TOPIC: BASIC WILDLAND FIRE BEHAVIOR

TIME FRAME: 2:00

LEVEL OF INSTRUCTION: Level I

BEHAVIORAL OBJECTIVE:

Condition: Given a written quiz

Behavior: The student will confirm a knowledge of terms and principles related to fire physics and wildland fire behavior

Standard: With a minimum 70% accuracy

MATERIALS NEEDED:

- Writing board with markers/erasers
- Appropriate audio visual equipment and screen
- Video: “Introduction to Fire Behavior”, (0:30)
- Slides/transparencies for this lesson
- Student Information Sheets 4202.3-1 through 3
- Topic Quiz

REFERENCES:

- CDF Fire Protection Traning Handbook 4300
- Wildland Firefighting, Clayton, Day, and McFadden, 1987

PREPARATION: A firefighter needs to have a basic understanding of fire behavior and physics This knowledge is necessary for safe and effective control of wildland fires.

PRESENTATION	APPLICATION

I. WILDLAND FIRE PHYSICS

Show video "Introduction to Fire Behavior"

A. Terminology

1. Fire Triangle

a) Heat

b) Oxygen

c) Fuel

d) Remove any side and fire cannot exist

NOTE: Diagram on chalkboard

1) Construct a fire line and remove the fuel

2) Apply dirt and remove oxygen

3) Apply water and remove the heat

2. Ignition Temperature

a) The temperature at which a substance will ignite and continue to burn without adding heat from an outside source

3. Sources of Heat

a) Direct application of flame (matches, blow torch)

b) Direct application of embers (lighted cigarette, cigar)

c) Electrical arcing (lightning, down power line)

PRESENTATION	APPLICATION
d) Friction (moving machinery, slipping pulley) e) Spontaneous combustion (pile of oily rags) 4. Heat Transfer **NOTE:** Hand out Student Information Sheet 4202.3-1, Heat Transfer	
	Display graphic 4202.3-1
a) Radiation 1) Heat is transferred from its source through the air in all directions • Like a campfire b) Convection 1) Heat is transferred by the movement of hot air rising and heating the fuel above • Like a hot air balloon c) Conduction 1) Heat is transferred within the fuel by direct contact (from the hot point to the cold point) • Like a metal rod versus a tree limb B. The Wildland Fire Environment 1. Weather Factors a) Wind	

PRESENTATION	APPLICATION
1) Provides oxygen 2) Provides velocity/speed 3) Causes spotting problems 4) Causes extreme heat at head of fire 5) Changes in the wind can be dangerous to the firefighter	Ask class to list and explain, "What to watch for"
• Whirlwinds, instability • Changes in direction of drifting smoke • Weather fronts approaching • Mountain shadows in the afternoon • Time of day, as evening may bring down-canyon winds • Approaching fog banks • Thunder heads	
b) Temperature 1) High temperature quickly dries out fuel 2) As ignition temperature is approached, less external heat is required to start a fire	
c) Humidity	

PRESENTATION	APPLICATION
1) Relative humidity (RH) • Amount of moisture in air vs amount of moisture air can hold = RH d) Fuel moisture 1) Live fuel moisture: • Living vegetation • Moisture drawn from soil through root system 2) Dead fuel moisture • Dead vegetation • Moisture drawn from surrounding air • Light fuels: (cured grass) change fuel moisture rapidly with weather changes • Heavy fuels: (slash, logs) change fuel moisture much slower • Time lag 1 hour, 10 hour, 100 hour, 1000 hour 2. Wildland fuel factors **NOTE:** Hand out Student Information Sheet 4202.3-2, Fuel Components	Display graphic 4202.3-2

PRESENTATION	APPLICATION

a) Brush in California is an extremely hot burning fuel

b) No burning fuel should be considered safe or easy to extinguish

c) Size of fuel

1) Light - Grass, leaves, and pine needles

- Responds quickly to changes in relative humidity

2) Medium - Brush and small trees

- Slower to change

3) Heavy - Logs, tree stumps and slash

- The slowest to change

d) Arrangement

1) Ground fuels

2) Aerial fuels

3) Uniformity

4) Patchy

5) Compactness

e) Volume

1) The amount of flammable material in a given area

2) Generally, as the amount of fuel increases, the heat produced by fire also increases

PRESENTATION	APPLICATION
3. Topography a) Aspect 1) Cardinal directions • North-south • East-west 2) Sun's path • The southwest receives most of the sun during the year • The southwest also receives most of the daily heat • It is the most hazardous exposure b) Steepness	
NOTE: Hand out Student Information Sheet 4202.3-3, Topography	
	Display graphic 4202.3-3
1) Fires burn faster upslope than downslope • Preheating by convection and radiation • Reduced angle between fire and fuel c) Extremely steep slopes 1) Fire will burn rapidly upslope	

PRESENTATION	APPLICATION
2) Burning materials may roll below the firefighter 3) Difficulty in working or escaping fire d) Canyon fire behavior 1) Wind normally travels up canyon during the day and down canyon at night 2) Wind across wide canyons is normally steady 3) Wind across narrow canyons is erratic and causes turbulence, drafts, whirlwinds, etc C. Large Fires 1. Yields intense heat in extreme conditions, temperatures up to 2650 degrees F may be encountered 2. Area Ignition a) Radiant heat preheating adjoining fuel b) Entire area ignites simultaneously c) Firefighters should work spot fires from control area or a clean burned area leaving no fire between them and the safe area	Initiate discussions and student feedback on how changes in fuel, topography, and weather will effect fire behavior Administer Topic Quiz

SUMMARY:

As a firefighter or a crew, it is vitally important to understand wildland fire physics terminology, including the fire triangle, ignition temperature, sources of heat, and heat transfer, and the components of the wildland fire environment, including weather factors, fuel factors, and topography.

EVALUATION:

The student will complete a written quiz at a time determined by the instructor.

ASSIGNMENT:

Review your notes and Student Information Sheets in preparation for the upcoming quiz. Study for the next session.