

PRACTICE EXAM 4: RED SEAL PLUMBER SIMULATION (125 QUESTIONS)

1. A plumber discovers a container of pipe primer that has been left open overnight in a small, unventilated storage room. The WHMIS pictogram on the label shows a flame inside a red diamond border. Before entering the room, what hazard must the plumber assess?

- A. Flammable vapour accumulation that could ignite from a spark, static discharge, or open flame
- B. Oxygen depletion caused by the primer absorbing all available oxygen from the enclosed space
- C. Toxic gas generation from the primer chemically reacting with moisture in the ambient room air
- D. Radiation hazard from ultraviolet-sensitive compounds in the primer that degrade in enclosed spaces

2. A plumber is assigned to repair a leaking valve on a compressed air line operating at 690 kPa (100 psi). The lockout/tagout procedure requires isolating the pneumatic energy. After closing the supply valve and applying a personal lock, what must be done before opening the valve body?

- A. Wait 30 minutes for the compressed air to naturally dissipate through microleaks in the piping
- B. Apply additional locks on adjacent valves upstream and downstream of the repair location
- C. Bleed the trapped compressed air to zero pressure through a bleed valve downstream of the isolation
- D. Wrap the valve body in a protective blanket to contain any residual air release during disassembly

3. A plumber must enter a valve chamber that qualifies as a confined space. The atmospheric testing equipment shows 20.8% oxygen, 0% LEL, and 0 ppm hydrogen sulfide. Are conditions safe for entry?

- A. No, because the oxygen level exceeds the normal 20.9% by an unsafe margin indicating enrichment
- B. Yes, all three readings are within acceptable limits for confined space entry to proceed safely
- C. No, because a zero LEL reading is impossible in a valve chamber and indicates a faulty gas monitor
- D. Yes, but only if the plumber wears a suppliedair respirator regardless of the atmospheric readings

4. A plumber working on a rooftop mechanical penthouse must install pipe supports at a height of 4 metres above the roof surface. The work area is near the roof edge with no permanent guardrails. What fall protection is required?

- A. Only a hard hat and safety boots, because the work is being performed on a flat roof surface
- B. A safety net installed below the work area to catch the worker in the event of a fall from height
- C. A safety warning line system placed 2 metres from the roof edge to alert workers of the hazard
- D. A personal fall arrest system with fullbody harness, shockabsorbing lanyard, and rated anchorage

5. An apprentice asks why the permit and inspection process is necessary when the journey person already knows the code. What is the best explanation of the inspection system's purpose?

- A. Inspections provide independent thirdparty verification that the work meets minimum code standards

- B. Inspections exist primarily to generate revenue for the municipality through permit fee collection
- C. Inspections are required only for apprenticelevel work and are waived for certified journeypersons
- D. Inspections serve as a training opportunity for municipal inspectors to learn current trade practices

6. A plumber is using an oxyacetylene torch for brazing. The acetylene regulator's delivery pressure is set to 18 psi. Is this pressure setting acceptable?

- A. Yes, 18 psi is within the normal operating range for acetylene used in plumbing brazing operations
- B. Yes, higher acetylene pressure produces a hotter flame that speeds up the brazing operation time
- C. No, acetylene must never exceed 15 psi gauge because it becomes unstable and can decompose explosively
- D. No, acetylene must be set to match the oxygen pressure exactly for a balanced and neutral flame

7. On an oxyfuel torch setup, the fuel gas hose uses lefthand threads with a groove cut into the connecting nut. What is the purpose of this reversethread convention?

- A. Lefthand threads reduce the torque required to tighten fuel gas connections during field assembly
- B. The reverse threading prevents accidental interchange of oxygen and fuel gas hose connections
- C. Lefthand threads provide a stronger mechanical connection for the higherpressure fuel gas supply
- D. The grooved nut indicates that the hose requires replacement and should not be used on the setup

8. A plumber needs to determine the volume of a rectangular cistern that measures 1.5 metres long, 1.0 metre wide, and 0.8 metres deep. What is the volume in litres?

- A. 120 litres, calculated by multiplying the three dimensions and converting cubic metres to litres
- B. 800 litres, calculated by using only the depth and width dimensions in the volume formula
- C. 3,300 litres, calculated by multiplying the dimensions in centimetres and converting to litres
- D. 1,200 litres, calculated by multiplying $1.5 \times 1.0 \times 0.8 = 1.2 \text{ m}^3 \times 1,000 \text{ litres/m}^3$

9. A foreman instructs a plumber to enter a 2metredeep trench that has no protective system installed. The plumber believes the unprotected trench is dangerous. What legal right protects the plumber's refusal to enter?

- A. The right to refuse unsafe work, which is protected by occupational health and safety legislation
- B. The right to strike, which allows workers to stop all work when any single hazard is identified
- C. The right to selfregulate, which permits workers to set their own safety standards on each project
- D. The right to compensation, which guarantees payment for any injury sustained in an unsafe trench

10. A plumber measures a hot water recirculation pipe run at 30 metres. The pipe is copper. Using the coefficient of linear expansion for copper (17×10^{-6} per $^{\circ}\text{C}$) and a temperature rise of 50°C , what is the approximate thermal expansion?

- A. 2.55 mm, which requires no special expansion accommodation for this short pipe run length

B. 12.75 mm, which is too small to require expansion accommodation in a residential installation

C. 25.5 mm, calculated as $30 \text{ m} \times 17 \times 10^{-6} / ^\circ\text{C} \times 50^\circ\text{C} = 0.0255 \text{ m} = 25.5 \text{ mm}$

D. 51.0 mm, calculated by doubling the expansion coefficient for copper pipe in hot water service

11. A plumber is reviewing a project's plumbing specifications organized under CSI MasterFormat. Under which division are the plumbing specifications typically found?

A. Division 15 — Mechanical, which was the legacy location before the MasterFormat system was updated

B. Division 02 — Existing Conditions, which covers all underground utilities including plumbing services

C. Division 26 — Electrical, which covers all building systems including plumbing power connections

D. Division 22 — Plumbing, which is the current MasterFormat division for plumbing specifications

12. A plumber is installing a face shield for protection during a brazing operation. What additional eye protection must be worn underneath the face shield?

A. No additional protection is needed because the face shield provides complete eye coverage by itself

B. Safety glasses or goggles must be worn under the face shield because it is not primary eye protection

C. A welding helmet with a shade 12 lens must be worn under the face shield for brazing operations

D. Tinted prescription eyeglasses are sufficient under the face shield if they have side shield attachments

13. A plumber needs to calculate the pressure exerted by a column of water 25 feet high. Using the imperial conversion factor of 0.434 psi per foot of water, what is the pressure?

- A. 10.85 psi, calculated by multiplying 25 feet by the conversion factor of 0.434 psi per foot
- B. 57.60 psi, calculated by dividing 25 feet by the conversion factor of 0.434 psi per foot
- C. 25.00 psi, because each foot of water exerts exactly 1 psi of pressure at the base of the column
- D. 5.78 psi, calculated by dividing the conversion factor of 0.434 by the column height of 25 feet

14. A WHMIS supplier label requires seven mandatory elements. Which of the following is NOT one of the seven required elements on a supplier label?

- A. The product identifier matching the name used on the Safety Data Sheet for that product
- B. Hazard pictogram(s) enclosed in the standard red diamondshaped border with black symbols
- C. The date of manufacture and the product's expiration date printed in a standardized date format
- D. Precautionary statements covering prevention, response, storage, and disposal of the product

15. A plumber has completed a soldering operation in a wall cavity containing wood framing and electrical wiring. What is the minimum fire watch period required after the torch is extinguished?

- A. No fire watch is required if a heat shield was used between the torch flame and all combustible materials

- B. 5 minutes, which is the standard fire watch duration for residential soldering operations in wood framing
- C. The fire watch period depends solely on the plumber's assessment of whether the materials are smouldering
- D. 30 to 60 minutes, as specified by the hot work permit requirements and jurisdictional fire safety codes

16. A plumber is working with a product whose SDS indicates an IDLH (Immediately Dangerous to Life or Health) concentration of 100 ppm. What does this value represent?

- A. The maximum concentration permitted in a workplace over an 8hour timeweighted average period
- B. The concentration at which the product's odour first becomes detectable to the average human nose
- C. The shortterm exposure limit (STEL) for a 15minute ceiling that must never be exceeded at any time
- D. The airborne concentration that poses an immediate threat to life or irreversible health effects if exceeded

17. A plumber is installing PEXA tubing using the coldexpansion fitting method. What property of PEXA allows this connection method to work?

- A. Thermal memory — PEXA returns to its original diameter after being expanded, gripping the fitting
- B. Chemical bonding — the expansion tool applies a solvent that fuses the PEXA to the brass fitting
- C. Magnetic attraction — the PEXA material contains iron particles that grip the ferrous metal fitting

D. Adhesive coating — the PEXA interior is precoated with an adhesive activated by the expansion tool

18. A plumber must install firestop material at a penetration where a 3inch ABS DWV pipe passes through a 2hour fire-rated concrete floor assembly. Why is an intumescent firestop device required at this penetration?

- A. The concrete floor lacks sufficient mass to maintain its fire rating without supplemental protection
- B. ABS pipe conducts heat along its length, transferring fire through the floor to the storey above
- C. The annular space between the pipe and the sleeve must be filled with rigid noncombustible material
- D. ABS melts and burns away in fire, leaving an open hole that the intumescent material seals by expanding

19. A plumber selects Schedule 80 steel pipe instead of Schedule 40 for a specific application. What is the primary difference between the two schedules?

- A. Schedule 80 has a larger outside diameter than Schedule 40 for the same nominal pipe size designation
- B. Schedule 80 is manufactured from stainless steel while Schedule 40 is manufactured from carbon steel
- C. Schedule 80 has a thicker wall and higher pressure rating than Schedule 40 for the same nominal size
- D. Schedule 80 uses a different thread taper than Schedule 40, requiring specialized dies for threading

20. When applying solvent cement to a PVC DWV joint, the plumber must work quickly after applying the cement. What happens if assembly is delayed more than 15–20 seconds after cement application?

- A. The cement changes colour, making it impossible to verify proper coverage on the joint surfaces
- B. The cement begins to set before the joint is fully engaged, resulting in a partial fusion that is weak
- C. The cement becomes excessively slippery, preventing the pipe from reaching full insertion depth
- D. The cement emits toxic fumes that exceed the permissible exposure limit for the work area

21. A plumber is installing copper pipe hangers on a horizontal run of 1 1/2 inch Type L copper tube. What is the maximum spacing between hangers?

- A. 2.4 metres (8 feet), which is the code maximum for copper tube sizes 1 1/4 inch through 2 inch
- B. 1.2 metres (4 feet), which is the universal hanger spacing for all copper tube sizes in all applications
- C. 3.0 metres (10 feet), which is the code maximum for copper tube sizes 2 1/2 inch and larger
- D. 1.8 metres (6 feet), which is the code maximum for copper tube sizes 1/2 inch through 1 inch

22. A plumber must join two sections of HDPE sewer pipe underground using electrofusion. How does this joining method work?

- A. A chemical adhesive is injected between the pipe ends inside a coupling sleeve under high pressure
- B. The pipe ends are heated simultaneously by a flat heating plate and pressed together under force

- C. A threaded mechanical coupling is handtightened over the pipe ends and sealed with a rubber gasket
- D. A fitting with embedded heating wires is placed on the pipe and electrical current melts the interface

23. A plumber is installing a pipe anchor on a long straight run of CPVC hot water supply. What is the function of the anchor in relation to thermal expansion?

- A. The anchor provides additional structural support to prevent the pipe from sagging between hangers
- B. The anchor reduces the coefficient of expansion of the CPVC by compressing the pipe at the fixed point
- C. The anchor fixes the pipe at a specific point, directing thermal expansion toward the expansion device
- D. The anchor absorbs thermal expansion through its internal spring mechanism that compresses and extends

24. A plumber prepares to solder a copper tube joint but discovers that the tube end was cleaned with emery cloth over an hour ago and has developed a visible tarnish. What is the correct action?

- A. Apply extra flux to compensate for the tarnish, as a thicker flux layer will dissolve the oxide layer
- B. Reclean the tube end with emery cloth to bright copper immediately before applying flux and assembling
- C. Proceed with soldering because the tarnish is superficial and will not affect the quality of the joint
- D. Anneal the tube end with the torch before cleaning to soften both the copper and the oxide layer

25. A plumber is installing a grooved mechanical coupling on a 4inch steel pipe in a fire sprinkler system. What must be present on the pipe end for the coupling to engage?

