

SI Forensics - Full Discipline Demo

Fractography and Glass

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Forensics - Full Discipline Demo
Course	SI Forensics - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Categorize the following statements about glass analysis as true or false.

⚡	
Large pieces of glass can be put back together to determine who committed a crime.	
⚡	
Fragments of broken glass may be transferred onto anything within a reasonable distance of the fracture.	
⚡	
A perpetrator wearing a wool sweater is more likely to retain glass evidence than a perpetrator wearing silk.	
⚡	
Visual properties of glass such as glass color, curvature, imprints, and any labels are of no interest to a forensic examiner.	
⚡ The study of the way glass fractures is called fractography.	

True	False
1	2

Correct answers:

1 The study of the way glass fractures is called fractography.

A perpetrator wearing a wool sweater is more likely to retain glass evidence than a perpetrator wearing silk.

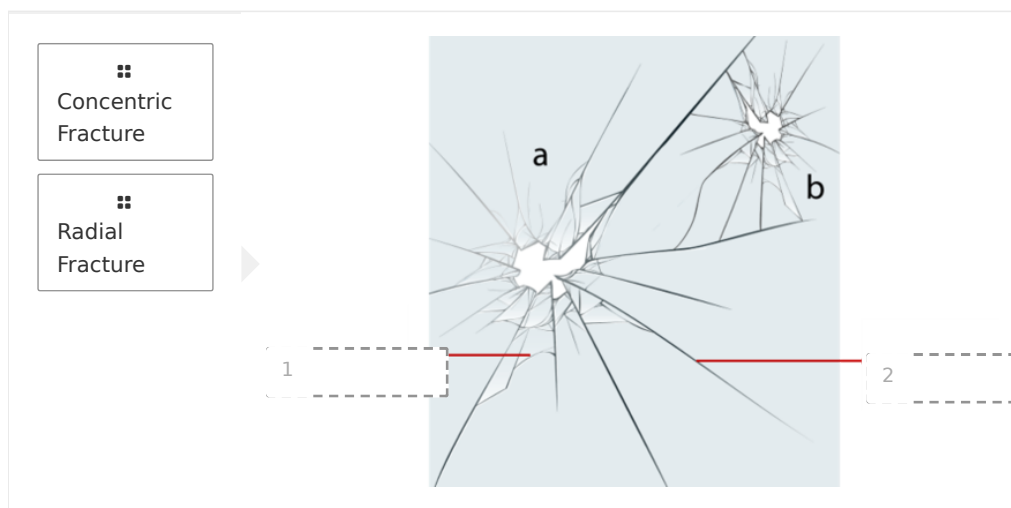
Fragments of broken glass may be transferred onto anything within a reasonable distance of the fracture.

2

Visual properties of glass such as glass color, curvature, imprints, and any labels are of no interest to a forensic examiner.

Large pieces of glass can be put back together to determine who committed a crime.

Label a concentric fracture and a radial fracture on the image below.



Correct answers:

- 1 Concentric Fracture 2 Radial Fracture

Order the following steps for determining the refractive index of a shard of glass with the first step at the top and the last step at the bottom.

≡ The Becke line disappears.

1 **Correct answer:** The shard of glass is submerged in a liquid of a known refractive index.

≡ The refractive index of the liquid the shard is submerged in is adjusted.

2 **Correct answer:** The Becke line is observed.

≡ The refractive index of the glass is determined to be the same as the refractive index of the liquid.

3 **Correct answer:** The refractive index of the liquid the shard is submerged in is adjusted.

≡ The Becke line is observed.

4 **Correct answer:** The Becke line disappears.

≡ The shard of glass is submerged in a liquid of a known refractive index.

5 **Correct answer:** The refractive index of the glass is determined to be the same as the refractive index of the liquid.

Exploration

Which of the following is not a factor that influences glass transfer?

- ☐ Distance between object and fracture
- ☐ Clothing type
- ☐ Size of glass fragments
- ☒ Glass color

✓

If you are examining two bullet holes that created radial fractures in a glass window, how can you determine which bullet hole was created first?

