

PRACTICE TEST 5: AIRCRAFT WELDING

Instructions: Select the best answer for each question. Each question is based on the Airframe Mechanic Certification Standards

1. The fuel gas used in oxyacetylene welding is:
 - A. Propane
 - B. Acetylene
 - C. Hydrogen
 - D. Natural gas
2. Oxygen cylinders are typically pressurized to approximately:
 - A. 500 psi
 - B. 1000 psi
 - C. 3000 psi
 - D. 2200 psi
3. Acetylene cylinders contain:
 - A. Acetone-soaked porous material absorbing acetylene
 - B. Liquid acetylene
 - C. Compressed gas only
 - D. Solid acetylene
4. The maximum safe working pressure for acetylene is:
 - A. 5 psi
 - B. 50 psi
 - C. 15 psi
 - D. 100 psi
5. Oxygen regulators function to:
 - A. Increase pressure
 - B. Reduce cylinder pressure to usable working pressure
 - C. Maintain 2200 psi
 - D. Measure temperature
6. A neutral flame has:
 - A. Equal proportions of oxygen and acetylene
 - B. Excess oxygen

- C. Excess acetylene
 - D. No oxygen
7. A carburizing flame is characterized by:
- A. Excess oxygen
 - B. Equal gas mixture
 - C. No fuel gas
 - D. Excess acetylene with feather beyond inner cone
8. An oxidizing flame features:
- A. Excess acetylene
 - B. Neutral mixture
 - C. Excess oxygen with shorter, pointed inner cone
 - D. No inner cone
9. For mild steel welding, the proper flame is:
- A. Neutral flame
 - B. Highly carburizing
 - C. Strongly oxidizing
 - D. Slightly oxidizing
10. The hottest part of the oxyacetylene flame is the:
- A. Outer envelope
 - B. Inner cone at approximately 6300°F
 - C. Feather
 - D. Tip
11. Backfire in welding is:
- A. Normal operation
 - B. Flame burning inside torch continuously
 - C. Oxygen leak
 - D. Momentary flame extinction with popping sound
12. Flashback occurs when:
- A. Flame is properly adjusted
 - B. Metal is too hot
 - C. Flame burns back into torch or hoses
 - D. Tip is too large
13. Flashback prevention requires:
- A. Higher gas pressure
 - B. Flashback arrestors and proper procedures
 - C. Larger tips
 - D. Removing regulators

14. Forehand welding technique:
- A. Points torch in direction of travel
 - B. Points torch backward
 - C. Uses no filler rod
 - D. Points torch away from weld
15. Backhand welding technique:
- A. Points torch forward only
 - B. Never used on steel
 - C. Points torch toward completed weld, better penetration
 - D. Requires no skill
16. Mild steel welding rod typically contains:
- A. Aluminum
 - B. Pure copper
 - C. Zinc coating
 - D. Carbon and manganese for strength
17. Gas welding rod diameter should be approximately:
- A. Equal to base metal thickness
 - B. Twice base metal thickness
 - C. Half base metal thickness
 - D. Random selection
18. SMAW stands for:
- A. Simple Manual Arc Welding
 - B. Shielded Metal Arc Welding (stick welding)
 - C. Standard Metal Alloy Welding
 - D. Surface Metal Application Welding
19. Arc welding uses:
- A. Alternating current only
 - B. Direct current only
 - C. AC or DC depending on application
 - D. No electrical current
20. DCEP (electrode positive) provides:
- A. Shallow penetration
 - B. No penetration
 - C. Surface cleaning only
 - D. Deep penetration, preferred for most applications
21. DCEN (electrode negative) provides:
- A. Maximum penetration

