

FIRE INVESTIGATION IS A HOT TOPIC

Fire & Explosives A



Chapter 12 & 13

Arson/ Fire is hard to investigate

Three things needed for investigation:

1. A motive must be established
2. Modus Operandi (the offender's pattern)
3. Must have a suspect

Introduction

- Fire and Explosives tend to destroy evidence.
- With fire and explosives evidence can be completely destroyed on purpose to hid a link between the suspect and the incendiary devise.
- However, residues remain at the scene.
 - Sometimes they soak into furnishings
 - Materials can be tested for residues

Introduction

- Most fires whether accidental or deliberate, leave some clue as to the heat source that started it.
- Fires burn at different temperatures which cause a different color flame and smoke.
 - Wood & Cloth fires = red yellow flame w/ gray-brown smoke
 - Gasoline = yellow white flame w/ black smoke
 - Cooking oil = yellow flame w/ brown smoke

Spontaneous Combustion

- Spontaneous Combustion is defined as the ignition of any chemical or material that is not initiated by the direct application of a flame.
- Stockpiles of low-rank coals may accumulate heat generated by oxidation and moisture re-adsorption. Given the right conditions this can lead to ignition.

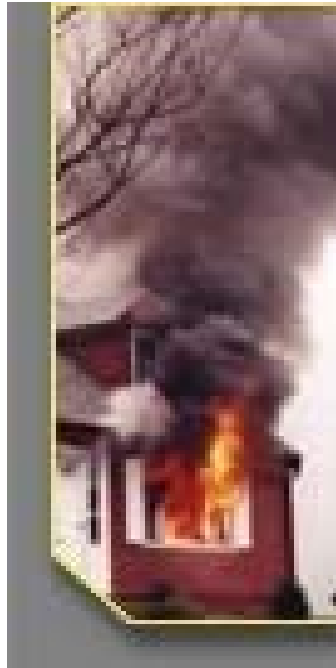
Spontaneous Combustion

Wet hay favors the growth of organisms which generate heat and can increase hay temperatures up to 150 degrees F. Once hay heats beyond this point, chemical reactions take over and can increase temperatures to the point of spontaneous combustion. With "wet" hay packed tightly in bales and stacked together in large quantities, fires are very possible.



Usually deaths that occur by fire/ arson

- Are considered ACCIDENTAL or
- Death by Smoke Inhalation (50-80%)



Common Causes of FIRE:

1. Most house fires start in the kitchen
2. Faulty wiring is dangerous (overloaded electrical outlet) HEATING & AIR CONDITIONING
3. Candles (near wood surfaces or drapes)
4. Electrical appliances
5. Electric blankets
6. Smoking in bed
7. Clothes dryers (clogged dryer vents)
8. oil burners/ space heaters
9. Ceiling Insulation and Down lights
10. Closet light obstruction (clothes too close to light bulb)

The CHEMISTRY OF Fire:

- HISTORY: Aristotle's four elements
EARTH, WATER, AIR, **FIRE**

Alchemy= the art of turning common metals into GOLD.

Pyrite AKA Fool's Gold bcs it fooled the Aristocrat's (aka King...Royalty)



Fire is not an element as it turns out but a transformation process during a combustion reaction. Noticeable quantities of heat and light (flame) are produced.

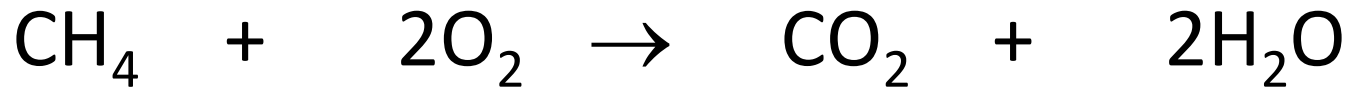


Fundamental Chemical Reaction of FIRE

COMBUSTION

Two examples of oxidation reactions:

Methane:



Glucose in your body: aka Cellular Respiration



Give the reaction for the oxidation of
Iron:

- In other words, give the reaction for rust:

Give the reaction for the oxidation of Iron:

- In other words, give the reaction for rust



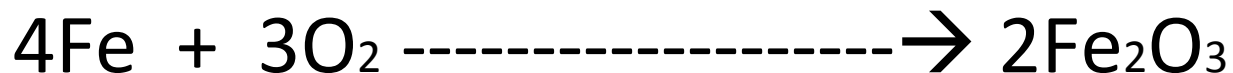
Write this equation and balance it:

Give the reaction for the oxidation of Iron:

- In other words, give the reaction for rust



Write this equation and balance it:



- **Arson Investigations**
- To light a fire, arsonists **need a flammable material and an accelerant** (such as kerosene or gas). Arson investigators look for these items when they're investigating the crime scene. Because all that's usually left of the evidence is charred remains, the investigators will collect fire debris and take it back to the forensics lab for analysis.

Chromatography

- **Chromatography** is the science which is studies the separation of molecules based on differences in their structure and/or composition.
- So accurate that it can be used to differentiate between different makes and grades of gasoline. Even what gas station it came from.