- A. A beveled end cut at a 37.5degree angle to match the coupling housing's internal taper geometry
- B. A threaded end with NPT tapered threads matching the coupling's internal thread engagement surface
- C. A flared end formed with a mechanical flaring tool to create a 45degree seat for the coupling gasket
- D. A groove rolled or cut into the pipe end near the extremity into which the coupling housing locks

26. A plumber is sizing a vent pipe for a horizontal branch drain carrying 15 DFU. The developed length of the vent from the drain connection to the roof terminal is 18 metres. Using the code sizing table, the minimum vent diameter at this load and length is 2 inches. If the same vent had a developed length of 45 metres, how would the minimum vent diameter change?

- A. The minimum diameter would remain 2 inches because vent sizing depends only on fixture unit load
- B. The minimum diameter would increase because longer vent runs have more friction and need larger pipe
- C. The minimum diameter would decrease because the longer run provides more air volume to the system
- D. The minimum diameter would remain the same because vent pipe diameter never changes with length

27. A plumber installs a backwater valve on a building's main drain to protect against municipal sewer backups. During normal drainage flow, how does the backwater valve operate?

- A. The valve remains closed at all times and opens only when a sensor detects outgoing drainage flow
- B. The valve blocks all flow in both directions and must be manually opened for each drainage event
- C. The valve opens only when the drainage flow reaches a minimum velocity of 0.6 metres per second
- D. The valve remains open during normal forward flow and closes only when reverse flow is detected

28. A commercial kitchen has a threecompartment pot sink, a prerinse station, two floor drains in the cooking area, and an employee washroom with a lavatory and water closet. Which fixtures must connect to the grease interceptor?

- A. The pot sink, prerinse station, and kitchen floor drains — but not the employee washroom fixtures
- B. All fixtures in the building must connect to the grease interceptor for comprehensive FOG capture
- C. Only the pot sink must connect because it generates the highest concentration of grease per fixture
- D. Only the floor drains must connect because grease settles on the floor and enters through floor drains

29. A plumber is installing a vented sewage ejector system in a basement. The ejector pit must be connected to the building's vent system. Where must the vent pipe connect to the pit?

- A. At the bottom of the pit below the pump to provide air circulation beneath the sewage level
- B. Through the sealed cover of the pit, extending upward to connect to the building's vent stack above
- C. On the force main (discharge pipe) between the check valve and the gravity drain connection point
- D. No vent connection is required on a sewage ejector pit because the sealed cover prevents gas escape

30. A plumber encounters a drainage system in an older commercial building where every fixture has its own individual vent pipe penetrating the roof independently. The building owner wants to reduce the number of roof penetrations during a renovation. What venting method could consolidate multiple individual vents?

- A. Replace all individual vents with air admittance valves to eliminate every roof penetration entirely
- B. Combine individual vents into branch vents that connect to a single vent stack penetrating the roof
- C. Connect all vent pipes to the building's HVAC return air duct for atmospheric pressure equalization
- D. Combine multiple individual vents into the soil stack itself by converting it to a wetvented configuration

31. A plumber is roughing in a basement bathroom below the level of the building sewer. The bathroom includes a water closet, lavatory, and shower. All three fixtures will connect to a sewage ejector. What is the minimum drain pipe diameter for the branch connecting the water closet to the ejector pit?

- A. 2 inches (50 mm), because the ejector pit eliminates the need for standard soil pipe sizing rules
- B. 3 inches (75 mm), because the branch carries water closet discharge and must meet soil pipe minimums
- C. 4 inches (100 mm), because all piping connected to ejector systems must be oversized by one diameter
- D. 1 1/2 inches (38 mm), because the ejector pump handles the pressurized discharge regardless of size

32. A building's DWV system passes the air pressure test at the roughin stage. Three months later, during the final inspection, the inspector notices sewer gas odour in the building. What could have happened between roughin and final?

- A. A trap was damaged, disconnected, or left dry during the construction period between inspections
- B. The air pressure test was performed incorrectly and the system actually had leaks from the beginning
- C. The building's HVAC system is drawing sewer gas in through the vent terminal on the roof surface
- D. The municipal sewer main pressure has increased since the roughin, forcing gas through all traps

33. In a DWV system, the fixture unit value for a bathtub is 2 DFU and the value for a lavatory is 1 DFU. If both fixtures connect to the same 1 1/2 inch horizontal branch drain (maximum capacity 3 DFU), is this branch adequately sized?

- A. No, because every branch carrying more than one fixture must be a minimum of 2 inches in diameter
- B. No, because the branch must be sized for the peak instantaneous flow rather than the DFU total
- C. Yes, the combined 3 DFU total matches the 1 1/2 inch branch capacity and the branch is adequate
- D. Yes, but only if a vent is connected within 300 mm of the bathtub trap to prevent selfsiphonage

34. A plumber is installing a new building sewer using PVC SDR 35 pipe with gasketed bell and spigot joints. Before lowering the pipe into the trench, what must the plumber verify about each joint?

- A. The solvent cement has been applied to both the bell and spigot surfaces before assembly in the trench
- B. The pipe ends have been threaded and wrapped with PTFE tape for gastight joint sealing in the ground

C. The pipe ends have been flared and fitted with compression nuts for underground mechanical connections

D. The gasket is properly seated in the bell, the spigot is beveled and lubricated, and alignment is correct

35. A plumber must install a 4inch cleanout on a horizontal building drain that changes direction by 90 degrees at a corner. Where must the cleanout be placed relative to this direction change?

A. At the midpoint of the straight run downstream of the 90degree direction change in the building drain

B. At or near the 90degree direction change to provide access for cleaning in both directions

C. On the vertical stack above the direction change where it is accessible from the floor above

D. At the building sewer connection point only, because a single cleanout serves the entire building drain

36. A plumber discovers during a renovation that an existing bathroom has a drum trap serving the bathtub. The drum trap is functioning and not leaking. Should the plumber replace it?

A. Yes, drum traps are not codecompliant for new work and should be replaced with a Ptrap during renovation

B. No, drum traps are superior to Ptraps for bathtubs and should be retained whenever they are functional

C. No, existing drum traps are grandfathered indefinitely and never need to be replaced regardless of work scope

D. Yes, but only if the renovation requires a permit — unpermitted renovation work can retain drum traps

37. A plumber is sizing storm drainage piping for a flat commercial roof. What two factors determine the required pipe diameter for the roof drain leaders (vertical storm drain pipes)?

- A. The height of the building and the number of floors that the leader pipe must pass through vertically
- B. The weight of the expected snow load on the roof and the structural capacity of the building framing
- C. The rainfall intensity for the geographic area (in mm/hr) and the roof area (in m²) served by each drain
- D. The number of roof drains installed on the roof and the minimum spacing required between each drain

38. A smoke test reveals sewer gas entering a building through a crack in a vent pipe inside a secondfloor wall cavity. The vent pipe is cast iron and the crack is approximately 100 mm long. What is the most appropriate repair method?

- A. Apply epoxy paste over the crack and wrap the area with fibreglass repair tape for reinforcement
- B. Cut out the damaged section and splice in a new section using nohub transition couplings
- C. Seal the crack with silicone caulk and monitor for six months to verify that the repair is holding
- D. Wrap the cracked section with rubber sheeting and secure it with stainless steel band clamps

39. A homeowner's septic system has a pump chamber (dosing chamber) between the septic tank and the disposal field. What is the function of this pump chamber?

- A. It aerates the effluent from the septic tank to convert the anaerobic waste to an aerobic condition
- B. It stores chlorine tablets that disinfect the effluent before it is distributed to the disposal field
- C. It provides additional settling time to allow finer suspended particles to separate before field distribution
- D. It distributes effluent to the disposal field in controlled, timed doses rather than continuous gravity flow

40. A building inspector requires a water test on a DWV system instead of an air test. The system extends from the basement to the third floor. To what level must the system be filled with water?

- A. To the top of the highest vent stack, ensuring that every joint including vent connections is submerged
- B. To the flood level rim of the highest fixture, which provides adequate head pressure for leak detection
- C. To the top of the thirdfloor branch connections only, as vent piping does not require water testing
- D. To a level that produces exactly 35 kPa (5 psi) of pressure at the lowest point of the drainage system

41. A plumber installs a sanitary tee on a vertical soil stack to receive a horizontal branch drain from a bathroom group. The branch enters the tee from the left side. When viewed from the front, in which direction does the sweep of the sanitary tee's branch opening curve?

- A. The branch sweeps straight into the stack at a 90degree angle with no directional curve whatsoever
- B. The branch curves upward against the direction of flow in the stack to create a mixing chamber

- C. The branch curves downward in the direction of flow in the stack to guide waste smoothly into the flow
- D. The branch alternates direction depending on whether the stack is a soil stack or a waste stack

42. A plumber calculates that a residential building has a total drainage load of 30 DFU. The building drain is installed at a slope of 1/4 inch per foot. According to the code sizing table, a 3inch building drain at this slope accommodates 27 DFU. Is a 3inch building drain adequate?

- A. Yes, because the 27 DFU capacity is close enough to 30 DFU with an acceptable safety margin
- B. No, the 3inch drain is undersized — a 4inch drain must be used because 30 DFU exceeds 27 DFU
- C. Yes, because the slope of 1/4 inch per foot provides additional capacity beyond the table value
- D. No, but a 3inch drain can be used if the slope is increased to 1/2 inch per foot to gain capacity

43. A plumber is installing underground DWV piping below a concrete slab. What must be done before the concrete is poured over the piping?

- A. The underground piping must be tested and inspected by the AHJ before it is concealed by concrete
- B. The piping must be wrapped in protective plastic sheeting to prevent concrete from contacting the pipe
- C. The piping must be filled with sand to prevent the concrete's weight from collapsing the empty pipe
- D. The piping must be coated with a release agent so it can be pulled out and replaced if it fails later

44. A residential building's main soil stack is 3 inches in diameter. A plumber is connecting a 4-inch water closet drain to the 3-inch stack. Is this connection code-compliant?

- A. Yes, because the water closet drain can be reduced from 4 inches to 3 inches at the stack connection
- B. Yes, because a 4-inch branch can connect to a 3-inch stack using a reducing sanitary tee fitting
- C. No, because a 3-inch stack cannot receive a branch larger than 3 inches regardless of fitting type
- D. No, because the soil stack receiving a water closet must be at least 4 inches to handle the discharge

45. A plumber discovers that a 2-inch trap arm from a shower runs 2.0 metres (approximately 80 inches) before connecting to the vent. The code maximum trap arm length for a 2-inch pipe is 1,525 mm (60 inches). What is the consequence of this violation?

- A. The trap arm is too short and should be extended to provide additional drainage capacity for the shower
- B. The trap is at elevated risk of self-siphonage because the long trap arm acts as a piston during discharge
- C. The vent connection will become submerged during normal shower use and will cease providing air supply
- D. The shower drain will produce excessive noise during discharge that transmits through the building structure

46. A plumber installs a combination wye and eighth bend at a point where a 3-inch horizontal branch drain connects to a 4-inch horizontal building drain. What angle does this fitting combination produce?

- A. A 45degree entry angle that provides a gradual connection between the branch and the building drain
- B. A 22.5degree entry angle that minimizes turbulence at the junction of the branch and building drain
- C. A 90degree entry angle with a long swept transition that prevents turbulence and back pressure buildup
- D. A 135degree entry angle that reverses the branch direction before entering the main building drain flow

47. A plumber investigates a complaint of slow drainage throughout an entire twostorey house. All fixtures drain slowly, and gurgling sounds are heard from multiple drains simultaneously. Where is the obstruction most likely located?

- A. In the building drain or building sewer, which is the only location that would affect all fixtures simultaneously
- B. In each individual fixture trap, because multiple traps have coincidentally become partially blocked
- C. In the vent stack at the roof, where the blockage prevents air from entering the system during drainage
- D. In the water supply system, where low pressure is causing insufficient water volume to flush the drains

48. A residential septic system's distribution box is designed to divide effluent flow equally among four disposal field trenches. If the distribution box settles unevenly and tilts to one side, what problem occurs?

- A. The effluent becomes more acidic because the uneven box allows excessive air contact with the waste
- B. The disposal field functions normally because the effluent eventually percolates evenly through all soil
- C. The septic tank upstream of the distribution box becomes overloaded and requires emergency pumping
- D. Most effluent flows to the lower trenches, overloading them while upper trenches are underutilized

49. A plumber is installing a vent for an island kitchen sink where running a conventional vent pipe through the roof is impractical. What venting solution is most commonly used for island sink installations?