- B. Shallow penetration, good for thin materials
 - C. No arc
 - D. Highest heat input
22. Arc length in SMAW should be approximately:
- A. Very long, 2 inches
 - B. As short as possible touching work
 - C. Equal to electrode core diameter
 - D. Random distance
23. GTAW stands for:
- A. Gas Tungsten Arc Welding (TIG)
 - B. Gas Transfer Arc Welding
 - C. General Tungsten Arc Welding
 - D. Ground Terminal Arc Welding
24. TIG welding uses what type of electrode?
- A. Consumable steel rod
 - B. Aluminum wire
 - C. Copper electrode
 - D. Non-consumable tungsten electrode
25. TIG welding shielding gas is typically:
- A. Oxygen
 - B. Carbon dioxide
 - C. Argon or helium
 - D. Acetylene
26. TIG welding is preferred for:
- A. Thick steel only
 - B. Precision welding of thin materials and aluminum
 - C. Rough welds
 - D. Underwater welding
27. MIG welding stands for:
- A. Manual Inert Gas welding
 - B. Molten Iron Gas welding
 - C. Multiple Input Gas welding
 - D. Metal Inert Gas welding (GMAW)
28. MIG welding uses:
- A. Consumable wire electrode fed continuously
 - B. Non-consumable electrode

- C. No electrode
- D. Tungsten only

29. The flat welding position is:
- A. Most difficult position
 - B. Easiest position with weld from above
 - C. Overhead position
 - D. Vertical position
30. Overhead welding position is:
- A. Easiest position
 - B. Same as flat position
 - C. Most difficult requiring skill to prevent sagging
 - D. Not used in aircraft
31. Vertical welding is typically done:
- A. Downhill for structural welds
 - B. Horizontally only
 - C. Never used
 - D. Uphill for better penetration on structural welds
32. Horizontal welding refers to:
- A. Weld axis horizontal on vertical surface
 - B. Flat position
 - C. Overhead position
 - D. No specific position
33. Butt joints join materials:
- A. Overlapping each other
 - B. At right angles
 - C. Edge to edge in same plane
 - D. With spacing greater than 1 inch
34. Lap joints have materials:
- A. Edge to edge
 - B. Overlapping with fillet weld
 - C. At acute angles
 - D. Not touching
35. Tee joints join materials:
- A. At approximately 90 degrees forming T-shape
 - B. Edge to edge
 - C. Overlapping
 - D. Parallel

36. Corner joints connect:
- A. Three materials in triangle
 - B. Materials in straight line
 - C. Overlapping materials
 - D. Two materials at edges forming L-shape
37. Edge joints weld:
- A. Materials at right angles
 - B. Materials overlapping
 - C. Parallel edges of two materials
 - D. Non-touching materials
38. Root opening in a butt joint is:
- A. Separation between materials allowing penetration
 - B. Final weld width
 - C. Depth of weld
 - D. Joint length
39. Bevel angle for welding grooves is typically:
- A. 90 degrees
 - B. 30–37.5 degrees per side
 - C. 10 degrees
 - D. 180 degrees
40. Root face is:
- A. Surface of finished weld
 - B. Top bead surface
 - C. Outside edge of joint
 - D. Small land at joint root before bevel starts
41. Chrome-moly steel 4130 contains approximately:
- A. 1% chromium, 0.3% molybdenum, 0.3% carbon
 - B. 4% carbon, 1% chromium
 - C. No alloying elements
 - D. 40% chromium
42. 4130 steel is used in aircraft for:
- A. Non-structural components only
 - B. Skin only
 - C. Engine mount tubes and structural tubing
 - D. Electrical components
43. Welding 4130 steel requires:
- A. No special considerations

- B. Preheat and post-weld heat treatment consideration
- C. Underwater welding
- D. No filler metal

44. Normalizing 4130 steel involves heating to:

- A. 200°F
- B. 3000°F
- C. 500°F only
- D. 1600–1700°F then air cooling

45. Welding round steel tubing requires:

- A. No rotation
- B. Welding only one side
- C. Rotating tube for consistent puddle control
- D. No filler metal

46. Rosette welding is used for:

- A. Joining outer sleeve to inner tube through holes
- B. Decorative purposes
- C. Surface coating
- D. Non-structural repairs

