FULL-LENGTH PRACTICE TESTS

Practice Test 10: Drainage, Waste, Vent, Storm Water, And Specialty Piping — Chapter 10

Questions 1–50

1. What is the primary function of the sanitary drainage system in a commercial building?

A. Conveying wastewater and sewage from plumbing fixtures to the building sewer by gravity flow

B. Distributing potable water to all plumbing fixtures

C. Collecting rainwater from the roof for landscape irrigation

D. Providing fire suppression water throughout the building

2. What physical principle governs the flow of wastewater through a sanitary drainage system?

A. Pressure from a recirculation pump pushing waste through the piping

B. Vacuum created by mechanical exhaust fans at the building sewer connection

C. Gravity, requiring all horizontal drainage piping to be installed at a minimum slope toward the point of discharge

D. Capillary action drawing wastewater through small-diameter tubing

3. What is the standard minimum slope required for horizontal sanitary drainage piping 3 inches in diameter and smaller?

A. 1/16 inch per foot

B. 1/4 inch per foot

C. 1/2 inch per foot

D. 1 inch per foot

4. What is the standard minimum slope required for horizontal sanitary drainage piping 4 inches in diameter and larger?

A. 1/4 inch per foot

B. 1/2 inch per foot

C. 1/16 inch per foot

D. 1/8 inch per foot

5. What is the primary function of the vent system in a sanitary drainage system?

A. Maintaining atmospheric pressure in the drainage piping to protect fixture trap seals and allow proper drainage flow

B. Exhausting sewer gases to the exterior through mechanical fans

C. Providing fresh air supply to the building's HVAC system

D. Equalizing water pressure between hot and cold water systems

6. What happens to fixture trap seals if the drainage vent system is inadequate or blocked?

A. The water temperature in the trap increases to unsafe levels

B. The trap fills with additional water creating a complete blockage

C. Siphonage or back-pressure can break the trap seal, allowing sewer gases to enter the building

D. The fixture flow rate increases beyond the design capacity

7. What is a fixture trap and what is its primary function?

A. A filter screen that prevents debris from entering the drainage system

B. A check valve that prevents backflow of wastewater into the fixture

C. A pressure relief device that protects the drainage system from surges

D. A U-shaped fitting that maintains a water seal between the fixture drain and the sewer system, preventing sewer gas from entering the building

8. What is the minimum trap seal depth required by the plumbing code for most fixture traps?

A. 1 inch of water seal

B. 2 inches of water seal

C. 4 inches of water seal

D. 6 inches of water seal

9. What piping material is most commonly used for sanitary drainage systems within commercial buildings?

A. Cast iron with no-hub couplings or hub-and-spigot joints

B. Type L copper tubing

C. PEX cross-linked polyethylene

D. Galvanized steel pipe

10. What is the primary advantage of cast iron drainage piping in commercial buildings compared to plastic alternatives?

A. Lower material and labor cost than all plastic piping options

B. Lighter weight for easier overhead installation

C. Superior sound attenuation, fire resistance, and structural durability

D. Greater flexibility allowing routing around obstructions without fittings

11. Where plastic drainage piping is permitted in commercial buildings, which material is most commonly specified?

A. PEX cross-linked polyethylene

B. Polybutylene pipe

C. CPVC chlorinated polyvinyl chloride

D. PVC or ABS plastic drainage pipe as permitted by the applicable code and building type

12. What fitting type must be used for changes in direction in horizontal-to-vertical sanitary drainage piping connections?

A. Short-radius elbows for compact routing in tight spaces

B. Long-sweep or sanitary-pattern fittings that maintain smooth flow and minimize turbulence

C. Standard 90-degree elbows identical to water supply fittings

D. Compression couplings without directional consideration

13. What is the primary function of a cleanout in a sanitary drainage system?

A. Providing access for clearing blockages and maintaining the drainage piping through removable plugs installed at required intervals and locations

B. Collecting grease from kitchen waste before it enters the drainage system

C. Venting sewer gases from the drainage system to the exterior

D. Connecting the building drain to the municipal sewer main

14. What is the maximum spacing between cleanouts on horizontal drainage piping per most plumbing codes?

A. 25 feet for all pipe sizes

B. 200 feet regardless of pipe size or accessibility

C. Typically 100 feet with additional cleanouts at changes in direction, at the base of stacks, and where piping transitions from vertical to horizontal

