PRACTICE EXAM 7: RED SEAL STEAMFITTER/PIPEFITTER SIMULATION (130 QUESTIONS)

1. A steamfitter is sizing a relief valve discharge line on a low-pressure steam boiler. According to good practice, the discharge piping should be sized so that it:

A. Is at least two pipe sizes smaller than the valve outlet to build back pressure

B. Matches the boiler feedwater line diameter regardless of valve size

C. Is no smaller than the valve outlet and adds minimal back pressure

D. Terminates inside the mechanical room for easy observation

2. When laying out a 45° offset using two fittings, the travel is related to the offset by which constant multiplier?

A. 1.155

B. 1.414

C. 2.000

D. 1.732

3. A pipefitter must join two sections of carbon steel pipe in a high-pressure steam line. Which joining method provides the highest-integrity permanent connection?

A. Butt-weld with full penetration

B. Threaded coupling with thread sealant

C. Grooved mechanical coupling

D. Slip-on flange with single fillet weld

4. Under CSA B51, the boiler and pressure vessel code, registration of a fitting design is primarily concerned with:

A. The aesthetic finish of the component

B. The installer's certification level

C. The colour coding of the piping system

D. The pressure-containing design and its safety

5. A hydrostatic test is being performed on a new piping system. The standard test pressure is typically specified as a multiple of the design pressure, commonly:

A. 1.5 times the design pressure

B. 0.5 times the design pressure

C. Exactly equal to the design pressure

D. 3.0 times the design pressure

6. Steam traps are installed on steam distribution systems primarily to:

A. Increase steam velocity through the main

B. Regulate the firing rate of the boiler

C. Reduce the steam pressure to the load

D. Remove condensate and air without losing live steam

7. A thermodynamic (disc) steam trap operates based on the difference in:

A. Electrical conductivity between phases

B. Magnetic permeability of the fluid

C. Velocity and pressure of flash steam versus condensate

D. Specific gravity of the condensate column

8. When brazing copper tube, the filler metal is drawn into the joint clearance primarily by:

A. Gravity feed from above the joint

B. Mechanical pressure from the torch tip

C. Electrostatic attraction to the flux

D. Capillary action between the surfaces

9. A pipefitter is commissioning a steam system and must confirm the pressure the system is designed to run at during normal service, as distinct from its peak relief setting. This value is referred to as the:

A. Bottom of pipe elevation

B. Branch outlet position

C. Basic operating pressure

D. Beginning of project datum

10. In a two-pipe hydronic system, the layout in which supply and return mains are routed so every terminal has an equal total circuit length—first-supplied is last-returned—is the reverse-return arrangement. This design is valued because it:

A. Requires no expansion compensation

B. Makes balancing harder because circuit lengths differ

C. Self-balances closely because circuit lengths are nearly equal

D. Eliminates the need for any flow control

11. The primary purpose of a dielectric union in a piping system is to:

A. Increase the flow coefficient of the joint

B. Separate dissimilar metals to limit galvanic corrosion

C. Provide a quick-disconnect for maintenance

D. Act as a pressure-reducing device

12. A steamfitter must calculate thermal expansion of a 30 m straight run of carbon steel pipe heated through 100°C. Using a coefficient of approximately 0.0000117 /°C, the expansion is closest to:

A. 3.5 mm

B. 1.2 mm

C. 35 mm

D. 350 mm

13. Which valve type is generally the best choice for throttling (regulating) flow rather than simple on/off service?

A. Gate valve

B. Knife valve

C. Globe valve

D. Full-port ball valve

14. On a P&ID, a plain circle with no line through it and an instrument tag inside typically represents a:

A. Pipe support location

B. Welded pipe joint

C. Field-mounted instrument

D. Equipment nameplate

15. A back-seating gate valve is fully open. Back-seating allows the operator to:

A. Throttle flow without stem wear

B. Increase the valve pressure rating

C. Reverse the direction of flow

D. Repack the stem under pressure safely

16. When fitting flanged joints, bolts should be tightened using a:

A. Single continuous clockwise sequence

B. Star (cross) pattern in stages

C. Outside-to-center spiral

D. Random order to save time

17. Schedule number in pipe specifications is fundamentally an indication of:

A. Wall thickness relative to pressure

B. The internal surface roughness

C. The pipe material grade only

D. The maximum flow rate allowed

18. A steamfitter installs a strainer ahead of a control valve. The strainer's main function is to:

A. Trap debris that could damage the valve

B. Reduce the system operating pressure

C. Add turbulence to improve mixing

D. Measure the flow rate of the fluid

19. Flash steam is generated when:

A. Cold water is sprayed into a steam main

B. Steam is superheated above saturation

C. Air binds the condensate return line

D. High-pressure condensate is released to a lower pressure

20. The Red Seal endorsement on a provincial trade certificate indicates that the holder:

A. Is licensed to design pressure vessels

B. Is exempt from provincial safety codes

C. Has supervisory authority over engineers

D. Has met an interprovincial standard of competency

21. A pipefitter must support a horizontal steam line to control sagging and allow movement. A roller-type support is chosen mainly because it:

A. Permits axial movement from thermal expansion

B. Prevents all movement in every direction

C. Acts as an anchor point for the run

D. Eliminates the need for a guide

22. When cutting and beveling pipe for welding, the bevel angle for a standard V-groove butt weld is most commonly about:

A. 37.5° per side (75° included)

B. 90° per side

C. 10° per side

D. 60° per side

23. A pressure-reducing valve (PRV) station on a steam line commonly includes a relief valve downstream because:

A. The relief valve increases downstream pressure

B. The PRV could fail open and over-pressurize the low side

C. Code prohibits PRVs without bypasses

D. The relief valve measures steam quality

24. Water hammer in a steam line is most directly caused by:

A. Excessive pipe insulation thickness

B. Slugs of condensate accelerated by steam flow

C. Oversized steam traps

D. Low steam temperature at startup

25. A pipefitter selects PTFE (Teflon) tape for sealing a threaded joint. The tape should be wrapped:

A. In the direction the threads turn in

B. Only on the last two threads

C. Against the thread direction so it loosens

D. Over the pipe end face only

26. The term "NPS" used in piping specifications stands for:

A. New Pipe Standard

B. Nominal Pipe Size

C. Net Pressure System

D. National Plumbing Spec

27. A globe valve installed for steam service should normally be oriented so that flow enters:

A. From either side; orientation does not matter

B. Through the bonnet cavity first

C. Against the bottom of the disc (under the seat)

D. In the reverse of the body arrow

28. When a steamfitter encounters an unfamiliar refrigerant or chemical on site, the first reference for safe handling should be the:

A. Equipment purchase invoice

B. Safety Data Sheet (SDS)

C. Manufacturer's advertising brochure

D. Local newspaper notice

29. In a steam heating system, a float and thermostatic (F&T) trap combines:

A. A bimetallic disc and an orifice plate

B. Two inverted buckets in series

C. A float for condensate and a thermostatic element for air

D. A solenoid and a check valve

30. A pipefitter must determine pipe wall thickness from an OD of 60.3 mm and an ID of 52.5 mm. The wall thickness is:

A. 7.8 mm

B. 3.9 mm

C. 5.2 mm

D. 1.95 mm

31. Expansion loops and expansion joints are installed in long steam mains to:

A. Increase the steam pressure along the run

B. Reduce the pipe diameter gradually

C. Absorb thermal growth and limit stress

D. Improve the appearance of the run

32. A check valve's primary function is to:

A. Throttle flow to a set rate

B. Prevent reverse flow in the line

C. Reduce pressure to the load

D. Relieve excess system pressure

33. When sizing a steam trap, the most important factor is the:

A. Colour of the trap body

B. Length of the discharge tailpiece only

C. Distance to the nearest valve

D. Condensate load and differential pressure

34. A pipefitter is asked to identify the "WP" stamped on a fitting. This designation refers to the:

A. Welder's personal stamp

B. Wrought pipe alloy number

C. Working pressure rating

D. Water pump connection

35. In oxy-acetylene welding, a carburizing (reducing) flame is characterized by:

A. A sharp hissing sound with no cone

B. A loud popping with a blue inner cone only

C. No visible flame at the tip

D. An excess of acetylene shown by a feather

36. A steamfitter must convert 150 psi to approximate kPa. The result is closest to:

A. 1034 kPa

B. 150 kPa

C. 2200 kPa

D. 21 kPa

37. The main reason for sloping (pitching) a steam main in the direction of flow is to:

A. Reduce friction losses to zero

B. Increase steam velocity at the outlet

C. Aid condensate drainage toward drip points

D. Prevent expansion of the pipe

38. A pipefitter selects a victaulic (grooved) coupling. The groove is formed on the pipe end by:

A. Roll grooving or cut grooving

B. Threading with a die

C. Brazing a ring on

D. Welding a collar

39. The function of an air vent on a hydronic system high point is to:

A. Remove trapped air that blocks circulation

B. Add fresh air to oxygenate the water

C. Increase the static head on the pump

D. Drain the system for service

40. A steamfitter reads "SCH 80" on a spec. Compared to SCH 40 of the same NPS, SCH 80 has:

A. A larger inside diameter

B. The same dimensions, different material

C. A lower pressure rating

D. A thicker wall and smaller bore

41. Cathodic protection of buried steel piping commonly uses sacrificial anodes made of:

A. Stainless steel

B. Lead

C. Copper

D. Magnesium or zinc

42. A two-stage pressure-reducing setup is used instead of a single stage when:

A. The fluid is incompressible water only

B. The pressure drop ratio is very large

C. There is no downstream load

D. The upstream pressure is below atmospheric

43. When a relief valve "simmers" before full lift, this refers to:

A. The valve body overheating dangerously

B. Permanent seat damage occurring

C. A slight leakage just below set pressure

D. The valve failing to ever open

44. A steamfitter installs a sight glass on a vessel to:

A. Magnify the pressure gauge reading

B. Visually indicate the liquid level

C. Filter particulates from the fluid

D. Reduce the operating temperature

45. The primary hazard addressed by a lockout/tagout (LOTO) procedure is:

A. Unexpected release of stored or live energy

B. Poor lighting in the work area

C. Excessive noise from equipment

D. Untidy storage of hand tools

46. A pipefitter must offset around an obstruction using a rolling offset. Solving a rolling offset requires first finding the:

A. Nominal pipe schedule

B. Flange bolt count

C. Material grade certificate

D. True offset from the two right-angle offsets

47. Superheated steam differs from saturated steam in that superheated steam:

A. Always contains entrained water droplets

B. Exists only below atmospheric pressure

C. Cannot be used for power generation

D. Is heated above its saturation temperature at a given pressure

48. When a thermostatic radiator trap fails closed, the most likely immediate symptom is:

A. Excessive steam blowing through the radiator

B. The radiator runs too hot continuously

C. The radiator stays cold due to trapped condensate

D. The boiler pressure drops to zero

49. A pipefitter must determine the centre-to-centre dimension between two screwed fittings. The "take-out" (fitting allowance) is:

A. The total length of the pipe stock

B. The pressure rating of the fitting

C. The amount the fitting adds beyond thread engagement

D. The weight of the assembled joint

50. A correctly sized inverted bucket steam trap discharges condensate:

A. Continuously as a steady stream always

B. Only when the system is shut down

C. Intermittently as the bucket loses buoyancy

D. Backward into the steam supply

51. The purpose of a vacuum breaker on a steam coil is to:

A. Prevent a vacuum that holds condensate and causes water hammer

B. Increase the operating vacuum for efficiency

C. Add steam pressure during low load

D. Vent live steam to atmosphere continuously

52. A steamfitter must verify pipe alignment before welding. Excessive "hi-lo" (mismatch) at the joint can lead to:

A. Reduced pipe weight

B. Stress concentration and weld defects

C. Lower fluid temperature

D. Increased wall thickness

53. A pressure gauge on a steam system reads in "psig." This means the reading is:

A. In absolute terms including atmospheric

B. In metric kilopascals only

C. A temperature equivalent

D. Gauge pressure, above atmospheric

54. When selecting hangers and supports, the maximum span between supports primarily depends on:

A. The colour of the insulation

B. The pipe size, material, and contents weight

C. The number of welders on site

D. The brand of the pipe

55. A steamfitter must purge a gas line before commissioning. Purging is done to:

A. Remove air or inert the line to prevent an explosive mixture

B. Increase the gas pressure rapidly

C. Add moisture to the line

D. Test the colour of the gas

56. The "saturation temperature" of steam at a given pressure is the temperature at which:

A. Steam superheats spontaneously

B. The pipe metal begins to melt

C. All condensate freezes

D. Water and steam coexist in equilibrium

57. A pipefitter uses a level and a transit to establish pipe grade. A grade of 1% means the pipe drops:

A. 1 unit of fall per 100 units of run

B. 1 unit of fall per 10 units of run

C. 10 units of fall per 100 units of run

D. 100 units of fall per unit of run

58. When two dissimilar pipe materials with different expansion rates are joined, the fitter must account for:

A. Identical thermal behaviour in both

B. No movement at the joint at all

C. Differential expansion stressing the connection

D. A reduction in total system pressure

59. A relief valve's set pressure must be:

A. Higher than the test pressure of the vessel

B. At or below the maximum allowable working pressure

C. Equal to atmospheric pressure

D. Twice the operating pressure always

60. A steamfitter encounters a "weld neck" flange. Its key advantage over a slip-on flange is:

A. It requires no welding at all

B. Better stress distribution and full-penetration weld

C. It is always cheaper to install

D. It cannot be used on high-pressure lines

61. Condensate return lines are often sized larger than expected because they must handle:

A. Only liquid water at low velocity

B. Pure superheated steam

C. A two-phase mix of flash steam and condensate

D. Compressed air exclusively

62. The primary reason to insulate steam piping is to:

A. Increase the pipe's pressure rating

B. Reduce heat loss and improve efficiency

C. Add structural strength to the pipe

D. Change the steam to a liquid faster

63. A pipefitter must identify the correct PPE for arc welding. Eye protection requires:

A. Clear safety glasses only

B. No eye protection if brief

C. Sunglasses rated UV

D. A welding helmet with a proper shade lens

64. When commissioning a hydronic system, "balancing" refers to:

A. Adjusting flow to each circuit for proper distribution

B. Levelling the boiler on its base

C. Equalizing the building's electrical load

D. Weighing the pipe supports

65. A steamfitter notes "ANSI Class 150" on a flange. This class number is primarily a:

A. Temperature in Celsius

B. Count of bolt holes

C. Pressure-temperature rating designation

D. Pipe diameter in millimetres

66. A safety valve differs from a relief valve in that a safety valve is designed to:

A. Open with a rapid full "pop" action for compressible fluids

B. Open gradually proportional to overpressure for liquids

C. Never reclose once opened

D. Only indicate pressure, not relieve it

67. A pipefitter calculates that a pump must overcome 20 m of head. Converting to approximate pressure, this equals about:

A. 20 kPa

B. 2 kPa

C. 196 kPa

D. 1960 kPa

68. When storing oxygen and acetylene cylinders, they must be:

A. Separated by distance or a barrier and stored upright

B. Laid horizontally and chained together

C. Stored in a sealed, unventilated locker

D. Kept beside open flame for warmth

69. A pipefitter must read an isometric drawing. Isometric drawings are used because they:

A. Show only the building floor plan

B. Eliminate the need for dimensions

C. Represent piping in 3D on a 2D sheet for clarity

D. Replace the need for a material list

70. A condensate pump (or condensate receiver set) is used when:

A. Steam pressure is too high to measure

B. Gravity drainage to the boiler is not possible

C. The system has no steam traps

D. The boiler runs on electricity only

71. The most appropriate test medium for a pneumatic pressure test, where hydrostatic is not feasible, is:

A. Live steam at full pressure

B. Liquid mercury

C. Clean dry air or inert gas, with extra safety precautions

D. Untreated seawater

72. A steamfitter selects a "Y-type" strainer over a "basket" strainer mainly for:

A. Filtering only gases

B. Compact installation in higher-pressure lines

C. Its larger debris-holding capacity always

D. Its ability to reduce pressure

73. When a globe valve is used in steam service, draining toward the seat helps:

A. Increase the flow coefficient permanently

B. Reverse the flow direction automatically

C. Prevent condensate pooling above the disc

D. Eliminate the need for a steam trap

74. A pipefitter notes that galvanized pipe should not be used for high-temperature steam because:

A. It is too expensive for any use

B. It cannot be threaded at all

C. The zinc coating can fail and release fumes at high temperature

D. It conducts electricity too well

75. Pipe expansion of 25 mm must be absorbed by an expansion joint. A bellows-type joint absorbs this through:

A. Threaded adjustment of the body

B. Flexing of its convoluted metal element

C. Sliding of a packed gland telescoping section

D. Rotation of a swivel elbow

76. A steamfitter must select gasket material for a 250°C steam flange. An appropriate choice is:

A. Spiral-wound or graphite-based gasket rated for the temperature

B. Standard rubber gasket

C. Plain paper gasket

D. Untreated cork sheet

77. When tying into an existing live system, the safest practice is to:

A. Cut into the line while pressurized to save time

B. Increase the pressure before cutting

C. Isolate, depressurize, drain, and verify zero energy first

D. Rely solely on a single closed valve without verification

78. A pipefitter reads "MAWP" on a vessel nameplate. This stands for:

A. Maximum Allowable Working Pressure

B. Minimum Average Water Pressure

C. Mean Annual Wall Penetration

D. Manual Air Withdrawal Procedure

79. The function of a desuperheater in a steam system is to:

A. Increase the steam superheat further

B. Reduce superheat by adding controlled water spray

C. Remove all condensate from the main

D. Boost the boiler firing rate

80. When a pipefitter performs a "dummy leg" support on an elbow, the purpose is to:

A. Support the line at a change of direction while allowing expansion

B. Block flow through the elbow

C. Act as a drain point only

D. Reduce the pipe diameter at the bend

81. A steamfitter must determine if a weld requires post-weld heat treatment (PWHT). This is typically governed by:

A. The colour of the electrode coating

B. The day of the week welded

C. Material type, thickness, and applicable code

D. The welder's personal preference

82. The primary purpose of a steam separator installed in a steam main is to:

A. Remove entrained moisture to improve steam quality

B. Add water to the steam intentionally

C. Increase the steam pressure

D. Reduce the pipe diameter

83. A pipefitter is told a valve is "fail-safe closed" (FC). On loss of actuator signal or air, the valve will:

A. Move to the fully closed position

B. Move to the fully open position

C. Lock in its last position

D. Begin to throttle automatically

84. When calculating friction loss in piping, increasing the pipe diameter while keeping flow constant will:

A. Increase the friction loss sharply

B. Have no effect on friction loss

C. Cause the fluid to reverse direction

D. Decrease the friction loss

85. A steamfitter must select a thermostatic air vent for a steam space. It operates by:

A. Opening to vent air when cool and closing on hot steam

B. Opening only when steam is present

C. Responding to line pressure only

D. Using an electric heater element

86. The "critical" angle that determines whether a steam trap can lift condensate against back pressure depends mainly on the:

A. Colour of the condensate

B. Differential pressure across the trap

C. Length of the steam main only

D. Number of flanges in the line

87. A pipefitter reads a spec calling for "socket weld" fittings. Socket weld joints are generally limited to:

A. Only plastic piping systems

B. The largest available pipe sizes

C. Smaller diameter, higher-pressure piping

D. Underground drainage only

88. When a steam system is first started after shutdown, warm-up should be done slowly to:

A. Save fuel during startup only

B. Increase the system pressure faster

C. Reduce the steam temperature permanently

D. Avoid thermal shock and water hammer

89. A pipefitter installs a pressure gauge with a "pigtail" (siphon) on a steam line to:

A. Increase the steam pressure to the gauge

B. Filter the steam before the gauge

C. Increase gauge response speed

D. Protect the gauge with a water seal from hot steam

90. The Bourdon tube inside a common pressure gauge works by:

A. Measuring electrical resistance change

B. Counting fluid pulses

C. Tending to straighten under internal pressure

D. Expanding a bimetallic strip

91. A steamfitter must select between schedule 40 and schedule 80 for a high-pressure application. The deciding factor is:

A. Which one is in stock that day

B. The required pressure rating and wall thickness

C. The colour of the end caps

D. The supplier's delivery schedule

92. When laying out a branch connection, a "weldolet" is used to:

A. Provide a reinforced welded branch outlet on a run pipe

B. Thread two pipes together

C. Cap the end of a header

D. Act as a removable plug

93. A pipefitter notices a steam trap is "blowing through" (passing live steam). The most likely cause is:

A. The trap is undersized for the load

B. The condensate line is oversized

C. A failed/stuck-open trap element

D. The steam pressure is too low to operate

94. Pipe threads on a tapered NPT joint seal because:

A. The threads are coated in epoxy at the factory

B. They are perfectly parallel and flat

C. The taper wedges the threads together as tightened

D. A rubber ring is moulded into the threads

95. A steamfitter must determine the volume of a cylindrical tank 2 m in diameter and 3 m tall. The volume is closest to:

A. 6 m^3

B. 18 m^3

C. 12 m^3

D. 9.4 m^3

96. When welding stainless steel pipe for a clean process line, back-purging with inert gas is done to:

A. Increase the weld bead width

B. Prevent oxidation (sugaring) on the inside of the weld

C. Speed up the welding travel

D. Reduce the electrode consumption

97. A pipefitter reads "FF" and "RF" on flange specs. "RF" stands for:

A. Raised Face

B. Reduced Flow

C. Reverse Flange

D. Female Fitting

98. The main role of a feedwater regulator on a steam boiler is to:

A. Maintain proper water level in the boiler drum

B. Control the steam outlet pressure

C. Adjust the burner air-fuel ratio

D. Vent flash steam to atmosphere

99. A steamfitter must select the correct fire extinguisher for an electrical fire. The appropriate class is:

A. Class A (ordinary combustibles)

B. Class K (cooking oils)

C. Class D (combustible metals)

D. Class C (energized electrical equipment)

100. When a pipe must penetrate a fire-rated wall, the steamfitter must install a:

A. Larger pipe to fill the gap

B. Standard pipe sleeve with no sealing

C. Decorative escutcheon ring only

D. Approved firestop assembly maintaining the rating

101. A pipefitter calculates pressure drop and finds velocity is too high in a steam main. Excessive steam velocity can cause:

A. Noise, erosion, and carryover of moisture

B. The steam to become colder than ambient

C. The pipe to gain wall thickness

D. The boiler to shut off automatically

102. The purpose of a "drip leg" (drip pocket) on a steam main is to:

A. Increase the steam pressure locally

B. Collect condensate for removal by a trap

C. Reduce the pipe diameter downstream

D. Vent live steam to the atmosphere

103. A steamfitter selects a butterfly valve for a large-diameter, low-pressure line mainly because it is:

A. The only valve rated for steam

B. Always the highest-pressure option

C. Incapable of throttling at all

D. Compact, lightweight, and economical for large sizes

104. When reading a welding procedure specification (WPS), the "essential variables" are those that:

A. If changed, require requalification of the procedure

B. Have no effect on weld quality

C. Only describe the paint colour

D. Apply only to brazing, not welding

105. A pipefitter must select a trap for a unit heater with a modulating steam supply. The best general choice is often a:

A. Simple manual valve cracked open

B. Float and thermostatic (F&T) trap

C. No trap at all

D. Open-ended pipe

106. A relief valve discharge that is piped to a safe location must be supported so that:

A. The valve carries the full weight of the discharge pipe

B. The pipe is sealed shut at the end

C. Reaction forces and pipe weight do not stress the valve

D. The discharge points back at the operator

107. A steamfitter must calculate the area of a 6-inch (150 mm) diameter pipe bore. Using $A = \pi r^2$, the area is closest to:

A. 7,850 mm^2

B. 450 mm^2

C. 900 mm^2

D. 17,700 mm^2

108. When a system uses a "primary-secondary" piping arrangement, the closely spaced tees serve to:

A. Hydraulically decouple the two loops

B. Increase the system pressure

C. Act as the main strainer

D. Replace the expansion tank

109. A pipefitter must identify a "blind flange." Its function is to:

A. Connect three pipes at one point

B. Reduce the pipe size at a joint

C. Close off the end of a piping run or vessel opening

D. Throttle the flow in the line

110. The main reason to use eccentric reducers (instead of concentric) on a horizontal pump suction line is to:

A. Increase the pump speed

B. Reduce the pipe pressure rating

C. Make the fitting cheaper

D. Prevent air pockets by keeping a flat top

111. A steamfitter encounters a "PRV pilot" line. The pilot in a pilot-operated relief valve serves to:

A. Sense system pressure and control the main valve opening

B. Carry the full relief flow alone

C. Heat the main valve body

D. Drain condensate from the line

112. When threading pipe with a die, cutting oil is applied to:

A. Speed up the rusting process

B. Increase the thread taper angle

C. Cool, lubricate, and improve thread quality

D. Permanently seal the threads

113. A pipefitter must ensure adequate "NPSH available" at a pump. NPSH relates to:

A. The pipe nominal schedule height

B. Preventing pump cavitation by ensuring sufficient suction pressure

C. The number of pump support hangers

D. The noise level of the pump motor

114. When commissioning a new steam main, blowing down (blowing out) the line before service is done to:

A. Pressurize the line permanently

B. Increase the steam temperature

C. Add scale to the interior

D. Remove construction debris and scale

115. A steamfitter selects "long radius" elbows over "short radius" where possible because long radius elbows:

A. Are always required by all codes

B. Cost less in every case

C. Reduce friction loss and turbulence

D. Cannot be used on steam

116. A pipefitter reads "DN50" on a European spec. DN50 corresponds approximately to:

A. NPS 2 (50 mm nominal)

B. NPS 6

C. NPS 1/2

D. NPS 12

117. The purpose of a "guide" on an expansion loop is to:

A. Direct thermal movement into the loop, not sideways

B. Anchor the pipe rigidly at that point

C. Drain condensate from the loop

D. Reduce the pipe pressure rating

118. A steamfitter encounters a "Hartford loop" on a steam boiler. Its purpose is to:

A. Prevent the boiler from losing water below a safe level if a return leaks

B. Increase the boiler firing rate

C. Superheat the outgoing steam

D. Filter the feedwater

119. When selecting valve packing for high-temperature steam, the material must:

A. Melt at operating temperature to seal

B. Be water-soluble for easy removal

C. Withstand the temperature without rapid degradation

D. Conduct electricity to ground the stem

120. A pipefitter calculates that a steam load requires 100 kg/h of condensate removal. The trap selected should have a capacity:

A. Exactly equal to 100 kg/h with no margin

B. Safely above the calculated load with a safety factor

C. Below the calculated load to save cost

D. Unrelated to the calculated load

121. The flat or raised machined surface on the end of a flange that contacts the gasket and seals against the mating flange is the:

A. Inlet flow passage

B. Stem housing

C. Flange face

D. Flow-direction indicator

122. A steamfitter must size a steam main for a given load. Larger steam mains than necessary will:

A. Always reduce installed cost

B. Increase steam velocity dangerously

C. Increase heat loss and standing condensate cost

D. Eliminate the need for traps

123. When a pressure vessel is fitted with a manway, its primary purpose is to:

A. Vent steam during operation

B. Act as the main relief device

C. Measure the internal pressure

D. Allow internal access for inspection and cleaning

124. A pipefitter must select a filler for joining aluminum components on an auxiliary line. Which electrode/filler designation indicates an aluminum filler suitable for that base metal?

