the lens were measured, the refractive index differed by no more than 4 in the 5th decimal place. Samples A, B, and C are the same.

Table 3

Results of the Three Referee Laboratories

Lab 1.

Refractive Index of Samples A, B, and C 1.47777.
(This lab was requested to do only refractive index measurements.)

Question 1: Could Item A and B have common origin with Item C?

	Item A	Item B
Lab 2	Yes	Yes
Lab 3	No	Yes

Question 2: What information did you develop to arrive at your conclusions in Question 1?

	Lab 2			Lab 3		
	Item A	Item B	Item C	Item A	Item B	Item C
Color	A, B, C colorless			A, B, C same		
Density	A, B, C 2.2614			A, B, C same		
Dispersion Curves	N_C 1.4758	1.4758	1.4758			
	N_D 1.4779	1.4779	1.4779			
	N_F 1.4828	1.4828	1.4828			
Physical Match				A, B, C none		
Refractive Index	N_D 1.4779	1.4779	1.4779	1.4769	1.4777	1.4777
Thickness				Sections not of uniform thickness		
UV Light				Fluorescence under UV light similar		

Table 4

Tabulation of Responses to Question 1

Question 1: Could Item A and B have common origin with Item C?

LAB CODE	Item A	Item B	LAB CODE	Item A	Item B	LAB CODE	Item A	Item B
A705	Yes	Yes	A804	No*	Yes	A899	Yes	Yes
A712	Yes	Yes	A805	Yes	Yes	A901	Yes	No*
A713	Yes	Yes	A806	Yes	Yes	A903	Yes	Yes
A715	Yes	Yes	A813	Yes	Yes	A904	Yes	Yes
A717	Yes	Yes	A815	No*	No*	A907	Yes	Yes
A718	INCON	Yes	A818	Yes	Yes	A908	Yes	Yes
A724	Yes	Yes	A821	Yes	Yes	A909	Yes	Yes
A726	INCON	INCON	A823	Yes	Yes	A915	Yes	Yes
A727	Yes	Yes	A827	Yes	No*	A921	Yes	Yes
A729	Yes	Yes	A829	No*	No*	A923	No*	No*
A730	Yes	Yes	A831	Yes	Yes	A925	Yes	No*
A731	Yes	Yes	A832	Yes	Yes	A926	No*	No*
A739	Yes	Yes	A833	No*	Yes	A948	No*	Yes
A740	INCON	INCON	A835	Yes	Yes	A958	Yes	Yes
A742	Yes	Yes	A837	Yes	Yes	A960	No*	Yes
A745	Yes	Yes	A838	Yes	Yes	A961	No*	No*
A746	Yes	Yes	A839	Yes	Yes	A962	Yes	Yes
A747	(see note below)		A842	Yes	Yes	A969	Yes	Yes
A748	Yes	Yes	A843	Yes	Yes	A970	Yes	No*
A750	Yes	Yes	A847	Yes	Yes	A974	Yes	INCON
A751	Yes	Yes	A848	Yes	Yes	A975	INCON	INCON
A752	Yes	Yes	A849	No*	Yes	A978	Yes	Yes
A754	Yes	No*	A853	Yes	Yes	A979	Yes	Yes
A756	Yes	Yes	A854	Yes	Yes	A980	No*	Yes
A757	Yes	Yes	A855	Yes	Yes	A986	Yes	Yes
A760	No*	INCON	A856	Yes	Yes	A987	No*	No*
A763	Yes	Yes	A859	Yes	No*	A994	Yes	Yes
A765	Yes	Yes	A860	Yes	Yes	A995	No*	Yes
A768	Yes	No*	A863	INCON	INCON			
A769	Yes	Yes	A866	Yes	Yes			
A772	Yes	Yes	A868	Yes	Yes			
A778	Yes	Yes	A872	No*	No*			
A779	No*	No*	A873	Yes	Yes			
A784	Yes	Yes	A874	Yes	Yes			
A786	Yes	Yes	A876	Yes	Yes			
A787	INCON	INCON	A883	INCON	Yes			
A789	Yes	Yes	A884	No*	No*			
A790	Yes	Yes	A885	Yes	Yes			
A794	Yes	Yes	A888	Yes	Yes			
A797	Yes	Yes	A894	Yes	Yes			
A798	Yes	No*	A896	Yes	Yes			
A799	Yes	No*	A897	Yes	Yes			

*Indicates response inconsistent with suppliers characterization of sample.

Note: Lab 747 checked both yes and no for Item A with no response given for Item B.

Table 4a

Summary of Responses to Question 1

Question 1: Could Item A and B have common origin with Item C?

Response	Item A	% of total labs (total = 112)	Item B	% of total labs (total = 112)
Yes	87	77.7	86	76.8
No	17	15.2	18	16.1
Inconclusive	7	6.3	7	6.3
Data Not Understood	1	.9	1	.9
Number of Labs reporting Yes for both A and B	77	68.8%		
Number of Labs reporting Yes for A and No for B	9	8.0%		
Number of Labs reporting No for A and Yes for B	7	6.3%		

Table 5

Frequency of the Reported Methods Used to Answer Question 2

Question 2: What information did you develop to arrive at your conclusions in Question 1?

Method	Number of Laboratories Reporting Use of This Method	% of Total Lab. (Total = 112)
Color	95	84.8
U.V. Light	95	84.8
Density	92	82.1
Refractive Index	91	81.3
Thickness	60	53.6
Physical Match	53	47.3
Elemental Analysis	44	39.3
Dispersion Curves	37	33.0
X-Ray Fluorescence	16	14.3
Microscopic Examination	4	3.6
Differential I.R.	2	1.8
Emission Spectroscopy	2	1.8
Visual Inspection	2	1.8
Polarized Light	2	1.8
Dispersion Staining	1	0.9
SEM/EDX	1	0.9
Opacity	1	0.9
Isotropic & Conchoidal Fracture	1	0.9
Scratch	1	0.9
DTA	1	0.9
Trace	1	0.9
Hardness	1	0.9

Table 6

Summary of Responses for Question 2

Question 2: What information did you develop to arrive at your conclusions in Question 1?

Method	Response	Number of Labs Reporting this Response
Color	Items A, B, C, clear and/or colorless	33
	Items A, B, C, same	18
	Similar	2
	Opaque	1
	Not significant	1
	Qualitative	1
U.V. Light	No fluorescence	29
	Same	17
	Slight orange	2
	Yellow/pink color	1
	All fluorescence in long wave UV	1
	Slight fluorescence	1
	Short UV fluorescence	1
	Light yellow fluorescence	1
	A fluorescence orange	1
	B fluorescence blue-white	1
	C fluorescence light orange	1
	Unable to exclude	1
	Short wave green fluorescence	1
	Qualitative	1
	Blue-purple	1
Density	Same or similar	43
	B and C same	3
	A and B same	2
	C greater than A and B	2
	A and C same	1
	B greater than A and C	1
	C less than B	1
	A different	1
	B much less than c, C less than or equal to A	1
	2.244	1
	2.255	1
	2.25	1
	2.258	1
	2.2472	1
	2.20 - 2.33	1
	2.1 g/cc	1

Table 6 (continued)

Method	Response	Number of Labs Reporting this Response
Density (con'd)	2.230 ± .010	1
	2.2614	1
	2.24	1
	2.334 g/ml	1
	.1995 - .42631	1
	B greater than 2.25	1
	A, 2.255	1
	B, 2.254	1
	C, 2.253	1
	A, 1.2581	1
	B, C, 1.2585	1
Thickness	Different	21
	Same or similar	6
	Inconclusive	5
	Irregular surfaces	5
	No parallel edges	2
	N/A	2
	B and C same	2
	Negative	1
	A thicker than B and C	1
	Difference noted but no significance attached	1
	Varies	1
	A and B thicker than C	1
	Unable to exclude	1
	Unequal surfaces	1
	A different, B and C same	1
	Not recorded	1
	No measureable side	1
Physical Match	Does not match	39
	Same	2
	Not possible	2
	2 parallel	1
Elemental Analysis	Same or similar	17
	B and C same	2
	B has more Al	2
	A and C same	1
	A, B contain Cu, C does not	1
	A contains Cd	1
	B contains P, A and C do not	1
	A contains Al	1
	B and C contain trace of Ni	1
	A and C different	1
	A contains more Ni	1
	A contains Ni, B and C do not	1

Table 6 (continued)

Method		Response	Number of Labs Reporting this Response
Elements reported:	main:	Si	8
		B	7
		Na	7
	other:	As	6
		Li	2
		Al	7
		Cu	2
		Ca	7
		Fe	6
		Mg	7
		Mn	4
		Zr	3
		Ma	1
		Ni	1
		Ti	3
		Zn	1
		Manganese	1
		Tantalum	1
Dispersion Curves		Qualitatively indistinguishable or same	4
		Questionable	1
		A and C same, but not B	1

The following values were given as Dispersion Curve data for items A, B, and C. Due to the fact that no other information was given with respect to units, calculations, methods used, etc., no analysis was performed and only the data reported is presented here.