D. Cleanouts are only required at the building sewer connection

15. What is the primary function of a grease interceptor in a commercial kitchen drainage system?

A. Filtering solid food waste from the drainage stream

B. Heating kitchen wastewater to dissolve grease before discharge

C. Increasing the flow velocity to prevent grease accumulation in piping

D. Separating fats, oils, and grease from kitchen wastewater before it enters the sanitary sewer to prevent sewer blockages and treatment plant interference

16. How does a grease interceptor function to remove grease from the waste stream?

A. Using chemical agents to dissolve grease within the interceptor tank

B. Slowing the flow velocity to allow grease to float to the surface and be retained while clarified water discharges from the bottom of the unit

C. Filtering waste through activated carbon media to absorb grease

D. Heating the waste stream to vaporize grease before discharge

17. What determines the required size of a grease interceptor for a commercial kitchen?

A. The fixture unit load, flow rate, and grease retention capacity based on the number and type of contributing kitchen fixtures and the local jurisdiction requirements

B. The total building occupancy regardless of kitchen size

C. The distance from the kitchen to the building sewer connection

D. The diameter of the building's main sanitary drain

18. What is the primary function of an acid waste system in a commercial building?

A. Neutralizing acidic condensate from high-efficiency boilers

B. Providing drainage for standard restroom fixtures

C. Storing chemicals for water treatment systems

D. Collecting and neutralizing corrosive chemical waste from laboratories, medical facilities, or industrial processes before discharge to the sanitary sewer

19. What piping material is required for acid waste drainage systems?

A. Standard cast iron with no-hub couplings

B. Type L copper with soldered joints

C. Chemical-resistant materials such as polypropylene, PVDF, or borosilicate glass that withstand the specific chemicals being drained

D. PVC schedule 40 identical to standard drainage piping

20. What component is required in an acid waste system before the waste discharges into the building's sanitary drainage?

A. A standard P-trap identical to restroom fixtures

B. An acid neutralization tank or basin that treats the acidic waste to an acceptable pH before discharge to the sanitary sewer

C. A grease interceptor to separate chemical residues

D. A backflow preventer to protect the municipal water supply

21. What is the primary function of a building storm drainage system?

A. Collecting wastewater from plumbing fixtures during heavy usage

B. Providing overflow capacity for the sanitary sewer system

C. Collecting and conveying rainwater from the roof and site to an approved point of discharge

D. Distributing reclaimed water for toilet flushing

22. What component collects rainwater at the roof level and directs it into the storm drainage piping?

A. A roof drain with a strainer dome that prevents debris from entering the piping while allowing water to flow into the storm drain leader

B. A plumbing vent terminal extending above the roof

C. A rooftop air handling unit condensate drain

D. A sanitary drainage stack vent through the roof

23. How is storm drainage piping sized for a commercial building?

A. Using the same fixture unit method as sanitary drainage sizing

B. Using the maximum pipe size available regardless of roof area

C. Based on the number of floors in the building

D. Based on the roof area served, the local rainfall intensity rate in inches per hour, and the pipe slope

24. What is the primary function of a secondary or emergency roof drainage system?

A. Providing a backup sanitary drainage path for restroom fixtures

B. Providing an overflow path for rainwater if the primary roof drains become blocked or overwhelmed, preventing structural roof overload

C. Collecting condensate from rooftop HVAC equipment

D. Draining the roof after fire suppression system testing

25. How does a secondary roof drainage system typically indicate that the primary system is not functioning properly?

A. By activating an alarm on the building automation system

B. By shutting down the primary drain system automatically

C. By discharging water at a visible location such as through the building exterior wall or scupper, alerting building occupants to the primary system failure

D. By diverting flow to the sanitary sewer system

26. What code requirement prevents the connection of storm drainage and sanitary drainage systems in most jurisdictions?

A. Storm and sanitary drainage must remain separate systems to prevent raw sewage from backing up through storm drains during heavy rain and to prevent rainwater from overloading sewage treatment plants

