Glass is a very common material and investigators can use fragments found at a crime scene to place a suspect at the scene.

Glass fragments may be found in a suspect’s clothing embedded in shoes, or they may be found on a victim of a hit and run accident.

Glass evidence can be placed together like pieces of a jigsaw puzzle, thus the evidence can be individualized.

By studying the fracture patterns of glass, an investigator can re-create a sequence of events to aid in reconstructing a crime.

Glass is a hard, amorphous material, usually transparent after it has been heated to an extremely high temperature. The process involves the superheating of crushed sand to produce a hot liquid, which is then allowed to cool to the clear, hard substance you recognize when you stare out the windows in your house or drink from a glass or place flowers in a vase. Glass was first made by melting sand and ashes over 4,000 years ago. Today, glassmakers add various oxides to modify the properties of glass—hard, colored, heat resistance, etc.

For a glass comparison, an investigator must have a known sample of glass (for example, broken glass from a suspect’s windshield) that he/she can compare against an unknown sample (glass found in a hit-and-run victim’s clothing). In the laboratory, physical properties of both samples such as color, texture, density can be analyzed.

Before man figured out how to craft glass, nature was already making it. When lightning strikes sand, the heat sometimes fuses the sand into long, slender glass tubes called fulgurites.
Another procedure can be used to identify glass - refractive index. Refractive index is a comparison of the speed of light in a vacuum to the speed of light through a substance. You already know that light travels as an electromagnetic wave. When light travels between mediums (substance that allow light to travel), the light wave is bent at a characteristic angle. The degree to which the light ray bends indicates the type of material or glass through which it is traveling. Additionally, in the lab, a scientist can completely immerse a glass fragment in a drop of liquid with a known refractive index at a set temperature. Light is transmitted through the sample, the visible glass fragment will appear to have a “halo” of light that appears around its perimeter thus producing what are known as Becke Lines (shown by the darker color in the photo).

Refractive Indexes of various substances:

* Water 1.333
* Diamonds 2.419
* Salt 1.544
* Acrylic Glass 1.492
* Pyrex Glass 1.472

As the temperature of the medium is raised, the Becke lines will start to disappear. Two samples of glass can be compared by using this method, and noting the temperature at which the lines vanish. Compare known temperatures with the unknown glass allows investigators to confirm a glass’s identity.
*Glass can be recycled, that is, crushed into a powder, melted, and then reformed. Glass has the quickest turnaround time, within 30 days recycled glass will reappear on shelves.
*Glass can be recycled an infinite number of times and it always maintains its characteristics.
*Making glass is like following a simple recipe of ingredients. The first 3 ingredients are in all glass: sand, soda ash and limestone, the fourth ingredient is the addition of chemicals to give glass their color.

There are many types of glass, some which you are familiar with. Tempered glass found in your automobile is made stronger than ordinary window glass by introducing stress through rapid heating and cooling of the glass surfaces. When the tempered glass breaks it does not shatter but fragments or “dices” into small squares with little splintering. In the U.S., the tempered glass of the windshield is also laminated. The glass derives its strength by sandwiching one layer of plastic between two pieces of ordinary glass. At the very peak (top) of the windshield, the laminated sheet is colored a light shade of blue to dim the bright light of the overhead sun.
Glass fracture patterns are unique; and caused by blunt impact, heat, and high velocity projectiles. Laboratory examination of recovered shards may reveal the direction and sequence of breaking forces or the type of projectile and its angle of penetration. Pieces of glass may be fitted together such that a recovered fragment can be identified as having been broken from a specific pane, bottle, or headlight to the exclusion of all others. Glass is slightly flexible, but when forced to its elastic limit, it will break or fracture. Glass’s elasticity also causes some glass fragments to recoil backward toward the direction of force (blowback), thus possibly leaving clues in the perpetrator’s clothing, hair, and so on. The penetration of ordinary window glass by a projectile, whether it is a bullet or stone, produces a familiar fracture pattern in which cracks both radiate outward and encircle the hole. The radiating lines are appropriately known as radial fractures, and the circular lines are termed concentric fractures. Think in terms of a spider web - radiating lines or fractures versus concentric lines or fractures. Often it is difficult to determine just from the size and shape of a hole in glass whether it was made by a bullet or by some other projectile. For instance, a small stone thrown at a comparatively high speed against a pane of glass will often produce a hole very similar to that produced by a bullet. On the other hand, a large stone can completely shatter a pane of glass in a manner closely resembling the result of a close-range shot. However, the presence of gunpowder residue should be an indicator of a gunshot versus stone.

By the 17th century, glass had become cheap enough for ordinary people to use it for windowpanes. This not only protected them from the elements, but also flooded their houses with light, initiating a great leap forward in hygiene. Dirt and vermin became visible which energized a move toward cleanliness. People could finally see the filth in which they were living.
Glass Evidence

When it penetrates glass, a high-velocity projectile such as a bullet, often leaves a round, crater-shaped hole that is surrounded by a nearly symmetrical pattern of radial and concentric cracks. The depth and size of the crater is wider at the exit side, and hence its examination is an important factor in determining the direction of impact. For example, think to yourself, there's a bullet hole in your window. As you look at the exit crater you find that crater is found to the inside of your house. Was the gun fired outside - in, or inside - out? Remember the crater is found to the exit side of the bullet hole. Such determinations are invaluable to an investigator in identifying the location of the discharging of a weapon.

When there have been successive penetrations of glass, it is frequently possible to determine the sequence of impact by observing the existing fracture lines and their points of termination. A fracture always terminates at an existing line of fracture. Look at the diagram and note the points of termination.

Stress marks are visible at the edge of broken glass. They are shaped like arches, with the perpendicular at the opposite surface where the crack originated. Thus, investigators can determine the direction of impact by examining the edges of a glass fragment that can be fitted into the mosaic of a broken window.