**Unit 6: Ballistics Notes**

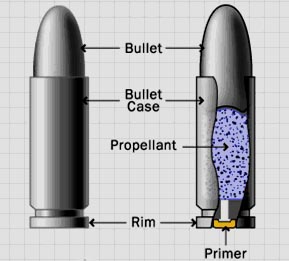
History of Gunpowder and Firearms

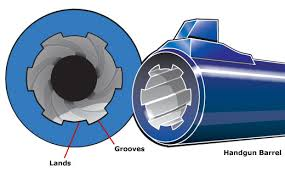
* The Chinese invented gunpowder over a thousand years ago using KNO3, charcoal and sulfur.
* Muzzle-loading matchlocks used wicks to ignite the gunpowder.
* The cartridge and breech loading followed.
* Later, flintlock weapons were used using sparks from flint to ignite the gun power (better in wet conditions).
* Gun power was forced down the muzzle (barrel) and packed down.
* Next, cartridges were developed that held the bullet, primer powder, and gun powder.
* A hammer hit the primer powder, the powder exploded to ignite the gunpowder and project the bullet.
* We still use cartridges today, loaded into the gun opposite the barrel, known as the breech.

Bullets, Cartridges, and Calibers

* Bullets and cartridges are packaged together.
* The bullet, usually of metal, is out front with the cartridge, holding the primer and propellant powders, behind.

How a Firearm Works

* The firing pin hits the base of the cartridge, igniting the primer powder.
* The primer powder sparks through the flash hole to the main propellant supply.
* The pressure of the explosion pushes the bullet from the casing into the barrel.
* The bullet follows the lands and grooves spiraling out of the barrel.



Lands and Grooves

* Rifling allowed the gun to shoot more accurately using
  + Lands: raised areas in the barrel
  + Grooves: indentations in the barrel
* Today, we can look at the lands and grooves to identify the gun

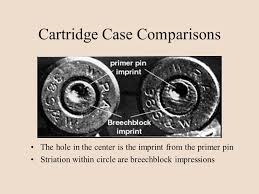
Firearms Now

* Long guns need two hands:
  + Rifles fire bullets
  + Shotguns fire small pellets (shot) or a slug.
* Handguns need only one hand:
  + Pistols are fired with one hand.
  + Colt: Samuel Colt developed a hand gun that shot multiple bullets, known as a revolver. These hold six cartridges.
  + Semiautomatic weapons hold ten cartridges in a magazine or clip. Each pull on the trigger releases one cartridge.
  + Fully Automatic weapons fire for as long as the trigger is pressed.

Caliber of the Cartridge

* Caliber is a measure the diameter of the cartridge.
* These usually are hundredths of an inch.
* Common calibers include .22, .25, .357, .38, .44, and .45.

Marks on the Spent Cartridge Casings

* Firing pin marks on a spent cartridge can be used to match it to a firearm.
* The fire pin marks can appear on the rim or on the center of the spent cartridge.
* Breechblock marks are produced as the cartridge casing slams backward and strikes the breechblock.
* Other marks left on spent cartridge casings include minute scratch extractor and ejector nicks.
* Rifling
  + Grooves cut or formed in a spiral down the barrel of a firearm
  + Increases accuracy and range
  + Types of marks
    - Rifling pattern
    - Breech mark
    - Firing pin impressions
    - Extractor mark
    - Ejector marks

Firearms Examiners will:

* Test firearms
* Test for gunshot residue to determine distance from muzzle to target
* Determine caliber and manufacturer of ammunition components
* Match bullets or cartridge casings to firearms
* Bullet Identification
* Obtain standard from firearm
* Compare crime scene bullet to standard using comparison macroscope
* Unique marks made by imperfections or irregularities = individual evidence
* Firearms Evidence
  + Firearm
  + Fired bullets
  + Spent cartridge cases
  + Spent shot shells
  + Shot
  + Shot shell wadding
  + Live ammunition
  + Gunshot residue (GSR)
  + Clothing

Firearms Database

NIBIN: National Integrated Ballistics Information Network

* Database of images
* Ballistics markings of firearms used in previous crimes
* Cartridge casings

Gunshot Residue

* Particles of unburned powder and traces of smoke are the residues of gunshots.
* They can leave a trace on the hand, arm, face, hair, or clothing of the shooter.
* They can also leave a trace on the victim.
* Chemical testing often can detect residue even if removal is attempted.
* The distance from the victim to the shooter can be determined by examination of the residue pattern on the victim.

Trajectory

* Two reference points are needed to define the trajectory.
* Investigators can figure the shooter discharged the firearm somewhere along that line.
* Reference points can be bullet holes in objects or victims.
* An entry point and exit point on a victim can be used.
* Gunshot residue or spent cartridge casings can be less specific reference points.
* Investigators can use lasers to trace a straight-line path to help determine the position of the shooter.

Bullet Wounds

* Generally, entrance wounds and smaller than exit wounds
* Entrance: skin stretches when bullet enters body
* Exit: bullet carries body tissue and bone with it
* Other signs: fibers in wound, GSR, stippling (burnt skin)
* Pass through: larger bullets, high-speed bullets
* Gunshot Wounds

