CHAPTER 15 FORENSIC INVESTIGATION OF EXPLOSIONS

EXPLOSIONS

- Explosives are substances that undergo a *rapid oxidation* reaction with the production of large quantities of gases.
- It is this sudden *buildup of gas pressure* that constitutes the nature of an explosion.
- The speed at which explosives decompose permits their classification as high or low explosives.

EXPLOSIONS

- The most widely used explosives in the *low-explosive group* are black powder and smokeless powder.
- *Black powder* is a mixture of potassium or sodium nitrate, charcoal, and sulfur.
- *Smokeless powder* consists of nitrated cotton (nitrocellulose) or nitroglycerin and nitrocellulose.

EXPLOSIONS

- Among the ***high explosives***, primary explosives are ultra-sensitive to heat, shock, or friction and provide the major ingredients found in blasting caps or primers used to ***detonate other explosives***.
- Secondary explosives are relatively insensitive to heat, shock, or friction and will normally burn rather than detonate if ignited in small quantities in the open air.

EXPLOSIONS

- This group comprises the majority of commercial and military blasting, such as dynamite, TNT, PETN, and RDX.

HIGH EXPLOSIVES

- In recent years, nitroglycerin-based dynamite has all but disappeared from the industrial explosive market and has been replaced by ammonium nitrate-based explosives (for example, water gels, emulsions, and ANFO explosives).
- *Secondary explosives must be detonated by a primary explosive*.

HIGH EXPLOSIVES

- In many countries outside of the United States, the accessibility of *military high explosives* to terrorist organizations makes them very common constituents of homemade bombs.
- *RDX* is the most popular and powerful of the military explosives, often encountered in the form of pliable plastic known as **C-4**.

HIGH EXPLOSIVES

- ***Triacetone triperoxide (TATP)*** **is a** ***homemade explosive*** **that has been used by terrorist organizations.**
- **TATP can be made by combining** **acetone** **and** ***peroxide*** **in the presence of an acid.**
- **Its existence has led to the** ***banning of most liquids on commercial aircraft*****.**

COLLECTION AND ANALYSIS

- The entire bomb site must be systematically searched with great care given to recovering any *trace of a detonating mechanism* or any other item foreign to the explosion site.
- Objects located at or near the origin of the explosion must be collected for laboratory examination.

COLLECTION AND ANALYSIS

- Often, a crater is located at the origin and loose soil and other debris must be preserved from its interior for laboratory analysis.
- One approach for screening objects for the presence of explosive residues in the field or laboratory is the ***ion mobility spectrometer (IMS)***.

COLLECTION AND ANALYSIS

- Preliminary identification of an explosive residue using the IMS can be made by noting the *time it takes the explosive to move through a tube*. A confirmatory test must follow.
- All materials collected for the examination by the laboratory must be placed in *sealed air-tight containers* and labeled with all pertinent information.

COLLECTION AND ANALYSIS

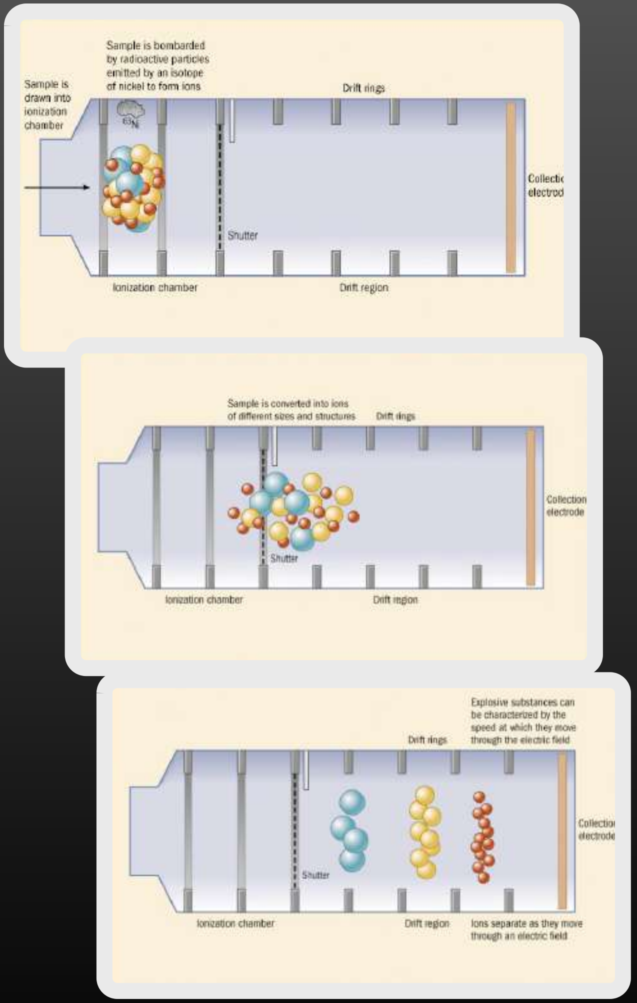
- Debris and articles collected from *different areas* are to be packaged in *separate air-tight containers*.
- It has been demonstrated that some explosives can diffuse through plastic and contaminate nearby containers.

BACK AT THE LAB

- Typically, in the laboratory, debris collected at explosion scenes will be ***examined microscopically*** for unconsumed explosive particles.
- ***Recovered debris*** may also be thoroughly ***rinsed*** with organic solvents and ***analyzed*** by testing procedures that include color spot tests, thin-layer chromatography, and gas chromatography-mass spectrometry.

BACK AT THE LAB

- Confirmatory identification tests may be performed on unexploded materials either by infrared spectrophotometry or X-ray diffraction.



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X-RAY DIFFRACTION

- *X-ray diffraction* is applied to the study of solid, crystalline materials.
- As the X-rays penetrate the crystal, a portion of the beam is reflected by each of the atomic planes.
- As the reflected beams leave the crystal's planes, they combine with one another to form a series of light and dark bands known as a *diffraction pattern*.

X-RAY DIFFRACTION

- Every compound is known to produce its own unique diffraction pattern, thus giving analysts a means for ***fingerprinting*** crystalline compounds.