PRACTICE EXAM 6: RED SEAL STEAMFITTER/PIPEFITTER SIMULATION (130 QUESTIONS)

1. A steamfitter is reviewing a P&ID and needs to identify a line carrying high-pressure steam. Which line designation abbreviation indicates high-pressure steam service?

A. HPS

B. LPS

C. CWS

D. HWR

2. When silver brazing a copper-to-copper joint, what is the primary purpose of applying flux?

A. To increase the melting point of the filler metal

B. To add structural strength to the completed joint

C. To slow the flow of filler into the joint gap

D. To prevent oxidation and promote filler metal wetting

3. A pipefitter must calculate the travel of a 45° offset where the set (rise) is 300 mm. What is the travel length?

A. 300 mm

B. 600 mm

C. 519 mm

D. 424 mm

4. Which valve type is best suited for throttling flow in a steam line?

A. Gate valve

B. Globe valve

C. Check valve

D. Ball valve

5. During a hydrostatic test, the test pressure is typically set to what level relative to the system design pressure?

A. Equal to design pressure

B. 0.5 times design pressure

C. 0.9 times design pressure

D. 1.5 times design pressure

6. A steam trap is failing closed. What is the most likely consequence in the system?

A. Excessive live steam loss to the condensate return

B. Increased flash steam at the receiver vent

C. Condensate backup and waterlogging of the line

D. Reduced load on the condensate pump

7. What is the function of a dielectric union in a piping system?

A. To allow rapid disconnection for maintenance

B. To increase flow turbulence at the fitting

C. To prevent galvanic corrosion between dissimilar metals

D. To act as a pressure-relief point in the line

8. When reading a welding procedure specification (WPS), the term "root pass" refers to which weld layer?

A. The final cosmetic layer on the joint face

B. The first weld bead deposited at the joint base

C. The intermediate fill passes between root and cap

D. The backing strip placed behind the joint

9. A pipefitter is laying out a rolling offset. Which two measurements are required to determine the true offset before calculating travel?

A. The horizontal run and the vertical rise

B. The pipe diameter and the wall thickness

C. The fitting angle and the gasket thickness

D. The flange bolt circle and the pipe schedule

10. Which standard primarily governs the design and construction of power piping in Canada?

A. CSA W47.1

B. CSA B51 only

C. ASME Section IX

D. ASME B31.1

11. A safety relief valve on a steam boiler is "simmering" below set pressure. What does this typically indicate?

A. The valve spring has been over-tightened

B. The system pressure has dropped too low

C. The valve seat is damaged or the valve is near set point

D. The discharge piping is undersized

12. What is the primary reason for installing an expansion loop in a long steam line?

A. To increase the velocity of steam flow

B. To provide a drainage point for condensate

C. To accommodate thermal expansion and contraction

D. To reduce the noise from steam hammer

13. When cutting threads on schedule 40 steel pipe with a power threader, what should be applied to the cutting dies?

A. Water-soluble degreaser

B. Thread-cutting oil

C. Anti-seize compound

D. Silicone spray

14. A pipefitter notices water hammer in a steam distribution line. What is the most likely cause?

A. Steam velocity that is too low for the pipe size

B. Excessive insulation on the supply main

C. An oversized safety relief valve

D. Condensate accumulation slugging through the line

15. Which type of pipe support permits axial movement while restraining the pipe vertically?

A. A rigid welded shoe anchor

B. A sliding or roller support

C. A spring hanger under full load

D. A guide with no vertical contact

16. On a boiler gauge glass, the water level should normally be maintained at approximately what point?

A. At the top of the visible glass

B. Just above the lowest visible point

C. At the mid-point of the glass

D. Filling the entire glass completely

17. What is the purpose of back-welding (or back-purging) when welding stainless steel pipe?

A. To increase the deposition rate of the cap pass

B. To prevent oxidation (sugaring) on the root's underside

C. To preheat the joint before the root pass

D. To slow the cooling rate of the weld

18. A pipefitter must support a horizontal run of NPS 4 schedule 40 water-filled steel pipe. The maximum support spacing is primarily governed by which factors?

A. The pipe weight, contents, and allowable sag/stress

B. The ambient temperature of the room only

C. The color coding of the system fluid

D. The thread engagement of the couplings

19. Which gas combination is most commonly used for oxy-fuel cutting of carbon steel?

A. Argon and hydrogen

B. Oxygen and acetylene

C. Nitrogen and propane

D. Carbon dioxide and helium

20. In a closed-loop hydronic heating system, what is the primary function of the expansion tank?

A. To filter sediment from the circulating water

B. To absorb pressure changes from water volume expansion

C. To boost the supply pressure to the pump

D. To separate air bubbles from the system fluid

21. When a pipefitter must bolt up a flanged joint, the correct tightening sequence is best described as:

A. A star or crisscross pattern in stages

B. Clockwise around the flange in one pass

C. Top bolt first, then fully tighten each adjacent

D. Tightening only the two bolts nearest the load

22. A condensate return system uses a vented receiver. What is the purpose of the vent?

A. To pressurize the receiver for pumping

B. To release flash steam and prevent over-pressurization

C. To draw makeup water into the receiver

D. To meter the condensate flow rate

23. Which non-destructive examination (NDE) method uses sound waves to detect internal weld defects?

A. Liquid penetrant testing (PT)

B. Magnetic particle testing (MT)

C. Ultrasonic testing (UT)

D. Visual inspection (VT)

24. A steamfitter is selecting gasket material for a 150 psi saturated steam flange. Which property is most critical?

A. Resistance to the temperature and pressure of the service

B. The color match to the piping system

C. The lowest possible material cost

D. Maximum compressibility under light load

25. What does the "schedule" number of a pipe primarily indicate?

A. The wall thickness relative to pressure rating

B. The outside diameter in millimetres

C. The length of a standard pipe joint

D. The thread pitch of the pipe ends

26. When using a transit or builder's level to set pipe grade, what does the term "invert" refer to?

A. The outside top surface of the pipe

B. The centerline elevation of the pipe

C. The inside bottom of the pipe

D. The flange face elevation

27. A pipefitter encounters a frozen threaded union that will not turn. What is the safest first approach?

A. Strike the union sharply with a sledgehammer

B. Apply penetrating oil and allow time to work

C. Heat the union to cherry-red with a torch immediately

D. Cut the union out with an abrasive wheel

28. Which document specifies the qualified ranges and parameters a welder must follow to produce a code-compliant weld?

A. The material test report (MTR)

B. The bill of materials

C. The isometric drawing

D. The welding procedure specification (WPS)

29. In steam systems, what is the primary purpose of a strainer installed upstream of a steam trap?

A. To reduce steam pressure before the trap

B. To meter condensate flow through the trap

C. To increase steam velocity into the trap

D. To protect the trap from debris and scale

30. A pipefitter must determine the center-to-center dimension for a piece of threaded pipe between two 90° fittings. This requires accounting for:

A. The bolt circle diameter of each fitting

B. The flash steam volume in the line

C. The fitting make-up (thread engagement) at each end

D. The schedule rating of the adjacent valve

31. Which of the following best describes "superheated steam"?

A. Steam heated above its saturation temperature at a given pressure

B. Steam that contains entrained water droplets

C. Steam at exactly its boiling point for the pressure

D. Steam that has condensed back to liquid water

32. When performing a confined space entry to service a piping system, what must be completed before entry?

A. The space must be painted with warning markings

B. The piping must be pressurized for leak detection

C. Atmospheric testing and a valid entry permit

D. The crew must remove all personal protective equipment

33. A globe valve is installed so that flow enters under the seat. What is the main advantage of this orientation in certain services?