B. Storm drainage piping uses different materials that are incompatible with sanitary waste

C. Storm water is warmer than sanitary waste and would damage sanitary piping

D. Combined systems would require larger grease interceptors

27. What is the primary function of an interior floor drain in a commercial building?

A. Providing overflow protection for the domestic water system

B. Connecting the building's potable water to the drainage system

C. Providing emergency drinking water access at floor level

D. Collecting water from equipment leaks, condensate, spills, or washdowns and conveying it to the appropriate drainage system

28. What must be maintained at every floor drain and fixture trap that is not regularly used?

A. A constant flow of fresh water through a dedicated supply line

B. The trap seal must be maintained by periodic priming or an automatic trap primer to prevent the water seal from evaporating and allowing sewer gas to enter the building

C. A sealed cap must be installed to permanently close unused drains

D. Insulation must be wrapped around the trap to prevent freezing

29. What is a trap primer and how does it function?

A. A device that automatically adds small amounts of water to infrequently used floor drain traps to maintain the water seal and prevent sewer gas entry

B. A chemical additive that prevents trap seal evaporation

C. A mechanical plug that seals unused floor drains permanently

D. A heating element that prevents trap water from freezing in cold climates

30. What is the primary function of a sewage ejector system?

A. Increasing the water pressure to fixtures below grade

B. Treating sewage before discharge to the municipal sewer

C. Providing backup drainage during municipal sewer surcharges

D. Collecting and pumping sewage and wastewater from fixtures located below the elevation of the building's gravity sewer connection

31. What components make up a complete sewage ejector system?

A. Only a submersible pump in an open floor pit

B. A sealed basin, submersible pump, check valve, gate valve, vent connection, high-level alarm, and discharge piping to the gravity drainage system

C. A grinder pump connected directly to each below-grade fixture without a basin

D. A gravity drain with a backwater valve at the floor level

32. What is the primary function of a backwater valve in a sanitary drainage system?

A. Preventing grease from entering the municipal sewer

B. Increasing the flow velocity in the building drain

C. Regulating the drainage flow rate to prevent surcharges

D. Preventing sewage from backing up into the building through the sewer connection during municipal sewer surcharges

33. What is the primary function of a sump pump in a commercial building?

A. Providing potable water pressure to below-grade fixtures

B. Recirculating hot water through the distribution system

C. Collecting and pumping clear water such as groundwater, condensate, or non-sewage drainage from below-grade areas to a storm drain or approved discharge point

D. Pumping fire suppression water from the basement to the roof

34. How does a sump pump differ from a sewage ejector in function and application?

A. Sump pumps handle clear water and non-sewage drainage while sewage ejectors handle sanitary waste, requiring sealed basins and vent connections

B. There is no functional difference between sump pumps and sewage ejectors

C. Sump pumps are larger and handle higher flow rates than ejectors

D. Sewage ejectors are used only in residential applications

35. What is the primary purpose of medical gas piping systems in healthcare facilities?

A. Providing natural gas for laboratory Bunsen burners

B. Distributing compressed air for pneumatic building controls

C. Supplying fuel gas to kitchen cooking equipment

D. Distributing medical-grade oxygen, nitrous oxide, medical air, vacuum, and waste anesthetic gas disposal to patient care areas

36. What code standard governs the installation of medical gas and vacuum systems?

A. NFPA 13 Standard for Sprinkler Systems

B. NFPA 99 Health Care Facilities Code, which establishes the requirements for medical gas piping installation, testing, and certification

C. ASHRAE Standard 62.1 Ventilation Standard

D. International Mechanical Code

37. What piping material is required for medical gas distribution systems?

A. PVC plastic pipe with solvent-welded joints

B. Black steel pipe with threaded connections

C. Type K or L copper tubing cleaned for oxygen service and joined by brazing with nitrogen purge

D. Galvanized steel pipe with mechanical couplings

38. What is the primary function of a natural gas piping system in a commercial building?

A. Distributing fuel gas from the utility meter to gas-fired equipment such as boilers, water heaters, rooftop units, and kitchen appliances