- A. A loop vent that rises above the countertop level and then descends back down to the drain below
- B. An air admittance valve (AAV) installed on the trap arm under the island counter above the flood rim
- C. A wet vent using the adjacent dishwasher drain as both a drainage pipe and a vent for the sink trap
- D. No vent is required for island sinks because the short trap arm provides adequate selfventing capacity

50. A building sewer connects to a municipal sanitary sewer main that runs 3 metres deep in the street. The building drain exits the foundation at 1.2 metres deep. The building sewer must slope from 1.2 metres at the building to 3 metres at the main over a horizontal distance of 25 metres. What is the approximate slope?

- A. 1/4 inch per foot, which is the code minimum for all building sewer piping regardless of conditions
- B. Approximately 1/8 inch per foot, which just meets the code minimum slope for 4inch sewer pipe
- C. Approximately 7.2% grade, calculated from the 1.8metre drop over the 25metre horizontal distance
- D. The slope cannot be calculated without knowing the exact pipe material and the friction coefficient

51. A plumber is troubleshooting a sewer gas odour in a recently renovated commercial office space. All visible traps have water seals intact, the vent terminal is clear, and no cracks are visible on exposed piping. What hidden source should be investigated?

- A. Air freshener products in the washroom that contain chemicals mimicking the smell of sewer gas
- B. A disconnected or damaged vent pipe concealed inside the wall cavity from the renovation construction
- C. The building's HVAC system recirculating odour from the mechanical room throughout the office space
- D. A missing or disconnected drain pipe behind a wall that was capped during the renovation but is now leaking

52. A plumber must determine if a septic system disposal field can be installed on a rural property. The first step in the site evaluation process involves testing the soil's ability to absorb water. What is this test called?

- A. A hydrostatic pressure test that measures the soil's resistance to pressurized water at a specific depth
- B. A percolation test (perc test) that measures the rate at which water drains from a test hole in the soil
- C. A compaction test that measures the soil's density and bearing capacity for the weight of the disposal field
- D. A pH test that measures the soil's acidity level to determine its compatibility with septic effluent chemistry

53. A plumber installs a DWV system in a threestorey building. The soil stack extends from the basement through all three floors and exits through the roof. At each floor, a bathroom group connects to the stack. How many riser clamps must be installed on this stack?

- A. One riser clamp at each floor level where the stack passes through the floor structure — minimum three
- B. One riser clamp at the base of the stack only, because the base supports the entire weight of the stack
- C. No riser clamps are required if the stack is supported at the roof penetration by a roof flashing device
- D. Two riser clamps — one at the bottom and one at the top — because intermediate support is not needed

54. A plumber is connecting a washing machine standpipe to a 2inch trap and horizontal branch drain. The standpipe height must be sufficient to prevent the washing machine's pump discharge from overflowing. What is the typical minimum standpipe height above the trap weir?

- A. 150 mm (6 inches) above the trap weir, providing minimal clearance above the standing water level
- B. 450 mm (18 inches) above the trap weir, which is the standard minimum for residential standpipes
- C. 750 mm (30 inches) above the trap weir to accommodate the highvelocity pump discharge from the washer
- D. 300 mm (12 inches) above the trap weir, matching the standard height for floor drain standpipes

55. A building's DWV system has been in service for 20 years. A video inspection reveals that the 4inch cast iron building drain has significant internal corrosion and scale buildup reducing the effective bore. What trenchless rehabilitation method can restore the pipe without excavation?

- A. Pipe bursting, which fractures the old pipe outward and simultaneously pulls new pipe into the space
- B. CIPP lining, which inserts a resinsaturated liner that cures in place to form a new pipe inside the old one
- C. Directional drilling, which bores a new pipe path parallel to the existing corroded building drain line
- D. Electrofusion, which applies electric current to the pipe wall to fuse the scale into a smooth surface

56. A plumber installs a floor drain in a parking garage. The drain must be connected to both a sand interceptor and an oil interceptor before the discharge enters the building sewer. In what order must the interceptors be installed?

- A. Oil interceptor first (upstream), then sand interceptor second (downstream) before the building sewer
- B. Sand interceptor first (upstream) to capture grit before it reaches the oil interceptor (downstream)
- C. Both interceptors must be combined in a single device — separate installation is not codecompliant
- D. The order does not matter because both interceptors perform the same separation function identically

57. A plumber installs a new water service to a building and discovers that the municipal main pressure is 380 kPa (55 psi). The highest fixture in the building is 10 metres above the service entry. Friction losses are estimated at 50 kPa. Is the municipal pressure adequate to serve the highest fixture without a booster pump?

- A. Yes — residual pressure at the highest fixture is approximately 232 kPa, well above the 140 kPa minimum
- B. No — the residual pressure falls below the 140 kPa minimum required for proper fixture operation

C. Yes — but only if all fixtures on the highest floor are tanktype water closets with no flushometer valves

D. No — because a minimum municipal supply pressure of 550 kPa is required for all new building connections

58. A plumber is troubleshooting a residential water system. The homeowner reports adequate pressure at the kitchen faucet but very low pressure at the master bathroom shower on the second floor. Both fixtures are on the same trunk line. What is the most likely cause?

A. The water heater is failing and cannot maintain adequate pressure to the shower's mixing valve inlet

B. The kitchen faucet has a flow restrictor that artificially creates the impression of adequate pressure

C. A partially closed valve, restricted pipe section, or clogged fixture component between the two fixtures

D. The municipal supply pressure fluctuates between floors due to the building's elevation above the main

59. A plumber installs a thermal expansion tank on the cold water supply to a water heater. The system's coldfill pressure is 415 kPa (60 psi). To what pressure must the expansion tank be precharged before connection?

A. 207 kPa (30 psi), which is half the system's coldfill pressure for optimal expansion absorption

B. 415 kPa (60 psi), matching the system's coldfill pressure for proper diaphragm positioning at startup

C. 550 kPa (80 psi), matching the maximum codepermitted fixture pressure for safety margin purposes

D. Zero pressure — the tank should be connected empty and the system fill pressure charges it automatically

60. A plumber discovers that a building's entire cold water supply produces a slight bluegreen tint. The piping is copper throughout. What is the most likely cause of the discoloration?

A. Bacterial contamination in the municipal water supply that is tinting the water with organic compounds

B. Residual flux from the soldering process that was not properly flushed from the piping after installation

C. Iron rust from a corroded section of galvanized steel pipe hidden inside a wall that feeds the copper system

D. Copper corrosion from aggressive water chemistry (low pH, high dissolved oxygen) dissolving the pipe walls

61. A plumber is installing a water supply for a commercial building with a laboratory that uses chemicals posing a health hazard. The lab's water connection requires what minimum level of backflow prevention?

A. A pressure vacuum breaker installed 300 mm above the highest fixture in the laboratory space

B. A double check valve assembly installed on the laboratory's dedicated supply branch line

C. A reduced pressure principle (RP/RPZ) assembly because the lab chemicals are a severe health hazard

D. An atmospheric vacuum breaker installed on each individual lab faucet above the flood level rim

62. A plumber installs a water heater with a directvent (sealed combustion) configuration. What distinguishes this venting type from a standard atmospheric draft water heater?

- A. A directvent heater draws combustion air from outdoors and exhausts outdoors through dedicated pipes
- B. A directvent heater uses a larger diameter vent pipe to accommodate the higher exhaust gas volume
- C. A directvent heater requires a masonry chimney while an atmospheric heater uses a metal vent pipe
- D. A directvent heater operates without any vent connection because its combustion is 100% efficient

63. A new residential building has a PRV, a water meter, and a water heater. The homeowner reports that hot water pressure fluctuates during showers. The cold water pressure is stable. What component should the plumber check?

- A. The water meter, which may have internal debris restricting flow to the hot water supply branch
- B. The municipal supply pressure, which may fluctuate during peak demand hours in the neighbourhood
- C. The PRV setting, which may need adjustment to provide consistent pressure to the hot water system
- D. The water heater's dip tube, which may have deteriorated and is directing cold water to the hot outlet

64. A commercial building requires a water supply connection for a cooling tower. The cooling tower water is treated with biocides and scale inhibitors. What backflow prevention is required?

- A. An air gap at the cooling tower fill point is the only acceptable protection for this severe hazard connection
- B. A reduced pressure (RP) assembly because the chemically treated cooling tower water is a health hazard
- C. A double check valve assembly because cooling tower chemicals are classified as minor hazard only

D. No backflow prevention is required because the cooling tower is an open atmospheric system

65. A plumber is installing a water service using soft copper (Type K, annealed). The service will be buried and will transition from underground to interior where it enters the building. What joining method is typically used for the underground section?

A. Flare fittings or compression fittings, because soldered joints are generally not approved for direct burial

B. Soldered joints using leadfree solder, which provide the strongest connection for underground service

C. Pushfit (SharkBite type) fittings, which are the standard for all underground copper water services

D. Brazed joints using BCuP alloy, which are required for all underground copper pipe installations

66. A building has a hot water recirculation system controlled by an aquastat on the return pipe. The aquastat is set to activate the pump when the return water drops below 50°C and deactivate it when the return reaches 55°C. What does this control strategy accomplish?

A. It maintains a constant flow rate through the recirculation loop regardless of the demand for hot water

B. It prevents the recirculation pump from operating during offpeak hours to conserve electrical energy

C. It maintains the return water temperature within a narrow range, ensuring hot water is always available near fixtures

D. It protects the recirculation pump from overheating by cycling it on and off at regular timed intervals

67. A plumber is sizing the water supply for a commercial washroom with four flushometer water closets and four wallhung lavatories. Each flushometer WC is rated at 6 WSFU and each lavatory at 1.5 WSFU. What is the total WSFU for this washroom?

- A. 15 WSFU, calculated by adding only the flushometer values because lavatories are insignificant
- B. 24 WSFU, calculated by adding half the flushometer values with all lavatory values for diversity
- C. 42 WSFU, calculated by adding the individual WSFU values for each flushometer WC and lavatory
- D. 30 WSFU, calculated by multiplying the number of fixtures (8) by the average WSFU value (3.75)

68. A plumber tests a PVB (pressure vacuum breaker) installed on a landscape irrigation system. The test shows that the check valve is leaking and the air inlet is not opening when supply pressure drops. What is the required action?

- A. Adjust the check valve spring tension to increase the sealing force against the valve seat surface
- B. Repair or replace the PVB because both the check valve and air inlet must function for adequate protection
- C. Leave the PVB in service and schedule a retest in 30 days to determine if the condition has worsened
- D. Install an additional AVB downstream of the PVB to provide supplemental backsiphonage protection

69. A plumber must install a water supply connection for an industrial boiler that uses chemical water treatment including oxygen scavengers and pH adjusters. What is the appropriate backflow prevention?

- A. A reduced pressure (RP/RPZ) assembly because chemically treated boiler water is a severe health hazard
- B. A double check valve assembly because boiler chemicals at low concentrations are a minor hazard only
- C. An atmospheric vacuum breaker installed 150 mm above the boiler's highest water level connection
- D. No backflow prevention because the boiler's automatic fill valve contains an integral check mechanism

70. A plumber is troubleshooting a residential water system where the pressure is adequate at the ground floor but noticeably low at the secondfloor bathroom. All secondfloor fixtures are affected. The PRV is set at 415 kPa (60 psi). What should be checked?

- A. The water heater thermostat, which may be set too low and affecting the perceived pressure at fixtures
- B. The municipal supply pressure, which may have dropped below the PRV's set point during peak hours
- C. The branch supply line to the second floor for a partially closed valve, restriction, or undersized pipe
- D. The expansion tank precharge, which may have been lost and is restricting flow to the upper floor

71. A plumber installs a potable water supply connection to a commercial dishwasher in a restaurant. The dishwasher manufacturer requires an air gap on the drain connection. The supply connection also requires backflow prevention. What level of backflow protection is appropriate for the supply?

- A. An atmospheric vacuum breaker on the supply line above the dishwasher's highest water level point
- B. A double check valve assembly installed on the supply branch serving the commercial dishwasher
- C. No additional supplyside protection is needed if the drain has an air gap for indirect waste protection

D. A reduced pressure (RP) device or an air gap because commercial dishwashers with chemical additives may pose a health hazard

72. A building with a PRV on the water service has an expansion tank on the cold supply to the water heater. The homeowner installs a second water heater for additional capacity. What must be done about the expansion tank?