47. Rosette weld holes should be:

- A. 1/4 inch diameter
- B. 3 inches diameter
- C. Not drilled
- D. 3/4 to 1 inch diameter, spaced 1.5–2 inches apart

48. Tube cluster welding sequence should:

- A. Weld all tubes completely first
- B. Use stepped sequence to control distortion and stress
- C. Random sequence
- D. Weld one tube fully first

49. Inner sleeve splices for steel tubing require sleeve length of:

- A. 1 inch
- B. Equal to tube diameter
- C. Four to six times tube outer diameter
- D. Random length

50. Outer sleeve splices use sleeve length of:

- A. Four to six times tube diameter
- B. Two times tube diameter

- C. Equal to tube diameter
- D. One inch only

51. Landing gear tube dent repair by welding:

- A. Is never allowed
- B. Uses aluminum filler
- C. Requires tube replacement always
- D. Fills dent with weld metal if within limits

52. Crack in steel tube welded structure:

- A. Can be ignored
- B. Requires evaluation, often requires replacement
- C. Always repairable by welding
- D. Self-healing

53. 30-degree fishmouth tube end provides:

- A. Proper fit for tube-to-tube cluster joints
- B. No benefit
- C. Weaker joint
- D. Decorative appearance

54. Excessive welding heat causes:

- A. Stronger welds
- B. No effect
- C. Distortion, grain growth, and weakening
- D. Better appearance

55. Tack welds in steel tubing:

- A. Are final welds
- B. Weaken joints
- C. Are not used
- D. Hold alignment before final welding

56. Complete penetration in butt welds means:

- A. Partial fusion
- B. Weld metal fuses through entire joint thickness
- C. Surface fusion only
- D. No fusion

57. Fillet weld size is measured by:

- A. Length only
- B. Weight
- C. Leg length of largest inscribed triangle
- D. Color

58. Undercutting in welds is:
- A. Groove melted into base metal at weld toe, weakens joint
 - B. Desirable condition
 - C. Extra metal deposited
 - D. Normal finish
59. Overlap in welding occurs when:
- A. Perfect fusion achieved
 - B. Penetration is complete
 - C. Joint is strong
 - D. Weld metal lays on surface without fusing
60. Porosity in welds appears as:
- A. Smooth surface
 - B. Gas pockets or voids weakening weld
 - C. Extra metal
 - D. Perfect fusion
61. Incomplete fusion means:
- A. Weld metal not fusing with base metal or previous passes
 - B. Perfect weld
 - C. Complete penetration
 - D. Strong joint
62. Excessive reinforcement creates:
- A. Optimal strength
 - B. Perfect profile
 - C. Stress concentration points and added weight
 - D. Improved appearance
63. Slag inclusions are:
- A. Desirable additions
 - B. Strengthening particles
 - C. Flux residue on surface only
 - D. Non-metallic material trapped in weld metal
64. Cracks in welds are:
- A. Acceptable in low-stress areas
 - B. Most serious defect requiring rejection
 - C. Cosmetic issues only
 - D. Self-healing
65. Hot cracks form:
- A. After cooling completely

- B. Only in cold weather
- C. During solidification at high temperature
- D. Never in steel

66. Cold cracks develop:

- A. After cooling, often from hydrogen embrittlement
- B. During welding
- C. Only at high temperatures
- D. Are impossible

67. Crater cracks occur:

- A. In middle of weld
- B. At weld end from rapid cooling of crater
- C. Only in aluminum
- D. Never happen

68. Visual weld inspection checks for:

- A. Internal defects only
- B. Color only
- C. Weight
- D. Surface defects, profile, uniform appearance, cracks

69. Dye penetrant inspection detects:

- A. Surface-breaking cracks through capillary action
- B. Internal defects only
- C. Subsurface flaws
- D. Magnetic properties