	Item A	Item B	Item C
	96.98	96.98	96.98
	68.4	78.4	68.4
	1.477	1.477	1.477
at 31°C-39°C	1.480	1.480	1.480
	62.13	62.02	62.24
	.0080	.0079	.0080

X-Ray Fluorescence	Same	7
	Samples run directly	1
	A and C same, B different	1
	B and C same, A different	1

Refractive Index (rounded to three decimal places)
Specific values reported for N_d (Sodium Line)

Item A	Frequency
1.475	1
1.476	4
1.477	19
1.478	22
1.479	6
1.480	1
1.484	1
1.487	1

Mean = 1.478
Standard deviation = .0018

Table 6 (continued)

Refractive Index (continued)

Item B	Frequency
1.475	1
1.476	4
1.477	18
1.478	21
1.479	8
1.480	1
1.484	1
1.487	1

Mean = 1.478
Standard deviation = .0018

Item C	Frequency
1.474	1
1.476	4
1.477	16
1.478	23
1.479	8
1.480	1
1.484	1
1.487	1

Mean = 1.478
Standard deviation = .0018

Other responses (statistical outliers excluded from above calculations) reported:

Item A	Item B	Item C
1.655	1.655	1.655
1.571	1.571	1.571
57.7	57.7	57.7

Other qualitative responses reported:

Same	7
Different	2
Comparative basis only	2
Very close	1
Specific refractive index not determined	1

Table 7

Tabulation of Responses to Question 2

Question 2: What information did you develop to arrive at your conclusions in Question 1?

LAB CODE	METHODS USED	Item A	Item B	Item C
705	Color	same	same	same
	Dispersion Curves	same	same	same
	Elemental Analysis	same	same	same
	Physical Match	no	no	no
	Refractive Index	same	same	same
	Thickness	different	different	different
	UV Light	same	same	same
	X-ray Fluorescence	same	same	same
712	Color	clear	clear	clear
	Density	Items A,B and C can be suspended in the same liquid mixture		
	Elemental Analysis	The same elements were found in all three items		
	Refractive Index	1.4778±.0004	1.4778±.0004	1.4776±.0004
	UV Light	no fluorescense	no fluorescence	no fluorescence
713	Refractive Index	1.477	1.477	1.477
	UV Light	no apparent fluorescence for all three items		
715	Color	A, B, C colorless, identical appearance		
	Elemental Analysis	identical to B&C	identical to A&C	identical to A&B
		Elemental emission spectrum: main: Si, B, Na other: As, Li, Al, Cu, Ca, Fe, Mg, Mn		
	Physical Match	none with B&C	none with A&C	none with A&B
	Thickness	inconclusive	inconclusive	inconclusive
	UV Light	identical to B&C (no effect)	identical to A&C (no effect)	identical to B&C (no effect)
717	Color			
	Density			
	Dispersion Curves			
	Elemental Analysis			
	Refractive Index	1.4782	1.4784	1.4781
	UV Light			
	Dispersion Staining			

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
718	Color	colorless	colorless	colorless
	Density	very slightly lighter than C	same as C	
	Refractive Index	1.478	1.478	1.478
	UV Light	no fluorescence	no fluorescence	no fluorescence
724	Color			
	Density	approx. 2.244	approx. 2.244	approx. 2.244
	Refractive Index	1.477	1.477	1.477
	UV Light			
726	Color	colorless	colorless	colorless
	Density	same as B&C	same as A&C	same as A&B
	Physical Match	does not match	does not match	does not match
	Refractive Index	Ca. 1.477	Ca. 1.477	Ca. 1.477
	Thickness	0.126-0.144"	0.150-0.155"	0.129-0.133"
	UV Light	no fluorescence	no fluorescence	no fluorescence
727	Color	clear	clear	clear
	Density	same	same	same
	Physical Match	same	same	same
	Refractive Index	all 3 very close		
	Thickness	0.3mm	0.3mm	0.3mm
	UV Light	none	none	none
729	Color			
	Density	comparative		
	Refractive Index	1.6554	1.6546	1.6547
	UV Light			
730	Color			
	Elemental Analysis			
	Thickness			
	UV Light			
731	Color			
	Density	2.255	2.255	2.255
	Elemental Analysis			
	Refractive Index	1.476	1.476	1.476
	Thickness	3.34	3.42	3.55
	UV Light			
739	Density			
	Elemental Analysis			
	Refractive Index	all three approx. 1.476		
	Thickness			

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
740	Color	No detectable differences between A, B, or C		
	Density	No detectable differences		
	Dispersion Curves	n_D=1.4774	n_D=1.4775	n_D=1.4774
		n_C=1.4752	n_C=1.4755	n_C=1.4754
		n_F=1.4831	n_F=1.4831	n_F=1.4832
	Physical Match	No physical match was found		
	UV Light	No differences noted under UV light		
	X-ray Fluorescence	Samples run directly (vacuum path)		
	Ratio			
	Zr/As	.2385	.2473	.2401
	Fe/As	0.368	.0371	.0324
	Si/As	.5809	.5728	.5432
742	Color			
	Dispersion Curves			
	Refractive Index	1.47840	1.47844	1.47844
	Thickness	.132-.136"	.134"	.131-.141"
	UV Light 254nm	slight orange	slight orange	slight orange
	X-ray Fluorescence	All have same elements		
745	Color			
	Density	A=B=C		
	Refractive Index	A=B=C	1.475 @ 489 NM 1.477 @ 585 NM 1.4785 @ 667 NM	
	Thickness			
	UV Light	No fluorescence observed under UV light for A, B or C		
746	Density			
	Elemental Analysis			
	Physical Match			
	Refractive Index	1.478	1.478	1.478
	UV Light			
747	Density			
	Dispersion Curves	96.98	96.98	96.98
	Physical Match	not possible	not possible	not possible
	Refractive Index	n_D=1.47812	n_D=1.47812	n_D=1.47812
	UV Light	No fluorescence	No fluorescence	No fluorescence
	SEM/EDX Si	69%	69%	69%
	Mg	6%	7%	6%
	Al	7%	7%	7%
	Na	18%	17%	18%
	K	trace	trace	trace
	Cl	trace	trace	trace

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
748	Color			
	Density			
	Dispersion Curves			
	Physical Match	negative	negative	negative
	Refractive Index	approx. 1.477	approx. 1.477	approx. 1.477
	Thickness	negative	negative	negative
	UV Light			
	Microscopic examination of sample surfaces			One surface has a ripple appearance
750	Color			
	Density			
	Refractive Index			
	UV Light			
	Viewed under polarized light			
751	Color			
	Dispersion Curves			
	Refractive Index	1.4774	1.4774	1.4774
	UV Light			
752	Color	colorless	colorless	colorless
	Density	compare	compare	compare
	Physical Match	no comparison	no comparison	no comparison
	Refractive Index	1.478±.001	1.478±.001	1.478±.001
	Thickness			
	UV Light	no effect	no effect	no effect
754	Color	All were clear and colorless - no difference noted		
	Density	Gradient densities of A, B, and C match		
	Dispersion Curves	Dispersion curve of A matches C, but not B		
	Elemental Analysis	Arsenic present in greater quantaties in A and C		
	Physical Match	No physical match possible		
	Refractive Index	Specific Refractive Index not determined		
	Thickness	Variable thicknesses within samples doesn't allow adequate comparison		
	UV Light	A, B, and C all failed to exhibit fluorescence		
756	Dispersion Curves		similar to C	similar to B
	Elemental Analysis	Spectrographic analysis indicates A, B, and C to be Borosilicates of sodium with significant levels of Ca, Mg, Fe, Al, As, Mn and Li. Trace amounts of Ni were found in B and C. Semi-quantitative showed differences between A and C.		
	Refractive Index	N_d=1.4786	N_d=1.4785	N_d=1.4787
		N_f=1.4839	N_f=1.4838	N_f=1.4839
		N_c=1.4765	N_c=1.4765	N_c=1.4766

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
757	Color	same	same	same
	Density	same	same	same
	Elemental Analysis	similar	similar	similar
	Physical Match	none	none	none
	Refractive Index	1.4774 (Sodium D line)	1.4774 (Sodium D line)	1.4774 (Sodium D line)
	Thickness	.143"(Ave.)	.128" (Ave.)	.065" (Ave.)
	UV Light	same	same	same
	X-ray spectrometry	Quantitatively same elements present in each		
	Fluorescent Spectrometry	sample:		
	Fluorescent Spectrometry	Si, Ca, Fe, Zn, As, and Zr		
		Semi-quantitative: Took net intensities of Si, Fe, As, and Zr.		
		Ratioed $\frac{As}{Zr}$ and $\frac{Si}{As}$ determined that within instrumental		
		and experimental capabilities the ratios to be consistent, one with another.		
760	Color	All clear glass		
	Density	Comparative basis only		
	Physical Match	No correlations found		
	Refractive Index	Comparative basis only		
	Thickness	No correlations found		
	UV Light	All exhibit yellow/pink color		
763	Color			
	Density	All 3 items have the same relative density		
	Physical Match	Could not match A or B with C		
	Refractive Index	All 3 have the same refractive index		
	Thickness	4.1x3.9x uneven	4.1x4.0x uneven	4.4x4.4x uneven
	UV Light			
765	Color	same	same	same
	Density @ 27°C	2.2506	same	same
	Refractive Index @ 27°C	1.478	same	same
	Microscopic exam			
	Hardness			
768	Color			
	Density	B<<C≤A		
	Dispersion Curves	68.4	78.4	68.4
	Physical Match			
	Refractive Index	1.4789	1.4787	1.4789
	Thickness			
	UV Light			
	X-ray Fluorescence			