A. The existing expansion tank must be resized or supplemented because the total heated water volume has increased

B. No change is needed because the PRV already limits the maximum pressure regardless of water volume

C. The second water heater eliminates the need for an expansion tank because thermal expansion is divided

D. A second PRV must be installed to match the second water heater before addressing expansion capacity

73. A plumber performs annual maintenance on a backflow preventer. The test reveals that the first check valve passes but the second check valve and relief valve are functioning correctly. What is the required action for a reduced pressure (RP) device with a failed first check?

A. The device passes the test because only one of the two check valves needs to function at any time

B. The device can remain in service for 30 days while a replacement first check valve kit is ordered

C. The device must be repaired immediately — both check valves must function for the RP to provide protection

D. The device must be replaced entirely because individual check valve replacement is not permitted

74. A plumber discovers that a building's PRV is set at 480 kPa (70 psi) but the downstream pressure gauge reads 520 kPa (75 psi) during a period of no water use. What could cause the downstream pressure to exceed the PRV's set point when no water is flowing?

- A. The PRV is functioning correctly — minor pressure creep above the set point is normal during noflow
- B. Thermal expansion from the water heater is raising the pressure above the PRV set point in the closed system
- C. The pressure gauge downstream of the PRV is defective and reading higher than the actual pressure
- D. The municipal supply pressure has dropped below the PRV set point, causing the valve to open fully

75. A plumber is installing a residential water softener. The homeowner's property is on a septic system. What concern should the plumber discuss with the homeowner?

- A. Water softeners are incompatible with septic systems and should never be installed on septic properties
- B. The softened water will corrode the septic tank's concrete and destroy the tank within five years
- C. The water softener's regeneration brine has no effect on septic systems and requires no special consideration
- D. Regeneration brine discharge may inhibit bacteria in the septic tank and may be restricted by local regulations

76. A plumber installs a wallhung lavatory in a public washroom designed for accessibility. The lavatory rim must be installed at what maximum height from the finished floor to comply with accessibility standards?

- A. 900 mm (36 inches), which is the standard mounting height for wallhung lavatories in public washrooms
- B. 750 mm (30 inches), which is the typical maximum recommended height for standard nonaccessible lavatories
- C. 865 mm (34 inches), which is the maximum rim height specified by most Canadian accessibility standards
- D. 1,000 mm (40 inches), which provides the maximum clearance beneath the fixture for wheelchair approach

77. A plumber connects the drain from a commercial ice machine to the building's drainage system. What connection method is required to prevent contamination of the ice supply?

- A. An indirect waste connection with an air gap between the ice machine drain and the floor drain receptor
- B. A direct connection to the nearest floor drain using a Ptrap dedicated exclusively to the ice machine
- C. A connection to the building's greywater recycling system for reuse of the ice machine drain water
- D. A backflow preventer on the ice machine drain hose to prevent sewer gas from entering the machine

78. A plumber is replacing an old 3.5 GPF (13litre) water closet with a new 1.28 GPF (4.8litre) highefficiency model. The existing 3inch drain has a slope of 1/4 inch per foot. After installation, the homeowner complains of frequent clogs. What is the most likely cause?

- A. The new toilet's flush mechanism is defective and not delivering the full rated flush volume per cycle
- B. The drain piping is too large for the reduced flush volume and solids are stranded due to insufficient flow
- C. The 3inch drain was originally designed for the higher flush volume and is now undersized for the new toilet
- D. The wax ring was not installed correctly and is partially blocking the outlet of the water closet horn

79. A plumber installs a tankless water heater sized for wholehouse use. The homeowner reports that the water is hot when only the kitchen faucet is running but becomes lukewarm when the shower is opened simultaneously. What is the problem?

- A. The gas supply line to the tankless heater is undersized and cannot deliver adequate fuel for full demand
- B. The tankless heater's flow capacity is insufficient to serve multiple fixtures at the required temperature rise
- C. The hot water distribution piping is undersized and cannot deliver adequate flow to both fixtures at once
- D. The cold water inlet temperature is too warm, confusing the heater's temperature control into reducing output

80. A plumber is installing a freestanding bathtub with floormounted supply connections. The wasteandoverflow assembly must be accessible for future maintenance. How is access typically provided?

- A. Through an access panel in the wall or floor adjacent to the tub's drain and overflow connections
- B. Through the top of the bathtub by removing the drain stopper and reaching down through the drain body
- C. Access is not required because freestanding bathtub waste assemblies are designed for permanent installation
- D. Through a removable section of the bathtub's exterior apron panel that exposes the underside of the tub

81. A plumber is troubleshooting a gasfired storage water heater that produces hot water but not enough to fill a standard bathtub. The tank is 190 litres (50 gallons). The thermostat is set to 60°C. What should be checked?

- A. The T&P relief valve, which may be discharging water continuously and reducing available hot water volume
- B. The gas control valve, which may be functioning on a reduced gas flow setting due to an internal defect
- C. The dip tube, which may have broken or deteriorated, allowing cold inlet water to mix at the hot outlet
- D. The anode rod, which may have corroded and is now blocking the hot water outlet port at the top of tank

82. A residential water treatment system includes a sediment filter rated at 5 microns, followed by an activated carbon filter, followed by a UV disinfection unit. In what order should water flow through these components and why?

- A. Carbon → Sediment → UV, to remove chlorine first so it does not damage the sediment filter media
- B. Sediment → Carbon → UV, to remove particles first, then chlorine, then kill microorganisms as the final step
- C. UV → Sediment → Carbon, to sterilize the water first before removing particles and chemicals
- D. UV → Carbon → Sediment, to ensure that sterile water passes through the filters for cleanest final output

83. A plumber is installing a residential fire sprinkler system under NFPA 13D. The water supply must deliver a minimum flow rate at a minimum pressure for a specific duration. What is the typical minimum duration that the supply must sustain?

- A. 30 minutes, matching the standard response time for fire departments in suburban residential areas
- B. 60 minutes, providing extended protection until professional firefighting resources arrive on scene
- C. 5 minutes, which is sufficient for early warning only before the occupants evacuate the residence
- D. 10 minutes, which is the standard design duration for residential fire sprinkler systems under NFPA 13D

84. A plumber is installing a commercial hand sink in a food preparation area. The code requires the sink to be equipped with what specific type of faucet control?

- A. A handsfree or selfclosing faucet (foot pedal, kneeoperated, or electronic sensor) for hygiene compliance
- B. A standard twohandle compression faucet with separate hot and cold controls for precise adjustment
- C. A singlehandle lever faucet that can be operated with the wrist or forearm without touching the handle
- D. A pushbutton timed faucet that delivers water for exactly 15 seconds per activation for conservation

85. A plumber discovers that a water softener is producing hard water even immediately after a regeneration cycle. What is the most likely cause?

- A. The salt level in the brine tank is adequate but the salt has formed a hard salt bridge above the water line
- B. The water supply pressure is too high for the softener's rated operating range and must be reduced
- C. The resin bed has exhausted its ion exchange capacity and the entire resin charge must be replaced
- D. The incoming water hardness has increased beyond the softener's rated capacity for singlecycle treatment

86. A plumber is replacing the heating elements in a residential electric water heater. Before removing the elements, what must be done in addition to shutting off the power?

- A. The gas supply valve must be closed and the pilot light extinguished before any work can begin safely
- B. The water supply must be shut off and the tank must be drained to below the level of the elements

C. The expansion tank must be isolated and depressurized to prevent water from flowing during the repair

D. The thermostat must be set to its lowest position to ensure the elements are completely cool before removal

87. A plumber installs an undercounter pointofuse water heater to supply a single lavatory in a remote restroom. What is the primary advantage of this configuration compared to running a long hot water supply line from the main water heater?

A. The pointofuse heater provides higher water pressure than the central heater can deliver at distance

B. The pointofuse heater eliminates the need for a T&P relief valve because the tank is smaller than 30 litres

C. The pointofuse heater requires no electrical or fuel connection because it heats water passively

D. The pointofuse heater eliminates the long dead leg, providing nearly instant hot water at the fixture

88. A plumber is installing a water closet and must choose between a wax ring and a waxfree rubber gasket seal for the connection to the closet flange. What advantage does a waxfree seal offer over a traditional wax ring?

A. A waxfree seal can be repositioned if the toilet needs to be lifted and reset without requiring replacement

B. A waxfree seal creates a permanent chemical bond between the toilet horn and the closet flange surface

C. A waxfree seal is significantly less expensive than a traditional wax ring for residential installation

D. A waxfree seal does not require a closet flange because it connects directly to the closet bend below

89. A plumber is called to repair a kitchen faucet that drips continuously from the spout even when both handles are fully closed. The faucet is a ceramic disc type. What component has most likely failed?

A. The spout O-ring that seals between the faucet body and the rotating spout has worn or deteriorated

B. The handle packing nut that compresses the stem packing against the valve body has loosened over time

C. The ceramic disc cartridge or its seals have worn and no longer create a watertight shutoff when closed

D. The faucet aerator screen has become clogged with mineral deposits, creating backpressure that causes drip

90. A plumber is installing a water heater in a location where the floor drain is not available for the T&P relief valve discharge. The code requires the discharge pipe to terminate at a visible location. What is an acceptable alternative termination point?

A. Through an exterior wall to the building's outside, terminating 150–300 mm above grade facing downward

B. Into a bucket placed beneath the discharge pipe that the homeowner empties on a weekly schedule

C. Connected to the building's sanitary drain with a P-trap to prevent sewer gas from entering the discharge

D. Into the water heater's drain valve port, which recirculates the discharged water back into the tank

91. A plumber is servicing a residential water treatment system. The homeowner reports that the reverse osmosis system is producing very little purified water and the storage tank is nearly empty. What is the most common cause of reduced RO production?

- A. The storage tank has lost its air precharge and cannot maintain pressure to deliver water to the faucet
- B. The RO faucet handle is faulty and is not opening the storage tank valve when the handle is turned
- C. The RO membrane has fouled or reached the end of its service life and cannot filter water effectively
- D. The incoming water pressure is too high, forcing water through the membrane faster than it can be stored

92. A plumber is installing a hydronic radiant floor heating system in a bathroom. The bathroom will have ceramic tile flooring. Compared to a room with thick carpet over the same radiant system, how will the ceramic tile room perform?

- A. The ceramic tile room will heat more effectively because tile has high thermal conductivity and transfers heat efficiently
- B. The ceramic tile room will heat less effectively because tile absorbs heat and prevents it from reaching the room air
- C. There is no performance difference because the radiant tubing temperature is the same regardless of flooring
- D. The ceramic tile room requires a higher supply water temperature because tile cools the water faster than carpet

93. A plumber is commissioning a new hydronic boiler and must set the system's coldfill pressure. The highest point of the distribution system is 8 metres above the boiler. What minimum fill pressure at the boiler ensures that the highest point is above atmospheric pressure?

- A. Approximately 55 kPa (8 psi), calculated by converting the 8metre height to a minimum static head pressure
- B. Exactly 207 kPa (30 psi), matching the pressure relief valve setting regardless of the system's height
- C. Approximately 80 kPa (12 psi), which adds a safety margin of approximately 2 psi above the static requirement
- D. Zero pressure, because the automatic fill valve will maintain the correct pressure after initial filling

94. A hydronic system with baseboard emitters and a noncondensing boiler operates with supply water at 80°C and return water at 65°C. The building owner wants to add a radiant floor heating zone to the system. The radiant floor requires a maximum supply temperature of 40°C. How is the lowtemperature supply achieved?

- A. A dedicated condensing boiler is installed exclusively for the radiant floor zone at a separate location
- B. The boiler operating temperature is lowered to 40°C to serve both the baseboard and the radiant floor
- C. The existing boiler's supply temperature remains unchanged, reducing radiant effectiveness but simplifying piping
- D. A threeway mixing valve blends hot boiler supply water with cooler return water to produce 40°C for the radiant zone

95. A plumber discovers that a hydronic boiler's circulator pump is making a loud cavitation noise. The system pressure gauge reads normal. What is the most likely cause?

- A. Air trapped at the pump impeller is causing cavitation — the air separator and vents should be checked
- B. The pump's impeller has worn down and is no longer creating sufficient head pressure to move water
- C. The boiler's highlimit control has tripped and the pump is running without heated water in the system
- D. The expansion tank is waterlogged and the resulting pressure fluctuations are causing the pump to cavitate

96. In a twopipe steam system, what is the correct pitch direction for the steam supply main?

- A. The supply main should be level with zero pitch to ensure even steam distribution to all branch takeoffs
- B. The supply main must pitch downward in the direction of steam flow to allow condensate to drain with the flow
- C. The supply main must pitch upward in the direction of steam flow to prevent condensate from pooling
- D. The pitch direction depends on whether the system uses a gravity return or a mechanical condensate return pump

97. A plumber is troubleshooting a hydronic system where one zone heats intermittently — it heats for 15 minutes, goes cold for 10 minutes, then heats again in a repeating cycle. The thermostat is calling for heat continuously. What is the most likely cause?