70. Magnetic particle inspection works on:

- A. All materials
- B. Aluminum only
- C. Ferromagnetic materials like steel
- D. Non-metals

71. Radiographic inspection uses:

- A. Sound waves
- B. Visual light only
- C. Magnetic fields
- D. X-rays or gamma rays to detect internal defects

72. Ultrasonic testing uses:

- A. X-rays
- B. High-frequency sound waves for internal defect detection

- C. Visible light
- D. Heat

73. Destructive weld testing includes:

- A. Breaking test samples to evaluate strength and quality
- B. Visual inspection only
- C. Non-destructive methods
- D. Color matching

74. Nick-break test:

- A. Leaves weld intact
- B. Measures hardness
- C. Notches and breaks weld to examine internal quality
- D. Tests color

75. Tensile test on welds measures:

- A. Color
- B. Hardness
- C. Conductivity
- D. Ultimate strength by pulling to failure

76. Bend tests evaluate:

- A. Color only
- B. Weld ductility and fusion quality by bending
- C. Weight
- D. Magnetic properties

77. Welding safety requires:

- A. No protection
- B. Sunglasses only
- C. Proper PPE including helmet, gloves, protective clothing
- D. No precautions

78. Welding helmet shade number for arc welding should be:

- A. #10–14 depending on current
- B. Always #2
- C. Not important
- D. Always #4

79. Welding in confined spaces requires:

- A. No special precautions
- B. Sealed environment
- C. No oxygen
- D. Adequate ventilation and monitoring for fumes

80. Welding fumes can contain:
- A. Only harmless gases
 - B. Toxic metal particles requiring ventilation
 - C. Pure oxygen
 - D. No harmful substances
81. Fire watch during welding:
- A. Monitors for fires for at least 30 minutes after welding
 - B. Is unnecessary
 - C. Only needed indoors
 - D. Is decorative
82. Compressed gas cylinders must be:
- A. Stored lying down
 - B. Left unsecured
 - C. Secured upright with caps when not in use
 - D. Stored in sunlight
83. Oxygen cylinder valves should be opened:
- A. Quickly all the way
 - B. With torch lit
 - C. Never opened
 - D. Slowly, standing to side of regulator
84. Acetylene hoses are typically:
- A. Green colored
 - B. Red colored
 - C. Blue colored
 - D. Yellow colored
85. Oxygen hoses are typically:
- A. Red colored
 - B. Black colored
 - C. Green colored
 - D. Yellow colored
86. Reverse polarity in DC welding means:
- A. Electrode is positive (DCEP)
 - B. No current flows
 - C. Electrode is negative (DCEN)
 - D. AC current used
87. Straight polarity in DC welding means:
- A. Electrode is positive (DCEP)

- B. AC current
- C. No polarity
- D. Electrode is negative (DCEN)

88. Preheating steel before welding:

- A. Weakens metal
- B. Reduces cracking risk and improves fusion
- C. Is never done
- D. Prevents welding

89. Post-weld heat treatment on 4130:

- A. May be required for stress relief or normalization
- B. Is always required
- C. Is prohibited
- D. Has no effect

90. Interpass temperature refers to:

- A. Final cooling temperature
- B. Preheat temperature only
- C. Temperature maintained between weld passes
- D. Room temperature

91. Peening welds involves:

- A. Painting the weld
- B. Grinding smooth
- C. Inspection only
- D. Hammering weld to relieve stress (limited use)

92. Weld spatter is:

- A. Desired finish
- B. Metal droplets expelled during welding, should be minimized
- C. Strengthening feature
- D. Required pattern

93. Weld throat in fillet welds is:

- A. Weld width
- B. Weld length
- C. Shortest distance from root to face
- D. Surface appearance

94. Stringer beads are:

- A. Narrow beads with little to no weaving
- B. Wide weave patterns

- C. Never used
- D. Surface coatings only

95. Weave beads use:

- A. No electrode movement
- B. Only vertical movement
- C. Circular motion only
- D. Side-to-side motion to cover wider area