B. Providing medical-grade gases to patient care areas

C. Distributing compressed air for pneumatic tools

D. Supplying gas for laboratory fume hood operation

39. What piping material is commonly used for interior natural gas distribution in commercial buildings?

A. PVC plastic pipe with solvent-welded joints

B. Type L copper tubing with flared connections

C. PEX cross-linked polyethylene tubing

D. Black steel pipe with threaded or welded joints and corrugated stainless steel tubing for certain applications

40. What safety device is required on the natural gas service entrance to a commercial building?

A. A temperature and pressure relief valve

B. A manual gas shutoff valve accessible for emergency use, and an earthquake shut-off valve where required by code

C. A backflow prevention assembly identical to water service

D. A pressure booster pump for upper floor gas appliances

41. What is the primary purpose of a compressed air system in a commercial building?

A. Providing clean, dry compressed air for pneumatic controls, laboratory equipment, dental stations, or industrial processes

B. Supplying breathing air for building occupants

C. Pressurizing the building's domestic water system

D. Operating the fire alarm notification appliances

42. What is the primary construction coordination concern for below-grade drainage piping?

A. Matching the pipe color to the finished floor color

B. Installing drainage piping after the concrete slab is poured

C. Using only the smallest available pipe diameter to minimize slab penetrations

D. Verifying pipe elevations, slopes, and connection locations before concrete placement because below-grade piping is extremely difficult and expensive to relocate after the slab is poured

43. What test is required on sanitary and storm drainage piping before the system is concealed?

A. An air pressure test at 100 psi for all drainage pipe materials

B. A water test or air test as permitted by the plumbing code, at the pressure and duration specified, to verify joint integrity and leak-free installation

C. A flow test using dyed water at every fixture

D. A video inspection of every pipe joint using a robotic camera

44. What must the construction team verify about drainage piping slope during installation?

A. That all pipes are installed perfectly level for maximum capacity

B. That all pipes slope toward the mechanical room regardless of discharge direction

C. That the pipe slope meets or exceeds the code-required minimum, is consistent throughout each run, and drains to the correct discharge point without sags or bellies

D. That the pipe slope matches the building floor slope exactly

45. What is the primary purpose of firestopping drainage pipe penetrations through fire-rated assemblies?

A. Maintaining the fire resistance rating of the penetrated assembly by sealing the annular space with a listed firestop system compatible with the pipe material

B. Preventing water from leaking through the floor penetration

C. Providing acoustic insulation at the pipe penetration

D. Supporting the drainage pipe at the floor penetration

46. What must be verified about drainage piping connections to the municipal sewer before the building system is placed in service?

A. That the building sewer pipe is the same color as the municipal main

B. That the connection was made within the last calendar year

C. That the municipal sewer line has been video-inspected within the past five years

D. That the building sewer connection is properly made at the correct location and elevation, the line is tested, and the connection is inspected and approved by the authority having jurisdiction

47. What is the primary purpose of a rainwater harvesting system in a commercial building?

A. Providing emergency drinking water during utility outages

B. Collecting, storing, and treating rainwater for non-potable uses such as toilet flushing, irrigation, and cooling tower makeup to reduce municipal water consumption

C. Increasing the capacity of the storm drainage system

D. Providing water for fire suppression systems

48. What is the primary plumbing code concern with graywater recycling systems in commercial buildings?

A. Graywater is identical to potable water and requires no special treatment

B. Graywater systems are prohibited in all commercial buildings

C. Ensuring proper treatment, cross-connection prevention with the potable system, and code-compliant distribution for approved non-potable uses

D. Graywater systems must discharge directly to the storm sewer without treatment

49. What documentation must the plumbing contractor provide for specialty piping systems such as medical gas, acid waste, and compressed air at project closeout?

A. As-built drawings, material certifications, test reports, certification records, equipment manuals, and maintenance procedures specific to each specialty system

B. Only the pipe manufacturer's standard product catalog

C. Only the final inspection certificate from the plumbing inspector

D. Only the specialty gas supplier's delivery receipts

50. What is the primary purpose of the plumbing contractor's closeout documentation for drainage systems?

A. Providing interior design specifications for restroom finishes

B. Establishing the construction project's final cost for drainage work

C. Calculating the building's structural loads from drainage piping

D. Providing the building operations team with accurate records of pipe routing, sizes, slopes, cleanout locations, interceptor maintenance requirements, and test results for long-term system operation and maintenance

ANSWER KEY 10: DETAILED EXPLANATIONS — PRACTICE TEST 10 DRAINAGE, WASTE, VENT, STORM WATER, AND SPECIALTY PIPING

Questions 1–50

1. **A. Conveying wastewater and sewage from plumbing fixtures to the building sewer by gravity flow** — The sanitary drainage system collects all wastewater and sewage produced by the building's plumbing fixtures and conveys it by gravity through a network of branch drains, stacks, and building drains to the building sewer connection with the municipal sewer main or on-site treatment system.