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
769	Color	none	none	none
	Density	same	same	same
	Dispersion Curves	All items ND=1.4768 NF=1.4792 NC=1.4758		
	Elemental Analysis	same analysis for all three items		
	Physical Match	no match	no match	no match
	Refractive Index	1.4767	1.4768	1.4768
	Thickness	no parallel edges		
	UV Light	none	none	none
772	Color	all three items colorless and clear		
	Density	all three items same density		
	Physical Match	all three items do not match		
	Refractive Index	1.4770	1.4768	1.4779
778	Color			
	Elemental Analysis			
	Physical Match			
	Refractive Index			
	UV Light			
	X-ray Fluorescence			
779	Color	all three same		
	Density	comparative density same		
	Physical Match	negative	negative	negative
	Refractive Index	1.4770	1.4773	1.4766
	Thickness	1.52-.165"	.136-.157"	.074"
784	Color	frosted on 2 sides	frosted on 2 sides	frosted on 3 sides
	Density	all densities the same		
	Dispersion Curves	1.477	1.477	1.477
	Physical Match	no physical matches		
	Refractive Index	1.477	1.477	1.477
	Thickness	no thickness measurable		
	UV Light	all fluorescence in long wave UV		
	X-ray Fluorescence	all contain Si, Ca, Fe, As, Zr		
786	Color	opaque	opaque	opaque
	Density	same level	same level	same level
	Elemental Analysis	no differences	no differences	no differences
	Thickness	3.66mm	1.52mm	1.71mm
	UV Light	slight fluorescence	slight fluorescence	slight fluorescence
	Weight	.1262gm	.0693gm	.1018gm
787	Physical Match	negative	negative	negative
	Thickness	.132"	.153"	.162"
	UV Light	negative	negative	negative
	IR	negative	negative	negative

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
789	Color			
	Density			
	Dispersion Curves			
	Refractive Index			
	UV Light			
790	Color	clear	clear	clear
	Density	all three match		
	Physical Match	none	none	none
	Refractive Index	all three match		
	Thickness	.1425	.0845	.1038
	UV Light	no fluorescence	no fluorescence	no fluorescence
794	Color			
	Density			
	Refractive Index			
	UV Light			
	Microscopic Exam			
797	Color	qualitatively indistinguishable		
	Density	only approximate 2.25 qualitatively indistinguishable		
	Dispersion Curves	qualitatively indistinguishable		
	Emmision Spectroscopy			
	Elemental Analysis	qualitatively indistinguishable		
	Physical Match	there was no match; qualitatively indistinguishable		
	Refractive Index	qualitatively indistinguishable; these were comparative not absolute		
	UV Light	qualitatively indistinguishable using short wave		
798	Color	same	same	same
	Density	same	same	same
	Elemental Analysis	same	more aluminum	same
	Physical Match	n/a	n/a	n/a
	Refractive index @ 28.6°C	1.478	1.478	1.478
	Thickness	n/a	n/a	n/a
	UV Light	same	same	same
799	Color	all three itemes clear and colorless; indistinguishable		
	Density	indistinguishable		
	Dispersion Curves	indistinguishable		
	Physical Match	no match with B or C	no match with A or C	no match with A or B
	Refractive Index	all indistinguishable ND=1.4769		
	Thickness	non-parallel surfaces	irregular surfaces	irregular surface
	UV Light	all items indistinguishable		
	X-ray Fluorescence	same as	Sl. different than A or C	same as A

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
804	Color	not significant		
	Density (gradient)	Item A found to be slightly less dense than I Items B and C		
	Dispersion Curves			
	Elemental Analysis	All items contain Si, B, Na, Mg, Ca, Zr, Ni, Fe, Ti, Al and Manganesetantalum. The presence of Ni in greater concentration in Item A than in the other items.		
	Thickness			
	UV Light			
805	Color			
	Density			
	Dispersion Curves			
	Elemental Analysis			
	UV Light			
806	Color			
	Density (relative)			
	Physical Match	negative	negative	negative
	Refractive Index (extinction tep °C in dibutyl Phthapate)	57.7	57.9	57.7
	Thickness	irregular	irregular	irregular
	UV Light			
813	Density			
	Dispersion Curves			
	Refractive Index			
	Thickness	.152-.160"	.153"	.154-.159"
	UV Light			
	X-ray Fluorescence			
815	Color			
	Density			
	Dispersion Curves			
	Elemental Analysis	Cu++	Cu++	none
	Refractive Index	approx 1.478	approx 1.478	approx 1.478
	Becke Line (yellow) Temp. Variation	approx 1.47611	approx 1.47611	approx 1.47636
	Thickness	n/a	n/a	n/a
	UV Light	short UV fluorescence	short UV fluorescence	short UV fluorescence
818	Density			
	Refractive Index			
	UV Light			
	X-ray Fluorescence	Si/Al, Si/As, Si/Fe ratios same for all three items Ca, Sr, Rb, K, Mg, Na absent from all three items slight difference in Zr/As ratio in Item A		

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
821	Color	clear	clear	clear
	Density	2.258	2.258	2.258
	Physical Match	none	none	none
	Refractive Index N_d	1.478	1.478	1.478
	Thickness			.069-.074"
	UV Light	light yellow fluorescence	light yellow fluorescence	light yellow fluorescence
823	Color	clear with 4 frosted faces	clear with 4 frosted faces	clear with 2 frosted faces
	Density			
	Dispersion Curves			
	Elemental Analysis	As, B, Si, Mg, Mn, Al, Na, Ca, Fe present in same amounts in all items		
	Physical Match	none	none	none
	Refractive Index N_f	1.4825	1.4826	1.4826
	N_d	1.4772	1.4773	1.4773
	N_c	1.4751	1.4752	1.4752
	Thickness	varies	varies	.0957"
	UV Light	no fluorescence	no fluorescence	no fluorescence
827	Density	not quantitated-all three have equal densities		
	Elemental Analysis		Al	
	Refractive Index	1.476	1.475	1.474
	Thickness	3.73mm	3.49mm	3.43mm
	UV Light			
	DTA	230°, 355° 510°, 585°		230°, 355° 510°, 585°
829	Density	no difference detected in densities		
	Refractive Index	all 3 samples approx 1.480 (Becke Line)		
	Thickness	thicker than B & C	same as C	Same as B
	UV Light	no difference noted in 3 items		
	Scratch (ie:streak)	pyrex scratches A & B; pryrex does not scratch C		
831	Color	colorless	colorless	colorless
	Density	2.2472	2.2472	2.2472
832	Color			
	Density (Relative)			
	Elemental Analysis			
	Physical Match	no match	no match	no match
	Refractive Index			
	UV Light			
	X-ray Fluorescence			

Table 7 Continued

LAB CODE	METHODS USED	Item A	Item B	Item C
833	Color	colorless	colorless	colorless
	Density	2.33>A>2.20	2.33>B>2.20	2.33>C>2.20
	Physical Match	none	none	none
	Refractive Index N_d^{25}	approx 1.476	approx 1.476	approx 1.476
	Thickness	.1646 x .1507	.1641 x .1523	.1540 x .1301
	UV Light	negative fluorescence	negative fluorescence	negative fluorescence
	Microscopic	4 frosted striated faces (perpendicular)	4 frosted faces 2 not striated 2 striated (parallel)	4 frosted faces 2 not striated 1 striated (parallel) 1 irregular
835	Color	clear	clear	clear
	Density	Comparative density the same in A, B, and C		
	Elemental Analysis	no significant differences noted		
	Physical Match	negative	negative	negative
	Refractive Index	1.477	1.477	1.477
	Thickness	difference noted but no significance attached in this case		
	UV Light	negative	negative	negative
837	Density			
	Dispersion Curves			
	Elemental Analysis			
	Refractive Index			
	UV Light			

Table 7 Continued

LAB CODE	METHOD	Item A	Item B	Item C
838	Color			
	Density			
	Dispersion Curves			
	Refractive Index			
	UV Light			
839	Color	clear	clear	clear
	Density	simultaneous side by side sink float on all three samples		
	Dispersion Curves	1.480 at 31°C-39°C	same	same
	Laser Emission Spec.	A, B, C qualitatively consistant		
	UV Light			
	X-ray Fluorescence	No significant differences in visual comparison of tracings and semiquantitative comparison of peak intervals. Elements present: Si, Ca, Fe, Zr, As		
842	Color			
	Density			
	Elemental Analysis			
	Physical Match			
	Refractive Index			
	Thickness			
	UV Light			
843	Color			
	Density			
	Refractive Index	1.478	1.478	1.478
	UV Light			
847	Density			
	Dispersion Curves			
	Refractive Index	1.4776	1.4776	1.4776
848	Density	same	same	same
	Refractive Index	same	same	same
	UV Light	same	same	same
849	Color			
	Density	2.1g/cc	2.1g/cc	2.1g/cc
	Elemental Analysis	Cd		
	Refractive Index	1.5710	1.5710	1.5710
	Thickness			
	UV Light			
853	Color	clear	clear	clear
	Density	approx same as C	approx same as C	approx same as A & B
	Elemental Analysis	Si, Ca, B, Mg, Al, Na, Ti, Zr	same as A	same as A
	UV Light	no fluorescence	no fluorescence	no fluorescence

