



Fire Protection Training

Procedures Handbook 4300

FIRE PHYSICS & CHEMISTRY

TOPIC: Fundamentals of Heat Transfer

TIME FRAME: 30 Minutes

LEVEL OF INSTRUCTION:

BEHAVIORAL OBJECTIVE:

Condition: A written quiz

Behavior: The firefighter will describe the methods of heat transfer and how fires can spread through the transfer of heat

Standard: With a minimum of 70% accuracy

MATERIALS NEEDED:

- Chalkboard
- Audio-visual equipment
- Transparencies

REFERENCES:

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

PREPARATION: Fires start, spread, and are controlled due to a basic principal of fire physics: the transmission of heat. A complete understanding of this principle is required for effective fire control operations and firefighter safety.

A firefighter needs to understand how fires spread in order to predict where the spread will occur, to confine, and to extinguish a fire



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FUNDAMENTALS OF HEAT
TRANSFER

PRESENTATION	APPLICATION
<p>I. THEORY OF HEAT TRANSFER</p> <p>A. Laws of Physics are Involved in the Transmission of Heat.</p> <ol style="list-style-type: none">1. "Law of heat flow".<ol style="list-style-type: none">a. Heat will flow from a hot object to a cold one. The colder object will absorb heat until both are the same temperature.b. Heat energy flows in all directions from where it is generated. It flows through all matter, be it solid, liquid, or gas. <p>II. THREE METHODS OF HEAT TRANSFER</p> <p>A. Conduction</p> <ol style="list-style-type: none">1. Heat may be conducted from one body to another by direct contact of the two bodies or through an intervening solid, liquid, or gas.<ol style="list-style-type: none">a. Metals are good conductorsb. Organic solids, such as wood, leather, cloth, are poor conductors.	<p>Ask class to define "Law of heat flow".</p> <p>What are the three methods of heat transfer?</p> <p>Define conduction.</p> <p>Ask class to give an example of conduction.</p>



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<p>c. Liquids and gases, including air, are very poor conductors due to the movement of their molecules.</p> <p>2. Heat conduction in structure fires</p> <p>a. Through walls, ceilings, floors or by metal columns, braces, or pipes which traverse floors, ceilings, or walls.</p> <p>B. Convection</p> <p>1. Transfer of heat by the movement of air or liquid. Example: As air near the base of a fire is heated, it expands and becomes lighter. As it rises, cooler air replaces it at the lower level.</p> <p>a. In structure fires convection transfers heat through stairwells, shafts, ducts, or holes burned through ceilings.</p>	<p>Ask class to list several materials and compare their conductivity.</p> <p>How can heat be conducted in a structure fire?</p> <p>Information Sheet #1</p> <p>Define convection</p> <p>Is convection a major cause of fire extension in structures?</p> <p>Information Sheet #2</p> <p>Why is convection of heat a serious problem in light combustibles</p>



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<p>b. The convection column carries heated or burning material aloft causing spot fires.</p> <p>C. Radiation</p> <p>1. Heat transferred through rays or waves similar to light rays. These heat rays travel through the air in the form of energy and are only converted to heat when they are absorbed by some substance, such as the sun heating the earth.</p> <p>D. Some Training Manuals Classify Direct Flame Contact as a Method of Heat Transfer. Because of the Proximity of the Flame to the New Fuel, It Makes All Three Methods of Heat Transfer More Efficient But Is Not In and of Itself an Independent Method of Heat Transfer.</p>	<p>such as shingles, grass, and brush?</p> <p>Define radiation</p> <p>Information Sheet #3</p>



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SUMMARY:

Heat is transferred in three ways. It may be conducted through a substance, convected by a substance or radiated from one substance to another.

EVALUATION:

A written quiz.

ASSIGNMENT:

To be determined by instructor(s).