A. E7018 low-hydrogen carbon steel rod

B. E6010 cellulosic carbon steel rod

C. ER4043 aluminum-silicon filler

D. ENiCrFe nickel-alloy rod

125. The "static head" on a hydronic pump refers to:

A. The friction loss in the longest run

B. The dynamic pressure from velocity

C. The vertical height of the water column in the system

D. The pump motor horsepower rating

126. A steamfitter must determine if a steam trap is failed by checking. A common non-invasive method is:

A. Ultrasonic and temperature testing of the trap

B. Cutting the trap open while in service

C. Removing the trap and weighing it

D. Painting the trap a different colour

127. When pipe must change elevation and direction simultaneously around an obstacle, the fitter uses a:

A. Straight coupling only

B. Rolling offset calculation

C. Single 90° elbow with no offset

D. Blind flange assembly

128. A steamfitter installs a "balanced-pressure" thermostatic trap. Its capsule fluid is chosen so it:

A. Freezes at operating temperature

B. Reacts only to magnetic fields

C. Responds to the steam saturation curve at varying pressures

D. Stays solid at all temperatures

129. When estimating material for a piping job, the "spool" refers to:

A. A reel of welding wire only

B. A prefabricated pipe section with fittings ready to install

C. The total project cost estimate

D. A type of pressure gauge

130. A pipefitter must verify that a relief valve has been tested and certified. The valve should carry:

A. A registration/certification stamp (e.g., National Board "V" or "UV")

B. No markings to keep it clean

C. Only the installer's initials

D. A decorative manufacturer's logo only

Practice Exam 7: Answer Key and Explanations

1. C — A relief valve discharge line must be no smaller than the valve outlet and impose minimal back pressure. Excess back pressure interferes with proper valve operation and lift, defeating the overpressure protection. Undersized discharge piping is a common code violation that compromises safety.

2. B — For a 45° offset, travel = offset × 1.414 (the constant for 45°, equal to 1/sin 45°). This is the most-used fitter constant because 45° fittings are standard stock. Memorizing it allows quick field layout without trigonometry.

3. A — A full-penetration butt-weld provides the highest-integrity permanent joint for high-pressure steam. It develops the full strength of the parent metal with no mechanical interface to leak or loosen. Threaded and grooved joints are limited to lower pressures and smaller sizes.

4. D — CSA B51 registration concerns the pressure-containing design and its safety. Designs are reviewed and registered (CRN) before fittings or vessels may be used, ensuring the component can safely contain its rated pressure. Installer certification and finish are separate matters.

5. A — Hydrostatic test pressure is commonly 1.5 times the design pressure. The elevated pressure proves integrity with a margin while water's incompressibility limits stored energy. This factor is standard across pressure-piping codes such as ASME B31.

6. D — Steam traps remove condensate and air while holding back live steam. This keeps the system efficient by draining water that causes water hammer and reduces heat transfer, without wasting energy through steam loss. It is the defining function of every trap type.

7. C — A thermodynamic disc trap operates on the velocity/pressure difference between fast-moving flash steam and slower condensate. High-velocity flash steam under the disc lowers pressure (Bernoulli effect) and snaps it shut; cooling condensate reopens it. This makes it simple and rugged with one moving part.

8. D — Brazing filler is drawn into the joint clearance by capillary action between closely fitted surfaces. Proper clearance (typically a few thousandths) is essential—too tight or too loose breaks capillary flow. This is why fit-up tolerance is critical in brazed copper joints.

9. C — The basic (normal) operating pressure is the pressure a system is designed to run at in routine service, below the relief set point. It defines steady-state conditions used for sizing traps, valves, and components. It is distinct from MAWP and from physical layout references like bottom-of-pipe elevation.

10. C — A reverse-return system routes piping so every terminal sees a nearly equal total circuit length, so the loop self-balances closely without extensive manual adjustment. Equal path lengths give roughly equal pressure drops across all terminals. This is the defining advantage over a direct-return layout, which has unequal lengths and is harder to balance.

11. B — A dielectric union separates dissimilar metals to limit galvanic corrosion. It places a non-conductive barrier between, for example, copper and steel, breaking the electrochemical cell that drives accelerated corrosion. Essential where copper tube meets steel equipment.

12. C — Expansion = $L \times \alpha \times \Delta T$ = 30,000 mm × 0.0000117 × 100 = 35.1 mm ≈ 35 mm. Carbon steel grows roughly 1 mm per metre per ~85°C, so a 30 m run through 100°C moves about 35 mm. This is why expansion compensation is mandatory on long hot runs.

13. C — A globe valve is best for throttling because its disc-and-seat geometry gives fine, stable flow control across the stroke. Gate and ball valves are on/off devices that erode when partially open. The globe's higher pressure drop is the trade-off for control.

14. C — A plain circle (no bar) with a tag inside is the ISA symbol for a field-mounted instrument located in the process area. A single horizontal bar through the circle indicates a main-panel/board-mounted instrument instead. Reading these symbols correctly is essential for locating instrumentation from the drawing.

15. D — Back-seating a fully open gate valve seals the stem against the bonnet, allowing the packing to be repacked safely under pressure. The back seat isolates system pressure from the stuffing box. It is a maintenance feature, not a throttling function.

16. B — Flange bolts are tightened in a star (cross) pattern in progressive stages. This seats the gasket evenly and prevents cocking the flange or crushing one side. Even, staged torque is essential for a leak-free joint.

17. A — Schedule number indicates wall thickness relative to the pressure the pipe can hold for a given size. Higher schedule means thicker wall and higher pressure capacity, with a correspondingly smaller bore. It is a pressure/thickness designation, not a flow rating.

18. A — A strainer ahead of a control valve traps debris that could score the seat or jam the trim. Protecting the precision valve internals preserves control accuracy and service life. It is purely a protective filtration device.

19. D — Flash steam forms when high-pressure condensate is released to a lower pressure and part of it re-evaporates. The hot water holds more energy than saturation allows at the lower pressure, so the excess flashes to vapor. Recovering this flash steam improves system efficiency.

20. D — The Red Seal endorsement signifies the holder has met an interprovincial standard of competency. It allows tradespeople to work across participating provinces and territories without re-examination. It certifies skill level, not design or supervisory authority.

21. A — A roller support permits axial movement caused by thermal expansion while still carrying the pipe weight. The pipe rolls freely as it grows and shrinks, preventing buckling and stress. Anchors and guides restrict movement; rollers allow it.

22. A — A standard V-groove butt weld uses about 37.5° per side, giving a 75° included groove angle. This provides adequate access for full root penetration and fill while limiting weld volume. It is the common bevel produced by pipe beveling machines.

23. B — A downstream relief valve protects against a PRV failing open and over-pressurizing the low-pressure side. If the reducing valve sticks open, the relief lifts to prevent damage to downstream equipment rated for the lower pressure. It is a required safety backup on PRV stations.

24. B — Water hammer occurs when slugs of condensate are accelerated by steam flow and slam into fittings or valves. The sudden deceleration of the dense water mass creates damaging pressure spikes. Proper drainage and slow warm-up prevent it.

25. A — PTFE tape is wrapped in the same direction the threads turn (clockwise viewed from the end) so it stays seated as the joint is made up. Wrapping the wrong way peels the tape off during assembly. Correct wrapping ensures the tape fills the thread spiral.

26. B — NPS stands for Nominal Pipe Size, a North American sizing standard. The nominal number is a size designation, not a precise dimension—actual OD is fixed while wall thickness varies with schedule. It allows consistent fitting compatibility.

27. C — A globe valve in steam service is normally installed so flow enters under the seat (against the bottom of the disc). This keeps the stem packing and bonnet on the low-pressure side when closed and aids draining. It follows the body flow arrow for proper performance.

28. B — The first reference for safely handling any unfamiliar chemical is its Safety Data Sheet (SDS). The SDS lists hazards, PPE, first aid, and handling/storage requirements in a standardized format. It is the authoritative source required to be on site.