- A. The boiler is shortcycling on the highlimit control because the supply temperature is set too high
- B. The circulator pump for that zone is overheating and cycling on its internal thermal protection switch
- C. The zone valve is opening and closing intermittently due to a loose wiring connection at the valve motor
- D. The zone valve actuator motor is cycling on and off due to an intermittent electrical connection or fault

98. A plumber installs an indirect water heater connected to a hydronic boiler. The boiler fires and the circulator runs, but the domestic hot water temperature in the indirect tank is not rising. What should be checked?

- A. The indirect tank's heat exchanger coil — the circulator may be running but hot boiler water may not be reaching the coil
- B. The domestic cold water supply to the indirect tank, which may have been left in the closed position
- C. The T&P relief valve on the indirect tank, which may be stuck open and discharging hot water continuously
- D. The boiler's gas valve, which may be providing only pilot flame without main burner ignition for heating

99. A steam boiler produces wet steam — steam that carries water droplets. What problem does wet steam cause in the distribution system?

- A. Wet steam provides better heat transfer than dry steam because the water droplets carry additional energy

- B. Wet steam has no negative effect on the distribution system and is considered normal in lowpressure steam
- C. Wet steam causes water hammer, reduces heat transfer efficiency, and can damage steam traps and controls
- D. Wet steam corrodes the steam supply piping faster than dry steam due to the dissolved oxygen in the droplets

100. A plumber is balancing a multizone hydronic system. Zone 1 (nearest to the boiler) has a ΔT of 8°C between supply and return, while Zone 3 (farthest) has a ΔT of 18°C . What does this indicate?

- A. Zone 1 is receiving too much flow (low ΔT) and Zone 3 is receiving too little flow (high ΔT) — the system needs balancing
- B. Both zones are operating normally because different ΔT values are expected at different distances from the boiler
- C. Zone 3 has a blockage in its return line that is preventing water from circulating through the emitters properly
- D. The boiler supply temperature is too low and must be increased to equalize the ΔT across all system zones

101. A plumber installs a new boiler and connects the automatic fill valve to the domestic water supply. The fill valve is set to maintain 103 kPa (15 psi) system pressure. What happens if a leak develops in the hydronic system that slowly loses water?

- A. The fill valve continuously adds makeup water from the domestic supply to maintain the set pressure

- B. The system pressure drops to zero and the boiler shuts off on the lowwater cutoff immediately
- C. The fill valve closes and an alarm sounds to alert the building owner to the leak before water is added
- D. The expansion tank absorbs the lost water volume and prevents the system pressure from dropping

102. A building has a hydronic heating system with four zones. During cold weather, all four zones call for heat simultaneously. The boiler cannot maintain the supply water temperature at the design setpoint. What is the most likely cause?

- A. The circulator pump is oversized and is moving water through the boiler too fast for adequate heating
- B. One of the four zone valves is stuck closed and all flow is being directed through only three zones
- C. The boiler is undersized for the total heat load of the building when all four zones operate simultaneously
- D. The expansion tank has lost its precharge and the resulting pressure fluctuations are reducing boiler output

103. A plumber is servicing a steam heating system and must test the steam traps. The plumber uses a contact thermometer to measure temperatures on both sides of a trap. The inlet reads 105°C and the outlet reads 104°C. What does this result indicate?

- A. The trap is functioning correctly — the small temperature drop indicates condensate is passing normally
- B. The trap has failed in the open position — live steam is passing through without adequate temperature drop

C. The trap has failed in the closed position — no flow is occurring and both readings are residual pipe temperature

D. The test is inconclusive — a temperature difference of 1°C is within the margin of error for contact thermometers

104. A plumber installs a hydronic system with both baseboard and radiant floor zones served by a primarysecondary piping configuration. Each secondary zone has its own circulator. What happens if the radiant floor circulator fails while the baseboard circulator continues to operate?

A. The entire system shuts down because the failed circulator creates a blockage in the primary loop

B. The baseboard circulator pushes hot water backward through the radiant floor zone, overheating the floor

C. Hot water from the primary loop thermosiphons through the idle radiant floor zone, providing partial heat

D. Only the radiant floor zone loses heat — the baseboard zone continues to operate normally and independently

105. A plumber notices that a hydronic boiler's gauge glass is dirty and difficult to read. The glass shows a stable water level at approximately midpoint. Should the gauge glass be cleaned or replaced?

A. Yes — the gauge glass must be maintained in readable condition because it is a critical safety indicator

B. No — the gauge glass is only a secondary indicator and the automatic lowwater cutoff provides protection

C. Yes — but only during the annual boiler service and not during the heating season when the system is active

D. No — replacing a gauge glass requires taking the boiler offline for a full day, which is impractical during heating

106. A plumber is installing a thermostat for a singlezone residential hydronic heating system. Where should the thermostat be located for the most accurate temperature sensing?

A. In the mechanical room near the boiler to monitor the overall system temperature at the heat source

B. On the coldest exterior wall of the building where the greatest heat loss occurs during winter months

C. On an interior wall approximately 1.5 metres above the floor, away from heat sources and direct sunlight

D. Near the ceiling of the main living area where the warmest air in the room accumulates during heating

107. A plumber discovers that a hydronic system's pressure relief valve has been piped with a discharge line that rises vertically 1 metre before turning down to the floor drain. Is this installation correct?

A. Yes, because the vertical rise ensures the discharged water has adequate head pressure to reach the drain

B. No, because the relief valve discharge pipe must pitch continuously downward to the drain with no rises

C. Yes, because a 1metre rise is within the maximum allowable elevation change for relief valve discharge

D. No, because the relief valve discharge pipe must terminate outside the building rather than at a floor drain

108. A medical gas system installer discovers that the interior of a recently brazed oxygen pipe section has dark discoloration when inspected with a borescope. What does this indicate and what must be done?

A. Normal discoloration from the brazing flux that will be removed when the system is purged with oxygen

B. Minor oxidation that can be cleaned with an acid flush before the system is placed into patient service

C. Contamination from the brazing filler metal that has dripped inside the pipe and must be wiped clean

D. The nitrogen purge was inadequate — oxide scale has formed and the section must be cut out and replaced

109. A compressed air system in an automotive shop has a main header running the length of the building. Branch connections supply air outlets at each work bay. The plumber notices that air tools at the farthest bay from the compressor produce less power than tools at the nearest bay. What is the most likely cause?

A. Pressure drop along the undersized header due to friction, reducing the available pressure at distant outlets

B. The air compressor's output pressure decreases over time during continuous operation and needs servicing

C. The tools at the farthest bay are older models with lower maximum operating pressure requirements

D. The air dryer is removing too much moisture, reducing the volume of air available at the distant outlets

110. A plumber is installing a swimming pool system with a variablespeed pump. What is the primary benefit of a variablespeed pump compared to a singlespeed pump for pool circulation?

A. A variablespeed pump can produce higher maximum pressure for more effective pool cleaning operations

B. A variablespeed pump requires no electrical connection because it operates on solar power exclusively

C. A variablespeed pump reduces energy consumption by up to 70% by adjusting speed to match demand

D. A variablespeed pump eliminates the need for a pool filter because the variable flow provides selfcleaning

111. A plumber installs a gas drip leg (sediment trap) on the supply pipe immediately before a residential furnace connection. What are the minimum dimensions of the drip leg?

A. 50 mm (2 inches) long with a cap, using the same diameter as the supply pipe serving the appliance

B. A minimum of 75 mm (3 inches) long with a cap at the bottom, typically the same diameter as the supply

C. 300 mm (12 inches) long with an accessible cleanout fitting for periodic sediment removal and cleaning

D. 25 mm (1 inch) long with a screen filter to catch debris before it enters the appliance's gas valve body

112. A medical gas system has passed the standing pressure test, the crossconnection test, and the purity test. What is the final step before the system is placed in patient service?

- A. A 30day monitoring period where the system is pressurized but not connected to patient outlets
- B. An endurance test where each outlet is opened continuously for 24 hours to verify sustained performance
- C. Approval from the local building inspector who issues the plumbing permit for the medical gas installation
- D. Final verification of all outlet labels, colour codes, and gasspecific DISS connectors by the thirdparty verifier

113. A plumber is installing irrigation piping and must connect the irrigation system to the building's domestic water supply. The system does not include chemical injection. The local code requires a PVB for this application. Where must the PVB be installed?

- A. Above ground, at least 300 mm (12 inches) above the highest sprinkler head in the entire system
- B. Below ground in a valve box at the same level as the irrigation zone valves for weather protection
- C. Inside the building near the water meter to protect it from freezing during the Canadian winter months
- D. At the highest physical point on the building's rooftop to provide maximum siphonbreaking height

114. A plumber is connecting a propane gas supply to a pool heater in an equipment room at the lowest level of a building. What specific safety concern applies to propane in this location?

- A. Propane produces higher levels of carbon monoxide than natural gas, requiring enhanced ventilation
- B. Propane gas lines in pool equipment rooms must be black steel — CSST is not permitted near chlorine
- C. Propane is heavier than air and will pool at the floor level of the lowest room, creating an explosion hazard
- D. Propane requires a higher operating pressure than natural gas, necessitating a separate pressure regulator

115. A plumber is servicing a compressed air system and finds that the automatic drain on the air receiver (storage tank) is not functioning. Condensate has accumulated to a level covering the bottom quarter of the tank. What is the immediate concern?

- A. The accumulated water reduces the effective air storage volume and introduces moisture into the system
- B. The water will cause the compressor to overheat because the reduced air volume forces more frequent cycling
- C. The tank's structural integrity is compromised because water weighs more than air and exceeds the load rating
- D. The water will freeze during cold weather and crack the air receiver if the system is in an unheated space

116. A swimming pool DE (diatomaceous earth) filter requires periodic maintenance. What does this maintenance involve?

- A. Adding fresh chlorine tablets to the filter tank to supplement the pool's main chemical treatment system
- B. Replacing the filter's internal UV lamp that sterilizes the water as it passes through the filter housing
- C. Replacing the sand media inside the filter tank with new specially graded pool filter sand every five years
- D. Backwashing to remove accumulated debris and adding fresh diatomaceous earth to recoat the filter grids

117. A plumber tests a newly installed gas piping system for leaks. The system is pressurized with air at 21 kPa (3 psi) and held for 30 minutes. The gauge shows no pressure drop. What is the next step before placing the system in service?

- A. Purge the system with gas to displace the test air before lighting any pilot lights or activating appliances
- B. Increase the test pressure to 105 kPa (15 psi) and hold for an additional 30 minutes for confirmation
- C. Connect all appliances and light the pilots to verify that gas flows correctly through the entire system
- D. Apply soap solution to every joint for a visual confirmation of leakfree status at each connection point

118. An oil interceptor serving an automotive repair facility has accumulated oil to a level where it is approaching the outlet baffle. What happens if the oil is not removed?

- A. The interceptor continues to function normally because the outlet baffle prevents oil from passing through

- B. The oil level blocks the inlet and causes wastewater to back up into the automotive repair bay floor drains
- C. Oil passes over or around the outlet baffle and enters the building sewer, violating environmental regulations
- D. The accumulated oil solidifies and permanently damages the interceptor's internal baffles and structure

119. A plumber is installing process piping in a pharmaceutical manufacturing facility. The pipe material specified is PVDF (polyvinylidene fluoride). What joining method is used for PVDF pipe?

- A. Solvent cement, using a PVDF-specific chemical bonding agent applied to both joint surfaces
- B. Socket fusion or butt fusion, which melts the pipe material to create a molecularly bonded joint
- C. Threaded connections using PVDF-compatible thread sealant rated for the process chemicals carried
- D. Mechanical compression fittings with EPDM Orings rated for the temperature and pressure conditions

120. A plumber is installing a pool heater. The heater must be connected to the pool circulation system after the filter. What happens if the heater is installed before the filter in the circulation loop?