Table 7 Continued

LAB CODE	METHODS	Item A	Item B	Item C
854	Color			
	Density			
	Refractive Index	1.478 @ 24.5°C for A, B, C		
	UV Light	A, B, C showed no fluorescence		
	X-ray fluorescence	Traces of As and Zr present in A, B, C		
855	Color	same	same	same
	Density	same	same	same
	Dispersion Curves	same	same	same
	Elemental Analysis	same	same	same
	Refractive Index	1.478	1.478	1.478
	UV Light	same	same	same
856	Color	same	same	same
	Density	same	same	same
	Physical Match	no	no	no
	Refractive Index	same	same	same
	UV Light	same	same	same
859	Color	same	same	same
	Density	=C	>A & C	<B
	Elemental Analysis	does not contain P	contains P	does not contain P
	Physical Match	negative	negative	
	Refractive Index	=C	differs slightly from C	=A
	Thickness	varies	varies	varies
	UV Light	=C	=C	=A & B
860	Color	untinted	untinted	untinted
	Density	same as C (comparative)	same as C (comparative)	same as C (comparative)
	Physical Match	negative	negative	negative
	Refractive Index	approx 1.478	approx 1.478	approx 1.478
	Thickness	thicker than C	thicker than C	thinner than A & B
	Other (specify)	isotropic & conchoidal fracture	isotropic & conchoidal fracture	isotropic & conchoidal fracture
863	Color	clear 2 sides frosted white 4 sides	same as A	same as A & B
	Density	similar	similar	similar
	Elemental Analysis	similar	similar	similar
	Thickness	not similar	not similar	not similar
	UV Light	fluorescence orange	fluorescence blue white	fluorescence light orange

Table 7 Continued

LAB CODE	METHODS	Item A	Item B	Item C
866	Color			
	Density	2.230 ± 0.010	2.230 ± 0.010	2.230 ± 0.010
	Elemental Analysis	Elements present: B,Si,Ca,Na,Al,Mg,Mn,As,Zr,Ti,Fe,Be		
	Physical Match	no	no	
	Refractive Index	1.477 + .001	1.477 ± .001	1.477 ± .001
	Thickness	4.50mm	5.04 -5.07mm	1.87mm
	UV Light			
868	Color			
	Refractive Index	1.476	1.476	1.476
872	Color	A, B, C colorless		
	Density	A, B, C same		
	Elemental Analysis	A, B, C same		
	Physical Match	could not match A, B, C		
	Refractive Index	A, B, C same		
	Thickness	.198"	.146"	.134"
	UV Light	A, B, C no fluorescence		
873	Color			
	Density			
	UV Light			
874	Color	similar	similar	similar
	Density	similar	similar	similar
	Refractive Index	similar	similar	similar
	Thickness	unable to exclude	unable to exclude	unable to exclude
	UV Light	unable to exclude	unable to exclude	unable to exclude
876	Color			
	Density	same	same	same
	Dispersion Curves			
	Refractive Index	N_C=1.4753 N_D=1.4773 N_F=1.4829	N_C=1.4754 N_D=1.4776 N_F=1.4821	N_C=1.4752 N_D=1.4776 N_F=1.4830
	UV Light	no fluorescence	no fluorescence	no fluorescence
883	Density			
	Dispersion Curves			
	Elemental Analysis			
	Refractive Index	1.47804	1.47807	1.47798
	UV Light	no fluorescence	no fluorescence	no fluorescence

Table 7 Continued

LAB CODE	METHODS	Item A	Item B	Item C
884	Color	clear	clear	clear
	Density			more dense than A & B
	Physical Match	no physical match	no physical match	no physical match
	Thickness	N_C= .191" N_D= .159" N_F= .169"	N_C= .203" N_D= .169" N_F= .174"	N_C= .157" N_D= .619" N_F= .137"
	UV Light	nothing detectable	nothing detectable	nothing detectable
885	Color	same	same	same
	Density	same	same	same
	Physical Match	none	none	none
	Refractive Index	1.478	1.478	1.478
	Thickness	unequal surfaces	unequal surfaces	unequal surfaces
	UV Light	short wave green fluorescence	short wave green fluorescence	short wave green fluorescence
	other (specify)	differential I.R. - inconclusive	differential I.R. - inconclusive	differential I.R. - Inconclusive
888	Dispersion Curves	V= 58.386	V= 58.226	V= 59.146
	Refractive Index	N_C= 1.4763 N_D= 1.4786 N_F= 1.4845	N_C= 1.4763 N_D= 1.4786 N_F= 1.4845	N_C= 1.4765 N_D= 1.4788 N_F= 1.4846
894	Density	same as C	same as C	same as A & B
	Physical Match	none	none	none
	Refractive Index	N_D= 1.4782	N_D= 1.4782	N_D= 1.4782
	UV Light	very slight orange fluorescence	same	same
896	Color	colorless	colorless	colorless
	Density	2.2614	2.2614	2.2614
	Dispersion Curves	N_C= 1.4758 N_D= 1.4779 N_F= 1.4828	N_C= 1.4758 N_D= 1.4779 N_F= 1.4828	N_C= 1.4758 N_D= 1.4779 N_F= 1.4878
	Refractive Index	N_D= 1.4779	N_D= 1.4779	N_D= 1.4779
897	Color	colorless	colorless	colorless
	Density	2.24	2.24	2.24
	Refractive Index	1.4766	1.4766	1.4766
	UV Light	no fluorescence	no fluorescence	no fluorescence
	X-ray fluorescence	same elements as B & C	same elements as A & C	same elements as A & B

Table 7 continued

LAB CODE	METHOD	Item A	Item B	Item C
899	Color	same	same	same
	Elemental Analysis	Si,As,Zn	Si,As,Zn	Si,As,Zn
	Refractive Index	1.4765	1.4761	1.4761
	X-ray Fluorescence	Si,As,Zn	Si,As,Zn	Si,As,Zn
901	Color	qualitative	qualitative	qualitative
	Elemental Analysis			
	Physical Match			
	Refractive Index	1.476-1.478 at 22.5°C	1.476-1.478 at 22.5°C	1.476-1.478 at 22.5°C
	Thickness	1.92mm	2.00-2.10mm	2.00-2.10mm
	UV Light	qualitative	qualitative	qualitative
903	Density	same	same	same
	Elemental Analysis	A,B,C similar.	Elements present:	C,B,Si,P,Mn,Pb; Fe,Na,Al
	Refractive Index	1.4777	1.4774	1.4770
	UV Light (long and short)	No fluorescence for A, B, C		
904	Color	same	same	same
	Density	same	same	same
	Dispersion Curves	same	same	same
	Refractive Index	same	same	same
	@ 25°C	Wavelength / Refractive Index		
		589.6 / 1.4774		
		488.0 / 1.4823		
		650.0 / 1.4764		
	Thickness	same	same	same
907	Color			
	Density			
	Dispersion Curves			
	Physical Match			
	Thickness			
	UV Light			
908	Color	colorless with frosted sides	colorless with frosted sides	colorless with frosted sides
	Density	2.334 g/ml	2.334 g/ml	2.334 g/ml
	Refractive Index	1.478-1.480	1.478-1.480	1.478-1.480
	UV Light	negative	negative	negative
909	Color			
	Density	A,B,C match by comparative analysis		
	Dispersion Curves			
	Elemental Analysis	All samples contained Si,Mg,Mn,B,Fe,Al,Na,Ca		
	Refractive Index	A,B,C match at 1.488 @ 25°C at the sodium line		
	UV Light	No fluorescence under short and long wave UV		
915	Color			
	Dispersion Curves	V=62.13	V=62.02	V=62.24
	Refractive Index	N_D=1.4777$_0$	N_D=1.4778$_1$	N_D=1.4777$_5$
	UV Light			

Table 7 continued

LAB CODE	METHOD	Item A	Item B	Item C
921	Color			
	Density			
	Elemental Analysis			
	Refractive Index			
	UV Light			
923	Visual Inspection			
925	Color			
	Density	2.255	>2.25	2.255
	Dispersion Curves			
	Physical Match	no fit	no fit	no fit
	Refractive Index	N_C=1.4750	N_C=1.4750	N_C=1.4750
		N_D=1.4773	N_D=1.4772	N_D=1.4772
		N_F=1.4825	N_F=1.4826	N_F=1.4827
	Thickness	.246"	.258"	.243"
	Trace	Trace: Fe Ti Cu Ca Zn	Trace: Fe Ti Cu Ca Zn	Trace: Fe Ti Cu Ca Zn
926	Color	colorless, 4 frosted sides	colorless, 4 frosted sides	colorless, 4 frosted sides
	Density	same	same	more dense than A&B
	Thickness	irregular	irregular	irregular
	UV Light	blue-purple	blue-purple	blue-purple
	Physical Match	none	none	none
948	Color	clear	clear	clear
	Density	similar	similar	similar
	Elemental Analysis	Zn, Al, Si	Zn, Si	Zn, Si
	Refractive Index	1.4799	1.4788	1.4790
	Thickness	.1417 inch		.1415 inch
		.1404 inch	.1623 inch	.1609 inch
	UV Light	no fluorescence	no fluorescence	no fluorescence
	Polarized Light	180° extinction	180° extinction	180° extinction
958	Color	clear	clear	clear
	Density Gradient	same	same	same
	Elemental Analysis	B, Si, Fe, As, Mg, Mn, Al, Ca, Na	B, Si, Fe, As, Mg, Mn, Al, Ca, Na	B, Si, Fe, As, Mg, Mn, Al, Ca, Na
	Physical Match	no	no	no
	Refractive Index	1.487 at 26°C	1.487 at 26°C	1.487 at 26°C
	Thickness	not recorded	not recorded	no measureable side
	UV Light	no fluorescence	no fluorescence	no fluorescence
960	Color	similar	similar	similar
	Density	different	same	same
	Physical Match	no	no	no
	Refractive Index	1.484 ±.004	1.484 ±.004	1.484 ±.004
	UV Light	same	same	same
	X-ray Fluorescence	different	similar	similar