29. C — A float and thermostatic trap pairs a float (for continuous condensate discharge) with a thermostatic element (for automatic air venting). The float handles varying condensate loads while the air vent prevents air binding on startup. This makes F&T traps ideal for modulating loads.

30. B — Wall thickness = (OD − ID) ÷ 2 = (60.3 − 52.5) ÷ 2 = 7.8 ÷ 2 = 3.9 mm. Wall thickness is always half the diameter difference because the wall exists on both sides of the bore. Here that gives 3.9 mm.

31. C — Expansion loops and joints absorb thermal growth and limit stress in long steam mains. By providing controlled flexibility, they prevent the pipe from buckling or overloading anchors and equipment. They are essential wherever significant length and temperature change combine.

32. B — A check valve prevents reverse flow, allowing fluid in one direction only. It protects pumps and equipment from backflow and keeps systems primed. It is an automatic, pressure-actuated device with no manual operation.

33. D — Steam trap sizing is governed primarily by the condensate load and the differential pressure across the trap. The trap must discharge the actual condensate rate at the available pressure difference. Undersizing causes backup; oversizing wastes steam and reduces reliability.

34. C — "WP" stamped on a fitting denotes its working pressure rating. This tells the fitter the maximum pressure the fitting may safely contain in service. Matching component ratings to system pressure is essential for safe assembly.

35. D — A carburizing flame shows an excess of acetylene, visible as a feathery "acetylene feather" around the inner cone. The fuel-rich mixture adds carbon and is used for specific processes like hardfacing. A neutral flame has a sharply defined cone with no feather.

36. A — 150 psi × 6.895 kPa/psi ≈ 1034 kPa. The conversion factor is roughly 6.9 kPa per psi, so 150 psi is just over 1000 kPa. Fitters use this to move between imperial gauges and metric specs.

37. C — Sloping a steam main in the direction of flow lets condensate drain toward drip points for removal. Gravity carries the water with the steam flow to where traps can discharge it, preventing accumulation and water hammer. Typical pitch is about 1 in 240 or steeper.

38. A — A grooved (Victaulic) coupling requires a groove formed by roll grooving or cut grooving on the pipe end. The coupling housing seats in the groove to provide mechanical restraint and a gasket seal. Roll grooving cold-forms the groove without removing metal.

39. A — An air vent at a hydronic high point removes trapped air that would otherwise block circulation. Air collects at high points and can air-bind the loop, stopping flow and heat transfer. Venting restores proper circulation.

40. D — For the same NPS, SCH 80 has a thicker wall and a smaller bore than SCH 40. Since OD is fixed by nominal size, added wall thickness reduces the inside diameter and raises the pressure rating. This is the basic schedule relationship.

41. D — Sacrificial anodes for steel are made of more active metals such as magnesium or zinc. Being more electronegative, they corrode preferentially and protect the steel cathodically. The anode is consumed instead of the protected structure.

42. B — Two-stage pressure reduction is used when the pressure drop ratio is very large. Splitting the reduction across two valves limits velocity, noise, and wear, and gives more stable control than forcing it through one stage. Each stage handles a manageable ratio.

43. C — "Simmering" is slight leakage just below a relief valve's set pressure as the disc nears lift. It indicates the valve is approaching set point, not full discharge. Persistent simmer can erode the seat over time.

44. B — A sight glass visually indicates the liquid level in a vessel. The transparent column shows the same level as the vessel interior, letting operators confirm water level at a glance. It is a direct, simple level indicator.

45. A — Lockout/tagout addresses the unexpected release of stored or live energy during service. Isolating and securing energy sources prevents machinery from starting or pressure/electricity from discharging onto workers. It is a fundamental safety procedure.

46. D — Solving a rolling offset begins with finding the true offset from the two right-angle (vertical and horizontal) offsets, using the Pythagorean theorem. The true offset is the hypotenuse, which then sets the travel and fitting angles. Without it the layout cannot be computed.

47. D — Superheated steam is heated above its saturation temperature at the given pressure, containing no liquid water. The added heat raises temperature beyond the boiling point for that pressure, which is valuable for power generation and long-distance transport. It carries more usable energy.

48. C — When a thermostatic radiator trap fails closed, condensate backs up and the radiator stays cold. Trapped condensate fills the heating element, blocking steam and stopping heat output. A trap failed open does the opposite—blowing steam through.

49. C — "Take-out" (fitting allowance) is the amount a fitting adds to the assembly beyond the thread engagement, used to find centre-to-centre cut lengths. Subtracting take-outs from the centre-to-centre dimension gives the end-to-end pipe length to cut. It is essential for accurate fabrication.

50. C — An inverted bucket trap discharges intermittently as the bucket loses buoyancy. When condensate fills around the bucket it sinks, opening the valve; live steam refills and floats it, closing again. This cyclic action is normal for the type.

51. A — A vacuum breaker prevents a vacuum that would hold condensate in a steam coil and cause water hammer. When steam condenses and pressure drops below atmospheric, the breaker admits air so condensate can drain freely. This protects the coil and improves drainage.

52. B — Excessive hi-lo (internal misalignment) at a weld joint creates stress concentration and weld defects. The mismatch causes uneven fusion and a notch effect that can initiate cracks under load. Proper alignment within tolerance is required for sound welds.

53. D — "psig" means gauge pressure—pressure above atmospheric, with the gauge reading zero at atmospheric. Absolute pressure (psia) adds atmospheric pressure to the gauge value. Most field gauges read in psig.

54. B — Maximum support span depends on pipe size, material, and the weight of contents (and insulation). Heavier or larger filled pipe needs closer supports to limit sag and stress. Code tables set spans based on these factors.

55. A — Purging a gas line removes air (or inerts the line) to prevent a flammable air-fuel mixture during commissioning. Displacing the explosive range with inert gas or fuel gas eliminates the ignition hazard. It is a critical safety step before service.

56. D — Saturation temperature is the temperature at which water and steam coexist in equilibrium at a given pressure. At this point, adding heat makes more steam without raising temperature until all liquid is vaporized. It rises with pressure.

57. A — A 1% grade means 1 unit of fall per 100 units of run. Grade is expressed as the ratio of vertical drop to horizontal distance as a percentage. This sets condensate or drainage slope precisely.

58. C — Joining materials with different expansion rates means the fitter must account for differential expansion stressing the connection. As temperature changes, the two metals grow by different amounts, loading the joint. Flexibility or proper joint design is needed to accommodate it.

59. B — A relief valve's set pressure must be at or below the maximum allowable working pressure (MAWP) of the protected equipment. This guarantees the valve relieves before the vessel is overstressed. Setting it above MAWP would defeat the protection.

60. B — A weld neck flange offers better stress distribution and a full-penetration butt weld at its tapered hub. The gradual transition reduces stress concentration, making it preferred for high-pressure and cyclic service. Slip-on flanges use fillet welds and are limited to lower duty.

61. C — Condensate return lines are sized larger to handle a two-phase mixture of flash steam and condensate. As condensate drops in pressure it flashes, greatly increasing volume and requiring more pipe area. Undersized returns cause backpressure and waterlogging.

62. B — Insulating steam piping reduces heat loss and improves system efficiency. Less heat radiated to surroundings means lower fuel use, less condensate formation, and safer surface temperatures. It does not change the pipe's structural or pressure rating.