2. **C. Gravity, requiring all horizontal drainage piping to be installed at a minimum slope** — Sanitary drainage systems rely entirely on gravity to move wastewater through the piping. All horizontal pipes must be installed at a continuous downward slope toward the point of discharge. Without adequate slope, solids settle in the pipe causing blockages and backup.

3. **B. 1/4 inch per foot** — Pipes 3 inches and smaller require a minimum slope of 1/4 inch per foot to maintain adequate flow velocity for carrying solid waste through the pipe. This slope generates sufficient velocity to keep solids suspended and moving toward the building drain without accumulation.

4. **D. 1/8 inch per foot** — Pipes 4 inches and larger require a minimum slope of 1/8 inch per foot. The larger pipe diameter provides greater cross-sectional flow area, allowing adequate velocity and carrying capacity at the reduced slope. This lower slope requirement is important for coordinating drainage piping with other overhead systems in limited ceiling spaces.

5. **A. Maintaining atmospheric pressure in the drainage piping to protect fixture trap seals and allow proper drainage flow** — The vent system admits air into the drainage piping to equalize pressure as water flows through the system. Without venting, the flowing water creates negative pressure that can siphon trap seals or positive pressure that forces sewer gas through trap seals into the building.

6. **C. Siphonage or back-pressure can break the trap seal, allowing sewer gases to enter the building** — When venting is inadequate, water flowing through drainage pipes creates pressure

differentials that pull water out of nearby fixture traps through siphonage or push sewer gas through trap seals through back-pressure. Either condition allows toxic and odorous sewer gases into occupied spaces.

7. **D. A U-shaped fitting that maintains a water seal between the fixture drain and the sewer system** — The fixture trap retains a water seal in its U-shaped bend that acts as a barrier between the building interior and the sewer system. This water seal prevents sewer gases containing hydrogen sulfide, methane, and other harmful gases from entering the building through fixture drain openings.

8. **B. 2 inches of water seal** — The plumbing code requires a minimum 2-inch water seal depth in fixture traps to provide adequate resistance against siphonage and back-pressure. A maximum seal depth of 4 inches is also specified because deeper seals create excessive resistance that impedes drainage flow and increases the risk of self-siphonage.

9. **A. Cast iron with no-hub couplings or hub-and-spigot joints** — Cast iron is the predominant drainage piping material in commercial construction due to its superior fire resistance, sound attenuation, structural strength, and long service life. No-hub couplings using stainless steel clamps provide quick assembly while hub-and-spigot joints are used for underground applications.

10. **C. Superior sound attenuation, fire resistance, and structural durability** — Cast iron's dense material mass significantly reduces the noise of water flowing through drainage piping compared to lightweight plastic pipe. It is noncombustible, providing inherent fire resistance without additional protection, and its structural strength withstands the physical stresses of commercial building environments.

11. **D. PVC or ABS plastic drainage pipe as permitted by the applicable code and building type** — PVC and ABS plastic drainage pipes are permitted in certain commercial applications depending on the building type, height, and local code amendments. Plastic pipe is lighter and less expensive than cast iron but provides less sound attenuation and requires additional fire protection at penetrations of rated assemblies.

12. **B. Long-sweep or sanitary-pattern fittings that maintain smooth flow and minimize turbulence** — Drainage fittings must provide smooth transitions that prevent turbulence, maintain flow velocity, and avoid creating pockets where solids can accumulate. Long-sweep elbows and sanitary tees direct flow gradually rather than abruptly, preventing blockages and maintaining proper system hydraulics.

