PRACTICE EXAM 5: RED SEAL PLUMBER SIMULATION (125 QUESTIONS)

1. A plumber is working in a mechanical room where a boiler leaks carbon monoxide into the space. The plumber's personal CO monitor alarms at 35 ppm. The plumber is wearing a halfface respirator with organic vapour cartridges. Is this respirator adequate for the CO hazard?

A. Yes, organic vapour cartridges filter all gasphase contaminants including carbon monoxide effectively

B. Yes, provided the plumber limits exposure to 15 minutes or less to stay below the shortterm limit

C. No, carbon monoxide is not filtered by organic vapour cartridges — the space must be evacuated immediately

D. No, but a P100 particulate filter can be added to the cartridge to provide combined gas and CO protection

2. A plumber's supervisor instructs the crew to skip the confined space atmospheric testing because "this manhole was tested last week and was fine." What is the correct response?

A. Atmospheric testing must be performed immediately before every entry — last week's results are not valid

B. The testing can be skipped if the manhole cover has remained in place since the previous test was conducted

C. The supervisor's instruction is acceptable if the manhole is a permitrequired space with no recent changes

D. Testing can be replaced with a visual inspection of the manhole interior using a flashlight from the surface

3. A plumber is selecting hearing protection for an operation that generates sustained noise at 105 dBA. Standard foam earplugs provide an NRR of 29 dB. Is single hearing protection adequate, or is dual protection required?

A. Single protection is always adequate for any noise level encountered on a plumbing construction jobsite

B. Single protection is adequate because 105 dBA minus 29 dB NRR reduces the exposure to approximately 76 dBA

C. Dual protection is required for any noise level above 85 dBA regardless of the individual protector's NRR rating

D. Dual protection (earplugs under earmuffs) should be considered because 105 dBA is extremely high noise exposure

4. A plumber is working alone on a residential service call. While soldering a joint in the basement, the plumber notices smoke rising from the wood joist above the work area. What is the correct first action?

A. Continue soldering to complete the joint, then address the smoking wood after the solder has set properly

B. Shut off the torch fuel supply immediately to remove the heat source causing the wood to smoulder

C. Spray water on the smouldering wood while keeping the torch lit to finish the joint before it cools

D. Leave the basement immediately and call the fire department before attempting any fire suppression action

5. An apprentice asks why the plumber always uses a torque wrench when tightening the bolts on a mechanical joint coupling, rather than just using a pipe wrench and tightening "until it feels right." What is the correct explanation?

A. Specified torque values prevent both undertightening (which causes leaks) and overtightening (which cracks fittings or deforms gaskets)

B. Torque wrenches are required by OSHA regulations on all mechanical joint connections in Canadian plumbing

C. The torque wrench provides a record of the tightening force that can be presented to the building inspector

D. Pipe wrenches cannot be used on mechanical joint bolts because their teeth would damage the bolt heads

6. A plumber encounters a product with the WHMIS signal word "Warning" and a single pictogram showing an exclamation mark inside a red diamond. Which hazard category does this combination indicate?

A. A severe hazard such as acute toxicity (fatal) or carcinogenicity requiring maximum protective measures

B. A flammable gas, liquid, or solid requiring ignition source elimination and fire suppression preparation

C. A corrosive substance causing serious eye damage or skin burns requiring chemicalresistant fullbody PPE

D. A less severe hazard such as skin or eye irritation, mild acute toxicity, or narcotic effects at high exposure

7. A plumber must install a pipe sleeve through a 2hour firerated wall assembly. The pipe is 2inch copper water supply. After installing the sleeve, what must be applied to the annular space between the pipe and the sleeve?

A. Expanding spray foam insulation to fill the entire annular space and provide thermal insulation around the pipe

B. Approved firestop material that maintains the fire rating of the wall assembly at the penetration point

C. Standard silicone caulk to seal the space against air infiltration and provide a finished appearance

D. Mineral wool packing only, compressed tightly into the annular space without any sealant or cover

8. A plumber is reviewing Safety Data Sheets for two solvent cements used on the jobsite. Product A has a flash point of 22°C and Product B has a flash point of 4°C. Which product presents the greater fire hazard and why?

A. Product A, because its higher flash point indicates that it releases vapour at a faster rate than Product B

B. Product B has a lower fire risk because the negative flash point means it cannot catch fire below freezing

C. Product B, because its lower flash point means it releases flammable vapour at a much lower temperature

D. Both products present identical fire hazards because all solvent cements have the same combustion characteristics

9. During a lockout/tagout procedure, a plumber applies a personal lock to an electrical disconnect. A second plumber arrives to work on the same system. What must the second plumber do?

A. Apply their own personal lock to the same disconnect — every worker must apply their own individual lock

B. Work under the protection of the first plumber's lock since the system is already safely locked out

C. Remove the first plumber's lock, apply their own lock, and return the first lock when their work is complete

D. Ask the first plumber to unlock the system so the second plumber can relock it under their own control

10. A plumber is calculating the weight of water in a full 6inch diameter steel pipe that runs 30 metres horizontally. The pipe's internal crosssectional area is 0.01824 m^2. What is the volume and approximate weight of the water?

A. 0.55 m^3 = 55 kg, which is negligible and requires no special support calculation for the pipe hangers

B. 1.09 m^3 = 1,090 kg, which would exceed the structural capacity of most standard pipe hanger systems

C. 0.27 m^3 = 270 kg, which is within the standard hanger capacity without additional engineering analysis

D. 0.547 m^3 = 547 kg, calculated as 0.01824 m^2 × 30 m = 0.547 m^3 and 1 litre of water weighs 1 kg

11. A plumber is laying out a pipe run on a concrete floor using a chalk line. What colour chalk is standard for temporary reference lines that may need to be removed later?

A. Red chalk, which is permanent and will not wash away even with aggressive cleaning and solvent use

B. Blue chalk, which is the standard for temporary reference lines and can be cleaned or washed away

C. Yellow chalk, which is used exclusively for underground utility marking and is never used indoors

D. White chalk, which is invisible on concrete surfaces and requires UV light for visibility after application

12. A plumber needs to install pipe in a location 4.5 metres above the floor. A stepladder cannot reach this height. What is the most appropriate access equipment?

A. Stacked scaffolding frames with no guardrails, provided the plumber wears a fall arrest harness system

B. A single extension ladder leaned against the pipe support structure at the correct 4:1 angle ratio

C. A properly erected scaffold platform with guardrails, midrails, and toeboards at the working height

D. A hydraulic scissor lift provided the plumber has been trained and certified to operate the equipment

13. A plumber is interpreting a plumbing specification that calls for copper tube conforming to "ASTM B88, Type L, hard drawn." What does this specification define?

A. The exact material, type, wall thickness, and temper of the copper tube required for the installation

B. The manufacturer and model number of the specific copper tube product to be purchased for the project

C. The maximum operating pressure of the copper tube when installed with soldered or brazed connections

D. The colour coding that must appear on the copper tube surface to identify it during the installation

14. A plumber must calculate the offset for a pipe that needs to change elevation by 18 inches while maintaining a 45degree angle. What is the horizontal offset?

A. 25.45 inches, calculated by multiplying the rise by the 45degree travel constant of 1.414 for the diagonal

B. 12.73 inches, calculated by multiplying the rise by the 45degree offset constant of 0.707 for the offset

C. 36.00 inches, calculated by multiplying the rise by 2.0 for the horizontal displacement at 45 degrees

D. 18.0 inches, because at 45 degrees the horizontal offset always equals the vertical rise exactly

15. A plumber discovers an electrical cord on a power tool has a missing ground prong. The tool must be used in a wet location to complete an urgent repair. What is the correct action?

A. Use the tool carefully in the wet location since the repair is urgent and the risk of shock is minimal

B. Do not use the tool — remove it from service and replace the cord or use a different properly grounded tool

C. Wrap electrical tape around the plug to insulate the gap left by the missing ground prong before use

D. Use the tool only if it is plugged into a GFCI outlet, which compensates for the missing ground prong

16. A plumber is installing a water heater in a location that requires an earthquake strap to prevent the heater from tipping during a seismic event. In which Canadian region is this requirement most commonly enforced?

A. British Columbia, which has the highest seismic risk in Canada and the most stringent restraint requirements

B. The Prairie provinces, where high winds create similar lateral forces that require equipment restraint

C. Northern Ontario, where ground frost heaving creates uplift forces that can topple unrestrained equipment

D. Atlantic Canada, where tidal forces and coastal erosion require all mechanical equipment to be restrained

17. A plumber is installing a copper water supply system and encounters a section where the pipe passes through a concrete foundation wall. A steel sleeve is cast into the wall. What must be placed between the copper pipe and the steel sleeve?

A. Pipe joint compound to lubricate the copper as it slides through the steel sleeve during thermal movement

B. Nothing — copper pipe can contact steel sleeves directly because the concrete isolates the two metals

C. A dielectric isolation material (plastic bushing, rubber grommet, or felt wrap) to prevent galvanic corrosion

D. Brazing flux applied to both the copper pipe and the steel sleeve to create a sealed weatherproof joint

18. A plumber cuts a piece of PEX tubing for a water supply connection and notices that the cut end is slightly oval rather than perfectly round. What caused this deformation and what is the concern?

A. The deformation is normal for PEX and has no effect on the connection quality with any fitting type

B. The tubing was cut with a dull or improper cutter — the oval shape may prevent the fitting from seating properly

C. The PEX has been stored in cold temperatures and the oval shape will selfcorrect once it reaches room temperature

D. The deformation indicates that the PEX tubing has exceeded its shelf life and the entire coil should be discarded

19. A plumber must join a 2inch CPVC pipe to a 2inch copper pipe at a transition point in a hot water supply system. Which method is correct?

A. Apply CPVC solvent cement to the copper pipe end and insert it into the CPVC fitting socket for a bond

B. Solder the copper pipe directly to the CPVC fitting using a lowtemperature solder and nonacidic flux

C. Heat the CPVC fitting with a torch to soften it, then press the copper pipe into the softened socket

D. Use a transition union or adapter fitting designed for CPVCtocopper connections at this junction point

20. A plumber is brazing a refrigerant copper tube connection. The specification requires a nitrogen purge during brazing. The plumber has only medicalgrade oxygen available on the jobsite. Can oxygen be used as a substitute?

A. No — oxygen accelerates oxidation and creates a fire/explosion hazard; only dry nitrogen may be used

B. Yes — medicalgrade oxygen is purer than nitrogen and provides superior interior surface protection

C. Yes — any inert or pure gas is acceptable for purging copper piping during brazing operations

D. No — but compressed air from the building's system can be used as an acceptable alternative to nitrogen

21. A plumber installs a spring hanger on a horizontal hot water pipe in a hydronic heating system. What is the purpose of the spring in this hanger compared to a standard rigid clevis hanger?

A. The spring reduces vibration transmitted from the circulator pump through the piping to the structure

B. The spring provides a visual indicator of pipe temperature by compressing proportionally to heat level

C. The spring absorbs vertical pipe movement from thermal expansion while maintaining continuous support

D. The spring acts as a shock absorber for water hammer events that occur when zone valves close rapidly

22. A plumber needs to install a section of pipe through a floor penetration in a residential building where the floor is not firerated. Is a firestop device required at this penetration?

A. Yes — firestop devices are required at every pipe penetration through every floor in every building

B. No — firestop devices are required only at penetrations through firerated assemblies, not nonrated floors

C. Yes — but only if the pipe material is plastic, because metal pipe does not require firestopping at any location

D. No — firestop devices are only required in commercial and institutional buildings, never in residential

23. A plumber is installing cast iron DWV pipe using nohub couplings. After assembling the coupling over the joint, the plumber tightens the band clamps. In what sequence should the clamps be tightened?

A. Tighten the centre clamp first, then the two outer clamps, to draw the gasket evenly from the middle

B. Tighten all clamps simultaneously using a multitool that engages all fasteners at the same time

C. Tighten the outermost clamp first to anchor the coupling, then work inward toward the centre clamp

D. Tighten the clamps alternately (one side then the other), progressing evenly to achieve uniform compression

24. A plumber discovers that a copper tube has been kinked during installation in a wall cavity. The kinked section is in a straight run with no fittings nearby. What repair is required?

A. Cut out the kinked section and splice in a new piece using two couplings and correctly prepared joints

B. Apply heat to the kinked area with a torch to anneal the copper, then reshape the kink with pliers

C. Install a repair clamp over the kinked section to reinforce the tube wall and restore the original diameter

D. Leave the kink in place if it reduces the internal diameter by less than 25% of the original tube bore

25. A plumber is installing PVC DWV pipe in an exterior location where the pipe will be exposed to direct sunlight. What concern must be addressed?

