

11 FIRE PROTECTION

ANSWERS—QUIZ 1

1. b
2. b
3. a
4. b
5. a
6. b
7. c
8. c
9. e
10. d
11. b
12. a
13. Heat energy is transmitted by convection, conduction, radiation, and direct flame contact.
14. An automatic sprinkler system is the best tool to reduce loss of life from fire because, properly installed and maintained, it is on-site, 24-hour a day fire protection.
15. Achieving the most efficient fire protection system requires the involvement of the architect, interior designer, urban planner, building contractor, electrical and structural engineers, fire detection-system manufacturers, building safety engineer, and local fire marshal.
16. Inspection of equipment should cover the following items: hydrants; fire pumps; control valves on piping that supplies water for fire protection; hose houses and associated equipment; sprinkler system water supplies, including tanks; automatic sprinkler systems; special types of protection; portable fire extinguishers; fire doors, aisles and exits; special hazards and operation processes; detectors; control room or panel checkouts; alarm and communication systems and routines; communication to the fire department or to other mutual aids.
17. *Flammable* refers to any substance that is easily ignited, burns intensely, or has a rapid rate of flame spread. *Flammable* and *inflammable* are identical in meaning. *Flame proof* refers to material incapable of burning.
18. When a fire breaks out in a building, protect adjacent buildings by closing every window facing the burning building, stationing fire brigade workers with fire

extinguishers or fire hoses at each window nearest the fire, and stationing fire fighters on the exposed building's roof with hose lines to keep the roof wetted down and with extinguishers to put out any burning embers.

19. If the following conditions are met, an employee might decide to fight a fire with an extinguisher: there is a clear exit, the fire brigade or department has already been called or is being called, the fire is small, such as one in a wastebasket or tool housing, the employee knows how to use the extinguisher, the extinguisher is in working order.
20. Essay can vary in content, but should hit upon several of the following key issues:
 - Prepare an emergency manual to outline procedures and drills and to assign responsibilities to each person involved.
 - Make prevention of personal injury and loss of life your primary objective.
 - Carefully plan and periodically carry out fire drills in a serious manner under strict circumstances.
 - Train employees to leave their seats and exit the building.
 - Post up-to-date instruction sheets to all employees, outlining evacuation routes.
 - Post maps for alternative routes.
 - Assign someone to call the fire department.
 - Post fire guards in each area to make sure they are evacuated, including rest rooms and lunchrooms.
 - Set up lights to simultaneously go on along with the fire alarm.
 - Perform a roll call outside.
 - Frequent fire drills show management's concern.