A. Reduced erosion of the seat and easier packing service when closed

B. Higher flow capacity than any other valve type

C. Automatic shutoff on reverse flow

D. Elimination of the need for a valve stem

34. What is the purpose of a reducing fitting in a piping system?

A. To change the direction of flow by 90 degrees

B. To connect pipes of different diameters

C. To provide a removable section for service

D. To anchor the pipe against thermal movement

35. During brazing, the filler metal flows into the joint primarily by which mechanism?

A. Gravity feed from the top of the joint

B. Mechanical pressure from the torch flame

C. Capillary action drawing filler into the gap

D. Electrostatic attraction to the base metal

36. A pipefitter reads a dimension on an isometric drawing marked "TOS." This abbreviation refers to:

A. The total offset span of the run

B. Top of steel (a reference elevation)

C. The type of support specified

D. The test operating sequence

37. Which factor most directly affects the steam-carrying capacity of a distribution main?

A. The exterior paint color of the pipe

B. The pipe diameter and the steam pressure

C. The number of pipe labels installed

D. The brand of the pipe hangers

38. When a relief valve discharges, where should the discharge piping ideally terminate?

A. Directly back into the boiler feedwater tank

B. Into the building's electrical room for monitoring

C. To a safe location away from personnel

D. Capped to prevent any steam release

39. A pipefitter must select a hanger for a vertical pipe riser. Which support component is typically used to carry the vertical load?

A. A horizontal roller guide

B. A sway brace only

C. A friction clamp on a smooth wall

D. A riser clamp at a floor penetration

40. What is the main reason for sloping a steam main in the direction of flow?

A. To increase steam velocity downstream

B. To reduce insulation requirements

C. To allow condensate to drain to trap points

D. To balance the pressure across the main

41. In an oxy-acetylene setup, what color is the standard hose for the oxygen line?

A. Green

B. Red

C. Yellow

D. Black

42. A pipefitter is asked to verify pipe alignment before welding. Which tool is most appropriate for checking that two pipe ends are concentric and aligned?

A. A torque wrench

B. A pipe alignment clamp (lineup clamp)

C. A feeler gauge only

D. A dial pressure gauge

43. What does the term "TDH" (total dynamic head) describe in a pumping system?

A. The total horsepower rating of the pump motor

B. The diameter of the discharge piping

C. The total equivalent height the pump must overcome

D. The temperature differential across the pump

44. A pipe weld shows excessive penetration with icicles hanging inside the bore. This defect is best described as:

A. Undercut along the weld toe

B. Excessive penetration / burn-through

C. Lack of fusion at the root

D. Porosity in the cap pass

45. When isolating a section of pressurized steam pipe for repair, the safest practice involves:

A. Closing one valve and beginning work immediately

B. Relying on a single check valve to hold pressure

C. Throttling the supply valve halfway

D. Locking out, depressurizing, and verifying zero energy

46. Which property of a fluid most directly determines the friction loss in a length of pipe at a given flow rate?

A. The color of the fluid

B. The fluid's viscosity and the flow velocity

C. The ambient lighting at the job site

D. The brand of the pump installed

47. A pipefitter must thread a long nipple. What defines a nipple versus a standard cut length of pipe?

A. A nipple is always made of copper

B. A nipple is a short length of pipe threaded on both ends

C. A nipple has no threads on either end

D. A nipple is larger than NPS 12

48. In a two-pipe steam heating system, what is the function of the second pipe?

A. To supply additional steam at higher pressure

B. To provide a redundant supply path only

C. To return condensate separately from the supply

D. To vent air directly to the atmosphere

49. What is the primary hazard associated with a "dead-leg" in a steam piping system?

A. Increased steam velocity at the branch

B. Higher flow capacity than the main

C. Improved condensate drainage

D. Condensate accumulation and corrosion or water hammer

50. When using a 4-foot level to set grade over a 20-foot pipe run, a pipefitter must account for:

A. The color of the level's vials

B. The weight of the spirit level only

C. The accumulated slope over the full run length

D. The thread sealant on the joints

51. Which welding process is commonly used for the root pass on pipe to achieve high-quality, controlled penetration?

A. Submerged arc welding (SAW)

B. Gas tungsten arc welding (GTAW/TIG)

C. Flux-cored arc welding (FCAW) only

D. Oxy-acetylene welding only

52. A pipefitter must select pipe for a high-temperature steam service. Which material consideration is most important?

A. The pipe's exterior gloss finish

B. The availability of color labels

C. The lowest purchase price available

D. The material's allowable stress at operating temperature

53. What is the purpose of a "weep hole" in a wall-mounted pipe sleeve or certain valve bodies?

A. To increase the pressure rating of the assembly

B. To allow drainage and indicate seal leakage

C. To provide a threading point for instruments

D. To anchor the sleeve to the structure

54. A pipefitter is told a joint must be "made up wrench-tight plus two turns." This instruction relates to:

A. Achieving proper thread engagement and seal on a threaded joint

B. The number of weld passes required

C. The torque on the flange bolts

D. The number of hangers per section

55. Which instrument is used to measure the pressure in a steam line directly?

A. A bourdon-tube pressure gauge

B. A measuring tape

C. A spirit level

D. A thread pitch gauge

56. When a centrifugal pump is "cavitating," what is occurring?

A. The pump is running dry with no fluid present

B. The motor is drawing zero current

C. The discharge valve is fully closed permanently

D. Vapor bubbles form and collapse, damaging the impeller

57. What is the primary function of a check valve in a piping system?

A. To throttle and regulate flow precisely

B. To prevent reverse flow in the line

C. To reduce the temperature of the fluid

D. To indicate the flow rate visually

58. A pipefitter must cut a 4° bevel preparation on pipe ends for welding. The bevel angle is specified to:

A. Reduce the weight of the finished pipe

B. Eliminate the need for any filler metal

C. Allow proper weld penetration and fusion at the joint

D. Provide a decorative finish to the joint

59. In hydronic systems, what does a "monoflo" or diverter tee accomplish?

A. It completely blocks flow to one branch

B. It reverses the direction of the main flow

C. It induces flow into a branch off the main loop

D. It reduces system pressure by half

60. A steamfitter must determine if a relief valve is correctly sized. The relief valve capacity must be:

A. Equal to or greater than the maximum generating capacity

B. Exactly half the system pressure rating

C. The same diameter as the smallest branch line

D. Determined solely by the pipe color code

61. What is the main reason for preheating certain steel pipe before welding?

A. To make the pipe easier to bend by hand

B. To reduce thermal shock and cracking risk

C. To eliminate the need for a cap pass

D. To increase the pipe's outside diameter

62. A pipefitter reads "FF" and "RF" on flange specifications. These abbreviations refer to:

A. Flat face and raised face flange types

B. Forward flow and reverse flow directions

C. Full flange and reduced flange sizes

D. Fixed fitting and rotating fitting

63. When sizing a steam trap, the most important consideration is:

A. The condensate load and operating pressure differential

B. The exterior color of the trap body

C. The brand name of the manufacturer

D. The length of the discharge label

64. A pipefitter must support copper tubing carrying hot water. Why should copper not be in direct contact with steel hangers?