- A. The pool water circulates in the wrong direction through the heater, reducing heating efficiency by half
- B. The heater operates normally but the filter efficiency is reduced because heated water is more difficult to filter

C. The pool chemistry becomes unbalanced because heated water dissolves more chemicals from the filter media

D. Unfiltered debris fouls the heat exchanger surfaces, reducing efficiency and potentially damaging the heater

121. A plumber encounters an existing medical gas outlet in a hospital corridor that has been painted over during a recent wall refinishing project. The outlet label and colour coding are no longer visible. What must be done?

A. The outlet must be cleaned, the paint removed, and the correct label and colour coding restored immediately

B. The outlet is acceptable as is because the DISS connector configuration identifies the gas type mechanically

C. The entire outlet must be replaced with a new unit because painted outlets cannot be reliably cleaned

D. The outlet must be capped and taken out of service permanently because its identity cannot be verified

122. A plumber installs an acid waste drainage system in a laboratory using CPVC pipe. The acid waste must be neutralized before entering the building sewer. What device accomplishes this neutralization?

A. A backflow preventer installed on the acid waste line to prevent the acid from reaching the building sewer

B. A sand interceptor that captures acid particles and prevents them from entering the downstream piping

C. A neutralization tank containing limestone chips that raise the pH of the acid waste to acceptable levels

D. A grease interceptor modified with acidresistant internals that chemically treats the waste before discharge

123. A plumber is connecting a natural gas supply to a residential tankless water heater. The manufacturer specifies a 3/4inch gas supply. The existing gas line from the meter is 1/2 inch. What is the correct action?

A. Connect the 1/2inch supply to the 3/4inch heater inlet using a reducing fitting to adapt the sizes

B. Upsize the gas supply line from the meter to the heater to match the manufacturer's 3/4inch requirement

C. Install a gas pressure regulator between the 1/2inch supply and the heater to compensate for the small line

D. The 1/2inch line is adequate for a residential tankless heater regardless of the manufacturer's specification

124. A swimming pool system has a salt chlorine generator that converts dissolved salt to chlorine for pool disinfection. What must the plumber verify about the pool circulation system for the generator to function?

A. The pool must have a dedicated chemical feed pump separate from the main circulation pump system

B. The pool filter must be a DE type because sand and cartridge filters are incompatible with salt systems

C. The pool heater must be installed upstream of the generator to preheat the water for efficient chlorine production

D. The generator cell must be installed on the return line after the filter and heater in the correct flow direction

125. A plumber is conducting a final check on a compressed air system before placing it in service. The system includes a compressor, air receiver, refrigerated dryer, particulate filter, and distribution piping. What is verified last before the system is activated?

A. All joints have been tested, drip legs are installed at low points, branch connections are from the top of headers, and drains are functional

B. The compressor's motor rotation direction matches the manufacturer's specification for proper compression

C. The air receiver's nameplate data matches the system's maximum operating pressure and volume ratings

D. The refrigerated dryer's condensate drain is connected to an approved drain with proper routing in place

Practice Exam 4: Answer Key and Explanations

1. A — The flame pictogram indicates a flammable product. Pipe primer contains volatile organic solvents that evaporate rapidly, and in an enclosed, unventilated room, flammable vapour can accumulate to concentrations within the explosive range. Before entering, the plumber must assess the vapour concentration with a combustible gas detector and ventilate the space.

2. C — After isolating and locking out a compressed air system, the trapped air between the isolation valve and the point of work must be bled to zero pressure through a downstream bleed valve or test port. Compressed air stores significant energy — opening a valve body with residual pressure can cause the valve components to be ejected forcefully, causing serious injury.

3. B — All three atmospheric readings are within safe limits: oxygen at 20.8% is within the 19.5%–23.0% acceptable range, 0% LEL indicates no combustible gas, and 0 ppm H₂S indicates no toxic gas. These conditions, combined with continuous ventilation and monitoring throughout the entry, permit safe confined space entry to proceed.

4. D — Working at 4 metres above the roof surface near an unguarded edge requires a personal fall arrest system: full-body harness, shock-absorbing lanyard or self-retracting lifeline, and an anchorage point rated at 22.2 kN (5,000 lbs-force) minimum. The height exceeds the threshold (typically 3 metres) at which fall protection becomes mandatory in all Canadian jurisdictions.

5. A — The permit and inspection system provides independent third-party verification by a qualified code official that the plumbing work meets minimum code standards for health and safety. This verification protects building occupants, the building owner, and the plumber — it ensures that concealed work has been reviewed before it becomes inaccessible.

6. C — Acetylene must never exceed 15 psi gauge pressure because it becomes unstable at higher pressures and can decompose explosively even without an ignition source. At 18 psi, the acetylene is in the danger zone. The regulator must be adjusted down to 15 psi maximum, and typical brazing operations use 5–7 psi.

7. B — The left-hand (reverse) thread convention on fuel gas fittings prevents the oxygen hose from being accidentally connected to the fuel gas supply, and vice versa. The grooved nut provides a tactile identifier in low-light conditions. Cross-connecting oxygen and fuel gas lines creates an extremely dangerous condition that can cause fire or explosion.

8. D — $\text{Volume} = L \times W \times H = 1.5 \times 1.0 \times 0.8 = 1.2$ cubic metres. Since 1 cubic metre = 1,000 litres, the cistern holds 1,200 litres. This rectangular volume calculation is fundamental to sizing storage tanks, cisterns, and containment vessels in plumbing applications.

9. A — The right to refuse unsafe work is enshrined in occupational health and safety legislation in every Canadian province and territory. A 2-metre-deep trench without shoring, sloping, or shielding exceeds the 1.2-metre threshold and presents a genuine danger of collapse. The plumber may refuse to enter without reprisal, and the hazard must be corrected before work proceeds.

10. C — $\Delta L = L \times \alpha \times \Delta T = 30 \text{ m} \times 17 \times 10^{-6}/^{\circ}\text{C} \times 50^{\circ}\text{C} = 0.0255 \text{ m} = 25.5 \text{ mm}$. This 25.5 mm of expansion over a 30-metre run must be accommodated by changes of direction, expansion loops, or expansion joints. Failing to account for this movement will stress joints and crack fittings.

11. D — Division 22 — Plumbing is the current CSI MasterFormat division for plumbing specifications. The legacy system placed plumbing under Division 15 — Mechanical, but the updated MasterFormat reorganized mechanical disciplines into separate divisions (22 for Plumbing, 23 for HVAC, 26 for Electrical).

12. B — A face shield is a secondary protector — it shields the face from splashes, sparks, and debris but does not seal around the eyes. Safety glasses or goggles must always be worn underneath a face shield as primary eye protection. Wearing a face shield alone is a common violation and a frequently tested exam point.

13. A — $\text{Pressure} = \text{height} \times 0.434 \text{ psi/foot} = 25 \times 0.434 = 10.85 \text{ psi}$. This pressure-head relationship is fundamental to water supply calculations. The reciprocal relationship ($1 \text{ psi} = 2.31 \text{ feet of head}$) provides the same result from the opposite direction: $10.85 \text{ psi} \times 2.31 = \text{approximately } 25 \text{ feet}$.

14. C — The seven mandatory supplier label elements are: product identifier, supplier identifier (name/address/phone), hazard pictogram(s), signal word, hazard statement(s), precautionary statements, and supplemental information. Date of manufacture and expiration date are not among the seven required WHMIS elements, though they may appear voluntarily.

15. D — A fire watch of 30 to 60 minutes must be maintained after hot work is completed, as specified by jurisdictional fire codes and hot work permit requirements. Combustible materials can smoulder undetected after torch work, and a fire can develop well after the flame has been extinguished. A fire extinguisher must remain accessible throughout the watch period.

16. D — IDLH (Immediately Dangerous to Life or Health) represents the airborne concentration at which exposure poses an immediate threat to life, could cause irreversible health effects, or could impair the worker's ability to escape. At or above the IDLH concentration, only supplied-air respirators or SCBA provide adequate protection — air-purifying respirators are not sufficient.

17. A — PEX-A has the highest degree of cross-linking, giving it thermal memory — the ability to return to its original shape after being deformed. The expansion tool temporarily stretches the tube to a larger diameter, the fitting is inserted, and the tube shrinks back to its original size, gripping the fitting tightly. An expansion ring reinforces the connection.

18. D — ABS pipe melts and burns away when exposed to fire, leaving an open hole through the fire-rated assembly. The intumescent firestop device expands when heated, crushing the softening ABS pipe and sealing the penetration before fire and smoke can pass through. Metal pipe does not present this problem because it retains its shape at typical fire temperatures.

19. C — Schedule 80 pipe has a thicker wall than Schedule 40 for the same nominal pipe size, providing a higher pressure rating and greater structural strength. The outside diameter is the same for both schedules (at the same nominal size), but the inside diameter of Schedule 80 is smaller due to the increased wall thickness.

20. B — Solvent cement begins evaporating immediately upon application. If assembly is delayed beyond 15–20 seconds, the cement starts to set before the pipe reaches full insertion depth, resulting in a partial fusion. The joint appears assembled but has not bonded properly across the full contact area, creating a weak connection that will fail under pressure or over time.

21. A — The maximum horizontal support spacing for copper tube sizes 1-1/4 inch through 2 inch is 2.4 metres (8 feet). This is the middle tier of the copper support spacing table: 1.8 m for 1/2"–1", 2.4 m for 1-1/4"–2", and 3.0 m for 2-1/2" and larger.

22. D — Electrofusion uses a fitting with embedded electrical heating wires placed over the pipe joint. When electrical current is applied to the wires, the surrounding HDPE melts at the interface between the fitting and the pipe, creating a molecular bond as strong as the pipe itself. Electrofusion is used for saddle connections, repairs, and situations where butt fusion equipment cannot be positioned.

23. C — A pipe anchor fixes the pipe rigidly to the building structure at a specific point, preventing movement in all directions. By anchoring the pipe at strategic locations, the plumber controls where thermal expansion occurs — directing it toward expansion devices (loops, offsets, or joints) designed to absorb the movement.

24. B — Cleaned copper begins to oxidize within minutes when exposed to air. A tube end that was cleaned over an hour ago and shows visible tarnish must be re-cleaned to bright copper immediately.

before flux is applied and the joint is assembled. Soldering over an oxidized surface produces a joint that appears complete but has not bonded properly.

25. D — Grooved mechanical couplings engage a groove that is rolled or cut into the pipe end near the extremity. The two-piece coupling housing locks into the groove, and a rubber gasket inside the housing seals the joint. Without the groove, the coupling has nothing to grip and cannot secure the connection.

26. B — Vent pipe diameter depends on both fixture unit load and developed length. A longer vent run has more internal friction, which reduces the effectiveness of air circulation. To compensate, the code requires a larger pipe diameter as the developed length increases, ensuring adequate air flow to the drainage system regardless of distance.

27. D — A backwater valve operates passively — it remains open during normal forward drainage flow (allowing wastewater to exit the building normally) and closes automatically when reverse flow is detected (preventing municipal sewer backup from entering the building). No sensors, manual operation, or minimum velocity is required.

28. A — Only fixtures in the food preparation and cleanup area connect to the grease interceptor: the pot sink, pre-rinse station, and kitchen floor drains. Employee washroom fixtures (lavatory, water closet) must NOT connect because their volume dilutes the grease concentration and reduces the interceptor's separation efficiency.

29. B — The vent pipe connects through the sealed gastight cover of the ejector pit and extends upward to join the building's vent stack. This vent connection prevents pressure buildup inside the sealed pit during pump operation, provides a path for sewer gas to escape to the atmosphere, and allows air to enter the pit as the pump evacuates sewage.

30. B — Combining multiple individual vent pipes into branch vents that connect to a single vent stack penetrating the roof is the code-compliant method for reducing roof penetrations. At least one full vent stack must still penetrate the roof — air admittance valves cannot replace every roof penetration.

31. B — The branch carrying water closet discharge is a soil pipe and must be a minimum of 3 inches (75 mm) regardless of the fixture unit calculation or the fact that it connects to an ejector pit rather than a gravity drain. The minimum soil pipe rule applies to all piping carrying water closet discharge.

32. A — Between the rough-in inspection and the final inspection, construction activities (drywall, tiling, fixture installation) can damage or disconnect traps, leave traps dry if fixtures are not connected and tested, or disturb vent connections. A dry or disconnected trap allows sewer gas to enter the building even though the piping passed the pressure test.

33. C — The combined load is 2 DFU (bathtub) + 1 DFU (lavatory) = 3 DFU, which exactly matches the maximum capacity of a 1-1/2-inch horizontal branch drain. The branch is adequately sized. Note that no water closet is connected to this branch — if one were, a minimum 3-inch pipe would be required regardless of the DFU total.