- ☐ The first bullet will create radial fractures that terminate at fractures created by the second bullet.
- ☐ The second bullet will create radial fractures that extend through fractures caused by the first bullet.
- ☒ The second bullet will create radial fractures that terminate at fractures created by the first bullet.
- ☐ The first bullet will create radial fractures that extend through fractures caused by the second bullet.

✓

What can be determined using the 3R Rule?

- ☒ Direction of Force
- ☐ Sequence of Gun Shots Through Glass
- ☐ Refractive Index
- ☐ Glass Type

✓

The Becke line appears when a piece of glass is submerged in a liquid with the same refractive index.

- ☐ True
- ☒ False

✓

Exercise 1

How did the evidence you circled in Photo 1 support the order in which the holes in the glass occurred?

Are the impact holes larger on the side of impact or on the side opposite impact?

How did you use the 3R rule to determine the side of impact in Photo 2?

Photo 1: Fractured Glass Pane
(SAMPLE ANSWER BELOW)

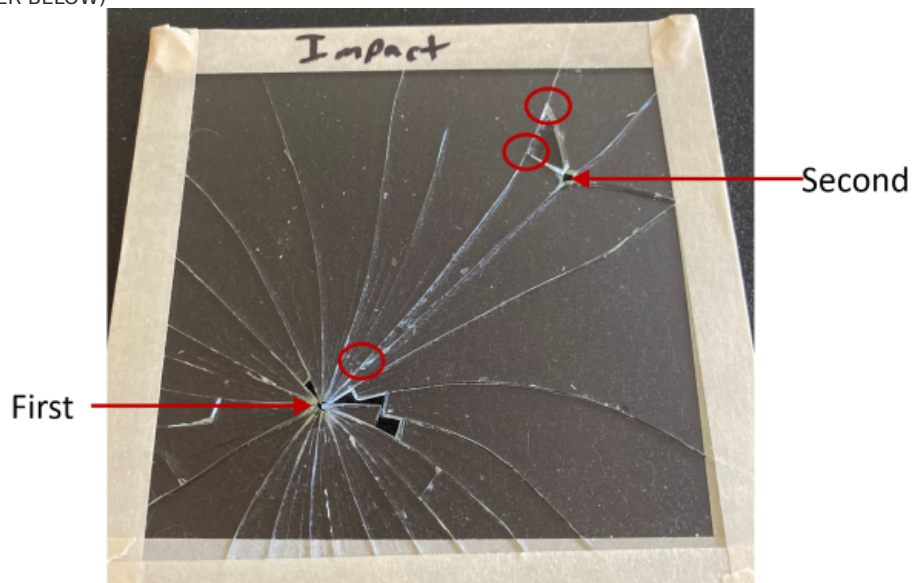
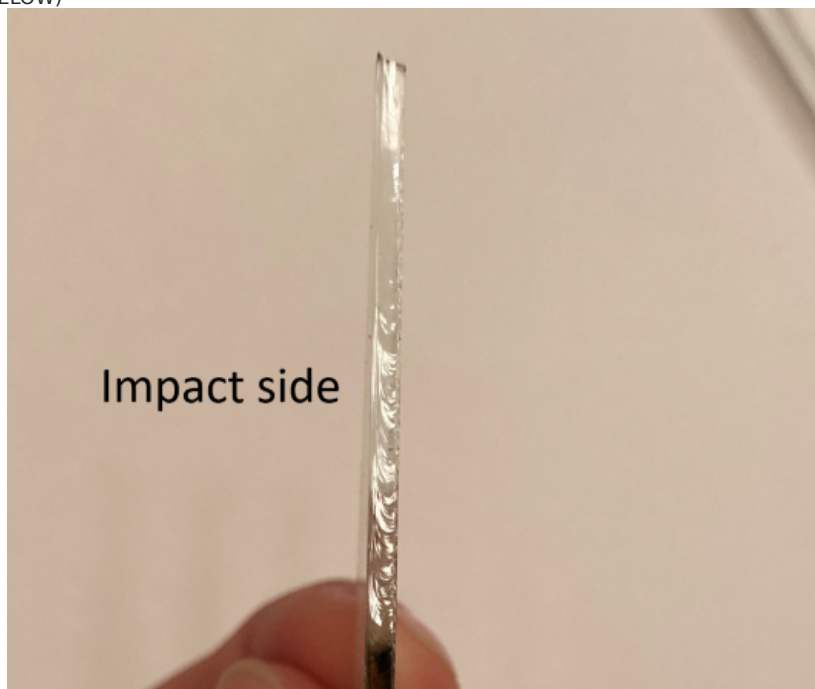