ANSWERS—QUIZ 2

1. a
2. a
3. a
4. a
5. b
6. b
7. d
8. a
9. c
10. b

11. a
 12. a
 13. Fire, or the process of combustion, occurs when fuel, oxygen, heat, and a chemical chain reaction join in a symbiotic relationship.
 14. Fires can be controlled in the following ways: heat can be taken away by cooling; oxygen can be taken away by excluding the air; fuel can be removed to an area where there is not enough heat for ignition; or the chemical reaction of the flame fire can be interrupted by inhibiting the rapid oxidation of the fuel and the concomitant production of free radicals, the lifeblood of the flame's reaction.
 15. Student must name and describe two types of foam from the following list: low-expansion foam; chemical foam; mechanical or air generated foam; protein concentrates; fluorinated surfactant foams; foam-water systems; wet water foam; wet water, high-expansion foam.
 16. Reserve the hose for fire fighting. Keep hose valves tight, since leakage will rot linen hose. Examine hose visually each year for mildew, rot, and damage by chemicals, vermin, and abrasions. If the hose is in doubtful condition, give it a hydrostatic pressure test. Replace damaged hose. Give the hose a pressure test after the fifth and eighth years of service. Then repeat the test every second year after the eighth year. Keep hose clean. Wash woven jacket, lined hose with laundry soap if necessary. Dry hose jackets thoroughly after use and keep them dry.
 17. Water can be supplied from underground supply mains from public water works; automatically or manually controlled pumps drawing water from lakes, ponds, rivers, surface storage tanks, underground reservoirs, or similar adequate sources; pressure tanks containing water and compressed air; or elevated tanks or reservoirs that depend on gravity.
 18. Every fire alarm system should meet the following criteria: when alarms are audible, the alarm sound should be clearly and immediately distinguishable from other signals that might be used in a given building. Provision for alerting hearing-impaired workers is necessary. Strategically locate audible alarm devices so they are clearly audible to all personnel. Train personnel to recognize the signal to respond according to that location's specific disaster control process.
- The fire alarm system should be composed of equipment that conforms to NFPA standards and is listed by UL. Maintain the system in good working order and test it at frequent intervals to ensure that it is working properly. The interval between tests should not exceed one month. All personnel should know the location of and means of contacting external fire protection sources.
19. Student must name and describe two of the following: thermal detectors, fixed temperature detectors, rate-compensated thermal detectors, rate of rise thermal detectors, line thermal detectors, eutectic-salt-line thermal detectors, bulb detection systems, smoke detectors, beam photoelectric detectors, reflected beam photoelectric detectors, products-of-combustion detectors, single chamber ionization detectors, dual chamber ionization detectors, low-voltage ionization detectors, flame detectors, infrared detectors, ultraviolet detectors, or combustion-gas detectors.
 20. Student should come up with an outline that touches many of the following points:
 - Site
 - location and age of building
 - accessibility for fire-fighting equipment
 - possibility of exposure
 - amount of water supply available
 - traffic
 - Building Construction
 - framework
 - fire-resistance ratings of materials
 - roof materials
 - interior and exterior wall materials and windows
 - floors
 - interior finish
 - shape
 - heat, ventilating, and air conditioning system
 - use
 - concealed spaces
 - exterior doors and exits
 - elevators, stairways and chutes
 - fuel sources for heating
 - storage areas
 - raw stock and finished goods
 - electrical systems
 - Building Contents

- materials, liquids, solid materials, location
- Management Factors
 - overall cleanliness, employee smoking policy
- People Factors
 - location of patrons, visitors, and employees
 - activity of people
 - location and accessibility of exits
- Fire Protection System
 - detection system
 - alarm system
 - emergency lighting
 - extinguishing system
- After the Fire
 - Cleanup
 - emergency plan for business

tem, emergency lighting, extinguishing system.

- After the Fire: Cleanup, emergency plan for business.

3. Other probable questions Margaret asked include:
 - What materials are flammable?
 - What materials in a process or operation are most likely to ignite/burn/explode?
 - What in the facility could be a source of ignition?
 - Are any open sparks or flames present?
 - Are high temperatures involved in any operations?
 - Where are flammable and combustible materials located?
 - Might any of the materials ignite because of convection or radiation?
 - What toxic gases might evolve into a fire?
 - How much time might it take for a fire to spread to other areas and adjacent facilities?
 - How many people are likely to be in the facility? Adjacent facilities?

ANSWERS—CASE STUDY

1. Class A fires occur in ordinary materials, such as wood, paper, excelsior, rags, and rubbish. The quenching and cooling effects of water, or of solutions containing large percentages of water, are of first importance in extinguishing these fires. Dry-chemical agents provide both rapid knockdown of the flames and the formation of a coating that tends to retard further combustion. Where total extinguishment is mandatory, water is used as a follow up.
2. Fire Hazard Analysis:
 - Site: location and age of building, accessibility for fire-fighting equipment, possibility of exposure, amount of water supply available, traffic.
 - Building Construction: framework, fire-resistance ratings of materials, roof materials, interior and exterior wall materials and windows, floors, interior finish, shape, heat, ventilating, and air conditioning system, use, concealed spaces, exterior doors and exits, elevators, stairways and chutes, fuel sources for heating, storage areas, raw stock and finished goods, electrical systems.
 - Building Contents: materials, liquids, solid materials, location.
 - Management Factors: Overall cleanliness, employee smoking policy.
 - People Factors: location of patrons, visitors, and employees; activity of people; location and accessibility of exits.
 - Fire Protection System: detection system, alarm sys-