A. PVC pipe can withstand prolonged UV exposure without any degradation and requires no protection

B. PVC pipe exposed to sunlight requires protection because its maximum operating temperature is exceeded

C. PVC degrades and becomes brittle when exposed to prolonged UV radiation and must be painted or shielded

D. PVC pipe exposed to sunlight must be replaced with CPVC because only CPVC is rated for outdoor use

26. A plumber is roughing in a residential DWV system. The water closet's closet bend connects to a 3inch horizontal branch that extends 2.5 metres to the soil stack. At what point along this branch must a vent connect?

A. Within the maximum trap arm length for 3inch pipe, which is 1,830 mm (72 inches) from the trap weir

B. At the midpoint of the branch, which provides equal air distribution to both ends of the horizontal run

C. At the soil stack connection only, because the stack vent above the highest branch provides adequate venting

D. Directly at the closet bend fitting itself, because water closets require the vent within 150 mm of the trap

27. A plumber discovers that an existing building's DWV system has a 4inch soil stack that reduces to 3 inches below the lowest branch connection. Is this reduction codecompliant?

A. Yes, because the section below the lowest branch carries less load and can be reduced one pipe size

B. Yes, but only if the reduced section is less than 3 metres in total length before reaching the building drain

C. No — a soil or waste stack must not be reduced in size as it descends; it must be at least as large at the base

D. No — the stack must increase in size as it descends to accommodate the accumulated drainage load

28. A plumber installs a floor drain in a new commercial building's elevator pit. The drain connects to the building's sanitary drainage system. What device must be installed on this floor drain to prevent contaminated water from the pit entering the potable water supply if the pit floods?

A. A backwater valve on the drain outlet to prevent the sanitary system from backing up into the elevator pit

B. An air gap on the drain connection because the elevator pit drain is an indirect waste connection

C. A grease interceptor on the drain to capture hydraulic oil from the elevator machinery before the drain

D. A reduced pressure backflow preventer on the water supply line to the elevator pit sump pump system

29. In a large commercial building, a relief vent is installed connecting a horizontal branch drain to the vent stack. Under what condition is a relief vent typically required?

A. When the horizontal branch exceeds 30 metres in length regardless of the number of fixtures connected

B. When the building drain changes direction by more than 45 degrees at any point along its horizontal run

C. When a single fixture has a DFU rating greater than 6 and creates excessive flow in the branch during use

D. In tall buildings where stack loading creates pressure fluctuations that exceed what standard venting controls

30. A plumber is installing a cleanout on a horizontal building drain at a point where the pipe is buried 600 mm below the finished concrete floor. How must the cleanout be made accessible?

A. The cleanout must be exposed by leaving a gap in the concrete floor directly above the cleanout fitting

B. The cleanout must be extended to the floor surface using a riser and a flushmounted cleanout cover

C. The cleanout is acceptable asis because cleanouts buried less than 1 metre deep do not require access

D. The cleanout must be relocated to a point where the pipe is above the floor level for direct access

31. A plumber is troubleshooting a DWV system where a single secondfloor bathtub drains very slowly, but the lavatory and water closet in the same bathroom drain normally. What is the most likely location of the problem?

A. In the bathtub's individual trap or trap arm, since the other fixtures on the same branch drain normally

B. In the horizontal branch serving all three fixtures, at a point downstream of the bathtub connection

C. In the vent stack, where a partial blockage is affecting only the bathtub's trap seal and drainage flow

D. In the building drain, where a partial blockage is restricting flow from the secondfloor branch only

32. A plumber is sizing a storm drainage leader (vertical pipe from a roof drain to the storm drainage system). The roof area served by this leader is 200 m^2 and the local rainfall intensity is 75 mm/hr. Using the code sizing table, the required leader diameter is 4 inches. If a second roof drain is added that divides the same 200 m^2 roof area equally, what diameter is required for each leader?

A. 4 inches each, because the code requires the same size regardless of how many drains serve the area

B. 2 inches each, because dividing the area in half requires exactly half the original pipe diameter

C. 3 inches each, because each leader now serves only 100 m^2 at the same rainfall intensity

D. The answer depends on the specific code sizing table entry for 100 m² at 75 mm/hr rainfall intensity

33. A plumber encounters an older building with a single running trap (house trap) installed on the building drain near the foundation wall. The running trap has two cleanout access points. Is this installation still acceptable under current code?

A. Yes, running traps on building drains are required by the current National Plumbing Code of Canada

B. Yes, running traps are acceptable on building drains in all jurisdictions without any restrictions applied

C. No, but existing running traps may be left in place if they are functional and accessible for maintenance

D. Running traps on building drains are no longer required by most current code editions and may be removed

34. A plumber is installing an underground building sewer and must verify the pipe slope using a digital level. The target slope is 1/8 inch per foot for the 4inch PVC sewer. What percentage grade should the digital level display?

A. 2.0%, which equals the 1/4inchperfoot slope required for pipe 3 inches and smaller in diameter

B. Approximately 1.0%, which is the equivalent of 1/8 inch per foot expressed as a percentage grade

C. 0.5%, which equals the 1/16inchperfoot slope that is the minimum for all underground sewer piping

D. 4.0%, which equals the 1/2inchperfoot slope recommended for maximum selfcleaning velocity

35. A plumber is installing a 3inch vent pipe through the roof of a building. The vent terminal must be located away from a rooftop air intake for the building's HVAC system. What is the typical minimum distance required between a vent terminal and an air intake?

A. 3 metres (10 feet) horizontally, or the vent must extend 900 mm (3 feet) above the air intake opening

B. 1 metre (3 feet) horizontally, with no height requirement relative to the position of the air intake

C. 6 metres (20 feet) horizontally regardless of the relative heights of the vent terminal and air intake

D. No minimum distance is required between vent terminals and air intakes on the same roof surface

36. A commercial building has a dental office on the second floor. The dental office produces wastewater containing dental plaster and impression material grit. What device must be installed on the dental office's drainage before it enters the building's main DWV system?

A. A grease interceptor sized for the dental office's total fixture count and wastewater generation volume

B. An oilwater separator to capture the petroleumbased lubricants used in dental handpiece equipment

C. A sand interceptor (sediment trap) to capture plaster, stone, and grit before it enters the drainage system

D. A chemical neutralization tank to treat the fluoride and sterilization chemicals in the dental wastewater

37. A homeowner reports that every drain in the house bubbles and gurgles when the washing machine discharges its full load. All fixtures drain normally otherwise. What is this symptom most likely caused by?

A. The washing machine's pump is defective and is pushing air into the drainage system during discharge

B. The building sewer is partially blocked, and the washing machine's largevolume discharge reveals the restriction

C. The vent stack on the roof is completely blocked, preventing air from entering during highvolume discharge events

D. The washing machine's standpipe is too short, causing water to overflow and introduce air into the system

38. A plumber is installing a septic system and must determine the required separation distance between the disposal field and the homeowner's drinking water well. What is the typical minimum separation?

A. 5 metres (16 feet), which is adequate for properties with sandy soil and a shallow well installation

B. 15 metres (50 feet) or greater, as specified by provincial regulations for protection of the well water quality

C. 30 metres (100 feet) is the universally required minimum distance regardless of soil type or well depth

D. No specific minimum distance is required if the well is drilled into bedrock below the disposal field depth

39. A plumber installs a combination wye and eighth bend to connect a 3inch horizontal branch to a 4inch vertical soil stack. The fitting is a DWV pattern with a smooth internal sweep. What is the entry angle that this fitting combination provides at the stack connection?

A. A 90degree entry with a long swept transition, equivalent to the sweep of two 45degree fittings

B. A 45degree entry angle, which is the angle of the wye fitting alone without the eighth bend addition

C. A 60degree entry angle, which splits the difference between a 45degree wye and a 90degree tee

D. A 135degree entry angle, which directs the branch flow upward against the stack flow for mixing

40. A plumber discovers during a renovation that a 2inch kitchen sink waste pipe runs horizontally for 3 metres before connecting to any vent. The maximum trap arm length for 2inch pipe is 1,525 mm (60 inches). The existing pipe exceeds this limit by nearly double. What is the consequence of this violation?

A. The kitchen sink will overflow during normal use because the long pipe creates excessive backpressure

B. The pipe will develop leaks at the joints due to excessive flow velocity in the overly long horizontal section

C. The kitchen sink trap is at high risk of selfsiphonage because the long trap arm acts as a piston during discharge

D. The vent connection will be submerged during normal use, converting the vent into a second drainage pipe

41. A plumber must select a test method for a newly installed DWV system in a building that is not yet heated. The outdoor temperature is 15°C. Which test method is most appropriate?

A. A water test, which is the most definitive method and can be used regardless of the ambient temperature

B. An air test, which does not require water and cannot freeze — making it the appropriate choice for cold conditions

C. A smoke test, which uses heated smoke that will not freeze in the piping during cold weather conditions

D. No testing is possible below 10°C — the plumber must wait for warmer weather before the test is performed

42. A plumber installs a 3inch horizontal branch drain serving a bathroom group. The branch connects to a 4inch vertical soil stack using a sanitary tee. The tee's branch inlet faces left when viewed from the front of the stack. In which direction does the tee's internal sweep direct the incoming waste?

A. Upward, against the flow in the stack, to create a mixing zone where the branch flow joins the stack flow

B. Horizontally, straight into the stack with no directional sweep to allow the branch flow to enter freely

C. Laterally, to the right side of the stack opposite the branch inlet, to distribute flow across the stack diameter

D. Downward, in the direction of gravity flow in the stack, guiding the waste smoothly into the descending column

43. A plumber is roughing in underground DWV piping for a slabongrade residential building. The plans show four closet bends, three floor drain connections, and the building drain. Before the concrete slab is poured, what must happen?

A. The underground piping must pass a pressure test and be inspected by the AHJ before concrete is placed

B. The underground piping must be photographed for documentation but does not require formal inspection

C. The concrete contractor must sign off on the pipe locations before the AHJ inspection can be scheduled

D. Only the closet bend locations need inspection — floor drains and the building drain are inspected later

44. A sewage ejector pump in a basement bathroom fails during a weekend. Raw sewage begins to accumulate in the sealed ejector pit. The homeowner calls the plumber. Until the pump is replaced, what prevents sewer gas from entering the basement?

A. The Ptraps on the basement bathroom fixtures continue to hold their water seals as a gas barrier

B. The sewage in the ejector pit itself acts as a water seal that blocks gas from passing through the pit

C. The sealed, gastight cover on the ejector pit contains the gas, which is vented through the pit's vent pipe

D. The check valve on the discharge line prevents gas from the gravity system from entering the ejector pit

45. A plumber is designing a wetvented bathroom group for a residential installation. The group consists of a water closet, a lavatory, and a bathtub. The code requires the wet vent section to be at least how many pipe sizes larger than the minimum drain size for the fixtures it vents?

A. One pipe size larger, providing minimal additional air space above the drainage water level in the pipe

B. Two pipe sizes larger, ensuring adequate air space above the water for ventilation of the downstream trap

C. Three pipe sizes larger, which is the standard for all wetvented configurations regardless of fixture type

D. The same pipe size — no oversizing is required for wet vent sections as long as the fixtures are limited

46. A plumber is repairing a broken section of vitrified clay sewer pipe. The break is located 1.5 metres deep in a landscaped backyard. The plumber excavates, removes the broken section, and must splice in a replacement. What pipe material and joining method is most commonly used for the replacement section?

A. A new vitrified clay section joined to the existing clay pipe using original lead and oakum joint method

B. A new cast iron section joined to the existing clay pipe using nohub transition couplings on each end

C. A new copper section joined to the existing clay pipe using flare fittings on each end of the repair splice

D. A new PVC section joined to the existing clay pipe using flexible transition couplings on each end

47. A plumber notices that a building's vent stack, which extends through the roof in a cold climate, has developed ice buildup that is restricting the vent opening. What causes this and what is the standard prevention method?

A. The standard solution is increasing the vent pipe diameter as it passes through the roof to reduce ice restriction

B. The ice is caused by rain entering the vent and freezing — a vent cap must be installed to keep rain out

C. The ice is caused by atmospheric moisture freezing on the cold exterior pipe — no prevention is available

D. The ice is caused by condensation from the building's HVAC exhaust that is incorrectly connected to the vent

48. A plumber installs a DWV system in a building where the code official has identified a concern about noise transmission from the drainage piping through the floor and ceiling assemblies. What pipe material recommendation addresses this concern?

A. PVC DWV pipe, which has natural sounddampening properties due to the flexibility of the plastic material

B. ABS DWV pipe, which produces less drainage noise than any other DWV pipe material currently available

C. Cast iron DWV pipe, which significantly reduces noise transmission through floor and ceiling assemblies

D. Copper DWV pipe, which eliminates drainage noise entirely due to the smooth interior bore of the tube

49. A plumber tests a DWV system with air at the coderequired 35 kPa (5 psi). The gauge holds steady for 5 minutes but then begins a slow, steady decline. What is the most likely cause?