Photo 2: Glass Shard Edge
(SAMPLE ANSWER BELOW)





Exercise 2

Based on the refractive index you have determined for each type of glass, what can you conclude about the origins of the questioned glass sample found on the suspect's clothing?

The refractive index of the questioned sample taken from the suspect's clothing is the same as the refractive index of the glass sample from the windowpane at the crime scene, but different from the kitchen glass sample taken from the suspect's home. Therefore, the glass fragments found on the suspect's clothing could not have originated from the kitchen glass as the suspect claims but is more likely to be from the broken window at the crime scene.

How would you determine the refractive index of these samples if you had access to a hot stage microscope?

Data Table 1: Becke Line Results
(SAMPLE ANSWER BELOW)

	Questioned Sample	Glass Pane Sample	Kitchen Glass Sample
Water	Visible	Visible	Visible
Canola Oil	Visible	Visible	Not Visible
Cedarwood Oil	Not Visible	Not Visible	Visible
Wintergreen Oil	Visible	Visible	Visible

Data Table 2: Sample Refractive Index
(SAMPLE ANSWER BELOW)

	Question Sample	Glass Pane Sample	Kitchen Glass Sample
Refractive Index	1.51	1.51	1.47

Competency Review

The closer an object is to breaking glass, the more likely it is that glass fragments will be transferred to it.

- ☐ True

☐ False

✓

_____ give the broken glass a spider web appearance.

- ☐ Radial fractures

☐ Concentric fractures

☐ Stress marks

☐ Becke lines

✓

The _____ states that the side of the glass where the stress marks form right angles is opposite to the side of impact.

- ☒ 3R rule ✓
- ☐ refractive index
- ☐ fractography
- ☐ law of transfer

Refractive index can be used to definitively determine that two glass samples originated from the same source.

- ☐ True
- ☒ False ✓

In the experimentation section, you used the patterns of the _____ as evidence for the order in which the holes in the glass were created.

- ☐ stress marks
- ☐ refractive index
- ☐ concentric fractures
- ☒ radial fractures ✓

In Exercise 1, the only way to determine the side of the glass that received the impact was to label the impact side at the start of the experiment.

- ☐ True
- ☒ False ✓

In Exercise 2, you were unable to definitively prove the source of the questioned sample.

- ☒ True ✓
- ☐ False

The refractive index from the windowpane glass was _____.

- ☐ 1.33
- ☐ 1.47
- ☒ 1.51
- ☐ 1.54



Extension Questions

Because of the way glass is produced, the same type of glass will often share many similar properties (glass from one windowpane may share the same properties as glass from another windowpane) and as a result, glass evidence cannot often be used to conclusively prove a person's guilt. Describe what uses analysis of glass evidence could provide to a criminal investigation. (SAMPLE ANSWER BELOW)

Analysis of glass evidence can provide several benefits that don't conclusively prove an individual's guilt. Fractography can be used to better understand how the crime occurred, which can provide valuable information to the investigators. Additionally, analysis of small glass fragments can provide evidence that proves an individual's innocence if the analysis determines that glass found on the suspect could not have originated from the crime scene, or it can serve to support other evidence of the individual's guilt.