A. Copper expands faster, breaking the hanger

B. Steel hangers cannot bear the weight of copper

C. Galvanic corrosion can occur between dissimilar metals

D. Copper conducts too much heat into the steel

65. What is the purpose of a "drip leg" installed at low points and ahead of equipment in a steam line?

A. To increase steam pressure at the equipment

B. To collect and drain condensate to a trap

C. To inject chemicals into the steam flow

D. To vent excess steam to atmosphere

66. A welding inspector rejects a weld for "undercut." This defect is:

A. Excess weld metal piled above the surface

B. Gas pockets trapped within the weld bead

C. A crack running along the weld centerline

D. A groove melted into the base metal at the weld toe

67. When calculating the fill volume of a pipe section, a pipefitter needs:

A. The pipe inside diameter and the length

B. The exterior paint thickness

C. The number of hangers installed

D. The color of the system fluid

68. A pipefitter is reviewing a spec calling for "Sch 80" pipe instead of "Sch 40" for the same NPS. The Sch 80 pipe will have:

A. A thicker wall and smaller bore

B. A larger outside diameter

C. A lower pressure rating

D. The same wall as Sch 40

69. What is the function of an air vent in a hydronic heating system?

A. To pressurize the system above atmospheric

B. To add makeup water automatically

C. To remove trapped air that impedes circulation

D. To meter the flow rate to each zone

70. A pipefitter must select the correct PPE for grinding pipe in a fabrication shop. The minimum should include:

A. Eye/face protection, hearing protection, and gloves

B. Only a pair of work gloves

C. A high-visibility vest alone

D. Steel-toe boots with no eye protection

71. In a steam system, the term "flash steam" refers to:

A. Steam that forms when hot condensate drops to lower pressure

B. A sudden burst of light from the burner

C. Steam injected to test the relief valve

D. The first steam produced at boiler startup

72. When laying out a branch connection (saddle/weldolet) on a main, the pipefitter must ensure:

A. The branch is always larger than the main

B. The branch is installed without any reinforcement

C. The opening and reinforcement meet code requirements

D. The branch is threaded rather than welded in all cases

73. A pipefitter must verify that a completed system is leak-free before service. A pneumatic test, compared to a hydrostatic test, carries:

A. Greater stored energy and higher safety risk

B. No risk because air is compressible

C. Lower test pressures in all cases

D. A requirement to use only nitrogen

74. Which of the following is the correct definition of "NPS"?

A. Nominal pipe size, a dimensionless designation

B. Net pressure standard for valves

C. New pipe specification code

D. National plumbing system rating

75. A pipefitter encounters a steam trap that is blowing live steam continuously. The most likely cause is:

A. The trap is undersized for the condensate load

B. The strainer upstream is completely clean

C. The trap has failed in the open position

D. The discharge line is too short

76. What is the main purpose of a vacuum breaker in a steam heating system?

A. To prevent vacuum that can hold condensate and damage equipment

B. To increase the operating pressure of the system

C. To inject air into the steam supply continuously

D. To meter the condensate return rate

77. When reading a piping isometric, a small circle with a line through it at a fitting most commonly indicates:

A. A pipe support location

B. A field weld or specific joint type

C. The flow rate at that point

D. The insulation thickness

78. A steamfitter must calculate the offset travel for a 60° fitting where the set is 400 mm. The constant for a 60° offset (travel = set × constant) is approximately:

A. 1.414

B. 2.000

C. 1.000

D. 1.155

79. What is the primary purpose of insulation on a steam distribution pipe?

A. To increase the pipe's structural strength

B. To reduce heat loss and improve efficiency

C. To change the color coding of the system

D. To increase the steam velocity inside

80. A pipefitter must select a valve that provides positive shutoff with minimal pressure drop when fully open. The best choice is:

A. A gate valve

B. A globe valve

C. A needle valve

D. A pressure-reducing valve

81. When a weld requires "post-weld heat treatment" (PWHT), the main goal is to:

A. Add additional filler metal to the joint

B. Change the pipe's outside diameter

C. Clean the surface of the weld bead

D. Relieve residual stresses in the weld zone

82. A pipefitter reviewing a drawing sees "BOP" noted at an elevation. This refers to:

A. Bottom of pipe elevation

B. Bypass operating pressure

C. Boiler outlet port

D. Branch offset point

83. What is the function of a pressure-reducing valve (PRV) in a steam system?

A. To increase steam pressure for the boiler

B. To prevent reverse condensate flow

C. To lower and maintain downstream pressure at a set value

D. To remove air from the steam supply

84. A pipefitter must determine the correct support spacing for insulated steam pipe. Compared to bare pipe of the same size, insulated pipe generally:

A. Requires no supports at all

B. Can span unlimited distances

C. Always uses half the supports

D. Adds weight, which may require closer support spacing

85. When fitting flanged joints, the gasket must be:

A. Thicker than the flange itself

B. Made of any available scrap material

C. Installed off-center for better sealing

D. Rated for the system's pressure and temperature

86. A pipefitter must identify the correct fitting to create a 90° change in direction with a smooth, long radius for reduced turbulence. This is a:

A. Standard short-radius elbow

B. A 45° elbow

C. A long-radius 90° elbow

D. A straight coupling

87. What is the primary reason a steamfitter installs a steam trap with the correct orientation arrow?

A. To match the color coding requirements

B. To increase the steam supply pressure

C. To reduce the pipe wall thickness needed

D. To ensure correct condensate flow direction through the trap

88. A pipefitter must perform a "tie-in" to an existing live system. The most critical safety step is to:

A. Begin cutting the live line immediately to save time

B. Confirm the line is isolated, drained, and de-energized

C. Rely solely on the system operator's verbal assurance

D. Increase the system pressure to flush the line first

89. Which of the following describes "saturated steam"?

A. Steam in equilibrium with water at the boiling point for its pressure

B. Steam heated far above its boiling temperature

C. Steam that has fully condensed to liquid

D. Steam mixed with combustion gases

90. A pipefitter must calculate the weight of water in a full NPS 6 line that is 30 m long. The key inputs required are:

A. The exterior paint type and the room temperature

B. The internal volume of the pipe and the density of water

C. The number of flanges and the bolt sizes

D. The color of the pipe and the valve brand

91. What is the purpose of a "balancing valve" in a hydronic distribution system?

A. To completely shut off a zone permanently

B. To increase the supply temperature

C. To act as the primary safety relief device

D. To adjust and set the flow rate to each branch or zone

92. When oxy-fuel cutting, a "drag" that is too large in the cut typically indicates:

A. The cutting speed or technique needs adjustment

B. The oxygen cylinder is completely full

C. The plate is too thin to cut

D. The torch tip is brand new

93. A pipefitter must determine the correct anchor placement for a steam main with expansion loops. Anchors are positioned to:

A. Allow the pipe to move freely in all directions

B. Eliminate the need for any expansion loops

C. Direct expansion toward the loops and control movement

D. Increase the steam pressure in the main

94. Which of the following best describes the purpose of a union in threaded piping?

A. To provide a disconnect point for servicing without cutting pipe

B. To permanently weld two sections together

C. To reduce the diameter of the run

D. To anchor the pipe to the structure

95. A steam boiler's low-water cutoff serves to:

A. Increase the firing rate when water is low

B. Add chemicals automatically to the water

C. Vent steam when pressure is high

D. Shut down the burner if water drops below a safe level

96. A pipefitter is asked to identify the "heat-affected zone" (HAZ) on a weld. This zone is:

A. The filler metal deposited in the joint

B. The flux residue on the surface

C. The slag covering the cap pass

D. The base metal adjacent to the weld altered by heat

97. What is the primary purpose of a sight glass on a condensate receiver or tank?

A. To indicate the liquid level inside the vessel

B. To increase the tank's pressure rating

C. To filter sediment from the condensate

D. To vent flash steam to atmosphere

98. A pipefitter must choose a thread sealant for a steam line. The sealant must be:

A. A water-based paint only

B. Rated for the temperature and pressure of steam service

C. The least expensive product available

D. Applied only to the female threads

99. When a piping system is designed with a "swing joint" using elbows, the purpose is to:

A. Increase the flow rate through the joint

B. Permanently lock the pipe in position

C. Accommodate movement or expansion flexibly

D. Reduce the diameter of the connected pipe

100. A pipefitter reviewing a weld map needs to confirm which welds require radiographic testing. This information is typically found in the:

A. Paint specification sheet

B. Hanger schedule only

C. Inspection/test plan or weld map notes

D. Material delivery receipt

101. What is the main function of a "Y-strainer" in a piping system?

A. To increase the pipe diameter at the fitting

B. To change flow direction by 90 degrees

C. To pressurize the downstream line

D. To remove particulates and protect downstream equipment

102. A pipefitter must select the correct grinding wheel for cutting steel pipe. The wheel must be:

A. Any abrasive wheel found in the shop

B. A wheel intended only for masonry

C. A wood-cutting blade adapted for metal

D. Rated for metal cutting and matched to the tool's RPM

103. When bending tubing without a mandrel, a common defect to avoid is:

A. Excessive polishing of the outer surface

B. Increased wall thickness at the bend

C. Flattening or kinking of the tube at the bend

D. The tube becoming longer than specified

104. A pipefitter must interpret a slope specified as "1:100" on a drainage or condensate line. This means:

A. One pipe per 100 fittings

B. A 100% grade over the run

C. A 1-unit drop over 100 units of run

D. One support per 100 metres only

105. What does a "globe valve" rely on to control flow?

A. A rotating ball with a bored passage

B. A swinging disc that opens with flow

C. A sliding gate perpendicular to flow

D. A disc moving against a seat as the stem turns

106. A pipefitter notices a flange leak after tightening. The most appropriate first response is:

A. Apply more sealant over the outside of the joint

B. Ignore the leak if it is small

C. Depressurize, inspect the gasket and faces, then re-make the joint

D. Increase system pressure to seat the gasket

107. What is the purpose of a "thermostatic" steam trap?

A. It opens and closes based on condensate temperature

B. It relies on a float and lever mechanism only

C. It uses centrifugal force to separate steam

D. It operates purely on system pressure with no temperature input

108. A pipefitter must determine the correct hanger rod size for a heavy pipe load. The rod must be:

A. Painted to match the system color

B. The same diameter as the pipe

C. Made of copper to prevent corrosion

D. Sized to safely carry the suspended load with a safety factor

109. When reading a P&ID, a dashed line between an instrument and a valve most commonly represents:

A. A welded pipe connection

B. A signal or control line (not process piping)

C. The insulation boundary

D. A drain to atmosphere

110. A pipefitter must store oxygen and acetylene cylinders. The correct practice is to:

A. Store them separated by distance or a barrier, upright and secured

B. Lay them on their sides next to each other

C. Store them in a sealed, unventilated cabinet

D. Keep valves open for pressure equalization

111. What is the purpose of a "float and thermostatic" (F&T) steam trap?

A. To discharge condensate and vent air over a range of loads

B. To increase steam pressure to the equipment

C. To act only as a pressure relief device

D. To meter steam flow into the trap

112. A pipefitter must calculate the number of threads to engage on a pipe joint. Thread engagement is governed by:

A. The pipe size and standard thread make-up dimensions

B. The exterior color of the pipe

C. The brand of the threading machine

D. The number of hangers nearby

113. When a steam main warms up from cold, the operator should open valves:

A. Fully and immediately to maximize flow

B. Only after the system has cooled further

C. Slowly to control condensate and prevent water hammer

D. In random order to balance the load

114. What is the main purpose of a "reducer" classified as "concentric" versus "eccentric"?

A. Concentric reducers are always larger than eccentric ones

B. They differ only in color coding

C. Eccentric reducers cannot be used on steam lines

D. Eccentric reducers maintain one flat side to manage drainage or air

115. A pipefitter is selecting bolts for a high-temperature flanged joint. The bolt material must be:

A. The cheapest grade available in the shop

B. Any galvanized bolt regardless of grade

C. Sized only by length, ignoring the grade

D. Rated for the temperature and stress of the service

116. What does "WOG" stamped on a valve indicate?

A. The valve's weight in kilograms

B. The welding procedure used

C. The water, oil, gas pressure rating of the valve

D. The wall thickness of the connected pipe

117. A pipefitter must lay out equally spaced holes on a bolt circle for a custom flange. The required information includes:

A. The bolt circle diameter and the number of bolts

B. The color of the gasket only

C. The steam pressure in the line

D. The length of the connected pipe run

118. When a centrifugal pump must be primed, this means:

A. The motor must be replaced before starting

B. The discharge valve must remain closed permanently

C. The pump speed must be doubled at startup

D. The pump casing and suction must be filled with liquid

119. What is the purpose of a "tell-tale" or telltale weep on a double-block-and-bleed valve arrangement?

A. To increase the flow capacity of the valve

B. To verify isolation by detecting leakage past the seats

C. To pressurize the line between the valves

D. To reduce the pipe diameter at the valve

120. A pipefitter must select pipe for a buried condensate return line. The most important consideration beyond pressure is:

A. Corrosion protection and proper bedding/support

B. The exterior gloss of the coating only

C. Matching the indoor pipe color scheme

D. The brand name printed on the pipe

121. What is the function of a "drip pan elbow" used with safety/relief valve discharge piping?

A. To collect and drain condensate and allow expansion at the discharge

B. To increase the relief valve set pressure

C. To reduce the discharge pipe diameter sharply

D. To seal the discharge line completely closed

122. A pipefitter reads "BWG" when specifying tubing. This refers to:

A. The bend radius of the tubing

B. Birmingham Wire Gauge, indicating tube wall thickness

C. The boiler working grade

D. The brazing wire grade

123. When fabricating from an isometric, the pipefitter must convert dimensions accounting for:

A. The color of the lines on the drawing

B. The number of revisions to the drawing

C. Fitting take-offs and end-to-end versus center-to-center dimensions

D. The paper size of the printout

124. What is the primary purpose of a "spool piece" in piping fabrication?

A. A prefabricated pipe section with fittings, made for field assembly

B. A device to store excess pipe length

C. A tool for measuring pipe diameter

D. A type of pump used in condensate systems

125. A pipefitter must ensure a relief valve discharge does not create excessive back pressure. Back pressure that is too high will:

A. Improve the valve's seating performance

B. Have no effect on relief valve operation

C. Reduce the pipe's required wall thickness

D. Impair the valve's ability to relieve at set pressure

126. When selecting a pump for a hydronic system, the two primary specifications to match are:

A. The pump color and the motor brand

B. The flow rate (capacity) and the total head

C. The number of bolts and the gasket type

D. The pipe label color and the insulation type

127. What is the main purpose of "purging" a gas pipeline before commissioning?

A. To increase the line pressure for testing

B. To paint the interior of the pipe

C. To remove air or contaminants, reducing explosion/contamination risk

D. To add lubricant to the valves

128. A pipefitter must select the correct method to join PEX tubing in a hydronic system. A common acceptable method is:

A. Oxy-acetylene brazing of the PEX directly

B. Arc welding the tubing ends together

C. Crimp or expansion fittings designed for PEX

D. Threading the PEX with standard pipe dies

129. When a steam trap is described as "inverted bucket," it operates based on:

A. The difference in buoyancy between steam and condensate acting on a bucket

B. A purely electronic temperature sensor

C. The color of the condensate flowing through

D. The external air pressure only

130. A pipefitter completing a system must document the work for the authority having jurisdiction. This typically includes:

A. The lunch schedule of the crew

B. The color preferences of the client

C. Only verbal confirmation to the supervisor

D. Test records, material certifications, and inspection sign-offs

Practice Exam 6: Answer Key and Explanations

1. A — HPS is the standard line designation for high-pressure steam. Abbreviations on P&IDs follow a consistent convention where the service is coded by fluid and pressure; LPS denotes low-pressure steam, CWS chilled/cold water supply, and HWR hot water return. Recognizing service codes is essential for correctly routing and isolating lines.

2. D — Flux prevents oxidation of the base and filler metals during heating and promotes wetting so the filler flows into the joint. Without flux, oxides form at brazing temperature and block capillary flow, producing a weak or incomplete joint. Clean, oxide-free surfaces are the foundation of a sound brazed connection.

3. D — Travel equals set divided by the sine of the offset angle; for 45°, travel = set × 1.414, giving 300 × 1.414 ≈ 424 mm. The 45° offset is the most common because the constant is easy to apply and fittings are readily available. Accurate travel calculation ensures the offset lands on the correct centerline.

4. B — A globe valve is designed for throttling because its disc-against-seat geometry allows fine, proportional flow control. Gate valves are meant for full-open or full-closed service and erode if throttled, while ball and check valves are unsuitable for regulation. Matching valve type to duty protects the valve and the system.

5. D — Hydrostatic test pressure is typically set at 1.5 times the system design pressure to confirm integrity with a safety margin. Water is used because it is nearly incompressible, storing little energy if a failure occurs. The elevated pressure exposes weak joints without subjecting the system to dangerous stored energy.

6. C — A trap failed closed cannot discharge condensate, so condensate backs up and waterlogs the line. This reduces heat transfer and creates water-hammer risk as slugs of liquid accumulate. Recognizing a failed-closed trap by line flooding is key to timely repair.

7. C — A dielectric union electrically isolates dissimilar metals to prevent galvanic corrosion at the connection. When two different metals contact in the presence of an electrolyte, the more active metal corrodes preferentially. The non-conductive separator interrupts that circuit, extending joint life.

8. B — The root pass is the first weld bead deposited at the base of the joint, establishing penetration and fusion at the root. It is the most critical pass because defects there compromise the entire weld. Subsequent fill and cap passes build on a sound root.

9. A — A rolling offset requires the horizontal run and the vertical rise to determine the true offset, which is the hypotenuse of those two legs. The true offset then drives the travel calculation through the fitting angle. Both legs must be measured accurately to avoid a misaligned run.

10. D — ASME B31.1 is the power piping code governing the design and construction of steam and high-temperature piping systems. CSA B51 addresses boiler and pressure vessel construction, and ASME Section IX covers welding qualification. Knowing which code applies ensures the correct design rules are followed.

11. C — Simmering at slightly below set pressure usually indicates a damaged seat or that the system is operating near the valve's set point. A worn or eroded seat cannot maintain a tight seal as pressure approaches the setting. Identifying simmer early prevents seat erosion from worsening into a constant leak.

12. C — An expansion loop accommodates the thermal expansion and contraction of long steam lines by providing flexible pipe geometry. As steel heats, it grows in length, and an unaccommodated line will buckle or overstress anchors. The loop absorbs that movement safely.

13. B — Thread-cutting oil lubricates and cools the dies, producing clean threads and extending die life. Cutting steel without proper oil generates excess heat, tears the threads, and dulls the dies quickly. The correct cutting fluid is essential for quality threads.

14. D — Water hammer in a steam line is most often caused by condensate accumulating and being driven as slugs through the pipe. When a slug strikes a fitting or valve, it produces the characteristic hammering shock. Proper drainage and trapping prevent this damaging condition.

15. B — A sliding or roller support permits axial movement from thermal expansion while still carrying the pipe's vertical load. A rigid anchor would prevent the needed movement, and a guide controls lateral position rather than bearing weight. Choosing the right support type allows expansion without overstressing the pipe.

16. C — The boiler gauge glass water level should normally sit at about the mid-point, giving a clear margin above the low-water point and room for fluctuation. A level too high risks carryover, and too low risks uncovering heating surfaces. Mid-glass is the standard safe operating indication.

17. B — Back-purging shields the underside of a stainless steel root weld with inert gas to prevent oxidation, known as sugaring. Oxidized root surfaces are brittle and corrosion-prone, compromising the joint. The purge preserves the corrosion resistance and integrity of the weld root.

18. A — Maximum support spacing is governed primarily by the pipe weight, its contents, and the allowable sag and stress between supports. A heavier water-filled line requires closer spacing to limit deflection. Support tables combine these factors to set safe spans.

19. B — Oxy-fuel cutting of carbon steel most commonly uses oxygen and acetylene, which produces the high flame temperature needed to preheat the steel for the cutting-oxygen stream. The process relies on the steel oxidizing rapidly once at ignition temperature. Acetylene's hot flame makes it the standard fuel gas.

20. B — The expansion tank absorbs the volume changes of water as it heats and cools, preventing dangerous pressure swings in a closed loop. Without it, thermal expansion would spike system pressure and lift relief valves. The cushion of air or a bladder maintains stable pressure.

21. A — Flanged joints are tightened in a star or crisscross pattern in stages to seat the gasket evenly and avoid distortion. Sequential one-side tightening would pinch the gasket and cause leaks. Progressive cross-pattern torque ensures uniform clamping load.

22. B — The receiver vent releases flash steam and prevents over-pressurization of an atmospheric condensate receiver. As hot condensate enters and flashes, the resulting vapor must escape to keep the tank at atmospheric pressure. The vent protects the vessel and allows proper condensate handling.

23. C — Ultrasonic testing uses high-frequency sound waves to detect internal weld discontinuities by reflecting off flaws. Penetrant and magnetic particle methods detect only surface or near-surface defects, and visual inspection cannot see inside the weld. UT is the standard for volumetric internal examination.

24. A — Gasket selection for steam service is driven primarily by resistance to the service temperature and pressure. A gasket that cannot withstand saturated steam conditions will fail, extrude, or leak. Matching gasket rating to operating conditions is the controlling factor.

25. A — The schedule number indicates pipe wall thickness relative to pressure rating for a given nominal size. Higher schedule numbers mean thicker walls and higher pressure capacity. Schedule, combined with NPS, defines the pipe's dimensions and strength.