A. The test plugs are properly sealed but the piping itself has expanded under pressure and will stabilize

B. A slow leak exists at a joint, fitting, or test plug connection — the system must be checked with soap solution

C. The air temperature inside the system is equalizing with the ambient temperature, causing a normal pressure change

D. The system has passed the test because the initial 5minute hold demonstrated adequate system integrity

50. A plumber must install a backwater valve on a basement floor drain to protect against sewer backup. Where is the valve installed relative to the floor drain?

A. Inside the floor drain body itself, replacing the standard strainer with a combination strainerbackwater device

B. On the floor drain's horizontal waste pipe between the floor drain trap and the connection to the building drain

C. On the building drain main before any fixture connections to protect the entire building from sewer backup

D. On the floor drain's waste pipe downstream of the building drain connection at the building sewer exit

51. A plumber is sizing a vent for a water closet in a residential bathroom. The water closet drain is 3 inches. The code requires the vent to be at least what minimum diameter?

A. 3 inches, matching the full diameter of the drain it serves for maximum air circulation capacity

B. 11/2 inches, which is the minimum vent diameter for a residential water closet per most code editions

C. 11/4 inches, which is the absolute minimum vent size for any pipe in any plumbing system application

D. 2 inches, which is exactly half the diameter of the 3inch drain pipe serving the water closet fixture

52. A plumber discovers that a building's building drain has a section with negative slope (backpitched) — the pipe actually runs uphill toward the sewer for approximately 1 metre before resuming the correct downhill slope. What problem does this create?

A. The backpitched section causes water hammer in the DWV system during simultaneous fixture discharge

B. The backpitched section has no practical effect on system performance because the overall slope is correct

C. The backpitched section causes the vent system to malfunction by creating an air lock at the high point

D. The backpitched section creates a permanent pool of standing water that traps solids and causes blockages

53. A plumber installs a 4inch building drain at a slope of 1/4 inch per foot. According to the code sizing table, this pipe at this slope accommodates 216 DFU. The same 4inch pipe at 1/8 inch per foot accommodates 180 DFU. A building has exactly 200 DFU of drainage load. Which slope must the plumber use?

A. 1/4 inch per foot, because 200 DFU exceeds the 180 DFU capacity at 1/8 inch per foot but fits within 216 DFU

B. 1/8 inch per foot, because it provides adequate capacity for 200 DFU with the standard safety margin applied

C. Either slope is acceptable because both are within the acceptable range for 4inch building drain pipe

D. Neither slope is acceptable — a 6inch building drain must be used because 200 DFU exceeds 4inch capacity

54. A plumber must install an indirect waste connection for a commercial steam table (food warming equipment). The steam table's drain cannot connect directly to the sanitary system. How is the indirect connection made?

A. A direct solventcemented connection to the nearest floor drain with a dedicated Ptrap for the steam table

B. A connection to the building's greywater recycling system through a dedicated filtered intake manifold

C. An air gap between the steam table's drain outlet and a floor sink or receptor connected to the drainage system

D. A check valve on the steam table's drain line that allows outflow but prevents sewer gas from backflowing

55. A plumber is investigating a residential sewer gas complaint. After checking all visible traps and confirming they have water, the plumber runs a smoke test. Smoke is observed entering the house through a gap between the bathtub and the floor where the tub meets the tile. What is the most likely source?

A. A cracked vent pipe inside the wall behind the bathtub that is leaking gas into the wall cavity

B. A failed seal between the bathtub's wasteandoverflow assembly and the Ptrap below the tub floor

C. The tile grout around the bathtub has deteriorated, allowing room air to circulate into the wall cavity

D. The HVAC system is creating negative pressure in the bathroom, drawing sewer gas through the tile grout

56. A plumber is installing a sanitary sewer lateral from a new house to an existing municipal sewer main that is 2.5 metres deep. The building drain exits the foundation at 1.0 metre depth. The horizontal distance is 20 metres. What is the average slope of the sewer lateral?

A. 1/8 inch per foot, which is the minimum slope for all building sewers regardless of depth or distance

B. Approximately 1/4 inch per foot, calculated from the 1.5 m drop over 20 m horizontal run (7.5% grade)

C. Approximately 1 inch per foot, which would be excessive and could cause solids stranding in the pipe

D. Approximately 7.5% grade, calculated as 1.5 m drop ÷ 20 m run × 100, which far exceeds the minimum

57. A plumber is sizing a water supply system for a twostorey residential building. The available pressure at the meter is 350 kPa (51 psi). After accounting for static head loss of 60 kPa, friction losses of 90 kPa, and meter losses of 25 kPa, what is the residual pressure at the highest fixture?

A. 350 kPa, because the available pressure at the meter remains unchanged throughout the building

B. 200 kPa, calculated by subtracting only the static head and meter losses from the available pressure

C. 175 kPa, calculated by subtracting all losses (60 + 90 + 25 = 175 kPa) from the 350 kPa supply

D. 275 kPa, calculated by subtracting only the friction losses from the available pressure at the meter

58. A plumber is installing a new potable water service using HDPE pipe. The service will pass beneath a driveway that carries vehicle traffic. What SDR rating of HDPE should be selected for this section?

A. A heavierwall SDR (lower number, such as SDR 9 or SDR 11) to withstand the traffic loads above the pipe

B. Any standard SDR is adequate because the burial depth protects the pipe from all surface traffic loads

C. SDR 35, which is the standard for all underground HDPE water service piping in residential applications

D. The SDR rating is irrelevant for HDPE because the material's flexibility absorbs traffic loads naturally

59. A plumber installs a water supply to a commercial laundry facility. The laundry uses large washing machines that generate water hammer when their fastacting solenoid valves close. Where must water hammer arrestors be installed?

A. On the main water service line entering the building, upstream of the branch serving the laundry room

B. On the water heater's hot water outlet to absorb the shock before it reaches the laundry supply line

C. On the laundry facility's main branch supply line at the point where it tees off from the building main

D. On both the hot and cold supply lines at each washing machine connection, as close to the valve as possible

60. A plumber discovers that a residential building's water supply piping was installed entirely with PEX but the transition from PEX to the copper stubouts at each fixture was made using pushfit fittings. The homeowner wants to know if pushfit fittings are acceptable for concealed installations. What is the correct answer?

A. Pushfit fittings are never acceptable for concealed installations regardless of the pipe material used

B. Acceptance varies by jurisdiction — some authorities approve pushfit fittings for concealed use, others do not

C. Pushfit fittings are acceptable only for exposed, accessible installations where they can be inspected visually

D. Pushfit fittings are universally accepted for all installations in all Canadian jurisdictions without restriction

61. A plumber installs a residential water heater with a directvent (sealed combustion) configuration. The intake and exhaust pipes pass through an exterior wall. What advantage does this configuration provide over an atmospheric draft water heater for a tightly sealed, energyefficient home?

A. Sealed combustion eliminates the risk of backdrafting because combustion air comes from outdoors, not from indoor air

B. Sealed combustion produces zero emissions because the combustion is contained within the sealed chamber

C. Sealed combustion allows the water heater to be installed without a T&P relief valve or discharge pipe

D. Sealed combustion eliminates the need for a vent entirely because the combustion gases are fully condensed

62. A plumber is testing a reduced pressure (RP) backflow preventer as part of annual maintenance. The test reveals that the first check valve holds, the second check valve holds, but the relief valve is stuck closed and will not open. Is the device acceptable for continued service?

A. Yes, because both check valves are functioning and the relief valve is a secondary safety feature only

B. Yes, because a stuckclosed relief valve actually provides a tighter seal against backflow than an open one

C. No — all three components must function correctly; a stuck relief valve cannot discharge if a check fails

D. No — but the device can remain in service for 90 days while a replacement relief valve kit is procured

63. A plumber is installing supply piping to a commercial building's cooling tower. The cooling tower water will be treated with biocidal chemicals. The plumber installs an RP backflow preventer on the supply line. Where must the RP device's relief valve discharge?

A. To a bucket or containment vessel located beside the RP device for periodic manual emptying by staff

B. To a floor drain through an air gap, ensuring that drain water cannot backsiphon into the RP device

C. Directly to the sanitary sewer through a Ptrap connection to prevent sewer gas from entering the space

D. To the cooling tower basin itself, where the chemically treated water returns for recirculation in the system

64. A plumber installs an expansion tank on a domestic hot water system. The homeowner later complains that the tank feels completely full of water when tapped — it sounds solid rather than partially hollow. What has happened?

A. The expansion tank is functioning correctly — a fullsounding tank indicates it is absorbing expansion properly

B. The expansion tank's air precharge was set too high, forcing all the water out and leaving only compressed air

C. The expansion tank was installed upside down, trapping the air charge at the bottom where it cannot function

D. The tank's diaphragm has failed or the air precharge has leaked out, and the tank is waterlogged with no air cushion

65. A plumber is troubleshooting a residential water system where the kitchen faucet aerator needs to be cleaned every two weeks due to white mineral buildup. The water supply is from a private well. What water treatment system would address this issue?

A. An ultraviolet (UV) disinfection unit installed at the point of entry to destroy mineralforming bacteria

B. A sediment filter rated at 1 micron installed at the point of entry to capture the dissolved mineral particles

C. A water softener (ion exchange system) installed at the point of entry to remove the calcium and magnesium

D. A reverse osmosis system installed at the kitchen sink to remove dissolved minerals from the drinking water

66. A plumber installs a new PRV on a residential water service. The PRV is set to 415 kPa (60 psi). One month later, the homeowner reports that the water pressure seems to have increased — fixtures are noisy, the toilet fill valve whistles, and the washing machine hoses bulge. The pressure gauge downstream of the PRV reads 580 kPa (84 psi). What is the most likely cause?

A. The PRV has failed in the open position and is no longer regulating — it must be repaired or replaced

B. The expansion tank has lost its precharge, causing thermal expansion to raise the pressure above the PRV setting

C. The municipal supply pressure has increased above 580 kPa, overwhelming the PRV's regulation capacity

D. The pressure gauge is defective and must be replaced with a calibrated gauge for an accurate reading

67. A plumber is selecting pipe for a hot water recirculation return line in a residential building. The return line will carry water at approximately 50–55°C continuously. Which pipe material is NOT suitable for this application?

A. Copper Type L, which is the standard material for hot and cold water supply piping in residential buildings

B. PVC, which has a maximum continuous service temperature of approximately 60°C and loses strength at elevated temperatures

C. CPVC, which is rated for continuous service at temperatures up to approximately 93°C in water supply applications

D. PEX, which is approved for hot water supply and hydronic heating applications up to its rated temperature limit

68. A plumber installs a tankless water heater and connects it to the gas supply, water supply, and venting system. During the initial startup, the heater fires for 3 seconds and then shuts off with an error code indicating insufficient gas flow. What is the most likely cause?

A. The water supply pressure is too high for the heater's flow sensor to activate the gas valve correctly

B. The venting system is creating excessive backpressure that the heater's pressure switch interprets as a fault

C. The heater's internal thermostat is set too low and must be increased above the factory default temperature

D. The gas supply line is undersized for the heater's BTU input, delivering insufficient gas volume at the required pressure

69. A plumber installs a residential water service using Type K soft copper. The service runs 15 metres from the curb stop to the building entry. The plumber uses a single continuous length from the coil with no underground joints. Why is this continuousrun approach preferred?

A. Every joint in an underground water service is a potential leak point and a location for root intrusion over time

B. The building code prohibits all joints on underground water services regardless of the pipe material used

C. Continuous copper runs conduct electricity better than jointed runs, improving the building's grounding path

D. Underground joints require cathodic protection that is more expensive than the additional length of pipe

70. A plumber installs a water supply system in a commercial building with a fire sprinkler connection protected by a DCVA. The fire sprinkler system is later modified to include antifreeze in certain exposed piping zones. Does the backflow prevention need to be upgraded?

A. No, because the DCVA provides adequate protection for all fire sprinkler system configurations regardless

B. No, because antifreeze at the concentrations used in fire sprinkler systems is classified as a minor hazard

C. Yes — antifreeze in the sprinkler system changes the hazard classification, potentially requiring an RP device

D. Yes — but only if the antifreeze concentration exceeds 50% by volume in the sprinkler system piping

71. A plumber discovers that a commercial building's hot water recirculation system has no check valve on the return line. What problem can this cause?