13. **A. Providing access for clearing blockages and maintaining the drainage piping through removable plugs** — Cleanouts are capped access points installed at regular intervals and at specific locations such as changes of direction that allow maintenance personnel to insert drain cleaning equipment to clear blockages without opening walls or ceilings to access the piping.

14. **C. Typically 100 feet with additional cleanouts at changes in direction, at the base of stacks, and where piping transitions from vertical to horizontal** — Plumbing codes require cleanouts at maximum 100-foot intervals on horizontal drainage runs, at every change of direction exceeding 45 degrees, at the base of each drainage stack, at the building drain connection, and wherever piping access would otherwise be difficult.

15. **D. Separating fats, oils, and grease from kitchen wastewater before it enters the sanitary sewer** — Grease interceptors are required on commercial kitchen drainage to capture FOG that would otherwise solidify in the sanitary sewer, causing blockages, overflows, and interference with wastewater treatment processes. Most jurisdictions mandate interceptors on all commercial food service establishments.

16. **B. Slowing the flow velocity to allow grease to float to the surface and be retained while clarified water discharges from the bottom** — Grease interceptors use baffled chambers that reduce flow velocity, allowing retention time for grease to separate from the wastewater by flotation. Lighter grease rises and accumulates at the top, while heavier solids settle to the bottom, and clarified water exits from the middle.

17. **A. The fixture unit load, flow rate, and grease retention capacity based on the number and type of contributing kitchen fixtures** — Grease interceptor sizing considers the total drainage fixture unit load from all contributing kitchen fixtures, the peak flow rate, the required grease retention capacity, and the local jurisdiction's specific sizing methodology. Undersized interceptors allow grease to pass through to the sewer.

18. **D. Collecting and neutralizing corrosive chemical waste from laboratories, medical facilities, or industrial processes** — Acid waste systems use chemically resistant piping to collect corrosive drainage that would destroy standard drainage piping materials. The waste is routed to a neutralization tank where it is treated to an acceptable pH range before discharge to the building's standard sanitary drainage system.

19. **C. Chemical-resistant materials such as polypropylene, PVDF, or borosilicate glass** — Standard drainage piping materials cannot withstand the corrosive effects of acids, solvents, and other chemicals discharged from laboratories and medical facilities. Specialty piping materials are selected based on their resistance to the specific chemicals expected in the waste stream.

20. **B. An acid neutralization tank or basin that treats the acidic waste to an acceptable pH before discharge** — Neutralization tanks contain limestone chips, calcium carbonate media, or chemical dosing systems that raise the pH of acidic waste to an acceptable range, typically between 5.0 and 12.5, before it enters the sanitary sewer. Discharge of untreated acid waste would damage sewer infrastructure and violate discharge permits.

21. **C. Collecting and conveying rainwater from the roof and site to an approved point of discharge** — The storm drainage system is separate from the sanitary system and handles only rainwater from roof surfaces and site areas. It conveys collected rainwater to the municipal storm

sewer, detention system, or other approved discharge point to prevent roof ponding and site flooding.

22. **A. A roof drain with a strainer dome that prevents debris from entering the piping while allowing water to flow** — Roof drains are installed at low points of the roof structure with strainer domes that allow water to enter while blocking leaves, debris, and other materials that would clog the storm drainage piping. The drain body connects to the vertical storm drain leader within the building.

23. **D. Based on the roof area served, the local rainfall intensity rate in inches per hour, and the pipe slope** — Storm drainage piping is sized using the roof area tributary to each drain, the design rainfall intensity for the building's geographic location, and the pipe slope. The plumbing code provides tables that relate these factors to the required pipe diameter for each section of the system.

24. **B. Providing an overflow path for rainwater if the primary roof drains become blocked or overwhelmed** — Secondary drainage systems provide emergency overflow capacity that prevents structural roof overload from ponding water when primary drains are blocked by debris or overwhelmed by rainfall exceeding the primary system's capacity. Building codes require secondary drainage for most commercial roofs.

25. **C. By discharging water at a visible location such as through the building exterior wall or scupper** — Secondary drains typically discharge through the building's exterior wall at a conspicuous location where flowing water is readily visible to building occupants and maintenance personnel. This visible discharge serves as an unmistakable alert that the primary system requires immediate attention.

