The Chemistry of Latent Fingerprints

The English began using fingerprinting almost by accident in July of 1858. Sir William Herschel, a British official in India, became frustrated with the dishonesty of some of the population and decided to require local businessmen to sign their contracts with a handprint. The concept was to impress the man with the need for honesty by making him “press” his hand on the contract making the contract more binding than just a signature. The practice was based more on superstition than on scientific fact. However, since that time, one of the most preferred items of scientific evidence has been the latent fingerprint---the unseen residue that remains where bare appendages come in contact with a surface. When recovered with expertise, the fingerprint can lead to the identification and conviction of suspects.

What is a fingerprint? The skin that covers the underside of human fingers and toes is unique in that it is corrugated. The network of ridges and depressions are called friction ridge skin. The ridges and furrows describe a unique pattern for each individual that is formed during fetal development by a wide range of random forces such as stresses placed on the hands or feet and distribution of cells or disease. Not even identical twins have the same fingerprints. These ridges carry thousands of sweat pores that excrete salty perspiration. Sweat mixed with body oils and dirt will produce fingerprints on a smooth surface.

Latent means hidden or invisible. In modern forensic usage, a latent fingerprint is any chance or accidental impression left by friction ridge skin on a surface. Although the salty perspiration leaves an impression, the latent fingerprint must be carefully recovered. Experts use chemicals to make latent fingerprints visible and computer enhancement to analyze the patterns. Computer extrapolations can then complete fingerprints from partial fragments. Technology has made it possible for experts to now retrieve identifiable latent fingerprints from most surfaces.

Chemical Reaction

Silver nitrate ($AgNO_3$) can react with the salt (NaCl) left from the perspiration on the friction ridge skin to form solid silver chloride (AgCl) and sodium nitrate. The silver chloride can then be converted to silver oxide (Ag_2O), which is dark in color and can be more easily seen.

Challenge

Suppose the fingerprint processing technique that uses silver nitrate to react with the salt from perspiration produced 5.8×10^{-2} grams of silver chloride. How much salt was left by the initial latent fingerprint?

Brainstorm the steps to solve this problem. Then, prepare a poster showing your teams steps and your solution.