A. The recirculation pump will overheat because it operates against uncontrolled flow in the return piping

B. Thermosiphon circulation can push hot water backward through the return line when the pump is off

C. The water heater's T&P relief valve will open because the missing check valve allows excess pressure buildup

D. Cold water from the supply line will enter the return line and mix with the hot water in the storage tank

72. A plumber must install a water supply connection to a commercial ice machine in a restaurant. The ice machine drain connects to an indirect waste receptor with an air gap. What backflow prevention is required on the water supply connection?

A. An air gap on both the supply and the drain connections to the ice machine for complete protection

B. A double check valve assembly on the supply line because the ice machine poses a minor hazard to the supply

C. No backflow prevention on the supply because the ice machine only processes potable water for ice making

D. An atmospheric vacuum breaker or other approved device on the supply to prevent backsiphonage of melt water

73. A residential water heater has a 50gallon (190litre) capacity. The homeowner's household consistently runs out of hot water after approximately 35 gallons of use. The thermostat is set correctly at 60°C. What is the most likely cause of the reduced effective capacity?

A. Sediment accumulation at the bottom of the tank that insulates the lower portion from the heat source

B. A failed mixing valve downstream of the heater that is adding cold water to the hot water supply stream

C. The water heater's energy factor has degraded over time and the unit no longer achieves its rated efficiency

D. The cold water dip tube has failed, causing incoming cold water to mix at the top near the hot water outlet

74. A plumber is installing a pressure booster pump system for a 15storey commercial building. The system divides the building into two pressure zones. The lower zone (floors 1–8) is served by the municipal supply through a PRV. The upper zone (floors 9–15) is served by the booster pump. What prevents the booster pump from creating negative pressure on the municipal main?

A. The PRV on the lower zone limits the supply pressure and prevents the booster from affecting the main

B. The booster pump's internal pressure regulator automatically limits suction pressure to atmospheric minimum

C. A break tank or reduced pressure backflow preventer isolates the booster pump's suction from the main

D. The building's expansion tank absorbs the negative pressure created by the booster pump during operation

75. A plumber is troubleshooting a residential water system where the water heater's T&P relief valve opens every afternoon around 3:00 PM. The system has a PRV and an expansion tank. The plumber checks the expansion tank and finds the air precharge at the correct pressure. What should be checked next?

A. The municipal supply pressure, which may spike during the afternoon due to system pressure fluctuations

B. The T&P relief valve itself, which may have a weakened spring that opens below its rated pressure setting

C. The water heater's thermostat setting, which may be too high and causing the water to reach unsafe temperatures

D. The expansion tank's diaphragm, which may have ruptured — allowing the tank to waterlog despite showing correct precharge

76. A plumber installs a new water closet on a closet flange that is recessed 12 mm below the finished floor surface. A standard wax ring was used. After installation, water seeps around the base of the toilet during flushing. What is the most likely cause?

A. The closet bolts were overtightened, cracking the porcelain base and allowing water to escape at the crack

B. The wax ring was installed upside down, with the wax horn facing downward instead of into the flange

C. The standard wax ring is too thin for the recessed flange — an extrathick wax ring is required to bridge the gap

D. The standard wax ring was compressed beyond the gap by the recessed flange and formed an adequate seal

77. A plumber is installing a commercial electric water heater in a mechanical room. The heater requires a 240volt electrical connection. Who is responsible for making the electrical connection?

A. The plumber, because the water heater is a plumbing appliance and all connections are within the plumbing scope

B. A licensed electrician, because the electrical connection exceeds the plumbing trade's scope of practice

C. Either the plumber or the electrician, depending on the project specifications and local trade jurisdiction

D. The water heater manufacturer's authorized service technician, who must commission all electrical connections

78. A plumber is installing a kitchen faucet with an integrated pulldown sprayer. The sprayer hose runs through the faucet body and has a counterweight to retract the sprayer head. During installation, the plumber must ensure that the sprayer hose does not contact any other plumbing components beneath the sink. Why?

A. Contact with drain piping could transfer vibration to the sprayer hose, causing premature hose failure

B. Contact with the hot water supply tube could melt the sprayer hose if the water temperature is excessive

C. The sprayer hose must hang freely so the counterweight can retract the sprayer head into the spout properly

D. Contact with the Ptrap could create a crossconnection between the supply and drainage systems

79. A plumber services a pointofuse reverse osmosis system. The homeowner reports that the RO faucet produces water very slowly and the storage tank feels empty when lifted. The system is three years old. What component should be checked first?

A. The RO membrane, which may have fouled or reached the end of its service life after three years of use

B. The storage tank's internal air bladder, which may have lost pressure and is not pushing water to the faucet

C. The incoming water supply pressure, which must be adequate for the RO system to produce purified water

D. The postcarbon filter, which may have clogged and is restricting the flow of purified water to the faucet

80. A plumber installs a gasfired storage water heater in a garage. The building code requires the ignition source to be elevated above the garage floor. What is the typical minimum elevation for the ignition source (pilot light or burner)?

A. 150 mm (6 inches) above the garage floor, which is the standard for all fuelburning appliances

B. 300 mm (12 inches) above the garage floor, matching the minimum required for dryer vent terminations

C. 600 mm (24 inches) above the garage floor, which exceeds most code requirements by a significant margin

D. 450 mm (18 inches) above the garage floor to protect against ignition of gasoline vapours pooling at floor level

81. A plumber is replacing an existing atmospheric draft gas water heater with a new powervented model. The existing Bvent chimney connector will no longer be used. What must be done with the abandoned Bvent?

A. The abandoned Bvent must be sealed or removed to prevent it from acting as an opening for downdraft or rain

B. The abandoned Bvent can be left in place asis because it will serve as additional ventilation for the room

C. The abandoned Bvent must be connected to the new powervent exhaust as a secondary discharge path

D. The abandoned Bvent must be labeled as "abandoned" but can remain open to the room for combustion air

82. A plumber installs a water softener and connects the regeneration brine drain to a floor drain receptor with an air gap. The homeowner later asks if the softener should be set for timeinitiated or demandinitiated regeneration. Which is more efficient?

A. Timeinitiated regeneration is more efficient because it occurs at predictable intervals regardless of usage

B. Both methods are equally efficient because they use the same amount of salt and water per regeneration cycle

C. Demandinitiated regeneration is more efficient because it regenerates based on actual water usage, avoiding unnecessary cycles

D. Timeinitiated is preferred for well water systems while demandinitiated is preferred for municipal water only

83. A plumber is installing a residential fire sprinkler system using a multipurpose configuration. The sprinkler heads in the bedrooms are concealed type with a flat cover plate. When a fire reaches the cover plate's activation temperature, what happens?

A. The cover plate activates an alarm but does not release water until the fire department arrives on scene

B. The cover plate drops away, exposing the sprinkler head, which then activates independently at its own temperature rating

C. The cover plate melts and releases water directly through the plate opening without an underlying sprinkler head

D. The cover plate signals the fire alarm panel, which then remotely opens the sprinkler head electrically

84. A plumber notices that a residential gas water heater in a utility closet is showing signs of incomplete combustion — yellow, flickering flames instead of steady blue flames at the burner. What is the most dangerous byproduct of incomplete gas combustion?

A. Water vapour, which condenses inside the flue and causes corrosion damage to the vent connector

B. Nitrogen oxide, which causes the hot water to develop a chemical taste at the kitchen faucet outlet

C. Sulfur dioxide, which produces the rotten egg smell frequently associated with gas appliance problems

D. Carbon monoxide (CO), a colourless, odourless toxic gas that can cause serious illness or death

85. A plumber replaces the cartridge in a singlehandle kitchen faucet. After reassembly, the faucet handle operates in reverse — turning it to the left produces cold water and turning it to the right produces hot water. What caused this?

A. The cartridge was installed 180 degrees out of its correct orientation and must be removed and rotated

B. The hot and cold supply tubes were connected to the wrong faucet inlet ports during reinstallation

C. The cartridge model is incompatible with the faucet body and must be exchanged for the correct model

D. The water supply stop valves were opened in the wrong order, creating a pressure imbalance at the faucet

86. A water heater's energy factor (UEF) is rated at 0.95. A second model under consideration has a UEF of 0.67. Which heater is more efficient and approximately how much more energy does it convert to usable hot water?

A. The 0.67 UEF model is more efficient because lower numbers indicate less energy wasted during operation

B. Both models are equally efficient because UEF measures capacity rather than energy conversion efficiency

C. The 0.95 UEF model converts approximately 28% more of its energy input into usable hot water than the 0.67 model

D. The 0.95 UEF model is only marginally better because the difference of 0.28 is within the measurement tolerance

87. A plumber installs a shower valve with an integral temperature limit stop set at the factory to 49°C maximum. The homeowner requests that the plumber adjust the limit stop to allow hotter water at the shower. What is the correct response?

A. Adjust the limit stop to the homeowner's requested temperature because the homeowner controls their own fixtures

B. Explain that the 49°C maximum is a code requirement for scald prevention and the limit stop must remain at or below this setting

C. Remove the limit stop entirely because the homeowner has signed a waiver accepting responsibility for the temperature

D. Adjust the limit stop to 55°C, which is the maximum temperature the code allows for shower valves with owner consent

88. A plumber is troubleshooting an electric water heater that produces hot water from the upper tap but only lukewarm water from the lower tap on the tank. What is the most likely cause?

A. The lower heating element has failed — only the upper element is heating, leaving the lower portion of the tank underheated

B. The upper thermostat is set too high, causing it to monopolize the electrical supply and starve the lower element

C. The dip tube has broken, directing cold inlet water to the lower portion of the tank instead of the bottom

D. Sediment has accumulated at the bottom of the tank, insulating the lower element from the surrounding water

89. A plumber installs a wholehouse UV disinfection system on a residential well water supply. The UV unit is installed as the last treatment component in a system that also includes a sediment filter and a water softener. Why must the UV unit be installed after the other treatment components?

A. UV light cannot penetrate turbid or particleladen water effectively — sediment must be removed first for UV to work

B. The UV unit generates heat that would damage the sediment filter and water softener if installed before them

C. The water softener adds sodium to the water that would corrode the UV unit's stainless steel chamber

D. The UV unit's electrical interference would disrupt the water softener's electronic control valve if installed nearby

90. A plumber is installing a commercial dishwasher in a restaurant. The dishwasher requires both a supply connection and a drain connection. The drain must connect to the sanitary system through what type of connection?

A. A direct Ptrap connection to the nearest sanitary drain for the fastest and most efficient drainage path

B. An indirect waste connection with an air gap between the dishwasher drain and the floor sink receptor

C. A direct connection to the grease interceptor to capture any food grease discharged during the wash cycle

D. A direct connection to the building sewer through a dedicated drain line bypassing the building's internal DWV

91. A plumber discovers that a residential water heater's anode rod is made of magnesium. The homeowner's well water has a sulphur smell (hydrogen sulfide odour) that intensifies when only the hot water is running. The cold water has minimal odour. What is the most likely cause?

A. The magnesium anode rod is reacting with sulfatereducing bacteria in the tank, producing hydrogen sulfide gas

B. The water heater's thermostat is set too high, causing the sulfur compounds in the water to vaporize faster

C. The hot water recirculation pump is pulling sulfurladen air into the piping through a loose connection

D. The water heater's dip tube is made of a sulfurcontaining material that dissolves at elevated temperatures

92. A plumber is filling a new hydronic heating system for the first time. The system has three zones, an air separator near the boiler, automatic air vents at all high points, and manual bleed valves on each radiator. What is the correct fill procedure?

A. Fill slowly from the lowest point, purging air through each zone sequentially while bleeding emitters from lowest to highest

B. Fill rapidly from the highest point to push air downward and out through the drain valve at the boiler

C. Pressurize the system to 207 kPa immediately and allow the high pressure to force air out of all vents

D. Fill each zone independently through separate fill connections, isolating each zone from the others during fill

93. A condensing boiler is paired with a radiant floor heating system that operates at 35°C supply and 25°C return. A separate baseboard zone operates at 75°C supply and 60°C return. When both zones are operating simultaneously, what return water temperature does the boiler see?

A. The boiler sees only the radiant return at 25°C because the primarysecondary tees isolate each zone

B. The boiler sees only the baseboard return at 60°C because it is the highertemperature return stream

C. The boiler sees a blended return temperature that depends on the flow rates and temperatures of both zones

D. The boiler sees both return temperatures alternately as the zone circulators cycle on and off independently

94. A plumber discovers that a residential hydronic system's automatic fill valve is allowing the system pressure to rise above the coldfill setpoint even when no heating is occurring. The expansion tank precharge is correct. What is the most likely cause?