26. **A. Storm and sanitary drainage must remain separate systems to prevent sewage backup through storm drains and rainwater overloading treatment plants** — Separate systems prevent raw sewage from backing up through exterior storm drain outlets during wet weather and prevent large volumes of rainwater from overwhelming sanitary sewer capacity and treatment plant processes. Most modern plumbing codes prohibit combined systems.

27. **D. Collecting water from equipment leaks, condensate, spills, or washdowns and conveying it to the appropriate drainage system** — Interior floor drains provide drainage for mechanical room equipment leaks, HVAC condensate, cleaning operations, and accidental spills. They protect the building from water damage and provide essential drainage in areas where water accumulation is expected or possible.

28. **B. The trap seal must be maintained by periodic priming or an automatic trap primer** — Trap seals in infrequently used floor drains evaporate over time, eventually breaking the seal and allowing sewer gas to enter the building. Regular manual priming with water or installation of automatic trap primers that periodically add small amounts of water maintain the seal continuously.

29. **A. A device that automatically adds small amounts of water to infrequently used floor drain traps to maintain the water seal** — Trap primers are connected to the building's water supply and periodically release a small volume of water into the floor drain to replenish the trap seal. They operate through pressure-activated, time-based, or electronic control mechanisms to maintain the seal without manual attention.

30. **D. Collecting and pumping sewage and wastewater from fixtures located below the elevation of the building's gravity sewer connection** — When plumbing fixtures are located below the building sewer elevation, gravity drainage to the sewer is impossible. Sewage ejector systems collect the waste in a sealed basin and pump it up to the gravity drainage system for discharge to the municipal sewer.

31. **B. A sealed basin, submersible pump, check valve, gate valve, vent connection, high-level alarm, and discharge piping** — A complete sewage ejector installation includes a gas-tight sealed basin that contains the sewage, a submersible pump sized for the connected fixture load, a check valve to prevent backflow, a gate valve for maintenance isolation, a vent connection for sewer gas relief, and a high-level alarm for pump failure notification.

32. **D. Preventing sewage from backing up into the building through the sewer connection during municipal sewer surcharges** — Backwater valves contain a check mechanism that allows normal flow from the building to the sewer but closes automatically when the municipal sewer surcharges and flow reverses direction. This prevents sewage from the overloaded municipal system from flooding the building through the sewer connection.

33. **C. Collecting and pumping clear water such as groundwater, condensate, or non-sewage drainage from below-grade areas** — Sump pumps handle non-sewage water including groundwater infiltration, HVAC condensate, equipment drainage, and other clean water collected in below-grade sumps. They discharge this water to the storm drainage system or other approved point, not to the sanitary sewer.

34. **A. Sump pumps handle clear water and non-sewage drainage while sewage ejectors handle sanitary waste, requiring sealed basins and vent connections** — The critical distinction is that sewage ejectors handle human waste and must meet stringent code requirements including sealed basins to contain sewer gas, vent connections for pressure relief, and alarm systems. Sump pumps handle clean water and have simpler installation requirements.

35. **D. Distributing medical-grade oxygen, nitrous oxide, medical air, vacuum, and waste anesthetic gas disposal to patient care areas** — Medical gas piping systems deliver life-critical gases directly to patient bedsides, operating rooms, and procedure areas through a dedicated distribution network. These systems are classified as life safety systems and require specialized installation, testing, and certification.

36. **B. NFPA 99 Health Care Facilities Code** — NFPA 99 establishes comprehensive requirements for medical gas and vacuum system design, installation, testing, certification, and maintenance. It

requires that medical gas installers hold specific certifications, that all piping be verified by an independent third-party inspector, and that complete testing documentation be maintained.

37. **C. Type K or L copper tubing cleaned for oxygen service and joined by brazing with nitrogen purge** — Medical gas piping must be copper tubing specifically cleaned and capped for oxygen service to prevent contamination. Joints are brazed using a continuous nitrogen purge inside the pipe to prevent oxide formation that could contaminate the gas supply and endanger patients.

38. **A. Distributing fuel gas from the utility meter to gas-fired equipment such as boilers, water heaters, rooftop units, and kitchen appliances** — The natural gas piping system receives gas from the utility meter and distributes it at regulated pressure to each gas-fired appliance in the building. The system includes pressure regulators, shutoff valves, flexible connectors, and safety devices at each equipment connection.