Chromatography

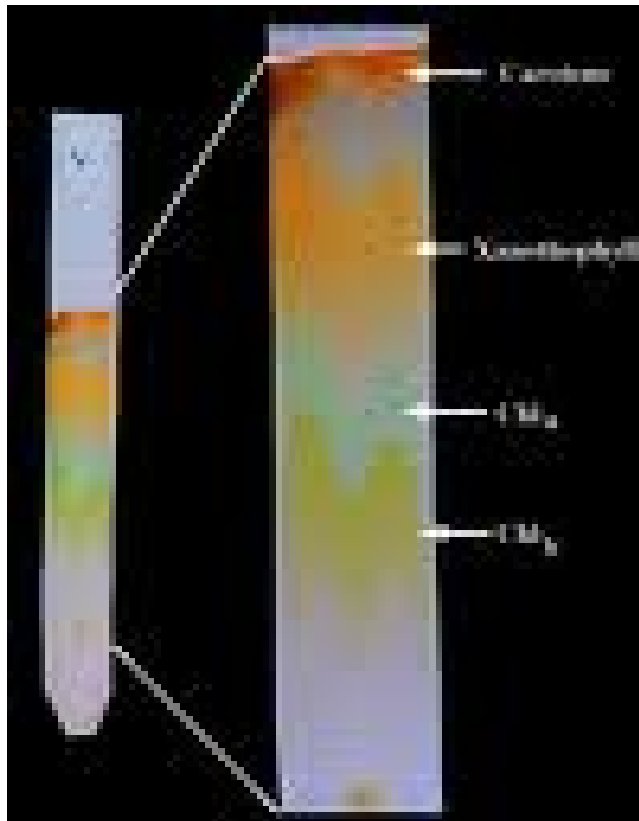
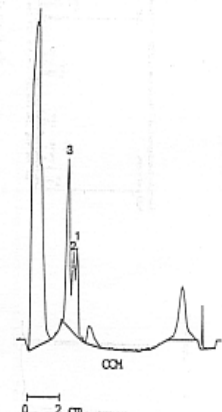
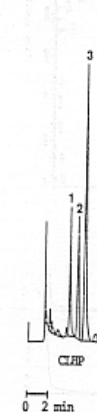
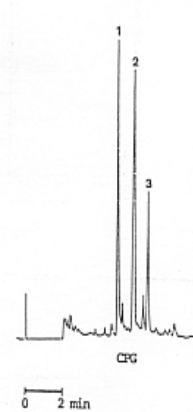


Figure 1. Gas chromatography, high-performance liquid chromatography and thin-layer chromatography of the same cannabis sample

Stationary phase: methyl silicone
 Oven temperature: 240°
 Carrier N₂: 0.5 bar
 Detection: flame ionization

Stationary phase: μ -Porasil
 Mobile phase: hexane 90 per cent
 chloroform 10 per cent
 Flow rate: 2 ml per min
 Detection: 220 nm

Stationary phase: silica gel
 Mobile phase: hexane 89 per cent
 chloroform 8.75 per cent
 dioxane 2.25 per cent
 Detection: 220 nm



- 1: cannabidiol
- 2: Δ -9-tetrahydrocannabinol
- 3: cannabinol

Flash Point

- **The flash point of a volatile liquid is the lowest temperature at which it can vaporize to form an ignitable mixture in air.**
- Liquid + Oxygen = Burn
- Measuring a liquid's flash point requires an ignition source. At the flash point, the vapor may cease to burn when the source of ignition is removed.

Flashpoint

1. Flammable and combustible liquids are present in almost every workplace.
2. **Fuels** and many common products like **solvents, thinners, cleaners, adhesives, paints, waxes and polishes** may be flammable or combustible liquids.
3. Everyone who works with these liquids must be aware of their hazards and how to work safely with them.



Fire Marshal



A **Fire Marshal** is often a member of a fire department but may be part of a building department or a separate department altogether. Fire marshals' duties vary but usually include **fire code enforcement and/or investigating fires for origin and cause**. Fire marshals may be sworn law-enforcement officers and are **often experienced firefighters**

Florida State Fire Marshal

Alex Sink

**State Fire Marshal
and Chief Financial Officer**



Fire Drills

According to Florida's State Requirements for Educational Facilities, a minimum of **ten** fire drills must be conducted per academic year, with two occurring during the first two weeks of the year

Did you know that the State Fire Marshal's Forensic Laboratory receives and examines over 10,000 evidence submissions every year?



Fire Marshal

A Fire Marshal writes the final report on the cause the a fire.