34. D — For gasketed PVC bell-and-spigot sewer joints, the plumber must verify that the rubber gasket is properly seated in the bell groove, the spigot end is beveled to avoid displacing the gasket during insertion, lubricant is applied to the spigot and gasket for smooth assembly, and the pipe sections are aligned and fully seated.

35. B — A cleanout must be installed at or near every change of direction greater than 45 degrees in horizontal drainage piping. The 90-degree corner is a prime location where blockages can occur, and the cleanout provides access for cleaning equipment to reach both directions from the turn.

36. A — Drum traps are not code-compliant for new work because they are difficult to clean, prone to debris accumulation, and provide poor self-cleaning action compared to P-traps. During renovation that involves the plumbing system, existing non-compliant components should be brought up to current code standards by replacing the drum trap with a P-trap.

37. C — Storm drainage pipe sizing is based on two factors: the rainfall intensity for the geographic area (measured in millimetres per hour, based on statistical weather data for the location) and the roof area served by each drain (in square metres). Together, these determine the peak stormwater flow rate that each leader pipe must handle.

38. B — Cutting out the damaged section of cast iron vent pipe and splicing in a new section using no-hub transition couplings is the correct permanent repair. Epoxy patches, silicone caulk, and rubber wraps are temporary measures that do not restore the pipe's structural integrity or provide a reliable long-term seal against sewer gas.

39. D — A dosing chamber (pump chamber) with a timed or demand-dosed pump distributes effluent to the disposal field in controlled, intermittent doses rather than continuous gravity flow. This allows the

soil in the disposal field to absorb each dose and rest between doses, providing more effective treatment and preventing hydraulic overloading.

40. A — A DWV water test requires filling the system to the top of the highest vent stack, ensuring that every joint in the entire system — drains, branches, stacks, and vent piping — is submerged under the full hydrostatic head. This is the most thorough test method because every connection is under pressure.

41. C — The sanitary tee's branch sweeps downward in the direction of flow in the vertical stack. This directional sweep guides the waste from the horizontal branch smoothly into the downward flow of the stack, preventing turbulence and ensuring that the branch entry does not impede the stack flow.

42. B — The 30 DFU load exceeds the 3-inch pipe's capacity of 27 DFU at 1/4 inch per foot slope. The plumber must install a 4-inch building drain, which accommodates up to 216 DFU at the same slope — providing substantial capacity for the current load and future expansion. Never install undersized piping based on "close enough."

43. A — Underground piping below a concrete slab must be tested (air or water test) and inspected by the authority having jurisdiction before the concrete is poured. Once concealed by concrete, the piping is inaccessible — any defects discovered later require demolishing the slab to access and repair the piping, at enormous cost.

44. D — A soil stack receiving water closet discharge must be at least 3 inches in diameter — it cannot be smaller than the water closet's drain connection. However, a 3-inch stack receiving a 4-inch branch would require a reducing fitting, and the stack below the water closet connection must be at least as large as the branch feeding it. The stack should be 4 inches.

45. B — When the trap arm exceeds the maximum permitted length (1,525 mm for 2-inch pipe), the full-bore discharge acts like a piston in the long pipe, creating a vacuum behind it that siphons the trap seal. The code limits trap arm length specifically to prevent self-siphonage by keeping the vent connection close enough to provide air.

46. C — A combination wye (45-degree entry) plus an eighth bend (45-degree turn) produces a total 90-degree change of direction. The combination provides a long, swept transition that minimizes turbulence at the junction — far superior to a short-pattern 90-degree elbow, which is prohibited in DWV systems.

47. A — When all fixtures throughout the entire building drain slowly with gurgling, the obstruction is in the building drain or building sewer — the only common point where a single blockage affects every fixture. Individual trap or branch blockages would affect only specific fixtures or groups, and vent blockages cause siphonage symptoms rather than universal slow drainage.

48. D — If the distribution box tilts, effluent flows preferentially to the lower trenches, which receive a disproportionate volume of effluent. These trenches become hydraulically overloaded and may fail (surfacing effluent), while the higher trenches receive little or no flow and are underutilized. The box must be leveled to restore equal distribution.

49. B — An air admittance valve (AAV) installed under the island counter above the flood level rim of the sink is the most common solution for island sink venting where routing a conventional vent through the roof is impractical. The AAV allows air to enter the drain for siphonage prevention while blocking sewer gas from escaping.

50. C — Drop = 3.0 m – 1.2 m = 1.8 m over 25 m horizontal distance. Grade = $1.8 \div 25 = 0.072 = 7.2\%$. This is a steep slope that exceeds the minimum code requirements. While adequate for drainage flow, the plumber should verify that the excessive slope does not cause solids stranding on the longest sections.

51. B — After confirming that visible traps are intact and the vent terminal is clear, the next suspect is concealed piping. A renovation may have inadvertently disconnected or damaged a vent pipe inside a wall cavity, creating a pathway for sewer gas to enter the wall space and migrate into the occupied area through electrical outlets, gaps, or unsealed penetrations.

52. B — A percolation test measures the rate at which water drains from a test hole dug in the native soil at the proposed disposal field location. The result, in minutes per inch, determines the soil's ability to absorb septic effluent and directly governs whether a conventional disposal field is feasible and how large it must be.

53. A — A riser clamp must be installed at each floor level where the stack passes through the floor structure, transferring the cumulative weight of the stack above to the building at that point. In a three-storey building with a basement, the stack passes through at least three floor levels, requiring a minimum of three riser clamps.

54. B — The standard minimum standpipe height for a washing machine connection is approximately 450 mm (18 inches) above the trap weir. This height prevents the machine's high-volume pump discharge from overflowing the standpipe while providing adequate air break above the trap to prevent siphonage.

55. B — CIPP (Cured-in-Place Pipe) lining is the appropriate trenchless rehabilitation method for restoring a corroded cast iron building drain. The resin-saturated liner is inserted through an access point, inflated against the interior wall, and cured to form a smooth, jointless new pipe inside the existing pipe — all without excavation.

56. B — The sand interceptor is installed first (upstream) to capture heavy grit, sand, and abrasive particles before they reach the oil interceptor. This protects the oil interceptor's internal coalescing media from fouling and abrasive damage. Oil separation occurs in the second (downstream) interceptor on already-clarified water.

57. A — Residual pressure = $380 \text{ kPa} - (10 \text{ m} \times 9.81 \text{ kPa/m}) - 50 \text{ kPa} = 380 - 98.1 - 50 = 231.9 \text{ kPa}$ (approximately 232 kPa). This is well above the 140 kPa minimum required at standard fixtures. No booster pump is needed for this building.

58. C — When one fixture has adequate pressure and another on the same trunk line does not, the problem is between the two fixtures. A partially closed valve (branch shutoff, fixture stop), a kinked or restricted supply tube, a clogged fixture cartridge, or undersized piping on the section serving the shower are the most likely causes.

59. B — The expansion tank's air pre-charge must match the system's cold-fill pressure — in this case, 415 kPa (60 psi). If the pre-charge is lower, the tank absorbs water prematurely and has insufficient capacity for expansion. If higher, the tank resists water entry and provides no expansion absorption.

60. D — Blue-green tinted water in an all-copper system indicates copper corrosion — the copper pipe walls are dissolving into the water. This is caused by aggressive water chemistry: low pH (acidic water), high dissolved oxygen, high chlorine residuals, or a combination. The water chemistry should be tested and treatment considered to stop the corrosion.

61. C — Laboratory chemicals pose a severe (health) hazard cross-connection. A reduced pressure principle (RP/RPZ) assembly provides the highest level of mechanical backflow protection, with dual

check valves and a relief zone that discharges to atmosphere if either check fails. DCVAs and vacuum breakers are insufficient for health hazards.

62. A — A direct-vent (sealed combustion) water heater draws combustion air from outdoors through a dedicated intake pipe and exhausts combustion gases outdoors through a separate exhaust pipe. The combustion process is completely isolated from the building's indoor air, eliminating any possibility of backdrafting or indoor air quality issues.

63. D — Hot water pressure fluctuation during showers while cold pressure remains stable points to the water heater itself. A deteriorated dip tube can break apart and redirect incoming cold water to the hot outlet at the top of the tank, causing temperature and pressure fluctuations. Dip tube failure is a common issue in aging water heaters.

64. B — Cooling tower water treated with biocides and scale inhibitors is a severe (health) hazard cross-connection. A reduced pressure (RP) assembly is required to protect the potable supply from potential backflow of these toxic chemicals. The RP device provides dual check valves with pressure-monitored relief.

65. A — Underground copper water services use flare fittings or compression fittings because soldered joints are generally not approved for direct burial. The joint must withstand ground movement, frost action, and soil chemistry without relying on a solder bond that could be compromised by these conditions.

66. C — The aquastat control strategy maintains the return water temperature within a narrow band (50–55°C), ensuring that hot water is always available near fixtures throughout the building. When the return temperature drops below 50°C (indicating the water in the loop has cooled), the pump activates and circulates water until the return reaches 55°C.

67. D — Total WSFU = (4 flushometer WC × 6 WSFU each) + (4 lavatories × 1.5 WSFU each) = 24 + 6 = 30 WSFU. Each fixture's individual WSFU value is added to determine the total water supply demand for sizing the branch serving this washroom.

68. B — Both the check valve and the air inlet must function correctly for a PVB to provide back-siphonage protection. A leaking check valve allows backflow, and a non-functioning air inlet cannot break the siphon. The PVB must be repaired (new internal components) or replaced before the irrigation system can operate.

69. A — Chemically treated industrial boiler water containing oxygen scavengers and pH adjusters is a severe (health) hazard. A reduced pressure (RP/RPZ) assembly is the minimum required protection. An integral check valve in the fill valve is not sufficient for a health hazard — testable, code-compliant backflow prevention is mandatory.

70. C — When all second-floor fixtures are affected but the ground floor is fine, the problem is in the branch supply line to the second floor. A partially closed valve at the branch takeoff, undersized piping on the riser, or mineral buildup in an older section of pipe between the floors are the most likely causes.

71. D — Commercial dishwashers with chemical rinse agents or sanitizing additives may pose a health hazard. An RP device or an air gap on the supply provides the appropriate level of protection. The drain air gap protects against back-siphonage of drain water, but the supply side needs its own independent backflow protection.

72. A — Adding a second water heater increases the total volume of water being heated. The existing expansion tank was sized for the original single heater's volume. With double the heated volume, the expansion is approximately doubled, and the tank must be resized or a supplemental tank added to absorb the additional expanded volume.

73. C — Both check valves in an RP assembly must function correctly to provide the rated protection. A failed first check allows unfiltered supply-side pressure to reach the relief zone, and while the second check may still prevent backflow, the device is operating with degraded protection. The failed check must be repaired immediately.

74. B — In a closed system (PRV installed), when no water is flowing, the only source of pressure increase above the PRV's set point is thermal expansion from the water heater. As the heater fires and warms the water, the expanded volume raises the pressure above the PRV setting because the PRV blocks the expansion from relieving upstream.

75. D — Regeneration brine from a water softener contains high concentrations of sodium chloride that can inhibit the anaerobic bacteria in a septic tank and may contaminate groundwater through the disposal field. Some jurisdictions restrict or prohibit softener brine discharge to septic systems. The plumber should inform the homeowner and verify local regulations.

76. C — Canadian accessibility standards (CSA B651 and provincial building codes) typically specify a maximum lavatory rim height of 865 mm (34 inches) above the finished floor for accessible installations. This height allows wheelchair users to approach and use the lavatory comfortably while maintaining adequate knee clearance beneath.

77. A — Ice machines, commercial dishwashers, and similar food-service equipment require an indirect waste connection with an air gap between the equipment's drain outlet and the floor drain receptor. This prevents any possibility of contaminated drain water back-siphoning into equipment that contacts food or ice.

78. B — The reduced flush volume of the high-efficiency toilet sends less water through the drain with each flush. On a drain that was originally installed for a higher-volume toilet, the reduced water flow may not generate sufficient velocity to carry solid waste through the pipe — particularly on longer horizontal runs or sections with marginal slope.

79. B — A tankless water heater has a finite heating capacity measured in litres per minute at a given temperature rise. When the simultaneous demand from multiple fixtures exceeds the heater's rated capacity, the heater cannot maintain the set delivery temperature and the water becomes lukewarm. The solution is a larger-capacity unit or a second unit.

80. A — Freestanding bathtub waste-and-overflow assemblies must be accessible for maintenance and repair. An access panel in the adjacent wall or floor provides this access. Since freestanding tubs are not built into alcoves with removable aprons, a dedicated access panel is the standard method for reaching the connections.