26. C — The invert is the inside bottom of the pipe, the reference used when setting grade for drainage and condensate lines. Grade is established from invert elevations so that flow runs continuously downhill. Confusing invert with crown or centerline produces grading errors.

27. B — Applying penetrating oil and allowing it time to work is the safest first approach to a frozen union, loosening corrosion without damage. Sudden heavy blows or immediate cutting risk injury and damage to reusable components. Patience with penetrant often frees the joint cleanly.

28. D — The welding procedure specification documents the qualified parameters a welder must follow to produce a code-compliant weld. It defines variables such as material, filler, preheat, and technique. Following the WPS ensures the weld meets the qualified standard.

29. D — A strainer upstream of a steam trap protects the trap from debris and scale that would otherwise foul or jam its mechanism. Trapped particulates can hold a trap open or closed, causing failure. The strainer extends trap life and reliability.

30. C — Determining a center-to-center dimension for threaded pipe requires accounting for the fitting make-up, the thread engagement at each end. The pipe must be cut shorter than the center-to-center distance by the take-off allowance. Ignoring make-up produces an oversized assembly.

31. A — Superheated steam is steam heated above its saturation temperature at a given pressure, containing no entrained moisture. It carries additional energy and stays dry through distribution, which benefits turbines and processes. Superheat is defined relative to the saturation point.

32. C — Confined space entry requires atmospheric testing and a valid entry permit before anyone enters. Testing confirms oxygen levels and the absence of toxic or flammable gases, and the permit documents controls. These steps protect entrants from life-threatening atmospheres.

33. A — Installing a globe valve with flow entering under the seat reduces seat erosion and allows packing service while the valve is closed and the bonnet is isolated from pressure. This orientation suits certain throttling and maintenance needs. Flow direction relative to the seat is a deliberate design choice.

34. B — A reducing fitting connects pipes of different diameters, transitioning the line size. Elbows change direction and unions provide disconnects, so the reducer's specific role is size transition. Selecting the correct reducer maintains proper flow geometry.

35. C — In brazing, filler metal flows into the joint by capillary action that draws molten filler into the close-fitting gap. The joint clearance must be controlled so capillary forces can act. This is why brazing relies on tight, clean joints rather than gravity or pressure.

36. B — TOS stands for top of steel, a reference elevation used on drawings to locate piping relative to structural steel. Elevations are dimensioned from such benchmarks for accurate field layout. Misreading the reference datum leads to incorrect installation heights.

37. B — Steam-carrying capacity of a main is governed primarily by the pipe diameter and the steam pressure, which together set the mass flow the line can deliver. Larger diameter and higher pressure increase capacity. Sizing a main requires balancing both factors against demand.

38. C — Relief valve discharge piping should terminate at a safe location away from personnel to avoid burns from released steam. The discharge must also be free-draining and unobstructed. Protecting people from the high-energy release is the governing concern.

39. D — A riser clamp at a floor penetration carries the vertical load of a pipe riser by bearing on the floor structure. Roller guides and sway braces handle lateral or expansion forces, not vertical weight. The riser clamp is the standard component for supporting vertical runs.

40. C — Steam mains are sloped in the direction of flow so condensate drains to trap points rather than pooling. Accumulated condensate causes water hammer and reduces efficiency, so directing it to drip legs is essential. Proper pitch keeps the main dry and safe.

41. A — The standard color for the oxygen hose in an oxy-acetylene setup is green, while the fuel-gas (acetylene) hose is red. Color coding prevents dangerous cross-connection of the gases. Recognizing hose colors is a basic safety requirement.

42. B — A pipe alignment clamp, or lineup clamp, holds two pipe ends concentric and aligned for welding. It maintains the correct fit-up and root gap while tacking. Proper alignment is essential for a sound root pass and a straight run.

43. C — Total dynamic head describes the total equivalent height the pump must overcome, combining static lift and friction losses. It determines the pump's required performance against the system. TDH is a core input when matching a pump to a system curve.

44. B — Icicles of weld metal hanging inside the bore indicate excessive penetration or burn-through at the root. Too much heat or too wide a gap lets molten metal sag through the joint. Controlling heat input and fit-up prevents this defect.

45. D — The safest practice for isolating pressurized steam is to lock out, depressurize, and verify zero energy before work begins. Relying on a single valve or partial throttling leaves stored energy that can injure. Verified zero-energy isolation is the cornerstone of safe maintenance.

46. B — Friction loss in a pipe is most directly determined by the fluid's viscosity and the flow velocity at a given flow rate. Higher velocity and viscosity increase resistance and pressure drop. These factors are central to sizing pipe and pumps.

47. B — A nipple is a short length of pipe threaded on both ends, used to join fittings closely. The defining feature is its short length with male threads at each end. Nipples come in standard lengths such as close, short, and long.

48. C — In a two-pipe steam heating system, the second pipe returns condensate separately from the steam supply. Separating supply and return improves drainage and distribution control. This arrangement avoids the flow conflicts of a single-pipe system.

49. D — A dead-leg allows condensate to accumulate and stagnate, leading to corrosion or water hammer when the slug is disturbed. Stagnant pockets also harbor scale and reduce system reliability. Eliminating or draining dead-legs protects the system.

50. C — Setting grade over a 20-foot run with a short level requires accounting for the accumulated slope across the full length. The small level reading must be projected over the entire run to achieve the intended pitch. Failing to scale the slope produces incorrect grade.

51. B — Gas tungsten arc welding is commonly used for the root pass on pipe because it gives precise, controlled penetration and a clean root. The non-consumable tungsten electrode and separate filler allow fine heat control. This produces the high-quality root that code work demands.

52. D — For high-temperature steam service, the controlling material consideration is the allowable stress at the operating temperature. Material strength declines as temperature rises, so the pipe must retain adequate strength under service conditions. This governs the safe pressure–temperature rating.

53. B — A weep hole allows drainage and reveals seal leakage by providing a visible path for escaping fluid. In sleeves and certain valve bodies, it signals when a seal has failed. The telltale leak prompts timely maintenance before a larger failure.

54. A — "Wrench-tight plus turns" describes achieving proper thread engagement and a tight seal on a tapered threaded joint. The instruction ensures the threads make up enough to seal under pressure without splitting the fitting. Correct make-up is essential for leak-free threaded connections.

55. A — A bourdon-tube pressure gauge measures steam line pressure directly by sensing pressure with a curved tube that deflects. The movement is translated to a dial reading. It is the standard instrument for reading system pressure at a glance.

56. D — Cavitation occurs when vapor bubbles form in the low-pressure region of a pump and collapse violently, damaging the impeller. It arises when suction pressure drops below the fluid's vapor pressure. Cavitation erodes components and reduces pump performance.

57. B — A check valve prevents reverse flow, allowing fluid to move in only one direction. It protects pumps and equipment from backflow and unwanted draining. The valve's disc or ball seats automatically when flow reverses.

58. C — A bevel preparation on pipe ends allows proper weld penetration and fusion by creating the groove the weld fills. Without the bevel, the weld cannot reach the joint root on thicker walls. Correct bevel geometry is essential to a full-strength weld.

59. C — A monoflo or diverter tee induces flow into a branch off the main loop, ensuring each heat emitter receives circulation in a one-pipe system. Its internal venturi diverts a portion of flow into the branch. This balances distribution without separate supply and return mains.

