Trace Evidence: Glass

1. Glass Introduction
	1. = a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ type of trace evidence
	2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of glass
		1. Common material in our \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		2. Found in many \_\_\_\_\_\_\_\_\_\_\_\_, sizes, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and types
		3. Composed of fused \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material
			* Mixture of:
				+ \_\_\_\_\_\_\_\_\_\_\_\_\_
				+ \_\_\_\_\_\_\_\_\_\_\_\_\_
				+ \_\_\_\_\_\_\_\_\_\_\_\_\_
				+ Other trace elements
		4. Variation in \_\_\_\_\_\_\_\_\_\_\_ formulas can alter significantly its characteristic \_\_\_\_\_
		5. Additives’ responsibilities
			1. Alumina (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
				* Aluminum oxide
				* Improves chemical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
			2. Boron Oxide (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
				* Addition used in borosilicate & aluminoborosilicate glasses.
				* Very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
			3. Lime (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
				* Added to improve \_\_\_\_\_\_\_\_\_\_\_\_\_\_ & chemical \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Lead oxide (\_\_\_\_\_\_\_\_\_\_\_\_)
	* + - * High lead content lowers \_\_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ hardness, but \_\_\_\_\_\_\_\_\_\_\_\_\_refractive index
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Glass
	1. Aluminosilicate & borosilicate
		* Can \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ temps.
	2. Laminated glass
		* Glass w\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - used in car \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. \_\_\_\_\_\_\_\_\_\_\_ glass
		* Fine crystal
	4. Soda lime glass
		* \_\_\_\_\_\_\_\_\_\_\_\_& \_\_\_\_\_\_\_\_\_\_\_ glass, glass containers, electric \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_, art objects
	5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (stressed) glass
		* Side & back windows of cars; breaks into \_\_\_\_\_\_\_\_\_\_\_\_
4. Glass as Evidence
5. Physical—\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	1. Can be used to \_\_\_\_\_\_\_\_\_\_\_\_people at a crime scene and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sequence of events
		* Does this make glass CLASS or INDIVIDUAL evidence???
			+ Can be used to reconstruct events
			+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
			+ Blood
	* Glass is slightly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		+ - When it reaches its \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
			- this leads to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
			- 2 Distinct types of fractures

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Key = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ cracks will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_when they hit \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cracks. This info can help determine \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of events.

* Direction of Impact
	+ Found from \_\_\_\_\_\_\_\_\_\_\_marks on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of broken glass.
	+ At the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

 glass will break with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 pattern (shell-like)



1. Density determination =
2. Refractive index (\_\_\_\_) determination
	1. Background:
3. **Refraction** = the \_\_\_\_\_\_\_\_\_\_\_\_ of a \_\_\_\_\_\_\_\_\_\_\_\_wave as it passes from one \_\_\_\_\_\_\_\_\_\_\_\_ to another
4. **Refractive Index (RI)**= a \_\_\_\_\_\_\_\_\_\_\_\_ of the speed of \_\_\_\_\_\_\_\_\_\_\_\_ in a vacuum to the speed of light in \_\_\_\_\_\_\_\_\_\_\_\_substance
	* + **Sample calculation**: speed of light in vacuum is 3.00 x 1010 and the speed of light in water is 2.25 x 1010
		+ Thus RI of water =

* 1. Determining the RI from samples in an investigation:
1. Different types of \_\_\_\_\_\_\_\_\_\_\_\_will have \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_
2. To analyze this property🡪

Glass fragments can be \_\_\_\_\_\_\_\_\_\_\_\_ in a liquid with a \_\_\_\_\_\_\_\_\_\_\_\_refractive index to help \_\_\_\_\_\_\_\_\_\_\_\_ the RI of the \_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. Analysis method 1

|  |  |
| --- | --- |
| **Liquid** | **Refractive index** |
| Ethyl acetate | 1.373 |
| n-butyl alcohol | 1.402 |
| Olive oil | 1.467 |
| Corn oil | 1.473 |
| Castor oil | 1.482 |
| Methyl salicylate | 1.522 |
| Clove oil | 1.543 |
| Canola oil | 1.465-1.467 |

--If the liquid has the \_\_\_\_\_\_\_\_\_\_\_\_RI as the glass sample, the glass will \_\_\_\_\_\_\_\_\_\_\_\_ under a microscope.

--If the liquid has a \_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_RI, the glass is visible and a \_\_\_\_\_\_\_\_\_\_\_\_ appears around perimeter (we call this halo the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).

. . . when RIs are the \_\_\_\_\_\_\_\_\_\_\_\_, the Becke line \_\_\_\_\_\_\_\_\_\_\_\_

. . . if Becke line appears on the \_\_\_\_\_\_\_\_\_\_perimeter = Glass has \_\_\_\_\_

. . . if Becke line appears on \_\_\_\_\_\_\_\_\_\_\_ perimeter = Glass has \_\_\_\_\_\_



* + - 1. Analysis method 2
* RI is dependant on:
	+ The \_\_\_\_\_\_\_\_\_\_\_\_of light
	+ The \_\_\_\_\_\_\_\_\_\_\_\_of the medium
	+ When the temp. of a liquid is changed, the RI changes rapidly, but the RI of an immersed solid will not
* \_\_\_\_\_\_\_\_\_\_\_\_usually used
* Oil \_\_\_\_\_\_\_\_\_\_\_\_so RI can be determined from its temp.
* Sample glass is immersed in oil
* Oil is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to determine match temp.
	+ - Glass \_\_\_\_\_\_\_\_\_\_\_\_
		- Oil RI = Glass RI
1. Chemical Tests
* \_\_\_\_\_\_\_\_\_\_\_\_
* Test for silicates, metal oxides, trace evidence