24 LABORATORY SAFETY

ANSWERS—QUIZ 1

1. a
2. a
3. b
4. b
5. d
6. d
7. a
8. a, d
9. d
10. The most cited OSHA standard covering laboratories is 29 CFR 1910.1450.
11. Poisons should be stored separate from all other chemicals and secured from unauthorized access.
12. Variables that impact the effectiveness of a fume hood are the sash-opening height, the amount of equipment in the hood, storage within the hood, air velocity, and hood location.
13. The Laboratory Standard covers workplace laboratories where relatively small quantities of hazardous chemicals are used on a nonproduction basis.
14. Gas-filled detectors and scintillation detectors are the two common types of portable radiation survey equipment.
15. The acronym "ALARA" stands for "as low as reasonably achievable."
16. "Laser" is an acronym for "light amplification by stimulated emission of radiation."
17. The three types of control measures that companies can use for laser hazards are engineering controls, administrative controls, and personal protective equipment.
18. Laser energy is the principal hazard of fiber optic devices.
19. Usually, laboratories are designed so that the HVAC system can maintain a negative pressure inside the lab in relation to the surrounding environment. This type of pressure relationship ensures that air moves from offices, hallways, and other nonlaboratory spaces into the laboratory. This relationship will serve to minimize potential exposure to odors or contaminants generated by laboratory operations.
20. Clean room ventilation hoods typically push air away from the product and toward the worker, thereby potentially increasing employees' exposure to chemical vapors. The hot, dry, and windy environment is associated with a number of potential medical problems for workers, including dermatologic, allergic, and respiratory ailments. Also, it is not surprising that workers who operate in a constant, unchanging environment that is completely isolated physically and emotionally from the outside should report a myriad of psychological problems.

ANSWERS—QUIZ 2

1. a
2. a
3. b
4. a
5. b, d
6. a
7. b
8. b
9. Some of the more common types of hazards that may be encountered in laboratories include biohazards, physical hazards, chemical hazards, and ionizing and nonionizing radiation.
10. Common safety interlocks that should be found on autoclaves include control lock-out switches that prevent cycles from starting if the door is not closed and locked, and mechanical steam pressure locks to prevent operators from opening a door while the chamber is under positive pressure.
11. Biological hazards, or biohazards, consist of pathogenic (disease-causing) microorganisms that could pose a risk to the health and physical well being of humans, animals, or other biological organisms.
12. The three elements of containment are laboratory practice and technique, safety equipment, and facility design.
13. Cryogenic liquids are extremely cold (below -130 F/90 C) refrigerated liquids normally stored at low pressures in specially constructed, multi-walled, vacuum-insulated containers.
14. An efficient, cost-effective means of controlling laboratory exposures to hazardous contaminants is by using local exhaust ventilation to remove contaminants at the source. Laboratory fume hoods function in this manner.
15. Time, distance, shielding, and quantity are the four

basic concepts for radiation protection methods.

16. The Nuclear Regulatory Commission sets radiation protection standards and rules for radioactive materials.
17. Suitable emergency eyewash facilities should be available to all laboratories where there is the possibility of a hazardous material exposure. Laboratories using strong acids or caustics should locate an eyewash unit immediately adjacent to the hazard. In all other cases, eyewash units should be located on the same level as the hazard, and the path of travel should be free of obstructions that might inhibit the immediate use of the equipment. The eyewash facilities should be in accessible locations that require no more than 10 seconds to reach. An eyewash station should be capable of providing a flow of tepid water for at least 15 minutes at a flow rate of at least 0.4 gallons per minute.
18. Methods of controlling radiation exposures (doses) include posting signs marking radiation areas, restricting access to these areas or to radiation-emitting equipment, and training the users in safe procedures and practices. Workers can also be separated from the radiation hazard by distance or shielding with appropriate materials to reduce radiation received to below the maximum permissible dose.

ANSWERS—CASE STUDY

1. The Occupational Exposure to Bloodborne Pathogens standard limits occupational exposure for all employees who could be "reasonably anticipated" as the result of performing their job duties to face contact with blood and other potentially infectious materials.
2. Universal precautions (treating body fluids/materials as if infectious) along with engineering and work practice controls are the primary control measures. The standard sets forth procedures to minimize needlesticks, minimize splashing and spraying of blood, ensure appropriate packaging of specimens and regulated wastes, and to decontaminate equipment or label it as contaminated before shipping to servicing facilities.
3. The training must include the following:
   - making accessible a copy of the regulatory test of the standard and explanation of its contents;
   - general discussion on bloodborne diseases and their transmission, exposure control plan, engineering and work practice controls, personal protective equipment, and hepatitis B vaccine;
   - response to emergencies involving blood;
   - how to handle exposure incidents;
   - the post-exposure evaluation and follow-up program; and
   - signs/labels/color-coding.