39. **D. Black steel pipe with threaded or welded joints and corrugated stainless steel tubing for certain applications** — Black steel pipe is the standard material for commercial natural gas distribution due to its strength, durability, and resistance to gas permeation. CSST is an approved alternative that offers flexibility and faster installation for certain applications per manufacturer's requirements and code provisions.

40. **B. A manual gas shutoff valve accessible for emergency use, and an earthquake shut-off valve where required** — The gas service entrance requires a readily accessible manual shutoff valve that allows emergency isolation of the building's entire gas supply. In seismic zones, code may also require an automatic seismic shutoff valve that closes when earthquake forces exceed a preset threshold.

41. **A. Providing clean, dry compressed air for pneumatic controls, laboratory equipment, dental stations, or industrial processes** — Commercial compressed air systems supply the specific air quality and pressure required for each application. Systems serving pneumatic controls, laboratory instruments, and dental equipment require oil-free, filtered, dried air at regulated pressures appropriate for each connected device.

42. **D. Verifying pipe elevations, slopes, and connection locations before concrete placement because below-grade piping is extremely difficult and expensive to relocate** — Below-grade drainage piping is cast into or buried beneath the concrete slab on grade. Errors in elevation, slope, or location require concrete demolition and removal to access and correct the piping, making verification before the pour critical to avoiding costly rework.

43. **B. A water test or air test as permitted by the plumbing code, at the pressure and duration specified** — Drainage piping must be tested after installation to verify joint integrity before the system is concealed. Water testing fills the system to flood level and checks for leaks. Air testing pressurizes the system to a low pressure and monitors for pressure drop. Both methods verify leak-free installation per code requirements.

44. **C. That the pipe slope meets or exceeds the code-required minimum, is consistent throughout each run, and drains to the correct discharge point** — Proper slope verification ensures that wastewater flows consistently toward the point of discharge without sags, bellies, or flat spots where solids accumulate and blockages form. A level or laser is used to verify slope at multiple points along each pipe run during installation.

45. **A. Maintaining the fire resistance rating of the penetrated assembly by sealing the annular space with a listed firestop system** — Every drainage pipe penetration through a fire-rated wall or floor creates an opening that compromises the assembly's fire resistance. The firestop system must be compatible with the pipe material, accommodate thermal movement, and restore the full fire rating of the penetrated assembly.

46. **D. That the building sewer connection is properly made at the correct location and elevation, tested, and inspected and approved by the AHJ** — The building sewer connection to the municipal main must be made at the location and elevation specified in the site utility plan, using approved connection methods. The completed connection must be inspected and approved by the authority having jurisdiction before backfilling and before the building drainage system is placed in service.

47. **B. Collecting, storing, and treating rainwater for non-potable uses such as toilet flushing, irrigation, and cooling tower makeup** — Rainwater harvesting captures roof runoff that would otherwise be discharged to the storm sewer, treats it to appropriate quality standards, stores it for use, and distributes it for non-potable applications. This reduces municipal water consumption and associated costs while managing stormwater runoff.

48. **C. Ensuring proper treatment, cross-connection prevention with the potable system, and code-compliant distribution for approved non-potable uses** — Graywater recycling systems must treat the water to safe quality levels, maintain absolute separation from the potable water system through air gaps and dedicated piping clearly identified as non-potable, and distribute the recycled water only for code-approved uses such as toilet flushing and irrigation.

49. **A. As-built drawings, material certifications, test reports, certification records, equipment manuals, and maintenance procedures** — Specialty piping systems require comprehensive documentation beyond standard plumbing closeout packages. Medical gas systems require third-party certification records, acid waste systems require material compatibility documentation, and compressed air systems require air quality test results specific to each system's requirements.

50. **D. Providing the building operations team with accurate records of pipe routing, sizes, slopes, cleanout locations, interceptor maintenance requirements, and test results** — Drainage system documentation enables the operations team to locate piping for future connections, find cleanouts for blockage clearing, schedule grease interceptor pumping, identify valve locations for isolation, and reference test records that confirm the installed system's integrity and code compliance.