Table 7 continued

LAB CODE	METHOD	Item A	Item B	Item C
961	Color	same as C	same as C	same as A & B
	Density	less than C	less than C	greater than A & B
	Physical Match	none	none	none
	Refractive Index	different from C	different from C	different from C
	Thickness	4.28	4.14	3.12
	UV Light	same as C	same as C	same as A & B
	Opacity of 4 ground Faces	two less than C	two less than C	all 4 opaque
962	Color	clear	clear	clear
	Dispersion Curves	nearly identical to C	slightly higher than A & C	nearly identical to A
	Physical Match	none	none	none
	Thickness	0.160 ±0.001	0.106 ±0.001	0.147 ±0.001
	UV Light	no fluorescence	no fluorescence	no fluorescence
969	Color			
	Density			
	Dispersion Curves			
	Refractive Index	1.478	1.478	1.478
	UV Light			
970	Color			
	Physical Match			
	Thickness			
	UV Light			
974	Color	colorless	colorless	colorless
	Density	same	same	same
	Dispersion Curves	0.0080	0.0079	0.0080
	Elemental Analysis	same	same	same
	Refractive Index	N_D=1.4786	N_D=1.4789	N_D=1.4786
	Thickness	.1299" NA	.1248" NA	N.D.
	UV Light	Nil	Nil	Nil
	Visual	mold marks	mold marks	mold marks
975	Color	same	same	same
	Density	similar	similar	similar
	Dispersion Curves	questionable	questionable	questionable
	Physical Match	no match	no match	no match
	Refractive Index	similar	similar	similar
	Thickness	same	same	same
	UV Light	same	same	same
978	Color	clear	clear	clear
	Density	2.255	2.254	2.253
	Dispersion Curves	identical to B & C	identical to A & C	identical to A & B
	Elemental Analysis		identical spectrums	
	Physical Match	negative	negative	negative
	Refractive Index	N_C=1.47595	N_C=1.47595	N_C=1.47595
		N_D=1.47805	N_D=1.47805	N_D=1.47805
		N_F=1.48325	N_F=1.48325	N_F=1.48325
	UV Light	no fluorescence	no fluorescence	no fluorescence

Table 7 continued

LAB CODE	METHODS	Item A	Item B	Item C
979	Color			
	Density			
	Refractive Index			
	UV Light			
980	Color	clear	clear	clear
	Density	1.2581	1.2585	1.2585
	Elemental Analysis	B, Mn, Mg, As, Fe, Al, Ni, Si	B, Mn, Mg, As, Si, Fe, Al	B, Mn, Mg, As, Si, Fe, Al
	Physical Match	none	none	none
	Refractive Index	1.4787	1.4787	1.4787
	Thickness	0.1592" 0.1568"	0.1322" 0.1599"	0.1254" 0.1384"
	UV Light	negative	negative	negative
986	Color	clear	clear	clear
	Density	between 0.1995 and 0.4263	same	same
	Elemental Analysis	Major: Si, B, Al, Na, Mg,Ca Minor: Fe, Ma, Ti, Zr, As, Ca	same same	same same
	Physical Match	2 parrallel sides clear - other frosted	2 parallel sides clear - other 4 frosted	2 parallel sides clear - other 4 frosted
	Thickness	not uniform	not uniform	not uniform
	UV Light	no fluorescence	no fluorescence	no fluorescence
987	Color	same	same	same
	Density	same	same	same
	Physical Match	no match	no match	no match
	Refractive Index	not same as C	not same as C	not same as A & B
	Thickness	no match	no match	no match
	UV Light	no fluorescence	no fluorescence	no fluorescence
994	Color			
	Density			
	Elemental Analysis			
	Refractive Index			
	UV Light			
995	Color	same	same	same
	Density	same	same	same
	Physical Match	none	none	none
	Refractive Index	1.4769	1.4777	1.4777
	UV Light	same	same	same
	Thickness	not uniform	not uniform	not uniform

Table 8

Summary of Responses to Question 3

Question 3: Specify the methods and/or instructions which were used for those methods checked in Question 2.

Methods or Instructions	Frequency
Refractive Index	
1. Cargille liquids	13
2. Cargille liquids, hot stage	11
3. Becke line method, Cargille standards	9
4. Cargille liquids, hot stage, monochromator	8
5. DC 550 silicone oil, hot stage, monochromator, microscope	4
6. Cargille liquids, hot stage, monochromator, microscope	3
7. Cargille oils, monochromator	3
8. 710 oil, hot stage	2
9. Refractometer, standard liquid and immersion method (Becke line)	2
10. Cargille liquids, hot stage, microscope, filters	2
11. Becke line method, sodium vapor lamp, hot stage	2
12. Sodium vapor lamp, hot stage, Cargille liquids	2
13. Hot stage, dibutylphthalate	2
14. Cargille liquids and filters	1
15. Direct method	1
16. Cargille liquids, Dow 550 silicone oil, hot stage	1
17. Microscope, Cargille liquids, sodium vapor lamp, color filters, benzyl alcohol, di-n-butyl phthalate	1
18. Refractometer	1
19. Cargille liquid, hot stage, interference filter	1
20. Cargille liquids, Becke line, red filters	1
21. Cargille liquids, microscope, narrow band filter	1
22. Phase contrast/hot stage microscopy	1
23. Tributyl citrate Bromobenzene	1
24. Cargille liquids, refractometer	1
25. Cargille liquids, monochromator, Emmon's method	1
26. Programmed hot stage, 3 filters	1
27. Monochromator, hot stage, Dow 550 oil	1
28. Monochromator, immersion liquids of chloroform and xylene	1
29. Becke line, Cargille liquids, refractometer	1
30. Hot stage	1
31. Cargille liquids, polarizing microscope	1
32. Cargille liquids, polarizing light	1
33. Hot stage, silicone oil, microscope, sodium filter	1
34. Dispersion staining objective	1
35. Becke line, microscope, Cargille liquids	1

Table 8 (continued)

Methods or Instructions

Density

1.	Bromoform and Bromobenzene	55
2.	Gradient tube and temperature gradient	4
3.	Bromoform and ethanol	4
4.	Sink-float method	4
5.	Bromoform and xylene	3
6.	$KHgI_3$ and water	3
7.	Bromobenzene and methylene iodine	3
8.	Bromoform and nitrobenzene	3
9.	Bromoform and Chlorobenzene	2
10.	Tetrabromoethane and ethyl alcohol	2
11.	Bromoform and tetrachloroethane	1
12.	Carbon tetrachloride and bromobenzene	1
13.	Benzene and Bromoform	1
14.	Hexane and Bromoform	1
15.	Density gradient oils	1
16.	$C_6H_6 + CH_2I_2$	1
17.	Bromoform and Ethylene Bromide	1
18.	Pycnometer	1
19.	Chloroform and tetrachromoethane	1
20.	Mercuric Iodide and Potassium Iodide	1
21.	Bromoform and Methylene	1
22.	Bromobenzene and tetra-bromoethane	1

U.V. Light

1.	Short wave	14
2.	Long wave	11
3.	U.V. viewing cabinet	3
4.	254 nm lamp	3
5.	354 nm lamp	1
6.	350 nm lamp	1
7.	365 nm lamp	1
8.	Short and long wave generator	1

Elemental Analysis

1.	Emission spectrography	20
2.	Ash spectrographic analysis	1
3.	Mixed liquid CO_3; graphite electrodes	1
4.	Energy dispersive X-ray	4
5.	Grating spectrograph	2

Table 8 (continued)

Methods or Instructions

Dispersion Curves	
1. Cargille liquids, hot stage, variable wavelength interference filters	16
2. Temperature vs. wavelength using hot stage, monochromator and microscope	2
3. Hot stage, sodium D lamp, daylight lamp with interference filters	1
4. Dispersion staining objective	1
5. Emmon's double variable method	1
6. McCrone objective and Cargille oils	1
Thickness	
1. Micrometer	10
2. Microcaliper	3
3. Caliper	4
4. Dial readout caliper	1
Physical Match	
1. Microscope	5
2. Visual and stereo	1
3. Jigsaw match method	1
X-Ray Fluorescence	
1. X-ray spectrometer	3
2. 30 KV, 1.5 ma 100 sec in air	2
3. Vacuum path, 100 sec run	1
4. 24 KV, 500 ma	1
5. Isotope source	1
Color	
1. Visual and microscopic exam	1
2. Incandescent and fluorescent light	1
3. Sunlight	1
4. Macroscopic and microscopic by eye	1
5. Visual and stereo examination	1
6. Visual exam under normal U.V. light	1

Table 9

Tabulation of Responses to Question 3

Question 3: Specify the methods and/or instructions which were used for those methods checked in Question 2.

