Introduction to Forensic Science – (Criminalistics)

Basic

Crime **S**cene **I**nvestigation Techniques

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Introduction to Forensic Science – (Criminalistics)

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Crime **S**cene **I**nvestigation Techniques

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This week the student will learn:

- Use of fire to destroy evidence
- Understand chemistry of fire
- Learn key terminology
- Proper method of fire scene search
- Differentiate between low and high explosives
- Proper method of harvesting explosives
- HOMEWORK
  - Read chapter 14

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B.L.E.V.E

Show tanker video

Review – Arson & Explosives

- A Criminalist
  - is only to detect & identify relevant materials collected at the scene
  - identify & reconstruct igniters or detonators.
- Fire department has primary responsibility for investigation.
- In explosions, a rigid protocol must be followed to ensure collection of every scrap of evidence, and not contaminate the scene.
  - Locate center of blast
  - Divide area into squares

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Review – Arson & Explosives

- The investigator will pick up and bag any large evidence from the square they are working in.
- All remaining debris is brushed onto the center of the square with a sterilized brush.
- The pile is then sifted for debris.
- All debris is bagged and moved to the lab.
- At the lab, all debris is analyzed for possible relationship to a device.
- It is subjected to microscopic and toxicological tests
- If residue, it is dissolved in acetone & water.

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Review – Arson & Explosives

- Accidental fires normally have a single point of ignition.
  - The building and the damage to it will lead the investigator to the source(s) of the fire.
  - Flammable liquids leave smells and markings.
  - The investigator looks to see if alarms or sprinklers were tampered with.
  - Also look for footprints, tire tracks, forced entry
- No scientific test is yet available to determine if a rubbish or paper pile was utilized to start the fire

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Review – Arson & Explosives

- B.L.E.V.E.
  - Acronym for "**boiling liquid expanding vapor explosion**".
  - When a vessel containing a pressurized liquid is ruptured (due to fire).
  - "Blast Leveling Everything Very Effectively."
- Oxidation
  - The combination of oxygen with other substances to produce new substances
  - It is the fundamental chemical reaction of fire.
- Energy
  - The capacity for doing work

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Review – Arson & Explosives

- Combustion
  - The rapid combination of oxygen with another substance, accompanied by the production of noticeable heat and gas. (NOT flatulation)
- Exothermic Reaction
  - A chemical transformation in which more energy is released than used.
- Endothermic Reaction
  - A chemical transformation in which less energy is released than used.

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Review – Arson & Explosives

- Ignition Temperature
  - The minimum temperature at which a fuel will spontaneously ignite.
- Flash Point
  - Minimum temperature at which a liquid fuel will produce enough vapor to burn
- Heat of Combustion
  - How hot a given substance burns when mixed with oxygen
- Pyrolysis
  - The decomposition of organic matter by heat.

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Review – Arson & Explosives

- Flammable Range
  - The entire range of possible gas and vapor fuel concentrations in air that are capable of burning.
- Glowing Combustion
  - Burning @ the fuel/air interface.
  - Cigarette or charcoal
- Spontaneous Combustion
  - Fire caused by a natural heat producing process with sufficient fuel and air.
- Oxidizing Agent
  - Substance that supplies oxygen to a chemical reaction.

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Review – Arson & Explosives

- Accelerant
  - ANY material used to start or sustain a fire.
  - Usually combustible liquids.
- Hydrocarbon
  - Any compound consisting only of hydrogen and carbon
- Explosion
  - Chemical or mechanical action resulting in the rapid expansion of gases.
  - Not normally associated with flatulation

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Review – Arson & Explosives

- High Explosive
  - Explosive with a speed of detonation exceeding 1,000 mps
- Detonation
  - Extremely rapid oxidation reaction accompanied by a violent disruptive effect and intense high-speed shock wave.
- Low Explosive
  - Explosive with a speed of deflagration less than 1,000 mps
- Deflagration
  - Very rapid oxidation reaction accompanied by a low intensity pressure wave that can have an effect on its surroundings.