60. A — A relief valve's capacity must be equal to or greater than the boiler's maximum generating capacity so it can relieve all the steam produced. An undersized valve cannot prevent overpressure during a full-fire upset. Adequate capacity is a fundamental safety requirement.

61. B — Preheating steel pipe before welding reduces thermal shock and the risk of cracking by slowing the cooling rate. This is especially important for thicker or higher-carbon materials prone to hard, brittle zones. Preheat helps produce a sound, crack-free weld.

62. A — FF and RF designate flat face and raised face flange types, describing the gasket contact surface. The face style must match between mating flanges and suit the gasket and service. Mixing incompatible faces risks leaks or flange damage.

63. A — Sizing a steam trap depends primarily on the condensate load and the operating pressure differential across the trap. The trap must discharge the expected condensate at the available pressure drop. Correct sizing prevents both flooding and steam loss.

64. C — Copper should not contact steel hangers because galvanic corrosion can occur between the dissimilar metals in the presence of moisture. The more active metal corrodes at the contact point. Isolating the metals with appropriate hanger materials prevents this.

65. B — A drip leg collects and drains condensate to a trap at low points and ahead of equipment. It provides a reservoir where condensate falls out of the steam flow for removal. This keeps the steam dry and prevents water hammer at equipment.

66. D — Undercut is a groove melted into the base metal at the weld toe that is not filled by weld metal. It reduces the cross-section and creates a stress concentration. Proper technique and heat control prevent this weakening defect.

67. A — Calculating the fill volume of a pipe section requires the inside diameter and the length, which define the internal cylindrical volume. Volume equals the cross-sectional area times the length. These inputs allow accurate fluid-quantity and weight calculations.

68. A — Schedule 80 pipe has a thicker wall and therefore a smaller bore than Schedule 40 of the same nominal size, since the outside diameter stays constant. The added wall increases pressure capacity. Recognizing this distinction is key when matching pipe to service.

69. C — An air vent removes trapped air that would otherwise impede circulation in a hydronic system. Air pockets block flow and reduce heat transfer at high points. Venting restores full circulation and system efficiency.

70. A — Minimum PPE for shop grinding includes eye and face protection, hearing protection, and gloves to guard against sparks, debris, and noise. Grinding throws hot particles and generates high sound levels. Layered protection addresses each hazard present.

71. A — Flash steam forms when hot, high-pressure condensate is released to a lower pressure and a portion instantly vaporizes. The condensate is above the saturation temperature for the new lower pressure, so it flashes. Recovering flash steam improves overall system efficiency.

72. C — A branch connection must ensure the opening and reinforcement meet code requirements so the main is not weakened by the cut. Removing metal for the branch reduces the main's pressure capacity unless compensated. Proper reinforcement restores the required strength.

73. A — A pneumatic test carries greater stored energy and higher safety risk than a hydrostatic test because compressed gas releases violently if a failure occurs. Water stores far less energy, making hydrostatic testing safer. The stored-energy hazard is why pneumatic testing demands extra precautions.

74. A — NPS means nominal pipe size, a dimensionless designation that loosely relates to the bore rather than an exact measurement. It standardizes pipe and fitting selection across schedules. Understanding NPS prevents confusion with actual outside diameter.

75. C — A trap blowing live steam continuously has most likely failed in the open position, allowing steam to pass straight through. This wastes energy and overloads the condensate system. Failed-open traps are identified by continuous steam discharge.

76. A — A vacuum breaker prevents a vacuum that can hold condensate in the system and damage equipment as steam condenses. Admitting air breaks the vacuum so condensate can drain freely. This protects coils and traps from collapse-induced damage.

77. B — On a piping isometric, a small circle with a line through it at a fitting commonly indicates a field weld or a specific joint type. Drawing symbols communicate where and how joints are made. Reading these symbols correctly guides fabrication and field work.

78. D — For a 60° offset, travel equals set times the constant 1.155 (1/sin 60°), giving the hypotenuse from the set. Each offset angle has its own constant derived from trigonometry. Using the right constant ensures the offset travel is cut correctly.

79. B — Insulation on a steam pipe reduces heat loss and improves system efficiency by limiting energy escape to the surroundings. It also protects personnel from burns and helps maintain steam quality. Reducing standby and distribution losses is its primary purpose.

80. A — A gate valve provides positive shutoff with minimal pressure drop when fully open because the gate withdraws completely from the flow path. This makes it ideal for isolation duty. It should not be throttled, but as an on/off valve it excels.

81. D — Post-weld heat treatment relieves residual stresses in the weld and heat-affected zone, reducing cracking and improving toughness. Welding leaves locked-in stresses that PWHT redistributes through controlled heating. This is required on certain materials and thicknesses.

82. A — BOP on a drawing refers to bottom of pipe elevation, used to locate the pipe's lowest point relative to a datum. It is one of several elevation references used in layout. Reading the correct reference prevents installation errors.

83. C — A pressure-reducing valve lowers and maintains downstream pressure at a set value regardless of upstream fluctuations. It allows a high-pressure main to feed lower-pressure equipment safely. Stable reduced pressure protects downstream components.

84. D — Insulated steam pipe adds weight, which may require closer support spacing than bare pipe of the same size. The combined weight of pipe, contents, and insulation increases deflection between supports. Support tables account for this added load.

85. D — A flange gasket must be rated for the system's pressure and temperature to seal reliably without extruding or failing. Using unsuitable material leads to leaks under service conditions. Matching the gasket rating to the duty is essential.

86. C — A long-radius 90° elbow provides a smooth, gradual change in direction that reduces turbulence and pressure loss compared with a short-radius fitting. Its larger centerline radius eases flow around the bend. This makes it preferred where flow efficiency matters.

87. D — Installing a steam trap with its arrow oriented correctly ensures condensate flows through the trap in the intended direction. Reversed installation prevents the trap from functioning. The directional arrow is the installer's guide to correct orientation.

88. B — Before a tie-in to a live system, the critical safety step is confirming the line is isolated, drained, and de-energized. Verifying zero energy protects workers from pressure and temperature hazards. Relying on assumptions or verbal assurance alone is unsafe.

89. A — Saturated steam is steam in equilibrium with water at the boiling point corresponding to its pressure. At this state, steam and liquid coexist and any heat loss begins condensation. It is the baseline condition from which superheat is measured.

90. B — Calculating the weight of water in a line requires the internal volume of the pipe and the density of water. Volume times density yields mass, and thus the load the supports must carry. These inputs feed both load and hydrostatic calculations.

91. D — A balancing valve adjusts and sets the flow rate to each branch or zone so the system distributes flow as designed. Without balancing, some zones receive too much flow and others too little. Proper balancing ensures even heating performance.

92. A — A cutting drag that is too large indicates the cutting speed or technique needs adjustment, as the oxygen stream is lagging through the kerf. Excessive drag produces a rough, angled cut. Correcting speed and torch angle restores a clean cut.

93. C — Anchors are positioned to direct expansion toward the loops and control pipe movement, ensuring the loop absorbs the growth. Without anchors, expansion would not be channeled into the flexible section. Anchor placement is integral to expansion-loop design.

94. A — A union provides a disconnect point for servicing threaded piping without cutting the pipe. Its three-part design lets a section be removed and replaced cleanly. Unions are essential where future maintenance or removal is anticipated.

95. D — A low-water cutoff shuts down the burner if the boiler water drops below a safe level, protecting against dry-firing. Operating with insufficient water can overheat and rupture the boiler. This safety device prevents catastrophic failure.