A. The expansion tank is oversized for the system and is absorbing too much water from the fill valve supply

B. The automatic fill valve is defective — its internal seat or diaphragm is leaking and continuously adding water

C. The boiler's circulator pump is creating additional pressure that the fill valve interprets as low system pressure

D. The pressure gauge is reading incorrectly and the actual system pressure is at the correct coldfill setting

95. A plumber is installing a hydronic heating system in a home with a concrete slabongrade floor. The homeowner wants radiant floor heating in the living room and baseboard convectors in the bedrooms. Both zones will be served by the same condensing boiler through a primarysecondary configuration. What is the key advantage of this piping layout?

A. Primarysecondary piping eliminates the need for zone valves because the closely spaced tees control flow

B. Primarysecondary piping allows the boiler to modulate its firing rate based on the number of active zones

C. Primarysecondary piping allows each zone to operate at a different temperature from a single boiler independently

D. Primarysecondary piping reduces the total pipe length required by combining supply and return into a single pipe

96. A plumber is servicing a steam boiler and observes that the lowwater cutoff's drain valve is seized shut and cannot be opened for the weekly test. What is the required action?

A. The LWCO drain valve must be freed, repaired, or replaced immediately so that weekly testing can resume

B. The LWCO can be tested by an alternative method such as lowering the boiler water level through the main drain

C. Weekly LWCO testing can be suspended until the next annual boiler service when the valve will be replaced

D. The boiler can continue to operate normally because the LWCO itself is functional even if the test valve is stuck

97. A hydronic system uses zone valves to control three heating zones. Zone 1 (master bedroom) calls for heat, and the zone valve opens. However, the circulator does not start and no water flows. What is the most likely electrical cause?

A. The zone valve's motor has failed and cannot open the valve despite receiving the signal from the thermostat

B. The boiler's highlimit control has tripped and is preventing the circulator from receiving power to operate

C. The transformer that powers the zone valve system has failed and no 24volt power is reaching any valve

D. The zone valve's end switch, which closes to energize the circulator when the valve is fully open, has failed

98. A plumber discovers that a hydronic boiler has a cracked section in its cast iron heat exchanger. Water is weeping from the crack when the boiler is cold but stops when the boiler heats up. What causes this pattern?

A. The crack closes when the cast iron expands during heating and opens when the iron contracts during cooling

B. Water pressure is higher when the system is cold because the expansion tank has more capacity available

C. The crack seals itself during heating as mineral deposits from the heated water fill the crack temporarily

D. Condensation from the flue gases collects at the crack when cold and evaporates when the boiler heats up

99. A plumber installs a new condensing boiler with PVC venting. The manufacturer requires the vent to slope back toward the boiler at a minimum pitch. Why is this slope direction required?

A. Condensate that forms inside the PVC vent must drain back to the boiler for collection and proper disposal

B. The slope prevents combustion gases from traveling too far through the vent before exiting the building

C. The slope creates a natural draft that assists the inducer fan in pushing exhaust gases through the vent pipe

D. The slope prevents rain and snow from entering the vent terminal and flowing into the boiler's combustion chamber

100. A plumber is balancing a twozone hydronic system using the proportional balancing method. Zone A has the longest piping circuit and Zone B has the shortest. Which zone's balancing valve is left fully open as the reference?

A. Zone B (shortest), because the shorter circuit has the lowest pressure drop and needs more restriction

B. Zone A (shortest), because the balancing method starts from the circuit with the least resistance to flow

C. Zone B is left fully open because all balancing adjustments are made on Zone A exclusively for simplicity

D. Zone A (longest), because the longest circuit has the highest pressure drop and should have no added restriction

101. A plumber is troubleshooting a hydronic system where the boiler fires but the supply water temperature rises very slowly and never reaches the setpoint. The circulator is running. What is a likely cause?

A. The boiler is massively oversized for the heat load, causing the water to heat too quickly and shortcycle

B. A zone valve is stuck open on a zone not calling for heat, circulating water through a cold zone continuously

C. The system is losing heat faster than the boiler can produce it — the boiler may be undersized or a zone valve stuck open

D. The expansion tank is waterlogged and absorbing all the heat energy before it can reach the distribution system

102. In a twopipe steam system, the condensate return main must slope in what direction?

A. Upward toward the boiler, creating a positive head that forces condensate into the boiler by gravity

B. Downward toward the boiler or toward a condensate return pump receiver for collection and return

C. Level, with zero slope, because the steam pressure pushes condensate through the return piping

D. In the opposite direction from the steam supply main to create counterflow for maximum heat exchange

103. A plumber is installing a hydronic system with PEX tubing for radiant floor heating. The PEX loops are connected to a manifold. What must be verified about each PEX loop before the concrete is poured over the tubing?

A. Each loop must be pressuretested to verify there are no leaks at connections or damage to the tubing

B. Each loop must be filled with antifreeze to protect against freezing during the concrete curing process

C. Each loop must be connected to the boiler and circulated at full temperature to test heat delivery capacity

D. Each loop must be measured for total length and the measurements compared to the design calculations

104. A steam boiler's pressuretrol (operating pressure control) is set to cut out at 10 psig and cut in at 2 psig. The highlimit pressure control is set at 15 psig. What happens if the pressuretrol fails in the "on" position?

A. The boiler will fire continuously and the pressure will rise until the safety relief valve opens at its set point

B. The circulator will increase speed to dissipate the excess heat and prevent overpressurization of the system

C. The expansion tank will absorb the excess pressure and prevent the safety devices from activating entirely

D. The highlimit pressure control will shut off the burner at 15 psig, preventing the pressure from rising further

105. A plumber discovers that a hydronic system has copper supply piping connected directly to a cast iron radiator without any dielectric isolation. The connection point shows green corrosion deposits on the copper and rustcoloured weeping on the cast iron. What is occurring?

A. Electrolytic (galvanic) corrosion at the dissimilar metal connection due to the absence of dielectric isolation

B. Chemical corrosion from the boiler water treatment chemicals attacking both metals at the connection point

C. Erosion corrosion from the highvelocity water flow through the reduced connection between pipe and radiator

D. Condensation corrosion from moisture in the room air condensing on the cold pipetoradiator connection

106. A plumber is commissioning a new radiant floor heating system. The system has been filled, purged of air, and pressuretested. Before the concrete is poured over the tubing, the plumber must maintain what condition in the PEX loops during the concrete pour?

A. The loops must remain pressurized with water during the concrete pour to prevent the tubes from being crushed

B. The loops must be drained and filled with compressed air during the pour to support the tube against the weight

C. The loops must be empty during the concrete pour to prevent the concrete's heat from expanding the water

D. The loops must be connected to the boiler and circulated at full temperature during the pour to cure the concrete

107. A onepipe steam heating system has several radiators that heat slowly compared to radiators closer to the boiler. A plumber recommends replacing the thermostatic air vents on the slowheating radiators. What characteristic should the replacement vents have compared to the vents on the fastheating radiators?

A. The replacement vents should have a lower temperature rating so they close later and allow more air to escape

B. The replacement vents should have a higher temperature rating so they remain open longer during system startup

C. The replacement vents should be the same as the originals because all vents in a onepipe system must match

D. The replacement vents should have a faster venting rate so air is expelled more quickly, allowing steam to arrive sooner

108. A medical gas installer is preparing to braze a joint on a nitrogen supply line. Unlike an oxygen line, does a nitrogen supply line still require a nitrogen purge during brazing?

A. No, because nitrogen piping carries nitrogen gas and therefore cannot develop internal oxide contamination

B. No, because nitrogen is an inert gas and the brazing heat cannot cause any chemical reaction inside the pipe

C. Yes, but only at half the flow rate used for oxygen piping because nitrogen systems are less critical than oxygen

D. Yes — all medical gas piping requires a nitrogen purge during brazing regardless of the gas the system will carry

109. A compressed air system in a commercial building uses copper piping for the distribution header. A plumber notices that the branch connections are taken from the bottom of the horizontal header rather than the top. What problem does this installation error create?

A. Bottom connections reduce the available air pressure at each branch because gravity opposes the flow direction

B. Condensate pooled at the bottom of the header flows directly into the branch lines and downstream to tools

C. The copper pipe wall is thinner at the bottom due to the manufacturing process and cannot support the branch weight

D. Bottom connections cause turbulence in the header flow that reduces the overall system capacity by half

110. A plumber installs an irrigation system for a commercial property. The system includes a chemical injection pump for applying liquid fertilizer through the sprinkler heads. What level of backflow prevention is required at the connection to the potable water supply?

A. A reduced pressure principle (RP/RPZ) assembly because chemical injection creates a severe health hazard

B. A pressure vacuum breaker (PVB) installed 300 mm above the highest sprinkler head in the system

C. A double check valve assembly (DCVA) because fertilizer at irrigation concentrations is a minor hazard

D. An atmospheric vacuum breaker (AVB) on each zone valve to prevent backsiphonage zone by zone

111. A plumber is installing a swimming pool sand filter. The filter manual specifies backwashing procedures. What does backwashing accomplish?

A. It adds fresh chlorine to the filter tank to sanitize the sand media and prevent bacterial growth inside the tank

B. It introduces fresh sand into the filter to replace media that has broken down during the filtration process

C. It preheats the pool water by circulating it through the heater at high velocity before returning to the pool

D. It reverses the water flow through the filter to flush accumulated debris out of the sand bed and to waste

112. A plumber is testing a new gas piping system. The system has been pressurized with air and has held the required pressure for the required duration with no drop. The test has passed. Before purging the system with gas, what must the plumber verify?

A. All windows in the building are open to provide maximum crossventilation during the purging process

B. The fire department has been notified and a fire truck is on standby during the gas purging operation

C. All appliance shutoff valves are closed and all ignition sources in the area are eliminated before purging

D. The gas meter has been installed and calibrated by the utility company before any gas enters the piping

113. A medical gas system verifier discovers that one oxygen outlet in a patient room delivers nitrogen when tested with a gasspecific analyser. This finding during the crossconnection test indicates what critical error?

A. A crossconnection exists between the oxygen and nitrogen piping systems that must be found and corrected

B. The oxygen outlet's DISS connector has been installed backward and must be reinstalled in the correct direction

C. The gas analyser is malfunctioning and must be recalibrated before the test results can be considered valid

D. The oxygen supply pressure is too low, allowing nitrogen from an adjacent system to migrate through the outlet

114. A plumber winterizes a residential irrigation system and discovers that one zone valve will not open when the controller activates it. The compressed air cannot pass through the zone to blow out the lateral piping. What action should the plumber take?

A. Skip the zone and document that it was not winterized — the homeowner can address the valve in spring

B. Manually open the zone valve using the manual override on the valve body, then proceed with the air blowout

C. Increase the compressor pressure above the valve's maximum rating to force the valve open mechanically

D. Disconnect the zone valve and blow compressed air directly through the lateral piping to evacuate all water

115. A process piping installation in a food manufacturing plant requires piping that meets sanitary standards for cleanability. The pipe must have no crevices, smooth internal surfaces, and be resistant to the cleaning chemicals used in the food industry. What pipe material is most commonly specified?

A. Black steel pipe with threaded joints, which is the standard for all industrial process piping applications

B. PVC Schedule 80 pipe with solventcemented joints for maximum chemical resistance in food processing

C. ABS DWV pipe repurposed for process use due to its smooth interior bore and chemical resistance

D. Type 304 or 316 stainless steel with polished interior surfaces and sanitary welded or clamped connections

116. A plumber installs a swimming pool circulation system with a salt chlorine generator. The generator cell is installed on the return line after the filter and heater. During the initial startup, the generator displays an error indicating low salt concentration. What must be done?

A. Replace the generator cell because the error indicates a manufacturing defect in the electrodes

B. Bypass the generator and add liquid chlorine to the pool manually until the salt level stabilizes naturally

C. Add the manufacturer's specified amount of poolgrade salt to the pool water until the reading reaches the required level

D. Increase the pool heater temperature to improve the conductivity of the water and clear the lowsalt error

117. A plumber is connecting a natural gas supply to a residential boiler. The gas supply pipe enters the mechanical room and must connect to the boiler's gas valve. What component must be installed on the gas supply pipe immediately before the boiler's gas valve?

A. A drip leg (sediment trap) with a cap at the bottom to collect moisture and debris before the gas valve

B. A pressurereducing valve to step the supply pressure down to the boiler's required inlet pressure level

C. A backflow preventer to prevent combustion gases from entering the gas supply pipe during boiler operation

D. A gas meter to measure the boiler's individual gas consumption separately from other building appliances

118. A compressed air system's refrigerated dryer has a condensate drain that discharges to a floor drain. The condensate contains oil from the oillubricated compressor. Can this condensate be discharged directly to the sanitary drain?