63. D — Arc welding requires a welding helmet with a proper shade lens to protect against intense UV/IR radiation and arc flash. The correct shade prevents "arc eye" and retinal damage. Clear glasses or sunglasses are inadequate for the arc's intensity.

64. A — Balancing a hydronic system means adjusting flow to each circuit so all terminals get their proper distribution. Without balancing, near circuits get too much flow and far ones too little. Balancing valves set the design flow at each branch.

65. C — ANSI/ASME Class 150 is a pressure-temperature rating designation for flanges. The class defines the allowable pressure at given temperatures, decreasing as temperature rises. It is not a bolt count or a dimension.

66. A — A safety valve is designed to open with a rapid full "pop" action for compressible fluids like steam and gas. The snap action quickly relieves the expanding gas; relief valves open gradually for incompressible liquids. The distinction reflects fluid behavior.

67. C — 20 m of water head × ~9.81 kPa/m ≈ 196 kPa. Each metre of water column equals about 9.81 kPa, so 20 m gives roughly 196 kPa. This converts pump head to pressure for selection.

68. A — Oxygen and acetylene cylinders must be separated by distance or a fire-rated barrier and stored upright. Separation prevents a leak from creating an explosive mixture, and upright storage keeps acetylene's acetone stable. This is a standard compressed-gas safety rule.

69. C — Isometric drawings represent piping in three dimensions on a 2D sheet for clarity. They show the true routing, fittings, and dimensions without the distortion of plan/elevation views, making fabrication and erection easier. They complement, not replace, material lists.

70. B — A condensate pump or receiver set is used when gravity drainage back to the boiler is not possible. The set collects condensate and pumps it to the boiler or deaerator against pressure or elevation. It maintains return when gravity alone won't do it.

71. C — Where hydrostatic testing is not feasible, the test medium is clean dry air or inert gas, with added safety precautions. Because compressed gas stores large energy, exclusion zones and careful procedures are required. It is used only when liquid testing is impractical.

72. B — A Y-type strainer suits compact installation in higher-pressure lines, including steam. Its inline angled body is strong and space-efficient, though it holds less debris than a basket type. It is the common choice for steam and high-pressure service.

73. C — In steam service a globe valve oriented to drain toward the seat prevents condensate from pooling above the disc. This reduces water accumulation that could cause hammer or corrosion. Correct orientation supports proper drainage.

74. C — Galvanized pipe is avoided for high-temperature steam because the zinc coating can fail and release toxic fumes at elevated temperature. Zinc also flakes and contaminates the system above its stable range. Bare or appropriate alloy pipe is used instead.

75. B — A bellows-type expansion joint absorbs movement through flexing of its convoluted (corrugated) metal element. The accordion-like bellows compresses and extends to take up thermal growth without leaking. It needs proper anchoring and guiding to function.

76. A — For a 250°C steam flange, a spiral-wound or graphite-based gasket rated for the temperature is appropriate. These materials maintain sealing under high temperature and pressure where rubber, paper, or cork would fail. Gasket selection must match service conditions.

77. C — The safest practice when tying into a live system is to isolate, depressurize, drain, and verify zero energy first. Confirming the line is truly de-energized prevents burns, releases, and injury. Relying on one unverified valve is unsafe.

78. A — MAWP stands for Maximum Allowable Working Pressure, the highest pressure a vessel may safely operate at. It is set by design and stamped on the nameplate, and relief devices are set at or below it. It is a fundamental safety limit.

79. B — A desuperheater reduces superheat by injecting a controlled water spray into the steam. The water evaporates and absorbs heat, bringing steam temperature closer to saturation for processes needing lower superheat. It is a temperature-control device.

80. A — A dummy leg supports the line at a change of direction (typically off an elbow) while still allowing expansion movement. It carries the load without rigidly anchoring the pipe, accommodating thermal growth. It is common on hot expanding lines.

81. C — Whether post-weld heat treatment is required is governed by material type, thickness, and the applicable code. PWHT relieves residual stress and tempers the heat-affected zone where code thresholds are exceeded. It is a code-driven requirement, not discretionary.

82. A — A steam separator removes entrained moisture to improve steam quality. Internal baffles or cyclonic action fling water droplets out of the flow, delivering drier steam for better heat transfer and reduced erosion. Drier steam protects downstream equipment.

83. A — A "fail-safe closed" (FC) valve moves to the fully closed position on loss of actuator signal or air. The actuator spring drives it closed so the process defaults to a safe shut state. Fail-open (FO) does the reverse.

84. D — Increasing pipe diameter at constant flow decreases friction loss because velocity drops and friction varies strongly with velocity. Larger bore means lower velocity and far less pressure loss per unit length. This is why upsizing reduces pumping cost.

85. A — A thermostatic air vent opens to vent air when cool and closes when hot steam reaches it. The temperature-sensitive element expands on contact with steam, sealing against steam loss while purging cooler air. This prevents air binding on startup.

86. B — A trap's ability to lift condensate against back pressure depends mainly on the differential pressure across it. The pressure difference provides the energy to push condensate up and out; insufficient differential means it cannot lift. Sizing must account for back pressure.

87. C — Socket weld fittings are generally limited to smaller-diameter, higher-pressure piping. The pipe inserts into the fitting socket and is fillet welded, which suits small bore but is impractical for large sizes. They offer strength without precise alignment of butt welds.

88. D — Slow warm-up after shutdown avoids thermal shock and water hammer. Gradual heating lets condensate drain and components expand evenly, preventing cracked fittings and slug impacts. Rushing startup is a common cause of damage.

89. D — A pigtail (siphon) on a steam gauge protects it with a water seal that keeps live steam off the Bourdon element. The trapped condensate buffers the hot steam, preventing overheating and extending gauge life. It is standard on steam pressure gauges.

90. C — A Bourdon tube tends to straighten under internal pressure, and this movement drives the gauge pointer. The curved flattened tube uncurls proportionally to pressure, giving a mechanical reading. It is the most common pressure-sensing element.

91. B — Choosing between schedule 40 and 80 is decided by the required pressure rating and wall thickness. The application's pressure and temperature dictate the minimum wall, and the schedule is selected to meet it with margin. Availability and cost are secondary to safety.

92. A — A weldolet provides a reinforced welded branch outlet on a run pipe. Its contoured base and built-up body reinforce the opening, allowing a strong branch connection without a tee. It is used for branch takeoffs on headers.

93. C — A trap "blowing through" live steam is most likely caused by a failed or stuck-open trap element. Worn or jammed internals can no longer close against steam, wasting energy continuously. It is a common failure mode requiring trap replacement.

94. C — NPT tapered threads seal because the taper wedges the threads tightly together as the joint is tightened. The interference along the taper, aided by sealant, forms a pressure-tight metal-to-metal seal. Parallel threads alone would not seal this way.

95. D — Volume = $\pi r^2 h = \pi \times 1^2 \times 3 \approx 9.42$ m³. With a 2 m diameter the radius is 1 m, so area is π m² and volume is about 9.4 m³. This is the standard cylinder volume calculation.

