



# Fire Protection Training

Procedures Handbook 4300

FIRE PHYSICS & CHEMISTRY

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**TOPIC:** Basic Fire Chemistry

**TIME FRAME:** 30 Minutes

**LEVEL OF INSTRUCTION:**

**BEHAVIORAL OBJECTIVE:**

*Condition:* A written quiz

*Behavior:* The student will describe what occurs in the combustion process, list the components of the fire tetrahedron, types of heat transfer, and the products of combustion

*Standard:* With a minimum of 70% accuracy

**MATERIALS NEEDED:**

- Chalkboard
- Chalk
- Appropriate visual aids

**REFERENCES:**

- IFSTA, Essentials of Fire Fighting, 2nd Edition, Chapter 1

**PREPARATION:** To effectively control or extinguish a fire, one must understand the components of basic fire chemistry and the fire environment.





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BASIC FIRE CHEMISTRY

PRESENTATION	APPLICATION
<p>B. Slow Oxidation</p> <ol style="list-style-type: none"><li>1. Rust - iron oxide</li><li>2. Oxidized paint</li></ol> <p>C. Rapid Oxidation</p> <ol style="list-style-type: none"><li>1. Free burning fire</li></ol> <p>D. Instantaneous Oxidation</p> <ol style="list-style-type: none"><li>1. Effects of instantaneous releases can be tremendous</li><li>2. Explosion - two types<ol style="list-style-type: none"><li>a. Detonation<ol style="list-style-type: none"><li>(1) Reaction faster than the speed of sound</li><li>(2) Usually accompanied with shock wave</li><li>(3) Example - tri-nitro-toluene (TNT)</li></ol></li><li>b. Deflagration<ol style="list-style-type: none"><li>(1) Reaction slower than speed of sound</li><li>(2) Usually no shock wave</li><li>(3) Example -black powder</li></ol></li></ol></li></ol>	<p>Have students give example of slow oxidation</p>

### III. HEAT

4304.1





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BASIC FIRE CHEMISTRY

PRESENTATION	APPLICATION
<ul style="list-style-type: none"><li>(1) Heat released during a substance's complete oxidation.</li><li>b. Spontaneous heating<ul style="list-style-type: none"><li>(1) Process where organic material increases in temperature without drawing heat from outside source.</li></ul></li><li>c. Heat of decomposition<ul style="list-style-type: none"><li>(1) The release of heat from decomposing compounds. i.e., Explosives</li></ul></li><li>d. Heat of solution<ul style="list-style-type: none"><li>(1) Heat released when a substance is dissolved in a liquid.</li></ul></li><li>2. Electrical<ul style="list-style-type: none"><li>a. Electrical heat energy is capable of causing a fire through:<ul style="list-style-type: none"><li>(1) Resistance</li><li>(2) Induction</li><li>(3) Leakage</li><li>(4) Dielectric heating</li><li>(5) Static heating</li><li>(6) Lightning and arcing</li></ul></li><li>b. The most common means of electrical heat sources causing combustion is when resistance or "short" (overload) occurs.</li></ul></li><li>3. Mechanical<ul style="list-style-type: none"><li>a. Friction</li></ul></li></ul>	

4304.1

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PRESENTATION	APPLICATION
<ul style="list-style-type: none"><li>b. Compression</li><li>4. Nuclear<ul style="list-style-type: none"><li>a. Fission - splitting atoms</li><li>b. Fusion - joining of atoms</li></ul></li></ul>	
<b>IV. LIGHT</b>  A. Definition Illumination, Radiance or Brightness in the Form of Rays Issuing from some Illuminating Body	
<b>V. FIRE TETRAHEDRON</b>  A. Elements <ul style="list-style-type: none"><li>1. Oxygen</li><li>2. Fuel</li><li>3. Heat</li><li>4. Chain reaction</li></ul>	Information Sheet #2  For additional information see lesson plan on Fire Tetrahedron
<b>VI. HEAT TRANSFER</b>  A. Conduction <ul style="list-style-type: none"><li>1. Heat transfer by direct contact</li><li>2. Heat transfer by an intervening object</li></ul>	Information Sheet #3  Information Sheet #4



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PRESENTATION	APPLICATION
<p>B. Convection</p> <ol style="list-style-type: none"><li>1. Heat transfer by movement of air or liquid</li></ol> <p>C. Radiation</p> <ol style="list-style-type: none"><li>1. Heat transfer through the air. Travels in all directions. Temperature decreases as distance from the source increases.</li></ol>	<p>Information Sheet #5</p>



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BASIC FIRE CHEMISTRY

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## ***SUMMARY:***

Fire is a naturally occurring phenomenon and reacts to physical laws of nature.

## ***EVALUATION:***

A written quiz.

## ***ASSIGNMENT:***

To be determined by the instructor(s).