A. Yes, because the small amount of oil in compressed air condensate is negligible and does not require treatment

B. No — oilcontaminated condensate requires an oilwater separator before it can be discharged to the drain

C. Yes, because refrigerated dryers remove all oil from the condensate before it reaches the drain connection

D. No — all compressed air condensate must be collected as hazardous waste regardless of oil content level

119. A plumber is installing an acid waste neutralization system for a laboratory. The neutralization tank contains limestone chips. Over time, the limestone is consumed by the acid. What maintenance does this system require?

A. The entire tank must be replaced annually because the acid erodes the tank material along with the limestone

B. The limestone level must be checked and replenished periodically as it is consumed by the acid neutralization

C. The tank must be flushed with fresh water weekly to prevent the limestone from becoming saturated with acid

D. No maintenance is required because the limestone regenerates naturally through chemical equilibrium processes

120. A swimming pool has four return inlets positioned on the walls. The return inlets are designed to create a specific circulation pattern in the pool. What is the purpose of this pattern?

A. Distributing treated, heated water throughout the pool volume and directing floating debris toward the skimmers

B. Creating a whirlpool effect that exercises the swimmers and provides a therapeutic massage experience

C. Generating waves across the pool surface that prevent algae from attaching to the pool walls and floor

D. Pushing all debris to the centre of the pool where the main drain vacuum suction can collect it efficiently

121. A medical gas system's final verification includes checking that each outlet has the correct DISS connector. What physical characteristic makes DISS connectors gasspecific?

A. Each gas type has a unique colour applied to the connector body that visually identifies the gas at the outlet

B. Each gas type has a unique electronic chip embedded in the connector that communicates with the equipment

C. Each gas type has a unique diameter and thread pitch combination that physically prevents wronggas connections

D. Each gas type uses a universal connector with a softwarecontrolled lock that verifies the gas before dispensing

122. A plumber is installing a pool heater and notices that the manufacturer specifies a bypass valve around the heater. What is the purpose of this bypass valve?

A. It allows the heater to be bypassed for maintenance without shutting down the pool's circulation system

B. It diverts excess heat away from the pool during summer months when heating is not required at all

C. It regulates the flow rate through the heater by diverting excess flow around it to prevent overheating

D. It provides an emergency relief path in case the heater's heat exchanger develops a leak during operation

123. A plumber is installing CSST (Corrugated Stainless Steel Tubing) for a gas supply in a residential addition. The CSST must be bonded to the building's grounding system. Where is the bonding connection typically made?

A. At the gas meter, where the CSST connects to the rigid steel piping from the utility service

B. At each individual appliance connection point where the CSST terminates at a rigid fitting or connector

C. At the electrical panel's grounding bus bar using a bonding clamp on the CSST's outer jacket

D. At the CSST manifold or the point where the CSST connects to rigid pipe, bonded to the grounding electrode system

124. A plumber installs a compressed air system with an aluminum piping kit designed for compressed air distribution. What is the primary advantage of aluminum piping over traditional black steel for this application?

A. Aluminum is corrosionresistant, lightweight, and uses pushtoconnect fittings for fast, reconfigurable installation

B. Aluminum has a higher pressure rating than steel, allowing smaller pipe sizes for the same system capacity

C. Aluminum eliminates the need for an air dryer because its smooth interior prevents condensation entirely

D. Aluminum piping does not require any supports or hangers because it is light enough to be selfsupporting

125. A plumber is servicing a swimming pool and discovers that the pool pump strainer basket contains a significant amount of debris including leaves, hair, and small stones. What maintenance action is required?

A. Replace the strainer basket with a new one because the debris has damaged the basket's mesh structure

B. Clean the strainer basket by removing the debris and reinstalling it to restore full flow to the pump suction

C. Upgrade to a larger strainer basket to handle the heavy debris load and extend the time between cleanings

D. Install a prefilter upstream of the pump strainer to reduce the amount of debris reaching the basket

Practice Exam 5: Answer Key and Explanations

1. C — Carbon monoxide is not filtered by organic vapour cartridges or any air-purifying respirator cartridge. CO is a chemical asphyxiant that displaces oxygen in the bloodstream, and it passes through standard cartridge filters unimpeded. The space must be evacuated immediately and only re-entered with supplied-air respiratory protection after the CO source is addressed.

2. A — Atmospheric conditions in confined spaces can change within hours due to biological decomposition, chemical reactions, temperature changes, and groundwater level fluctuations. Testing must be performed immediately before every entry — results from a previous day or week are not valid. This is a non-negotiable requirement regardless of a supervisor's instruction.

3. D — At 105 dBA, dual hearing protection (earplugs under earmuffs) should be considered. While the NRR math suggests single protection might suffice, real-world protection is typically half the rated NRR due to fit variations. At extremely high noise levels, dual protection provides an additional 5 dB beyond the higher-rated single protector, offering a critical safety margin.

4. B — The correct first action when any fire situation develops during soldering is to shut off the torch fuel supply immediately. Removing the heat source is the priority — the smouldering wood may self-extinguish once the radiant heat from the flame is removed. If it does not, the fire extinguisher (which must be immediately accessible) is the next response.

5. A — Manufacturer-specified torque values exist because both extremes cause failure: under-tightening allows the gasket to leak, while over-tightening can crack the fitting body, crush the gasket beyond its designed compression range, or strip the bolt threads. A torque wrench applies precisely the force needed — no more, no less.

6. D — The "Warning" signal word with the exclamation mark pictogram indicates a less severe hazard category — typically skin or eye irritation, mild acute toxicity (harmful rather than fatal/toxic), narcotic effects, or respiratory tract irritation. The "Danger" signal word would be used for the more severe categories within the same hazard classes.

7. B — Every pipe penetration through a fire-rated assembly must be sealed with approved firestop material that maintains the fire resistance rating of the wall. Standard spray foam, silicone caulk, and mineral wool alone do not qualify as fire-rated assemblies. Approved firestop systems are tested, listed, and must be installed per the manufacturer's tested configuration.

8. C — Flash point is the lowest temperature at which a product releases enough vapour to form an ignitable mixture with air. Product B's flash point of -4°C means it releases flammable vapour even in sub-freezing conditions — at normal room temperatures, the vapour concentration could easily reach the explosive range. Lower flash point = greater fire hazard.

9. A — Every worker performing work on a locked-out system must apply their own personal lock. Working under another person's lock violates the fundamental principle of personal lockout — only the person who applied a lock may remove it. If the first plumber removes their lock while the second is still working, the system could be re-energized unexpectedly.

10. D — Volume = cross-sectional area × length = 0.01824 m² × 30 m = 0.547 m³. Since 1 m³ = 1,000 litres and 1 litre of water weighs 1 kg, the water weighs approximately 547 kg. This weight must be added to the pipe's empty weight when designing the hanger support system.

11. B — Blue chalk is the standard colour for temporary reference lines on construction jobsites. It can be wiped or washed away when no longer needed. Red chalk is permanent and is used when the line must remain visible through subsequent construction activities. Using the wrong colour can create problems during finish work.

12. C — A properly erected scaffold platform with guardrails, midrails, and toeboards provides a stable, level working surface at height with passive fall protection. For sustained pipe installation work at 4.5 metres, a scaffold is safer and more productive than a ladder (which limits tool use and movement) or a lift (which may not fit the space).

13. A — The ASTM B88 specification defines the manufacturing standard for copper water tube. "Type L" specifies the wall thickness (medium). "Hard drawn" specifies the temper (rigid). Together, these three elements completely define the material: the manufacturing standard, the wall thickness type, and the physical condition of the tube.

14. D — At a 45-degree angle, the horizontal offset equals the vertical rise. This is a geometric property of a 45-degree right triangle — both legs are equal. Therefore, an 18-inch rise at 45 degrees produces an 18-inch horizontal offset. The travel (diagonal) would be 18 × 1.414 = 25.45 inches, but the question asks for the offset, not the travel.

15. B — A tool with a missing ground prong has a compromised safety grounding system. Using it in any condition — especially in a wet location — creates a serious electrocution risk. The tool must be removed from service immediately and either repaired (cord replaced) or replaced with a properly grounded tool. Urgency does not override electrical safety.

16. A — British Columbia has the highest seismic risk in Canada, and provincial and municipal building codes in BC commonly require earthquake straps on water heaters and other heavy equipment to prevent them from toppling during seismic events. A falling water heater can rupture gas and water connections, causing fire and flooding.

17. C — Copper pipe passing through a steel sleeve in a concrete foundation wall creates a galvanic corrosion cell if the two metals contact directly. A dielectric isolation material — plastic bushing, rubber

grommet, or felt wrap — must be placed between the copper and the steel to electrically separate them and prevent accelerated corrosion.

18. B — An oval cut end indicates the tubing was deformed during cutting — typically by a dull blade, excessive cutter force, or using a tool not designed for PEX. The oval shape prevents the fitting from seating evenly and concentrically, which can compromise the seal of crimp, clamp, or expansion connections. The tubing should be re-cut with a sharp, proper PEX cutter.

19. D — CPVC and copper cannot be joined by solvent cement (cement does not bond to metal), soldering (heat destroys CPVC), or heat fusion. A transition union, adapter fitting, or mechanical coupling designed specifically for CPVC-to-copper transitions provides a code-compliant, leak-free connection between the two dissimilar materials.

20. A — Oxygen must never be used as a purge gas — it accelerates oxidation rather than preventing it, and inside a pipe being heated by a brazing torch, concentrated oxygen creates a severe fire and explosion hazard. Only dry, oil-free nitrogen is acceptable for purging medical gas, refrigerant, and other critical copper piping during brazing.

21. C — A spring hanger absorbs vertical pipe movement caused by thermal expansion and contraction while maintaining continuous support for the pipe. As the pipe expands and moves vertically, the spring compresses or extends, accommodating the movement without lifting the pipe off the hanger or overloading the support structure.

22. B — Firestop devices are required only at penetrations through fire-rated assemblies (fire-rated walls, floors, and ceilings). A penetration through a non-fire-rated floor does not require a firestop device, though a sleeve may still be required to protect the pipe from damage and allow thermal movement.

23. D — No-hub coupling band clamps should be tightened alternately — one side, then the other, progressing evenly — to draw the neoprene gasket uniformly around the pipe joint. Tightening one clamp completely before the other can shift the gasket off-centre, creating an uneven seal that may leak.

24. A — A kinked copper tube must be cut out and replaced — kinks cannot be repaired. Heating and reshaping work-hardens the copper further and risks cracking. Repair clamps do not restore the original bore diameter. The kinked section is removed and a new piece is spliced in using two couplings with properly prepared joints.

25. C — PVC degrades significantly when exposed to prolonged ultraviolet (UV) radiation from sunlight. The material becomes brittle, discoloured, and structurally weakened. Exterior PVC pipe must be painted with a UV-resistant latex paint, wrapped in UV-protective tape, or shielded from direct sunlight to prevent degradation.

26. A — The maximum trap arm length for 3-inch pipe is 1,830 mm (72 inches). The water closet's trap is integral, and the 2.5-metre (approximately 98-inch) branch to the stack must have a vent connection within 1,830 mm of the trap weir. The plumber must install a vent on this branch before it reaches the stack to comply with the trap arm limit.

27. C — A soil or waste stack must never be reduced in size as it descends — the stack must be at least as large at the base as it is at any point above. Reducing the stack below the lowest branch constricts the flow path at the point where all accumulated drainage from the stack must transition to the building drain.

28. B — An elevator pit floor drain is an indirect waste connection — the drain receives water that may have been in contact with hydraulic oil, equipment lubricants, and other contaminants. An air gap between the drain outlet and the sanitary connection prevents back-siphonage of contaminated drain water.

29. D — Relief vents are typically required in tall buildings (generally above 5 to 10 storeys) where the volume and velocity of drainage falling through the stack create significant pressure fluctuations that standard individual or branch venting cannot adequately control. The relief vent provides additional air circulation between the horizontal branch and the vent stack.

30. B — A buried cleanout must be extended to the floor surface using a riser pipe and a flush-mounted cleanout cover that is accessible at the finished floor level. A cleanout buried 600 mm below concrete without surface access is useless — the plumber cannot reach it when maintenance is needed.

31. A — When one fixture drains slowly but other fixtures on the same branch drain normally, the problem is isolated to the slow fixture's individual trap, trap arm, or the section of piping unique to that fixture. The branch and stack are clear (proven by the other fixtures draining normally), so the blockage is between the bathtub and the branch connection.

32. D — The correct answer requires consulting the specific code sizing table entry for the reduced catchment area (100 m^2) at the same rainfall intensity (75 mm/hr). Pipe sizing is not directly

proportional to area — a pipe serving half the area does not require exactly half the diameter. The sizing table must be used for each specific area and intensity combination.

33. D — Running traps (house traps) on building drains were once common but are no longer required by most current code editions. They create an unnecessary double-trap condition on every fixture in the building and restrict drainage flow. Existing running traps may be left in place if functional or may be removed during renovation work.