96. B — Back-purging stainless steel welds with inert gas prevents oxidation ("sugaring") on the inside of the weld. Shielding the root from oxygen preserves corrosion resistance and a clean bore, critical for process lines. Without it the back side oxidizes and degrades.

97. A — "RF" on a flange spec stands for Raised Face. The raised sealing surface concentrates gasket load for a better seal and is the most common flange face type. "FF" (flat face) mates full-faced, typically with cast-iron equipment.

98. A — A feedwater regulator maintains the proper water level in the boiler drum. It admits feedwater to match steaming rate, protecting against low-water (dangerous) and high-water (carryover) conditions. Stable level is essential for safe boiler operation.

99. D — A Class C extinguisher is correct for energized electrical equipment. Its non-conductive agent safely interrupts electrical fires without shock risk to the operator. Once power is removed the fire may be treated as Class A.

100. D — A pipe penetrating a fire-rated wall requires an approved firestop assembly that maintains the wall's rating. The firestop seals the annular space against fire and smoke passage. A bare sleeve or escutcheon does not preserve the rating.

101. A — Excessive steam velocity causes noise, erosion, and carryover of moisture. High velocity scours pipe and fittings and entrains water droplets, damaging equipment and reducing steam quality. Proper sizing keeps velocity within safe limits.

102. B — A drip leg collects condensate from a steam main so a trap can remove it. The enlarged pocket lets water drop out of the fast steam flow into the trap below. It prevents condensate buildup and water hammer.

103. D — A butterfly valve is chosen for large-diameter, low-pressure lines because it is compact, lightweight, and economical in big sizes. Its simple disc-in-body design saves space and cost versus gate or globe valves. It also offers reasonable throttling at large diameters.

104. A — On a WPS, "essential variables" are those that, if changed beyond limits, require requalification of the procedure. They are factors (like material, thickness, preheat, process) that affect weld mechanical properties. Changing them invalidates the qualification.

105. B — A float and thermostatic (F&T) trap is the best general choice for a unit heater with modulating steam. It handles varying condensate loads continuously and vents air on startup, matching the changing pressure of modulating service. This prevents waterlogging at low loads.

106. C — A relief valve discharge line must be supported so reaction forces and pipe weight do not stress the valve. Independent support and drip-pan elbows isolate the valve from loads and discharge thrust. This keeps the valve functioning correctly and safely.

107. D — Area = $\pi r^2 = \pi \times 75^2 \approx 17{,}671$ mm² ≈ 17,700 mm². With a 150 mm diameter the radius is 75 mm, giving roughly 17,700 mm². This is the bore cross-sectional area.

108. A — Closely spaced tees in a primary-secondary arrangement hydraulically decouple the two loops. The minimal pressure drop between the tees prevents one loop's pump from driving flow in the other. This lets loops operate independently.

109. C — A blind flange closes off the end of a piping run or a vessel opening. It bolts to a mating flange to seal the end while allowing future access. It is removable, unlike a welded cap.

110. D — Eccentric reducers on a horizontal pump suction line are installed flat-side-up to prevent air pockets. Keeping the top flat avoids a high spot where air collects and starves the pump. This protects against cavitation and loss of prime.

111. A — In a pilot-operated relief valve, the pilot senses system pressure and controls the main valve's opening. The small pilot uses system pressure to hold the main valve shut until set point, then vents to open it. This gives tight, accurate relief at high capacity.

112. C — Cutting oil during pipe threading cools, lubricates, and improves thread quality. It reduces friction and heat that would tear threads and dull the die, producing clean, sealable threads. Proper lubrication extends tool life.

113. B — NPSH (net positive suction head) relates to preventing pump cavitation by ensuring sufficient suction pressure. Available NPSH must exceed the pump's required NPSH or the liquid flashes to vapor and damages the impeller. It governs suction-side design.

114. D — Blowing down a new steam main before service removes construction debris and scale. Purging loose material prevents it from fouling traps, valves, and equipment downstream. It is a standard commissioning step.

115. C — Long radius elbows reduce friction loss and turbulence compared with short radius. The gentler bend lets flow change direction with less resistance and erosion. They are preferred wherever space allows.

116. A — DN50 corresponds approximately to NPS 2 (50 mm nominal). DN (diamètre nominal) is the metric equivalent of NPS, with DN50 ≈ 2-inch pipe. Knowing the equivalence lets fitters read both standards.

117. A — A guide on an expansion loop directs thermal movement into the loop rather than sideways. By restraining lateral motion while allowing axial growth, it forces the pipe to expand into the loop's flexibility. Proper guiding is essential for the loop to work.

118. A — A Hartford loop prevents the boiler from losing water below a safe level if a return line leaks. By connecting the equalizer near the normal water line, it stops siphoning the boiler dry through a broken return. It is a classic low-water safeguard on steam boilers.

119. C — High-temperature steam valve packing must withstand the temperature without rapid degradation. Materials like graphite resist heat and maintain a stem seal where lower-grade packing would burn out. Correct packing selection prevents stem leaks.

120. B — A steam trap should be sized with capacity safely above the calculated load, applying a safety factor. The margin handles startup loads and pressure variation so the trap never backs up condensate. Common factors are around 2–3 times running load.

121. C — The flange face is the machined sealing surface (flat or raised) that bears on the gasket to seal against the mating flange. Its finish and type—RF or FF—must match the gasket and adjoining flange. The bonnet, by contrast, houses the stem on a valve and is unrelated to flange sealing.

122. C — Oversizing a steam main increases heat loss and standing condensate cost. More surface area radiates more heat and holds more condensate, raising fuel use and warm-up losses. Correct sizing balances velocity against these losses.

123. D — A manway allows internal access to a pressure vessel for inspection and cleaning. It provides a sealable opening for personnel to enter and service the interior. It is not a relief, venting, or measuring device.

124. C — ER4043 is an aluminum-silicon filler used to weld aluminum base metals, making it the correct choice for an aluminum line. E7018 and E6010 are carbon-steel electrodes, and ENiCrFe is a nickel-alloy filler—none suit aluminum. Matching filler chemistry to base metal is essential for a sound, corrosion-resistant weld.

125. C — Static head is the vertical height of the water column in the system. It is the pressure the pump must overcome due to elevation, independent of flow. It is distinct from friction (dynamic) head.

126. A — A common non-invasive trap check is ultrasonic and temperature testing. Listening for flow patterns and comparing inlet/outlet temperatures reveals whether the trap is passing steam, blocked, or working. It avoids removing the trap from service.

127. B — When pipe changes elevation and direction at once around an obstacle, the fitter uses a rolling offset calculation. It resolves the combined vertical and horizontal offset into a true offset and travel. This determines the fitting angles and pipe length.

128. C — A balanced-pressure thermostatic trap uses a capsule fluid that responds to the steam saturation curve at varying pressures. The fill boils slightly below steam temperature at any pressure, so the trap self-adjusts its discharge point. This makes it versatile across pressures.

129. B — A "spool" is a prefabricated pipe section with fittings, ready to install. Shop fabrication of spools improves quality and speeds field erection. It is a fundamental unit of piping fabrication and estimating.

130. A — A certified relief valve carries a registration/certification stamp such as the National Board "V" or "UV" mark. The stamp proves the valve was built and tested to code. Fitters must verify it before installation.