LAB CODE

705 1) X-ray fluorescence - Vacuum path - 100 second run
2) Refractive Index. - three wavelengths: 700, 590, 490. 1.486 Cargille liquid
3) Dispersion Staining - Cargille liquid 1.486 Nd
4) UV - long, short wave

712 1) Relative density determination using a bromoform and bromobenzine mixture and alternate heating and cooling of a water jacket
2) Elemental Analysis: the samples were powdered and subjected to arc source emission spectrography.
3) Refractive Index determination: a stereo microscope, monochromator and Hot Stage were used with Cargille immersion liquids 1.480 and 1.490

713 1) Refractive index using Cargille liquids and hot stage (Becke line)

715 1) Stereomicroscopy
2) Emission Spectroscopy
3) Caliper
4) UV light (short and long)

717 1) Density - Gradient tubes using mixtures of bromobenzene and methylene iodine.
2) Refractive index - Cargille liquids, hot stage and monochromator
3) Elemental Analysis - Jarrell-Ash Spectrographic analysis

718 1) Density gradient columns with mixture of bromobenzene and bromoform.
2) Cargille liquids observing Becke line of sodium lamp with hot stage. Working on hot stage with 1.482 liquid, match point for A is 36°, B & C, 35°.

724 1) Color/UV light for visual
2) Density: gradient tubes using bromoform and monobromobenzene.
3) Refractive Index using Cargille liquids.

726 1) Density using comparative floatation method with bromoform and nitrobenzene.
2) Refractive Index using Cargille liquids.
3) Thickness using micrometer.
4) UV Fluorescence using long and short wave length lamps.

Table 9 continued

LAB CODE

727 1) Refractive Index using 710 oil on hot stage.
2) Sensitivity gradient with bromoform and etoh.
3) Visual observation

729 1) Density - gradient tube - temperature gradient
2) Refractive Index - refractometer

730 1) Elemental Analysis: 10 mg sample crushed and mixed Li_2CO_3 flux; graphite electrodes
2) Microscope
3) UV dual wavelength exam
4) Microcaliper

731 1) Density: sink-float with Bromoform/Bromobenzene and measure density of mixture. Density gradient tube: 7" liquid gradient; range 2.300-2.200 g/cc
2) Refractive Index using Cargille liquids
3) Emission Spectrograph: 10 mg samples of each specimen; 60 sec exposure

739 1) Density gradient tubes with mixtures of bromoform and bromobenzene
2) Refractive Index using Cargille liquids at room temp on polarizing microscope
3) Emission Spectrograph
4) Micrometer Caliper

740 1) Density comparison using density gradient column with bromobenzene and bromoform
2) Visual comparison
3) Dispersion curves using Cargille liquids, hot stage, variable wavelength interference filter
4) UV Light
5) X-ray fluorescence

742 1) Refractive Index using DC550 silicone oil, hot stage, high intensity monochromator, polarizing microscope.
2) X-ray fluorescence - 30 KV, 1.5 ma, 100 seconds in air
3) Thickness gauge
4) UV fluorescence using hand-held 254 nm lamp

745 1) Refractive index by Becke line method using Cargille liquids at 3 wave lengths using narrow pass interference filters at 489, 585 and 667 NM.
2) Density (comparative) using bromoform and bromobenzene.
3) Caliper
4) Fluorescence under short wave UV

Table 9 continued

LAB CODE	
746	1) Density comparison by mixtures of bromobenzene and bromoform 2) Refractive Index: comparative RI determined by Becke line method using Cargille standards. 3) Elemental Analysis: qualitative emission spectrograph. 4) UV Light: visual examination in short and long UV. 5) Physical Match: visual comparison of surfaces at 18X.
747	1) Density gradient tube of bromoform and 1, 1, 2, 2 tetrachlorethane. 2) Hartman graph paper. 3) Refractive Index: Cargille liquids, hot stage, monochromator, Emmon's method AMR scanning scope, EDAX Energy dispersive x-ray.
748	1) Refractive Index using Cargille liquids, hot stage. 2) Density gradient tubes with mixture of bromobenzene and bromoform. 3) Microscope. 4) UV viewing cabinet. 5) Micrometer.
750	1) Examination with short wave UV mineralite. 2) Refractive Index-comparison exam using monochromator at several different wavelengths and immersion liquids consisting of varying mixtures of chloroform and xylene. 3) Density gradient comparison using density gradient tube and mono-bromobenzene and bromoform.
751	1) Color using incandescent and fluorescent lights. 2) Refractive Index using Cargille liquids, hot stage and monochromator. 3) UV light using light box with both short and long wave UV 4) Dispersion curve using Cargille liquid, hot stage and monochromator.
752	1) Refractive Index using dibutyl phthalate and hot stage. 2) Density comparison by sink-float method using variable temperature.
754	1) Density determined by gradient tube using bromoform and chlorobenzene. 2) Dispersion curves determined by temperature vs. wavelength method using hot stage monochromator and microscope. 3) Elemental analysis determined with emission spectrograph.
756	1) Refractive Index using Cargille liquids and hot stage. 2) Dispersion curves. 3) Spectrographic analysis.
757	1) Refractive Index using Cargille liquids and hot stage. 2) Density using mixture of bromoform and bromobenzene. 3) Elemental analysis using energy dispersive x-ray. 4) Physical match by binocular microscope.

Table 9 continued

LAB CODE	
760	1) UV light. 2) Refractive Index by observation of Becke line using Cargille liquids. 3) Density by sink-float method in mixture of bromoform and ethanol.
763	1) Relative density using carbon tetrachloride and bromobenzene. 2) Refractive Index using Cargille liquids observing Becke line. 3) Vernier calipers.
765	1) Density in benzene/bromoform. 2) Refractive Index using Cargille liquids.
768	1) Relative density in bromoform xlyene. 2) Dispersion curve using Cargille liquids, hot stage and filter. 3) Refractive Index using Cargille liquids.
769	1) Refractive Index and dispersion curves using Cargille oils and monochromator. 2) Elemental analysis by emission specgrograph. 3) Density using bromobenzene and bromoform. 4) UV light source 354 nm.
772	1) Density gradient tubes with mixutre of hexane and bromoform 2) Refractive Index using refractometer calibrated with standard piece of glass and standard liquid and immersion method (Becke line).
778	1) Refractive Index using hot stage and 710 fluid. 2) X-ray fluorescence.
779	1) Density gradient tubes using bromobenzene and methylene iodide. 2) Refractive Index using Cargille liquids and hot stage. 3) Micrometer.
784	1) Refractive index using Cargille liquids and hot stage. 2) Density gradient for comparative densities with a mixute of bromobenzene and bromoform . 3) Micrometer. 4) Stereo microscope.
786	1) Density gradient tubes with mixture of bromoform and xylene. 2) Elemental analysis using DC Arc with emission spectrograph.
787	None listed
789	1) Density using mixture of $KHgI_3$ with water. 2) Refractive index using Cargille liquids, microscope and narrow band filter about 590. 3) Dispersion curves using Cargille liquids, microscope, 3 narrow band filters: 590, 480, 670.

Table 9 continued

LAB CODE	
790	1) Densities compared using sink-float method (bromoform and bromobenzene) 2) Refractive indices compared using programmed hot stage and 3 filters
794	1) Density with thermal density gradient column 2) Refractive Index direct comparison using Becke line method - sodium vapor lamp, hot stage. 3) Microscope
797	1) Density gradient tubes with mixture of bromobenzene and bromoform. 2) Refractive Index and dispersion curves using Cargille liquids, hot stage, monochromator. 3) Elemental analysis using emission spectrograph.
798	1) Refractive Index using Cargille liquids. 2) Density gradient using bromobenzene and bromoform. 3) Elemental analysis.
799	1) Refractive Index using Cargille liquids, hot stage, and sodium D lamp 589 Mu. 2) Dispersion using hot stage, sodium D lamp 589 Mu, daylight lamp with interference filters for wave lengths of 655 Mu and 487 Mu. 3) Density gradient tubes with mixtures of bromobenzene and bromoform. 4) X-ray fluorescence, net counts of the elements Fe, Cu, Pb, Sr, and Zr were ratioed to the As net count in each sample to produce numberical values for comparative purposes.
804	1) Density gradient using bromoform and nitrobenzene. 2) Recording fluorescence spectrophotometer. 3) Elemental analysis by grating spectrograph.
805	1) Color using sunlight and incandescent. 2) Density using mixture of bromobenzene and bromoform. 3) Dispersion using Cargille liquids. 4) Elemental analysis. 5) UV light using short and long wave generator.
806	1) Color and physical match - semi-micro observation 10X to 40X on stereoscope. 2) Dial readout vernier caliper. 3) Density gradient tubes using aqueous solution of mercunic potassium iodide. 4) Refractive index using hot stage, silicon oil, microscope, sodium filter.
813	1) Density gradient tubes with mixtures of bromoform and bromobenzene. 2) UV light 254 and 350 mm. 3) X-ray fluorescence using 30 KV, 1.5 ma. 4) Dispersion curve and refractive index indirectly using dispersion staining objective. 5) Vernier calipers.