34. B — 1/8 inch per foot = 0.125 ÷ 12 × 100 = approximately 1.04%, commonly expressed as 1.0% grade. The digital level should display approximately 1.0% when the pipe is set to the correct slope. The 2.0% grade corresponds to 1/4 inch per foot (required for pipe 3 inches and smaller).

35. A — Vent terminals must be located at least 3 metres (10 feet) horizontally from any air intake, or the vent must extend 900 mm (3 feet) above the air intake opening. This prevents sewer gas exiting the vent terminal from being drawn into the building through the HVAC system's air intake.

36. C — A sand interceptor (sediment trap) captures dental plaster, stone, impression material grit, and similar heavy particles before they enter the building's drainage system and cause blockages. Mercury amalgam is captured by a separate dedicated amalgam separator on each dental unit — not by the sand interceptor.

37. B — Universal bubbling and gurgling during a single high-volume discharge event (washing machine) that does not occur during normal individual fixture use indicates a partial blockage in the building sewer that is only revealed when the system is challenged with a large, sustained volume. The partial blockage allows normal fixture flows to pass but cannot handle the washing machine's high-volume discharge.

38. B — The minimum separation between a septic disposal field and a drinking water well is typically 15 metres (50 feet) or greater, as specified by provincial regulations. Some jurisdictions require greater distances depending on soil type, well depth, and groundwater flow direction. The separation prevents contamination of the well by septic effluent.

39. A — A combination wye (45-degree) plus eighth bend (45-degree) produces a total 90-degree change of direction with a long, swept internal profile. This is the same fitting combination recommended at the base of stacks and for horizontal-to-horizontal connections where a smooth transition is needed to prevent turbulence.

40. C — A trap arm exceeding the maximum code length by nearly double creates a severe self-siphonage risk. The long horizontal pipe fills with the kitchen sink's full-bore discharge, acts as a piston, and generates a vacuum behind the flowing water that evacuates the trap seal. The vent connection is too far away to provide the air needed to prevent this siphonage.

41. B — An air test does not use water and cannot freeze — making it the appropriate test method for DWV systems in unheated buildings during cold weather. A water test would freeze in the piping at -15°C, potentially cracking pipes and fittings. The standard DWV air test at 35 kPa held for 15 minutes is temperature-independent.

42. D — The sanitary tee's internal sweep curves downward in the direction of gravity flow in the vertical stack. This directs the waste from the horizontal branch smoothly into the descending column of waste in the stack, minimizing turbulence and preventing the branch flow from impeding the stack flow.

43. A — All underground piping below a concrete slab must pass a pressure test (air or water) and be inspected by the AHJ before the concrete is poured. Once covered by concrete, the piping is permanently inaccessible — defects discovered later require expensive slab demolition to access and repair.

44. C — The sealed, gastight cover on the ejector pit is the primary barrier against sewer gas entering the basement. Even with a failed pump, the cover contains the gas within the pit, and the vent pipe connected through the cover provides a path for the gas to escape through the building's vent system to the atmosphere above the roof.

45. B — The code requires the wet vent section to be at least two pipe sizes larger than the minimum drain size for the fixtures it vents. This oversizing ensures that the drainage flowing through the wet vent section never fills the pipe completely — the air space above the water level provides ventilation for the downstream trap.

46. D — PVC is the most commonly used replacement material for broken clay sewer pipe sections. Flexible transition couplings (with neoprene gaskets and stainless steel band clamps) accommodate the slight diameter difference between PVC and clay pipe, providing a watertight, code-compliant joint at each end of the repair splice.

47. A — In cold climates, warm, moist sewer gas rising through the vent stack contacts the cold pipe above the roof line, causing moisture to condense and freeze on the pipe interior. Over time, this ice

buildup restricts or blocks the vent opening. Increasing the vent pipe diameter above the roof line (typically by one size) provides a larger opening that remains functional despite partial ice accumulation.

48. C — Cast iron DWV pipe significantly reduces the transmission of drainage noise through floor and ceiling assemblies due to its high mass and density. The heavy material dampens the vibrations caused by flowing water, providing a much quieter installation than plastic (ABS or PVC) pipe, which transmits sound readily.

49. B — An initial 5-minute hold followed by a slow, steady pressure decline indicates a small leak somewhere in the system. The air is escaping through a defective joint, fitting, or test plug at a rate slow enough that the initial hold appeared stable but fast enough to cause a measurable drop over the full 15-minute test period. Soap solution applied to all connections will reveal the leak as bubbles.

50. B — The backwater valve is installed on the floor drain's horizontal waste pipe between the trap and the connection to the building drain. In this position, it allows the floor drain to function normally during forward flow but prevents reverse flow from a surcharged building drain or sewer from pushing back through the floor drain into the basement.

51. B — The minimum vent diameter for a residential water closet is typically 1-1/2 inches per most code editions. While the absolute minimum vent size in any system is 1-1/4 inches, a water closet vent must be at least half the diameter of the 3-inch drain (1.5 inches) — and 1-1/2 inches is the standard specification.

52. D — A back-pitched (negative slope) section in the building drain creates a permanent pool of standing water at the low point where the pipe runs uphill. Solids, grease, and debris settle in this pool and accumulate over time, creating a recurring blockage point. The back-pitched section must be corrected to restore continuous downhill flow.

53. A — The 200 DFU load exceeds the 180 DFU capacity of a 4-inch pipe at 1/8 inch per foot but falls within the 216 DFU capacity at 1/4 inch per foot. The plumber must install the building drain at the steeper 1/4-inch-per-foot slope to accommodate the full load. This is a common code application question.

54. C — An indirect waste connection with an air gap is required for commercial food equipment (steam tables, ice machines, dishwashers) to prevent any possibility of drain water back-siphoning into

equipment that contacts food. The air gap is a physical separation between the equipment's drain outlet and the floor sink or receptor.

55. A — Smoke entering through the gap between the bathtub and the floor indicates that sewer gas is present in the wall cavity behind the tub. The most likely source is a cracked or disconnected vent pipe concealed in the wall, allowing gas to leak from the DWV system into the wall space and migrate to the gap at the tub-floor junction.

56. D — Drop = 2.5 m − 1.0 m = 1.5 m over 20 m horizontal distance. Grade = 1.5 ÷ 20 = 0.075 = 7.5%. This is a steep slope that far exceeds the code minimum of 1/8 inch per foot (approximately 1%). While adequate for drainage, the plumber should verify that the excessive slope does not cause water to outrun solids on long sections.

57. C — Residual pressure = 350 − (60 + 90 + 25) = 350 − 175 = 175 kPa. This exceeds the 140 kPa minimum required at standard fixtures. The calculation confirms that the available municipal pressure is adequate without a booster pump for this building configuration.

58. A — Under a driveway with vehicle traffic, the HDPE pipe must withstand external compressive loads from the vehicles above. A heavier-wall SDR (lower SDR number = thicker wall) such as SDR 9 or SDR 11 provides the structural strength needed. Standard SDR ratings for open-field burial may not be adequate under traffic-loaded surfaces.

59. D — Water hammer arrestors must be installed on both the hot and cold supply lines at each washing machine connection, as close as possible to the solenoid valves that cause the hammer. Installing arrestors at the building main or water heater allows the pressure wave to travel through the piping before reaching the arrestor.

60. B — Push-fit fitting acceptance for concealed (in-wall) installations varies by jurisdiction. Some provincial and local authorities approve push-fit fittings for concealed use in residential applications; others restrict them to exposed, accessible locations only. The plumber must verify the local AHJ's position before installing push-fit fittings in concealed locations.

61. A — Sealed combustion (direct-vent) draws combustion air from outdoors through a dedicated intake pipe, completely isolating the combustion process from indoor air. In a tightly sealed, energy-efficient home, an atmospheric draft water heater competes with exhaust fans and other appliances for indoor air, risking backdrafting — sealed combustion eliminates this risk entirely.

62. C — All three components of an RP assembly must function correctly: both check valves must hold, and the relief valve must open when needed. A stuck-closed relief valve cannot discharge if a check valve fails later, defeating the RP's primary safety function. The device must be repaired immediately before being returned to service.

63. B — The RP device's relief valve must discharge to a floor drain through an air gap. The air gap prevents drain water from back-siphoning through the relief port into the RP assembly. Without the air gap, a backed-up floor drain could create a pathway for contaminated water to bypass the RP's check valves entirely.

64. D — A tank that sounds completely solid when tapped (no hollow air-charge sound) has lost its diaphragm integrity or air pre-charge. The tank is waterlogged — filled entirely with water with no air cushion to compress. It cannot absorb thermal expansion and must be replaced. Checking with a tire gauge on the Schrader valve confirms zero pre-charge.

65. C — White mineral buildup on aerators indicates hard water — elevated calcium and magnesium that precipitate as scale. A water softener (ion exchange system) removes these hardness minerals at the point of entry, preventing scale formation throughout the entire plumbing system including the water heater, piping, and fixture components.

66. A — A downstream pressure of 580 kPa when the PRV is set at 415 kPa indicates the PRV has failed in the open position and is no longer regulating. The PRV must be repaired or replaced immediately. While thermal expansion can raise pressure above the PRV setting in a closed system, the extreme overshoot (165 kPa above setpoint) with symptoms throughout the house points to PRV failure.

67. B — PVC has a maximum continuous service temperature of approximately 60°C and loses structural strength at elevated temperatures. A recirculation return line carrying water at 50–55°C continuously is near PVC's upper limit and could cause the pipe to soften, sag, and fail over time. Copper, CPVC, and PEX are all rated for this temperature range.

68. D — An error code indicating insufficient gas flow typically means the gas supply line cannot deliver adequate gas volume at the required pressure to support the tankless heater's high BTU input. Tankless heaters require significantly larger gas lines than storage water heaters — a 3/4-inch minimum supply is common, and some high-output units require 1-inch lines.

69. A — Every underground joint is a potential failure point — joints can develop leaks over time due to ground movement, frost heaving, corrosion, and soil chemistry. A continuous run of soft copper from a coil eliminates all underground joints, significantly reducing the risk of leaks and root intrusion over the life of the service.

70. C — Antifreeze in a fire sprinkler system changes the hazard classification because antifreeze (typically propylene glycol) is a chemical additive that could contaminate the potable supply if backflow occurs. The DCVA may no longer provide adequate protection for this elevated hazard, and an RP device may be required per the local authority's assessment.

71. B — Without a check valve on the return line, thermosiphon circulation can develop when the pump is off — hot water naturally rises and flows backward through the return line due to the density difference between hot and cold water. This uncontrolled circulation wastes energy and can cause hot water to enter the cold supply piping.

72. D — An ice machine processes potable water but the melt water and drain water can contain contaminants from the ice bin, food contact, and cleaning chemicals. An atmospheric vacuum breaker or other approved device on the supply prevents back-siphonage of melt water from entering the potable supply.

73. D — A failed dip tube allows incoming cold water to exit near the top of the tank and mix with the hot water at the outlet, rather than being delivered to the bottom for heating. The effective hot water capacity is drastically reduced because only the upper portion of the tank maintains full temperature.

74. C — A break tank (atmospheric storage tank) or a reduced pressure backflow preventer on the booster pump's suction side isolates the pump from the municipal main. Without this isolation, the booster pump could draw the main pressure below atmospheric, creating back-siphonage conditions that would affect neighboring buildings on the same main.

75. D — If the Schrader valve shows correct pre-charge but the T&P still opens during heating, the diaphragm inside the tank may have ruptured. A ruptured diaphragm allows water to fill both sides of the tank — the Schrader valve reads the trapped air charge on one side, but the tank is actually waterlogged on the water side and cannot absorb expansion.

76. C — When the closet flange is recessed below the finished floor, a standard-thickness wax ring may not bridge the gap between the toilet horn and the flange. An extra-thick wax ring provides additional wax material to fill the gap and create a complete seal. The recessed flange is one of the most common causes of water closet base leaks.

77. B — A 240-volt electrical connection exceeds the plumbing trade's scope of practice. A licensed electrician must make the electrical connection, including running the circuit from the panel, installing the disconnect, and wiring the heater. The plumber handles the water supply, drainage, venting, and gas connections (if applicable).

78. C — The pull-down sprayer relies on a counterweight on the hose to retract the sprayer head back into the faucet spout after use. If the hose contacts other components (P-trap, supply tubes, disposal), it cannot hang freely and the counterweight cannot function — the sprayer will not retract properly.

79. A — After three years of service, the RO membrane is the most likely component to have fouled or reached the end of its usable life. Membrane fouling from scale, biofilm, or chlorine damage reduces permeability, slowing production to a trickle. Replacing the membrane (and the pre-filters) typically restores normal production.