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Review – Arson & Explosives

- Black Powder
  - Mixture of potassium nitrate, carbon & sulfur (75/15/10)
- Safety Fuse
  - Cord containing a core of black powder
  - Burns at a uniform rate
- Smokeless Powder (single base)
  - Explosive consisting of nitrocellulose
- Smokeless Powder (double base)
  - Explosive consisting of a mixture of nitrocellulose and nitroglycerine

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Review – Arson & Explosives

- Primary Explosive
  - High explosive that is easily detonated by heat or shock
- Secondary Explosive
  - High explosive that needs to be detonated by a primary explosive.
- Detonating Cord
  - Cordlike explosive with a core of high explosive material (usually PETN)
  - Also called primacord

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Review – Arson & Explosives

- Streamers
  - Lines of accelerant placed to cause the fire to spread
- Evidence of liquid accelerant
  - More severe burning on floor than ceiling
  - More severe charring on underside of items
- 1st item of business
  - Notes
  - Photographs
  - Sketches
- Collect 2-3 qts of ash & soot from point of origin
- Immediately place in air-tight containers

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Review – Arson & Explosives

- When packaging arson debris, only fill container 2/3 full, to allow “headspace”.
- Collect standards for comparison
- If sample contains soil or vegetation, freeze it to slow process
- If suspect is located, collect his clothes and place into an air-tight container.
- Vapor concentration method is 100 times more sensitive than standard headspace testing.

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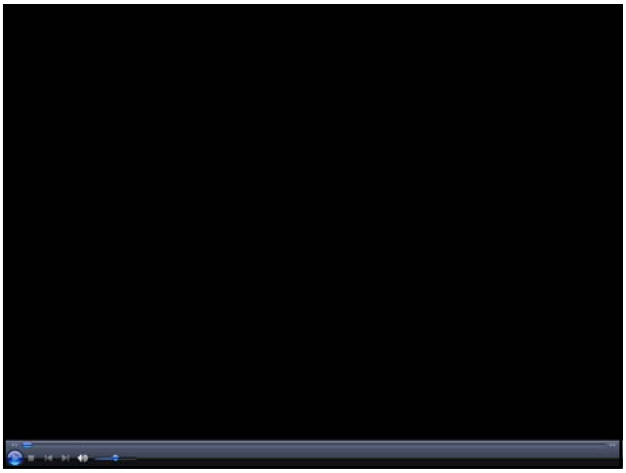
Review – Arson & Explosives

- Have you ever seen or heard what happens when alkali metals become wet?



Review – Arson & Explosives

- Low explosives only become “really” dangerous when they are confined.
- Black powder and smokeless powder are two most favorite low explosives.
- Fuel + oxidizer = low explosive
- Therefore, potassium chlorate and sugar make explosive.
- Add concentrated sulfuric acid and it is self igniting.
- Natural gas and air are a low explosive

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Review – Arson & Explosives

- Primary explosives (high) are so sensitive, they are used as primers for secondary explosives.
- Secondary explosives (high) are stable and can even be used as fire tinder.
- They need a primary.
- Secondary used for most military and commercial blasting
  - Dynamite
  - TNT
  - PETN
  - RDX (C-4)
  - Tetryl
- 1867 Alfred Nobel (Nobel peace prize) invented Dynamite

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Review – Arson & Explosives

- Dynamite and nitroglycerine related explosives have been replaced by ammonium nitrate and ANFO explosives
- ANFO – Ammonium nitrate and fuel oil (Oklahoma City)
  - a ratio of 2.5 to 3 quarts of fuel oil per 50 pounds of ammonium nitrate produces excellent results
- TATP – popular in Middle Eastern countries
  - Acetone
  - Hydrogen Peroxide
  - Hydrochloric Acid
- Molotov Cocktail
  - 1/3 oil
  - 2/3 gasoline
  - Gas rag as fuse
- ANNM or amonium nitrate and nitromethane is the most powerful type of AN explosive. It usually contains a 60:40 mix of AN and NM

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Review – Arson & Explosives

- Undetonated residue remains at the site of the explosion
- All loose soil and debris must be collected from the crater
- Items blown from blast area must be collected.
- Stationary items near blast origin must be inspected for residue.
- Extreme protection against contamination must be employed.
- Some explosives and accelerants can penetrate plastic, so don't place evidence bags near each other

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My youngest student
And most faithful employee

Quiz Week #5