Table 9 continued

LAB CODE	
815	1) Density gradient tubes using bromoform and bromobenzene. 2) Dispersion curves using Cargille liquids with blue, yellow and red filters. 3) Emission spectrograph 4) Refractive index using Cargille liquids. Temperature variation using Cargille liquids, hot stage, phase contrast and no filter.
818	1) Density comparison via thermally generated density gradient. 2) Refractive index comparison via dispersion staining objective. 3) X-ray fluorescence analysis using X-ray spectrometer. 4) Microscope.
821	1) Refractive index using Cargille liquids and Becke line. 2) Density using bromoform/xylene density gradient columns.
823	1) Thickness. 2) UV. 3) Refractive index using hot stage, monochromator and Cargille oils. 4) Dispersion curves. 5) Comparative density analysis using 1,1,2,2 tetrabromoethane and ethyl alcohol. 6) Elemental analysis using emission spectrograph
827	1) Refractive index using Cargille liquids. 2) Density gradient tubes using bromoform and bromobenzene. 3) Elemental analysis using emission spectrograph. 4) DTA: Tracor-Stone DTA
829	1) Density using bromoform and bromobenzene. 2) Refractive index using Cargille liquids and Becke line, red filter. 3) Stage micrometer. 4) Long and short wave UV light.
831	1) Density gradient tube using bromoform and bromobenzene.
832	1) Density using 8 microdensity gradient oils in column. 2) Refractive index and dispersion curves using Cargille liquids, hot stage, monochromator, microscope observing the Becke line. 3) X-ray fluorescence using spectrometer. 4) Visual color comparisons.
833	1) Density gradient tubes using bromoform and bromobenzene. 2) Refractive index using refractometer, Becke line using Cargille liquid. 3) Microscope 10X.
835	1) Refractive index using Cargille liquids. 2) Density gradient tubes using bromobenzene and bromoform. 3) UV light. 4) Elemental analysis using emission spectrograph.
837	1) Refractive index and dispersion curves using Cargille liquids, monochromator, hot stage. 2) Density by sink-float method 3) Elemental analysis by 1.5M spectrograph

Table 9 continued

LAB CODE

838 1) Color - Visual and microscopic examination
2) Density: Relative density by utilizing mixtures of bromoform and bromobenzene
3) Dispersion Curves: Hot stage; Cargille liquid; interference filter
4) Refractive Index: Cargille liquids; hot stage; interference filter
5) UV Light: Short and long range UV light

839 1) Density - Sink/float method using C_6H_6 + CH_2I_2 - All 3 samples run simultaneously; initially 100% CH_2I_2 - when samples sunk, endpoint was backtitrated several times using 7ul additions of each liquid
2) X-ray Fluorescence - All tube 24KV 500ma - present total count to 10,000 counts -
a) visual compaison of tracings - no sig. diff.
b) semiquant. comparison of peak intervals - no sig. diff. Elements present: Si, Ca, Fe, Zr, As
3) General - microscopic - all clear - some edges frosted others cut A & B had one thickness of 0.164" (surfaces were parallel) C had no parallel surfaces thickness varied 0.068"-0.091"
4) Dispersion - cargille liquid, mettler hot stage (31°, 33°, 35°, 37°, 39°C) 1.480

	A	B	C
31°	617nm	617	616
33°	557	557	556
35°	516	514	515
37°	479	478	479
39°	456	456	456nm

5) Laser emission spec. - Qualitative - all consistant.

842 1) Density - Density gradient tubes using mixture of bromoform and ethylene bromide
2) Refractive Index - using cargille liquids
3) Elemental Analysis - using spectrograph

843 1) Density gradient tubes with mixture of bromobenzene and bromoform
2) Refractive index using cargille liquids and refractometer

847 1) Float/sink test in known liquids followed by density gradient tubes with mixture of bromobenzene and bromoform
2) Refractive index using cargille liquids, mettler hot stage. Evaluated as temp. vs. λ only no calculations made.
3) Same as 2) except two runs (w) different media at diff. temp.

Table 9 continued

LAB CODE

848 1) Density - Sink-float using aqueous solution of potassium mercuric iodide
2) Refractive index using dibutylphthalate and the hot stage microscope. All three samples have comparable match point temperatures.

A = 59.7°C
B = 59.4°C
C = 59.8°C

849 1) Refractive Index - direct
2) Density gradient tubes with mixture of bromobenzene and bromoform- density by RI of mixture
3) Visual inspection for color and physical properties was inconclusive
4) Qualitative Emission Spectrographic Analysis for elements indicated Cadmium present in Sample A and absent in Samples B & C. No discernible difference in composition was detected for Samples B and C.

853 1) Density gradient c bromobenzene and bromoform
2) Emission spectrograph

854 1) Density using floatation method
2) Dispersion curves - refractive index 1.478 at 24.5°C for sample A, B, C.
3) UV Light - no fluorescence on all three samples
4) X-ray fluorescence - traces of As and Zr present in all three samples A, B, C

Ratio of $\frac{K\alpha_{As}}{K\alpha_{Zr}}$ agrees in sample A, B and C within experimental error. ($K\alpha_{As}$ fixed @ 50,000 counts)

855 1) Color determination - Macroscopic and microscopic by eye
2) Density - Density gradient tubes with bromoform/bromobenzene mixture
3) Elemental Analysis - Emission Spectrograph
4) Refractive Index and dispersion - Equipment - A) Cargille liquids, B) Mettler Hot stage, C) AO Star Microscope, D) Balzer light filters, 589A, 486A, 656A.
Procedure - Using the Becke line method, the exact temperature for extinction for each wavelength was recorded in a cargille liquid of known refractive index. From this data refractive index and dispersion were calculated.
5) Thickness - Micrometer.

Table 9 continued

LAB CODE		
856	1)	Density - Sink-float method using Bromobenzene and methylene iodide
	2)	Refractive Index - Using cargille liquids, Becke line method, determining refractive indices at 4.880nm, 589.6nm, and 650.0nm
	3)	UV Lamp
859	1)	Color - Visual and stereo examination
	2)	Density - Gradient tube c bromobenzene/bromoform
	3)	Elemental Analysis - SEM/Energy Dispersive X-ray
	4)	Physical Match - Visual and stereo examination
	5)	Refractive Index - Phase contrast/hot stage microscopy (monochromator not available)
	6)	Thickness - Visual and stereo examination - direct comparison
	7)	UV Light - Visual comparison
860	1)	Birefringence and Micro Appearance by polarizing microscope
	2)	Short and long UV wavelengths
	3)	Refractive index using cargille liquids by Becke line method
	4)	Comparative floatation method using a mixture of s-tetra-bromoethane and absolute alcohol
863	1)	Physical naked eye observation and UV light naked eye
	2)	Density gradient types with mixture of bromobenzene and bromoform
	3)	Elemental Analysis Emission Spectrograph
	4)	Thickness - micrometer measurement
866	1)	Density gradient tubes pycnometer
	2)	Refractive index using cargille liquids and sodium filter
	3)	Elemental Analysis - emission spectrograph B, Si, Ca, Na, Al, Mg, Mn, As, Zr, Ti, Fe, Be
868	1)	Visual observation of color
	2)	Refractive index using cargille liquid and 3 monochromatic filters
872	1)	Density - Comparative floatation Method using mixture of bromobenzene and bromoform, no differences detected between samples A, B, and C qualitatively
	2)	Elemental Analysis - Qualitative comparison of emission spectra did not reveal any significant differences in elemental composition
	3)	Refractive Index - The Immersion Method using a Mettler FP-5 hot stage, Dow Corning 710 Silicone Oil and red, yellow, and blue filters. No difference was noted in refractive indices of Samples A and B, however the refractive index of Sample C was different
	4)	Color - Samples A, B, and C were colorless
	5)	Physical Match - Samples A, B, and C could not be mechanically matched.
	6)	Thickness - Sample A - 0.198"-thick, Sample B - 0.146"-thick, Sample C - 0.134"-thick
	7)	UV Light - Samples A, B, and C did not exhibit fluorescence when exposed to UV light.