96. Multi-pass welding:

- A. Weakens joints
- B. Builds thick welds with multiple layers for strength
- C. Is not allowed
- D. Uses one pass only

97. Root pass in welding is:

- A. First pass at joint root providing penetration
- B. Final weld pass
- C. Surface coating
- D. Not important

98. Purge gas on backside of welds:

- A. Contaminates weld
- B. Is never used
- C. Prevents oxidation on root side during welding
- D. Causes porosity

99. Tungsten contamination in TIG welding:

- A. Strengthens welds
- B. Is desirable
- C. Improves appearance
- D. Tungsten particles in weld causing inclusions

100. Welding procedure specifications (WPS) provide:

- A. No guidance
- B. Detailed parameters for qualified welding procedures
- C. Random suggestions
- D. Decorative information

Practice Test 5: Answer Explanations

- 1. B. Acetylene** Oxyacetylene welding uses acetylene as fuel gas combined with oxygen producing flame temperatures up to 6300°F suitable for welding steel and other metals.
- 2. D. 2200 psi** Oxygen cylinders are typically pressurized to approximately 2200 psi when full at 70°F. Pressure varies with temperature according to gas laws.
- 3. A. Acetone-soaked porous material absorbing acetylene** Acetylene cylinders contain porous filler material saturated with acetone that absorbs acetylene safely preventing dangerous decomposition that occurs with compressed acetylene above 15 psi.
- 4. C. 15 psi** Maximum safe working pressure for acetylene is 15 psi. Above this pressure acetylene becomes unstable and can spontaneously decompose explosively even without oxygen.
- 5. B. Reduce cylinder pressure to usable working pressure** Oxygen regulators reduce high cylinder pressure (2200 psi) to usable working pressures (typically 5-50 psi) required for welding operations providing controlled gas flow.
- 6. A. Equal proportions of oxygen and acetylene** Neutral flame has approximately equal volumes of oxygen and acetylene producing inner cone with no feather or pointed appearance, ideal for welding most steels.
- 7. D. Excess acetylene with feather beyond inner cone** Carburizing (reducing) flame has excess acetylene producing white feather extending beyond inner cone. Adds carbon to weld used for specific applications like cast iron.
- 8. C. Excess oxygen with shorter, pointed inner cone** Oxidizing flame has excess oxygen creating shorter pointed hissing inner cone. Causes oxidation generally undesirable for welding except specific applications like brass.
- 9. A. Neutral flame** Mild steel welding requires neutral flame providing proper heat without adding carbon (carburizing) or oxygen (oxidizing) that would alter weld metal properties.
- 10. B. Inner cone at approximately 6300°F** Inner cone of oxyacetylene flame is hottest part at approximately 6300°F where primary combustion occurs. This high temperature melts steel for welding.
- 11. D. Momentary flame extinction with popping sound** Backfire is momentary flame extinction with distinctive pop caused by touching work, overheating tip, or obstructed tip. Flame usually reignites immediately.
- 12. C. Flame burns back into torch or hoses** Flashback is dangerous condition where flame burns back into torch or hoses causing sustained burning inside equipment. Requires immediate valve closure and equipment inspection.

13. B. Flashback arrestors and proper procedures Flashback prevention uses flashback arrestors (check valves preventing reverse flow), proper gas pressures, clean equipment, and correct operational procedures including lighting sequence.

14. A. Points torch in direction of travel Forehand welding technique points torch in direction of travel with filler rod between torch and completed weld. Provides good visibility and control.

15. C. Points torch toward completed weld, better penetration Backhand welding technique points torch back toward completed weld with rod ahead. Provides deeper penetration and narrower higher weld bead.

16. D. Carbon and manganese for strength Mild steel welding rod contains carbon and manganese providing strength and deoxidizing properties matching base metal composition for compatible welds.