96. D — The heat-affected zone is the base metal adjacent to the weld whose microstructure was altered by welding heat without melting. Its properties differ from both the weld and the unaffected base metal. The HAZ is often where cracking and hardness problems appear.

97. A — A sight glass indicates the liquid level inside a condensate receiver or tank, allowing visual monitoring. Maintaining the correct level protects pumps and ensures proper operation. The glass gives an at-a-glance check of the vessel's contents.

98. B — Thread sealant for a steam line must be rated for the temperature and pressure of steam service to maintain a seal. Unrated sealants degrade and leak under steam conditions. Selecting a service-appropriate sealant ensures a durable joint.

99. C — A swing joint built from elbows accommodates movement or expansion flexibly by allowing the assembly to rotate slightly. This relieves stress from thermal growth or settlement. It is a simple way to add flexibility at connections.

100. C — The welds requiring radiographic testing are identified in the inspection/test plan or weld map notes. These documents specify the NDE requirements for each weld. Consulting them ensures the correct examinations are performed and recorded.

101. D — A Y-strainer removes particulates to protect downstream equipment such as valves, traps, and pumps. Its screen captures debris while allowing flow to continue. Regular cleaning of the strainer maintains protection and flow.

102. D — A grinding or cutting wheel must be rated for metal cutting and matched to the tool's RPM for safe operation. Using an unrated or overspeed wheel risks shattering. Matching wheel specification to the application is a fundamental safety practice.

103. C — Bending tubing without a mandrel risks flattening or kinking the tube at the bend, which restricts flow and weakens the wall. Internal support or proper benders prevent the cross-section from collapsing. Avoiding kinks preserves the tube's capacity and strength.

104. C — A slope of 1:100 means a 1-unit drop over 100 units of run, defining the pipe's pitch for drainage. This ratio sets how steeply the line falls. Correctly interpreting the ratio ensures proper condensate or drainage flow.

105. D — A globe valve controls flow with a disc that moves against a seat as the stem turns, throttling the opening. This perpendicular disc-and-seat action gives fine regulation. The design distinguishes it from gate, ball, and check valves.

106. C — The correct first response to a flange leak is to depressurize, inspect the gasket and faces, then re-make the joint. Adding sealant or raising pressure masks rather than fixes the problem. Proper re-assembly with a sound gasket resolves the leak safely.

107. A — A thermostatic steam trap opens and closes based on condensate temperature, holding condensate until it cools below steam temperature. It uses a temperature-sensitive element to actuate. This makes it well suited to applications tolerant of some condensate backup.

108. D — A hanger rod must be sized to safely carry the suspended load with an appropriate safety factor. The rod diameter is selected from load tables for the pipe weight. Undersizing risks failure of the support.

109. B — On a P&ID, a dashed line between an instrument and a valve represents a signal or control line rather than process piping. Different line styles distinguish process flow from instrumentation. Reading these conventions correctly is essential to understanding the system.

110. A — Oxygen and acetylene cylinders must be stored separated by distance or a barrier, kept upright and secured. Separation prevents a fuel-and-oxidizer hazard, and securing prevents cylinders from falling. These storage rules are basic compressed-gas safety.

111. A — A float and thermostatic trap discharges condensate via the float while venting air through the thermostatic element, handling a range of loads. The combined mechanism removes both condensate and air efficiently. This makes F&T traps versatile for varying conditions.

112. A — Thread engagement is governed by the pipe size and standard thread make-up dimensions defined for tapered pipe threads. These standards set how far the pipe threads into a fitting. Following them ensures a proper, sealing connection.

113. C — A cold steam main must be warmed by opening valves slowly to control condensate and prevent water hammer. Rapid admission of steam drives accumulated condensate as damaging slugs. Gradual warm-up protects the system during startup.

114. D — An eccentric reducer maintains one flat side, allowing it to manage drainage or air by keeping either the bottom or top of the line level. A concentric reducer keeps the centerline common. Choosing the right reducer prevents trapped condensate or air.

115. D — Bolts for a high-temperature flanged joint must be rated for the temperature and stress of the service. Bolt strength declines with temperature, so the grade must suit the conditions. Using under-rated bolts risks joint failure.

116. C — WOG stamped on a valve indicates its water, oil, gas pressure rating, defining the non-shock pressure it can handle in those services. It guides selection for general fluid duty. Reading the WOG rating ensures the valve suits the application.

117. A — Laying out a bolt circle requires the bolt circle diameter and the number of bolts to space the holes evenly. From these, the angular spacing and hole positions are calculated. Accurate layout ensures the flange bolts align with the mating part.

118. D — Priming a centrifugal pump means filling the casing and suction with liquid so the impeller can move fluid rather than air. A centrifugal pump cannot pump air effectively, so it must be primed before starting. Proper priming prevents running dry and damage.

119. B — A tell-tale weep on a double-block-and-bleed arrangement verifies isolation by detecting leakage past the seats. If either seat leaks, fluid appears at the bleed point. This confirms a positive, verifiable isolation between the blocks.

120. A — For a buried condensate return line, the key consideration beyond pressure is corrosion protection and proper bedding and support. Soil moisture and movement attack and stress buried pipe. Coatings and correct bedding extend the line's service life.

121. A — A drip pan elbow collects and drains condensate and allows expansion at a relief valve discharge. It supports the discharge piping while letting the valve outlet move freely. This protects the relief valve from piping loads and drains accumulated condensate.

122. B — BWG stands for Birmingham Wire Gauge, used to indicate tube wall thickness. A given BWG number corresponds to a specific wall, with higher numbers being thinner. It is a common way to specify tubing for heat exchangers and similar work.

123. C — Fabricating from an isometric requires accounting for fitting take-offs and the difference between end-to-end and center-to-center dimensions. The pipe must be cut shorter than centerline dimensions by the fitting allowances. Correct take-off math produces accurate spool pieces.

124. A — A spool piece is a prefabricated pipe section with fittings, made in the shop for field assembly. Prefabrication improves quality control and speeds installation. Spools are a standard unit of modular piping fabrication.

125. D — Excessive back pressure impairs a relief valve's ability to relieve at its set pressure by opposing the valve's opening force. The valve may not lift fully or at the correct point. Keeping discharge piping properly sized limits back pressure and preserves valve function.

126. B — Selecting a pump for a hydronic system requires matching the flow rate (capacity) and the total head to the system requirements. These two values define the pump's operating point on its curve. Correct matching ensures adequate circulation without waste.

127. C — Purging a gas pipeline before commissioning removes air or contaminants, reducing explosion and contamination risk. Displacing the air with an inert gas or product prevents a combustible mixture. Purging is a critical commissioning safety step.

128. C — PEX tubing is commonly joined with crimp or expansion fittings designed for the material, not by welding or threading. These mechanical fittings form reliable, code-accepted connections. Using the correct PEX joining method ensures a durable, leak-free system.

129. B — An inverted bucket trap operates on the difference in buoyancy between steam and condensate acting on a bucket. Steam floats the bucket to close the valve, and condensate lets it sink to open. This mechanical action discharges condensate while holding steam.

130. D — Documenting a completed system for the authority having jurisdiction typically includes test records, material certifications, and inspection sign-offs. These records prove the work meets code and was properly examined. Complete documentation is required for acceptance and future reference.