81. C — A broken or deteriorated dip tube allows incoming cold water to exit at the top of the tank near the hot water outlet instead of being delivered to the bottom where it would be heated. This cold water mixes with the hot water at the outlet, reducing the effective hot water volume and delivery temperature.

82. B — The correct order is sediment filter → carbon filter → UV disinfection. Sediment removal first protects the carbon filter from premature clogging. Carbon removal of chlorine second is essential because chlorine damages UV-transmissive sleeves and reduces UV effectiveness. UV disinfection last kills microorganisms in water that is already clear and chlorine-free.

83. D — NFPA 13D specifies a 10-minute minimum supply duration for residential fire sprinkler systems. This duration is designed to provide occupants time to evacuate — the primary life-safety

objective of residential sprinklers. Commercial systems under NFPA 13 require significantly longer durations.

84. A — Health codes in most Canadian jurisdictions require hand sinks in food preparation areas to have hands-free operation — foot pedals, knee-operated valves, or electronic sensor-activated faucets. This prevents food handlers from contaminating faucet handles with soiled hands and then recontaminating clean hands by touching the same handles to turn off the water.

85. A — A salt bridge is a hard crust of salt that forms above the water line in the brine tank, creating a gap between the salt and the water below. The brine tank appears to have adequate salt, but the water cannot dissolve the salt through the bridge, so no brine is produced for regeneration. Breaking the bridge restores normal operation.

86. B — Before removing heating elements, the water supply must be shut off and the tank drained to below the element level. Elements are submerged during normal operation, and removing one with the tank full would release a large volume of hot water. Electric water heaters do not have gas supply valves or pilot lights.

87. D — A point-of-use heater installed directly at the remote fixture eliminates the long dead leg (the section of pipe between the central heater and the fixture that fills with cooled water between uses). Hot water is available almost instantly because the heater is immediately adjacent to the fixture, eliminating wait time and water waste.

88. A — A wax-free rubber gasket seal can be repositioned — if the toilet needs to be lifted and reset (to adjust alignment, shim the base, or check the flange), the gasket can be reused. A wax ring deforms permanently on initial compression and must be replaced every time the toilet is lifted, adding cost and labor.

89. C — In a ceramic disc faucet, water shutoff is achieved by two precision-ground ceramic discs that slide against each other. When the discs or their surrounding seals wear, they no longer create a complete shutoff, allowing water to pass through even in the fully closed position. Replacing the cartridge or disc assembly resolves the drip.

90. A — When a floor drain is not available, the T&P discharge pipe may terminate through an exterior wall to the outside of the building, ending 150–300 mm above grade and facing downward. This

provides a visible discharge point (so the homeowner can see if the valve is releasing) while safely directing the hot water away from occupied areas.

91. C — The most common cause of reduced RO production is a fouled or exhausted membrane. Over time, the membrane accumulates scale, biofilm, and contaminants that reduce its permeability, slowing the rate at which purified water passes through. RO membranes typically last 2–5 years before replacement is needed depending on water quality and usage.

92. A — Ceramic tile has high thermal conductivity and transfers heat from the radiant tubing to the room surface efficiently, allowing the system to operate at lower supply water temperatures while still delivering adequate heat. Thick carpet insulates the floor surface from the tubing, requiring higher supply temperatures and reducing overall system effectiveness.

93. C — The minimum fill pressure must overcome the static head of the water column to the highest point ($8\text{ m} \times 9.81\text{ kPa/m} \approx 78.5\text{ kPa}$) plus a safety margin to keep the highest point above atmospheric pressure. Approximately 80 kPa (12 psi) provides the static head requirement plus a small margin to prevent vacuum conditions at the top.

94. D — A three-way mixing valve blends hot boiler supply water (80°C) with cooler return water to produce a mixed supply temperature of 40°C for the radiant floor zone. The baseboard zone continues to receive full boiler temperature directly. This is the standard method for serving mixed-temperature zones from a single boiler.

95. A — Cavitation noise in a circulator pump with normal system pressure most commonly indicates air trapped at the pump impeller. Air prevents the impeller from gripping the water effectively, causing vapour bubble formation and collapse (cavitation). Checking and bleeding the air separator, automatic vents, and the pump's air bleed resolves the noise.

96. B — In a two-pipe steam system, the supply main must pitch downward in the direction of steam flow. This allows condensate that forms as steam transfers heat through the pipe wall to drain by gravity in the same direction as the steam flow, toward drip legs and condensate return points. Counter-pitched supply mains trap condensate and cause water hammer.

97. D — Intermittent heating with a continuously calling thermostat points to an electrical problem at the zone valve actuator. A loose wire, corroded connection, or failing actuator motor causes the valve to

open (heat flows), lose connection (valve closes, heat stops), regain connection (valve opens again) in a repeating cycle. Checking and securing electrical connections resolves the intermittent cycling.

98. A — If the boiler fires and the circulator runs but the indirect tank water isn't heating, hot boiler water may not be reaching the heat exchanger coil. A closed isolation valve on the boiler water supply or return to the indirect tank, a failed aquastat on the indirect that isn't calling for the boiler water circulator, or air-locked coil piping are common causes.

99. C — Wet steam (steam carrying water droplets) causes water hammer when high-velocity steam strikes pooled condensate, reduces heat transfer efficiency at emitters because water occupies space that should contain steam, and can damage steam traps, valves, and controls through erosion and impact. The boiler water level should be checked and the steam quality improved.

100. B — A low ΔT (8°C) indicates excessive flow — the water passes through the emitters too quickly to transfer its full heat load. A high ΔT (18°C) indicates insufficient flow — the water stays in the emitters longer and gives up more heat per pass because it moves too slowly. Balancing valves on Zone 1 must be partially closed to redirect flow to Zone 3.

101. A — The automatic fill valve continuously adds makeup water from the domestic supply to maintain the set pressure. This masks the leak — the system appears to maintain pressure, but it is doing so by constantly replacing lost water. The plumber should check the relief valve discharge, visible piping, and the boiler's drain valve for evidence of water loss.

102. C — When all four zones call simultaneously and the boiler cannot maintain supply temperature, the boiler's output is insufficient for the total heat load. The boiler was either undersized during original design, or the building's heat load has increased (additions, reduced insulation, increased ventilation). A larger or additional boiler is needed.

103. B — A properly functioning trap should show a significant temperature drop between its inlet (steam temperature) and outlet (condensate temperature, noticeably cooler). A drop of only 1°C from 105°C to 104°C indicates that live steam is passing through the trap without condensing — the trap has failed in the open position and must be repaired or replaced.

104. D — In a primary-secondary system, each secondary zone operates independently through its closely spaced tees. If the radiant floor circulator fails, no water flows through that zone and it loses

heat. The baseboard zone's circulator continues to operate normally through its own set of closely spaced tees, unaffected by the failed circulator.

105. A — The gauge glass is a critical safety indicator that provides direct visual verification of the boiler's water level. A dirty, obscured, or unreadable gauge glass prevents the operator from confirming proper water level, which is essential for safe boiler operation. The glass should be cleaned or replaced to restore full visibility.

106. C — The thermostat should be located on an interior wall approximately 1.5 metres (5 feet) above the floor, away from direct sunlight, supply registers, radiators, exterior walls, kitchens, and other heat sources or cold spots. This location provides the most representative reading of the room's average air temperature.

107. B — The pressure relief valve discharge pipe must pitch continuously downward from the valve to the drain termination with no rises, dips, or traps. A vertical rise in the discharge pipe creates a water column that exerts back-pressure on the relief valve, preventing it from opening at its rated pressure — effectively increasing the system's actual relief pressure above the safe limit.

108. D — Dark discolouration on the interior of a brazed medical gas pipe indicates that the nitrogen purge was inadequate and oxide scale has formed on the copper surface. This scale can break loose and contaminate the gas supply — in oxygen piping, loose oxide particles are a fire and explosion hazard. The affected section must be cut out and replaced with a properly purged joint.

109. A — Pressure drop along the main header increases with distance from the compressor due to friction in the pipe. An undersized header creates a significant pressure differential between the nearest and farthest outlets — tools at distant bays receive less pressure and produce less power. The solution is a larger-diameter header or a ring (loop) configuration.

110. C — Variable-speed pool pumps reduce energy consumption by up to 70% compared to single-speed pumps by adjusting motor speed to match the actual demand. During low-demand periods (filtration-only, overnight), the pump runs at a fraction of full speed, consuming dramatically less energy while maintaining adequate circulation.

111. B — A drip leg (sediment trap) for gas appliances is typically a minimum of 75 mm (3 inches) long with a cap at the bottom, using the same pipe diameter as the supply line. This length provides adequate

volume to collect moisture, pipe scale, and debris before they can enter the appliance's gas valve and cause malfunction.

112. D — The final step before a medical gas system is placed in patient service is verification of all outlet labels, colour codes, and gas-specific DISS connectors by the independent third-party verifier. This ensures that every outlet delivers the correct gas and cannot be accidentally connected to the wrong equipment.

113. A — A pressure vacuum breaker (PVB) must be installed above ground, at least 300 mm (12 inches) above the highest sprinkler head in the entire irrigation system. This height ensures the air inlet is above the potential siphon height. Below-ground installation, indoor installation, and rooftop installation are not correct for PVBs.

114. C — Propane is heavier than air (specific gravity 1.52) and will sink to the lowest point in any space. In a pool equipment room at the lowest level of a building, leaked propane pools on the floor creating invisible explosive pockets. Specific ventilation and gas detection requirements apply to propane installations in below-grade or enclosed low-level spaces.

115. A — Accumulated water in the air receiver reduces the effective air storage volume (less air available for demand peaks), introduces moisture into the distribution system (damaging tools and controls), and can cause corrosion of the receiver's interior. The drain must be repaired immediately and the accumulated condensate drained.

116. D — DE filter maintenance involves periodic backwashing to flush accumulated debris from the filter grids, followed by adding fresh diatomaceous earth to recoat the grids. The DE powder is the actual filtration medium — it coats the grids and traps particles as small as 3–5 microns as water passes through.

117. A — After the gas piping passes the pressure test, the system must be purged with gas to displace the test air before any pilot lights are lit or appliances activated. The purge ensures that the piping contains only gas (not an air-gas mixture) when appliances are ignited. An air-gas mixture can cause delayed ignition or explosive lighting.

118. C — When the oil level approaches or reaches the outlet baffle, oil passes over or around the baffle and enters the building sewer. This discharges petroleum products into the municipal sewer system,

violating environmental regulations and damaging wastewater treatment plant processes. The interceptor must be cleaned before the oil level reaches the baffle.

119. B — PVDF pipe is joined by socket fusion or butt fusion, which melts the pipe material at the joint interface and creates a molecularly bonded connection. Solvent cement does not work on PVDF, and threaded connections are not suitable for the chemical purity requirements typical of pharmaceutical applications.

120. D — Unfiltered pool water contains debris, algae, body oils, and particulates that would deposit on the heater's heat exchanger surfaces, forming an insulating layer that reduces heat transfer efficiency and can cause the heat exchanger to overheat and fail. The filter removes these contaminants before the water reaches the heater.

121. A — Medical gas outlets must display visible, legible labels and colour coding at all times so that healthcare workers can correctly identify the gas at each outlet. A painted-over outlet with no visible identification is a patient safety hazard — the paint must be removed and the correct label and colour coding restored immediately.

122. C — A neutralization tank containing limestone (calcium carbonate) chips raises the pH of acid waste to an acceptable level (typically 6–9) before the waste enters the building sewer. As the acidic effluent flows through the limestone bed, the acid reacts with the calcium carbonate, neutralizing it. The limestone is consumed over time and must be replenished periodically.

123. B — The gas supply line must be sized to match the manufacturer's specification for the appliance's BTU input rating. A 1/2-inch line cannot deliver adequate gas volume for a tankless heater requiring 3/4-inch supply — the appliance will underperform, produce error codes, or fail to fire at full capacity. The line must be upsized from the meter.

124. D — The salt chlorine generator cell must be installed on the return line after the filter and heater, in the correct flow direction marked on the cell housing. This ensures that clean, heated water flows through the cell for optimal chlorine generation, and that concentrated chlorine does not pass through the filter media or heat exchanger.

125. A — The final system check verifies all installation quality items: joints tested and leak-free, drip legs installed at all low points and end-of-run positions, branch connections taken from the top of the

header (not the bottom), and all manual and automatic drains functional. This comprehensive check confirms the system is ready for safe and reliable operation.