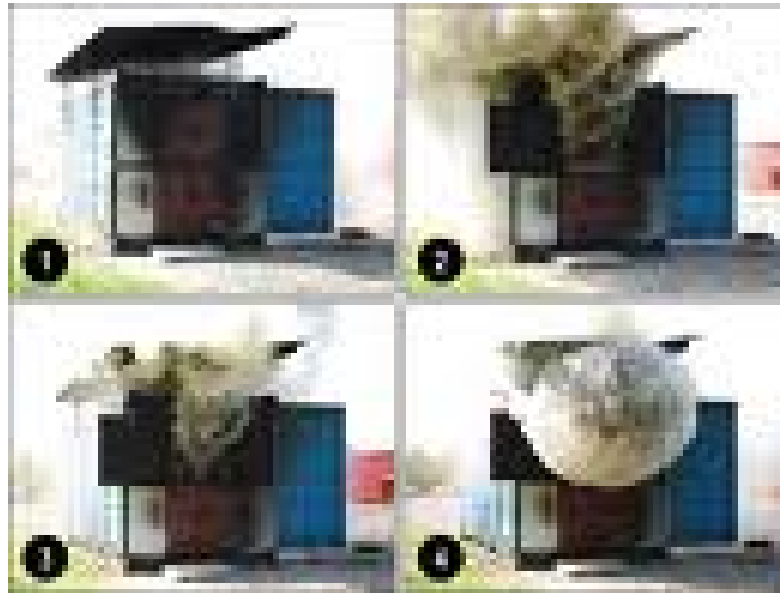


BACKDRAFT

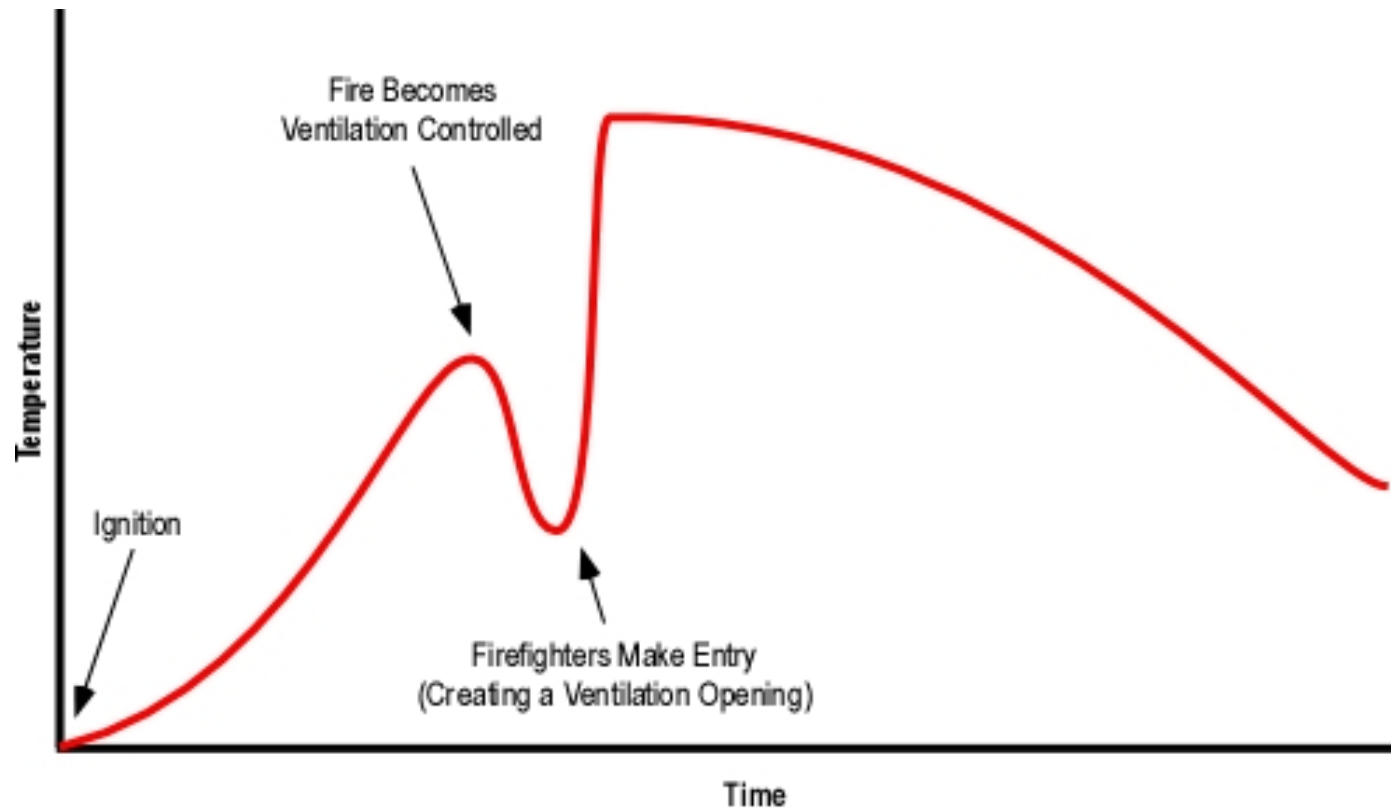


- A **backdraft** is a situation which can occur when a fire is starved of oxygen
- If oxygen is re-introduced to the fire (by opening a door/window to a closed room) combustion will restart often resulting in an explosive effect as the gases are heated by the combustion and expand
- May also be called FLASHOVER

BACKDRAFT Example



Temperature vs Time



One of the best ways for Arson Investigators to identify

- Foul play is by locating two (or more) POINT OF ORIGINS.
- Point of Origins are where the fire start and is the best starting point to figure out how the fire was started.
- GOTO following website for more information:
http://www.interfire.org/res_file/fseab_ro.asp