Table 9 continued

LAB CODE		
873	1)	Density free floatation method with chloroform and tetra-cromoethane
874	1)	Refractive Index - Becke line comparative between samples using Cargille Refractive index liquids
	2)	Density - Comparative, sink-float-neutral bouyancy method, utilizing Bromoform/Bromobenzene
875	1)	Refractive index using cargille liquids, hot stage, monochromator and Hartman dispersion graph
	2)	Density - Bromoform, bromobenzene density gradient tube
	3)	Dispersion as noted above
883	1)	Refractive Index - Mettler hot stage dibutyl phthalate as immersion oil
	2)	Dispersion - Emmons double variable method
	3)	Density - comparative only: Bromobenzene and bromoform as an immersion oil
	4)	Emission Spec. - 2 mg of sample mixed with graphites burned for 90 sec.
884	1)	Density - Floatation balancing method with bromobenzene and bromoform. C more dense than A or B
	2)	Simple ultraviolet light
	3)	Thickness - micrometer caliper
	4)	No instrumentation at temporary lab site
885	1)	Refractive Index using cargille liquids, polarized light
	2)	Density gradient (sink-float) with mixture of bromoform/ethanol
	3)	UV light for fluorescence
	4)	Jigsaw match method for physical match
	5)	Differential infrared analysis
888	1)	Refractive Index - double variation method - Dow oil #550 - RI. D. 1.49628 Microscope C 1.49240 F. - 1.50609 Dndt = 3.67×10^{-4} - hot stage Results: A) N_C - 1.4763, N_D - 1.4786, N_F - 1.4845; B) N_C - 1.4763, N_D - 1.4786, N_F - 1.4845; C) N_C - 1.4765, N_D - 1.4788, N_F - 1.4846 Diversion V = 58.386 V - 58.226 V = 59.146
	2)	Dispersion curve plotting (λ_0) wavelength (N_m) against temperature.
894	1)	Density determination by sink-float method using bromoform/benzene
	2)	Refractive index determination by hot-stage, sodium vapor lamp and cargille liquids
	3)	Microscopic examination

Table 9 continued

LAB CODE		
896	1)	Density - density balance and liquid mixture of Bromoform and absolute alcohol
	2)	Refractive Index and Dispersion - Monochromator, hot stage, phase microscope, silicone oil
897	1)	Density gradient tubes with mixture of bromobenzene and bromoform. Density determined by refractive index of bromobenzene-bromoform mixture taken from level of glass in density gradient tube. Refractive index of this liquid determined on Abbe refractometer.
	2)	Refractive index of glass using Cargille liquids and hot stage
	3)	X-ray fluorescence on Finnigan X-ray fluorescence spectrometer
	4)	UV light in Chromato-Vue cabinet
899	1)	Sp Gr. - Bromoform and bromobenzene
	2)	Refractive Index - Cargille liquids and mettler FP-52
	3)	Elemental Analysis - E.D.X.
	4)	Dispersion Staining - McCrone Lens - Leitz Orthopl
901	1)	Refractive Index - Becke line - using Bausch and Lomb Dynazoom Scope and cargille liquid standards
	2)	Elemental Analysis - Emission spectrograph - Baird Atomic Instrument, Kodak Glass Plates - Ultra Carbon Carbon Electrodes
	3)	Physical comparison, - Using Bausch and Lomb Stereoscope (7-30x)
903	1)	Density - Using mixture of Bromobenzene and Bromoform. A, B, & C similar
	2)	Elemental analysis using Emission Spectrograph revealed the following elements: C, B, Si, P, Mn, Pb, Fe, Na, Al. A, B, & C similar
	3)	Refractive index using Cargille Liquids, Mettler Hot Stage and Monochromator. A, B, & C similar.
	4)	Fluorescence check using Ultraviolet Light, both short and long wave. Negative.
904	1)	Density gradient tubes with mixtures of bromobenzene and bromoform
	2)	Refractive index using cargille liquids and narrow band pass filters 589.6, 488.0, 650.0
907	1)	Density using bromobenzene and bromoform in a test tube. (sink-float)
	2)	Dispersion using McCrone objective and Cargille Oils.
908	1)	Refractive Index - Immersion method using Cargille liquids
	2)	Density - Pycnometer method using liquid (bromoform/bromobenzene mixture) from comparative density column.

Table 9 continued

LAB CODE		
909	1)	Density gradient tubes with mixture of bromobenzene and bromoform. Samples of Exhibits A, B, and C match in two different tubes. Samples settled at the same levels - comparative analysis only.
	2)	Emission spectrographic analysis, qualitative analysis only, all samples contained Si, Mg, Mn, B, Fe, Al, Na, and Ca.
	3)	Observed under short and long wave UV light - no fluorescence in any of the samples
	4)	Refractive index and dispersion curves using Cargille liquids and the Mettler hot stage. Glass samples were match in Cargille liquid of 1.488 @ 25°C at the sodium D line.

	Temperature, °C*		
Wavelength	Exh C	ExhA	Exh B
6559 nm	47.0	47.3	47.4
5905 nm	49.9	50.0	49.6
4864 nm	55.2	55.5	55.4

*Temperatures at which the RI of glass matches that of liquid.

915	1)	n_D and V determined using Cargille 1.480 oil, monochromator, hot stage and microscope.
	2)	UV light exam done using UV illuminator (short and long wave)
	3)	Visual exam done using zoom stereoscope (10-60x)
921	1)	Color - Microscope
	2)	Density - Density gradient using bromobenzene and bromoform
	3)	Refractive Index - Becke Line Method using Cargille liquids
	4)	Elemental Analysis - Emission Spectrograph
	5)	UV Light - the three pieces of glass were placed under UV light and observed.
923	1)	Visual inspection
925	1)	Density - temperature-gradient density column utilizing aqueous solution of mercuric iodide and potassium iodide
	2)	Refractive Index - Using Cargille liquids, Mettler microfurnace on AO phase contrast microscope, determined at 3 wavelengths (C, D, F) using filters.
	3)	EDX - Nuclear semiconductor, Inc., Model 440, Energy-dispersive X-ray apparatus; Tracor-North. 880 Antlyzer, Minicollimator System.
926	1)	Density - Used floatation balancing method with bromoform and bromobenzene. Sample C more dense than A and B.
	2)	Color - Visual exam under normal and UV light.

Table 9 continued

LAB CODE	
948	1) Density - Comparative density using Bromoform/Bromobenzene mixture 2) Refractive Index - Cargille liquids using Mettler Hot Stage and Sodium Light N_d^{25C} Becke line. 3) EDAX (Energy Dispersive Analysis of X-rays) 4) Thickness - by micrometer 5) Fluorescence - long and short-wave UV light 6) Polarized Light - polarizing filter
958	1) Color by microscopic examination using the stereo microscope 2) Refractive index using Becke Line, bright field microscope and Cargille Liquids 3) Density Gradient using comparative method with glass tubes and Bromoform and Bromobenzene mixture 4) UV Light using both short and long-wave UV 5) Elemental Analysis using the Emission Spectrograph and a 60 sec. burn time for the glass
960	1) Retractive Index - Cargille Liquid 2) Density - Bromobenzene, Methylene 3) X-ray Fluorescence - Isotope Source
961	1) Color - Visual, microscopic comparison 2) Density - Sink-float technique using bromoform and mono-bromobenzene 3) Physical Match - Visual, microscopic examination 4) Ref. Index - Microscope, Cargille liquids, sodium vapor lamp. Also, microscope, color filters and mixtures of benzyl alcohol and di-m-butylphthalate. 5) Thickness - Vernier calipers. Other opposing faces very similar 6) UV Light - Fluorescence observations. None observed. 7) Opacity - Visual comparison
962	1) Dispersion curve using Cargille liquid N_D^{25} 1.480, MP - 2 stage Relative values obtained: A: N_C 1.4756, N_D 1.4779, N_F 1.4835; B: N_C 1.4757, N_D 1.4780, N_F 1.4837; C: N_C 1.4756, N_D 1.4779, N_F 1.4835 Dispersion curves practically identical for Exhibits A and C, while B is slightly higher. Since the refractive index variation across a single headlamp is often greater than variations between headlamps, the strongest statement one can make from the above data is the the Exhibits could have the same origin.

Table 9 continued

LAB CODE	
969	1) Refractive Index using Mettler Hot Stage 2) Density gradient using bromobenzene and bromoform
970	None specified
974	1) Density - sink or float. Bromoform and alcohol 2) Elemental Analysis - Emission Spectrograph, qualitative 3) Fluorescence - Shortwave UV 4) Index of Refraction - B & L high intensity monochromator Mettler hot stage Leitz-Dialux Phase Microscope Dow Corning 550 oil
975	1) Density - Floatation method 2) Refractive Index - Cargille liquids temperature - wavelength variation method with monochromater and hot stage
978	1) Indices determined using monochromator. Phase microscope and Mettler Hot Stage (using DOW 550 oil) 2) Densities determined by displacement method and by buoyancy method 3) Elemental analysis by emission spectroscopy 4) Fluorescence checked using 254 nanometer wavelength light and 365 nanometer wavelength (no fluorescence detected)
979	1) Density tube bromobenzene-bromoform 2) UV light (fluorescence) 3) Refractive index liquids Tributyl Citrate and Bromobenzene
980	1) Density - "floatation method" using bromoform and nitrobenzene, density of mixture with pycnometer 2) Elemental Analysis - emission spectroscopy Sample A: B, Mn, Mg, As, Si, Fe, Al, Ni Sample B: B, Mn, Mg, As, Si, Fe, Al Sample C: B, Mn, Mg, As, Si, Fe, Al 3) Refractive Index - "Becke line" using Cargille oils, refractive index of mixture with Abbe refractometer 4) Thickness - micrometer
986	1) Density - Density gradient tubes with mixtures of bromobenzene and bromoform 2) Elemental Analysis - Used ARL Spectrographic Analyzer for emission spectrum 3) Fluorescence - Used shortwave UV lamp
987	1) Becke lines for refractive index 2) Density gradient tubes using Bromoform-Bromobenzene 3) UV irradiation 4) Physical matching under microscope

Table 9 continued

LAB CODE		
994	1)	Density - Bromoform and Benzene - Gradient
	2)	Refractive Index - Cargille Liquids and Hot Stage
	3)	Elemental Analysis - Spectrograph
	4)	UV Light & Color - Self-explanatory
995	1)	Refractive index using Cargille liquids and calibrated Dow Corning 550 Silicone oil in combination with Mettler Hot Stage, samples run separately and at same time, side by side.
	2)	Gradient density tubes were made using mixtures of Tetrabromoethane and bromobenzene. Comparative density only, no calibration beads used.

END