80. D — Gas-fired water heaters installed in garages must have their ignition source (pilot light, burner, or electronic ignition) elevated at least 450 mm (18 inches) above the garage floor. Gasoline vapours are heavier than air and pool at floor level — the elevation keeps the ignition source above the expected vapour accumulation zone.

81. A — An abandoned B-vent that is no longer connected to an appliance must be sealed at the top (to prevent rain, animals, and downdraft) and at the bottom (to prevent the chimney from acting as a cold air duct drawing conditioned air out of the building). Alternatively, the B-vent can be completely removed.

82. C — Demand-initiated (metered) regeneration bases the cycle on actual water consumption rather than a fixed timer. It regenerates only when the measured volume of treated water indicates the resin bed is nearing exhaustion. This avoids unnecessary regeneration cycles that waste salt and water — saving both resources and operating costs.

83. B — A concealed sprinkler head has a temperature-rated cover plate that drops away at its activation temperature, exposing the standard sprinkler head underneath. The sprinkler head then activates

independently at its own (higher) temperature rating. Two separate temperature events must occur: the cover plate drops first, then the sprinkler head activates.

84. D — Carbon monoxide (CO) is the most dangerous byproduct of incomplete gas combustion. It is colourless and odourless, making it undetectable without a CO detector. Yellow flames indicate insufficient oxygen for complete combustion, meaning CO is being produced. The heater must be shut off, the space ventilated, and the combustion air and venting investigated.

85. A — The cartridge was installed 180 degrees out of its correct orientation, reversing the hot and cold ports. Single-handle faucet cartridges are keyed to install in a specific rotational position. Removing the cartridge, rotating it 180 degrees, and reinstalling it will restore correct hot-left/cold-right operation.

86. C — The 0.95 UEF model is more efficient — it converts 95% of input energy to usable hot water versus 67% for the 0.67 model. The difference (0.95 − 0.67 = 0.28) means the higher-rated model converts approximately 28 percentage points more of its energy input into usable hot water, resulting in significantly lower operating costs.

87. B — The 49°C maximum delivery temperature at showers is a code requirement for scald prevention — it is not optional or adjustable at the homeowner's request. The plumber must explain that the limit stop is a safety device required by the plumbing code and cannot be legally increased beyond 49°C regardless of the homeowner's preference.

88. A — In a dual-element electric water heater, the upper and lower elements typically alternate — the upper heats first, then hands off to the lower. If the lower element fails, only the upper portion of the tank is heated. Hot water from the upper tap confirms the upper element works; lukewarm from the lower tap confirms the lower element has failed.

89. A — UV disinfection requires clear, particle-free water to be effective. Turbidity (cloudiness from suspended particles) blocks and scatters UV light, creating shadows where microorganisms can pass through the UV chamber without receiving a lethal dose. The sediment filter and softener upstream remove particles and scale that would reduce UV transmission.

90. B — Commercial dishwashers require an indirect waste connection with an air gap between the machine's drain outlet and a floor sink receptor. This prevents any possibility of drain water back-siphoning into the dishwasher, which contacts food and could cause contamination. The air gap is a physical separation, not a mechanical device.

91. A — The magnesium anode rod reacts with sulfate-reducing bacteria naturally present in the water heater tank, producing hydrogen sulfide gas — the rotten egg smell. The reaction occurs only in the hot water (where the anode is located), which is why the cold water has minimal odour. Replacing the magnesium anode with an aluminum-zinc alloy rod typically eliminates the smell.

92. A — The correct procedure is to fill slowly from the lowest point in the system, allowing water to rise gradually and push air upward through the piping to the automatic air vents and manual bleed valves. Bleed each emitter from lowest to highest as the water reaches each level, ensuring all trapped air is expelled before the system is fully pressurized.

93. D — In a primary-secondary system with multiple secondary zones at different temperatures, the boiler's actual return temperature depends on how much water flows from each zone through the closely spaced tees back into the primary loop. The blended return is a flow-weighted average of all active zone returns — not simply the temperature of one zone.

94. B — An automatic fill valve that continues adding water beyond the cold-fill setpoint has an internal defect — a worn seat, torn diaphragm, or stuck mechanism is allowing water to pass continuously. This slowly overfills the system, raising the pressure above the setpoint. The fill valve must be repaired or replaced.

95. C — Primary-secondary piping with closely spaced tees allows each secondary zone to operate at its own temperature independently — the radiant floor at 35°C and the baseboard at 75°C — from a single boiler. A mixing valve on the radiant zone controls its supply temperature without affecting the baseboard zone's temperature.

96. A — The LWCO is a critical safety device that must be testable at all times during operation. A seized drain valve prevents the weekly operability test that confirms the device will shut off the burner in a low-water emergency. The valve must be freed, repaired, or replaced immediately to restore the ability to test this life-safety device.

97. D — When a zone valve opens but the circulator does not start, the most likely electrical cause is a failed end switch inside the zone valve actuator. The end switch closes when the valve reaches the fully open position, completing the circuit that energizes the circulator. A failed end switch means the valve opens but never sends the signal to start the pump.

98. A — Cast iron expands when heated, and the expansion can temporarily close a hairline crack that weeps water when the iron is cool and contracted. This pattern of cold-weeping/hot-dry is characteristic of a cracked cast iron section and indicates that the section must be replaced — the crack will worsen over time and eventually leak at all temperatures.

99. A — Condensate that forms inside the PVC vent must drain back toward the boiler by gravity for proper collection and disposal. If the vent slopes away from the boiler, condensate pools inside the vent pipe and can eventually block exhaust gas flow, cause the inducer fan to work harder, or trigger a pressure switch fault.

100. D — The proportional balancing method uses the circuit with the highest pressure drop (longest circuit, Zone A) as the reference — its balancing valve is left fully open because it already has the most resistance. All other circuits (Zone B, shorter) have their valves partially closed to add resistance and equalize pressure drops across the system.

101. C — When the boiler fires but supply temperature rises very slowly or never reaches setpoint despite the circulator running, heat is leaving the boiler faster than it can produce it. A zone valve stuck open on a non-calling zone circulates water through an unheated space, continuously removing heat. Alternatively, the boiler may be undersized for the total connected load.

102. B — The condensate return main must slope downward toward the boiler (in a gravity return system) or toward a condensate return pump receiver. Gravity returns use the natural slope to drain condensate back to the boiler. Mechanical return systems use a receiver and pump to push condensate back when gravity return is not possible.

103. A — Each PEX loop must be pressure-tested before concrete is poured over the tubing. A leak in a PEX loop under a concrete slab is extremely difficult and expensive to repair after the concrete is placed. The standard practice is to pressurize all loops to the required test pressure and verify that pressure holds before and during the concrete pour.

104. D — If the pressuretrol fails "on," the boiler fires continuously and steam pressure rises. The high-limit pressure control (set at 15 psig) is the safety backup — it shuts off the burner at 15 psig, preventing the pressure from continuing to rise to the safety relief valve setting. This is the same concept as the high-limit aquastat in a hot water system.

105. A — Green corrosion on the copper and rust-coloured weeping on the cast iron at a direct copper-to-iron connection indicate galvanic (electrolytic) corrosion. The two dissimilar metals in contact with the system water form a galvanic cell, with the less-noble metal (iron) corroding preferentially. Dielectric isolation must be installed to stop the corrosion.

106. A — The PEX loops must remain pressurized with water during the concrete pour. The hydrostatic pressure inside the tubes prevents the weight of the wet concrete from crushing or collapsing the tubing. Draining the tubes before the pour removes this internal support and risks tube deformation under the concrete load.

107. D — Replacing the thermostatic air vents on distant, slow-heating radiators with faster-venting models allows air to be expelled more quickly from those radiators during system startup. When air is purged faster, steam arrives sooner, equalizing the heating rate with the radiators closer to the boiler that naturally receive steam first.

108. D — All medical gas piping — regardless of which gas it will carry — requires a continuous nitrogen purge during every brazing operation. The purge prevents interior oxide scale formation on the heated copper surface. Even a nitrogen supply line must be purged with nitrogen during brazing because the inside of the pipe is exposed to atmospheric air during installation.

109. B — Branch connections taken from the bottom of the header draw directly from the condensate pool that accumulates by gravity at the lowest point of the horizontal pipe. This moisture flows into the branches and downstream to tools, causing corrosion, damage to pneumatic equipment, and poor tool performance. Branches must always be taken from the top.

110. A — Chemical injection (fertilizer) into an irrigation system creates a severe (health) hazard cross-connection. A reduced pressure principle (RP/RPZ) assembly is the minimum required protection because the toxic chemicals could cause illness if back-siphoned or back-pressured into the potable water supply.

111. D — Backwashing reverses the normal flow direction through the sand filter, lifting and agitating the sand bed to dislodge trapped debris, which is then flushed out of the filter tank through the waste discharge line. After backwashing, the filter is rinsed briefly in the forward direction before returning to normal filtration service.

112. C — Before purging the tested piping with gas, all appliance shutoff valves must be closed (so gas fills only the piping, not the appliances) and all ignition sources in the area must be eliminated. During the purge, the air-gas mixture exiting the piping at the purge point is temporarily in the explosive range and must not contact any ignition source.

113. A — An oxygen outlet delivering nitrogen is definitive proof of a cross-connection between the oxygen and nitrogen piping systems. A physical connection exists between two systems that must be completely independent. This is a potentially fatal error that must be found and corrected before the system can be certified for patient use.

114. B — Most solenoid zone valves have a manual override — a lever, screw, or bleed mechanism that allows the valve to be opened manually without the electrical signal from the controller. Using the manual override allows the compressed air to flow through the zone for winterization without requiring the electrical issue to be resolved first.

115. D — Sanitary piping in food manufacturing requires Type 304 or 316 stainless steel with polished interior surfaces (eliminating crevices where bacteria can harbour) and sanitary connections — either welded with polished weld beads or sanitary tri-clamp fittings that can be disassembled for cleaning and inspection.

116. C — The low-salt error means the salt concentration in the pool water is below the generator's minimum operating threshold. Pool-grade salt must be added to the water according to the manufacturer's dosing chart until the salt level reaches the specified range (typically 2,700–3,400 ppm). The generator cannot produce chlorine without adequate salt.

117. A — A drip leg (sediment trap) with a cap at the bottom must be installed on the gas supply pipe immediately before every gas-fired appliance's gas valve. It collects moisture, pipe scale, and debris that could foul or damage the gas valve's internal components, causing malfunction or unsafe operation.

118. B — Compressed air condensate from an oil-lubricated compressor contains emulsified oil that cannot be discharged directly to the sanitary drain without treatment. An oil-water separator must be installed on the condensate drain to remove the oil before the water portion is discharged. Environmental regulations govern the disposal of oil-contaminated condensate.

119. B — The limestone chips in the neutralization tank are consumed by the chemical reaction with the acid waste — the calcium carbonate reacts with the acid, neutralizing it while the limestone dissolves.

The limestone level must be checked and replenished periodically (typically every 3–6 months depending on acid volume) to maintain neutralization capacity.

120. A — The return inlets are positioned to create a circulation pattern that distributes treated, filtered, heated water evenly throughout the entire pool volume and directs floating debris (leaves, body oils, insects) toward the skimmers on the pool surface for removal. Proper circulation ensures uniform water quality and temperature throughout the pool.

121. C — Each medical gas type has a unique combination of diameter and thread pitch in its DISS connector. An oxygen connector physically cannot mate with a nitrogen adapter, a nitrous oxide adapter, or any other gas's adapter. This mechanical specificity prevents the most dangerous possible error — delivering the wrong gas to a patient.

122. A — The bypass valve allows the pool circulation system to continue operating (filtration, chemical treatment) while the heater is isolated for maintenance, repair, or during seasons when heating is not needed. Without a bypass, the entire circulation system must be shut down to service the heater.

123. D — The bonding connection is typically made at the CSST manifold or at the point where the CSST connects to rigid pipe, using an approved bonding clamp connected to the building's grounding electrode system (ground rod, metallic water pipe, or grounding bus). This provides a low-resistance path to ground that dissipates lightning-induced surges.

124. A — Aluminum compressed air piping is corrosion-resistant (unlike black steel, which rusts internally), lightweight (easier to install), and uses push-to-connect fittings that can be assembled and reconfigured quickly without threading, welding, or soldering. These advantages make aluminum systems increasingly popular for workshop and industrial compressed air distribution.

125. B — The strainer basket is a routine maintenance item — it is designed to collect debris and must be cleaned regularly by removing the debris and reinstalling the basket. A basket full of debris restricts suction flow to the pump, potentially causing the pump to lose prime or overheat. Regular cleaning maintains full circulation capacity.