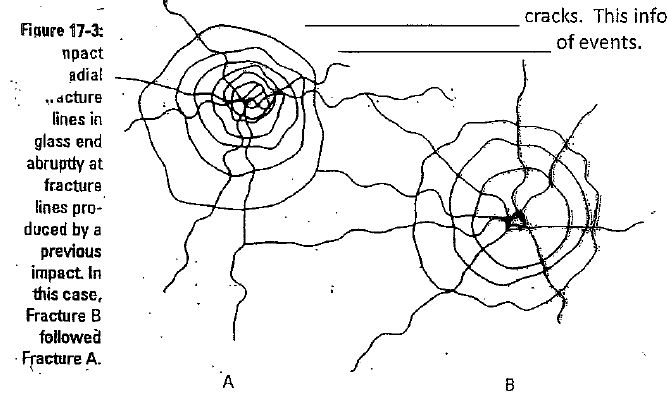
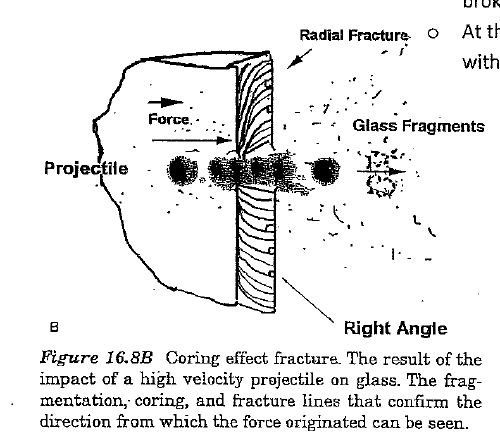
Trace Evidence: Glass

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. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

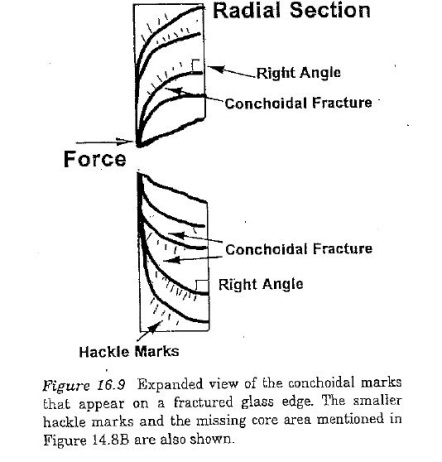
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 |

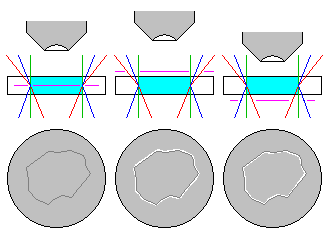
--If the liquid has the \_\_\_\_\_\_\_\_\_\_\_\_RI as the glass sample, the glass will \_\_\_\_\_\_\_\_\_\_\_\_ under a microscope.

--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