17. A. Equal to base metal thickness Gas welding rod diameter typically equals base metal thickness for optimal heat balance and filler metal deposition rate matching welding speed.

18. B. Shielded Metal Arc Welding (stick welding) SMAW (Shielded Metal Arc Welding) is stick welding using consumable flux-coated electrode providing arc shielding and slag formation protecting molten weld.

19. C. AC or DC depending on application Arc welding uses AC (alternating current) or DC (direct current) depending on material, electrode type, and application requirements. DC provides more control.

20. D. Deep penetration, preferred for most applications DCEP (Direct Current Electrode Positive/reverse polarity) concentrates heat at workpiece providing deep penetration preferred for most steel welding applications.

21. B. Shallow penetration, good for thin materials DCEN (Direct Current Electrode Negative/straight polarity) concentrates heat at electrode providing shallow penetration suitable for thin materials and surfacing applications.

22. C. Equal to electrode core diameter Arc length in SMAW should approximate electrode core wire diameter. Too long causes unstable arc and porosity; too short causes sticking.

23. A. Gas Tungsten Arc Welding (TIG) GTAW (Gas Tungsten Arc Welding) commonly called TIG (Tungsten Inert Gas) uses non-consumable tungsten electrode with inert gas shielding for precision welds.

24. D. Non-consumable tungsten electrode TIG welding uses non-consumable tungsten electrode maintaining arc while separate filler rod adds metal. Tungsten's high melting point (6170°F) prevents electrode consumption.

25. C. Argon or helium TIG welding uses inert shielding gases argon or helium (or mixtures) protecting molten weld from atmospheric contamination without reacting with weld metal.

26. B. Precision welding of thin materials and aluminum TIG welding preferred for precision work on thin materials, aluminum, stainless steel, and exotic alloys requiring clean high-quality welds with excellent control.

27. D. Metal Inert Gas welding (GMAW) MIG (Metal Inert Gas) welding technically GMAW (Gas Metal Arc Welding) uses consumable wire electrode with inert or active gas shielding.

28. A. Consumable wire electrode fed continuously MIG welding uses consumable wire electrode fed continuously through gun melting to become weld metal. Provides high deposition rates for production welding.

29. B. Easiest position with weld from above Flat welding position is easiest welding from above with gravity assisting puddle control, providing highest deposition rates and easiest learning curve.

30. C. Most difficult requiring skill to prevent sagging Overhead welding position is most difficult working against gravity requiring skill preventing molten metal from sagging or falling, demanding proper technique and smaller electrodes.

31. D. Uphill for better penetration on structural welds Vertical welding typically proceeds uphill for structural welds providing better penetration and fusion. Downhill welding faster but less penetration used for sheet metal.

32. A. Weld axis horizontal on vertical surface Horizontal welding has weld axis horizontal on vertical surface. Gravity tends to pull molten metal downward requiring proper technique maintaining weld profile.

33. C. Edge to edge in same plane Butt joints join materials edge-to-edge in same plane. Most common joint requiring groove preparation (beveling) for thick materials achieving full penetration.

34. B. Overlapping with fillet weld Lap joints have materials overlapping with fillet welds along overlapped edges. Simple joint but lower strength efficiency than properly made butt joints.

35. A. At approximately 90 degrees forming T-shape Tee joints join materials at approximately 90 degrees forming T-configuration. Typically use fillet welds on one or both sides depending on loading.

36. D. Two materials at edges forming L-shape Corner joints connect two materials at edges forming L-shaped configuration. May use fillet welds outside, inside, or both depending on requirements.

37. C. Parallel edges of two materials Edge joints weld parallel edges of sheet materials together typically used on thin materials where edges are turned up and melted together.

38. A. Separation between materials allowing penetration Root opening is gap between materials in butt joints allowing welding electrode to reach joint root ensuring complete penetration through joint thickness.

39. B. 30-37.5 degrees per side Bevel angle for groove welds typically 30-37.5 degrees per side (60-75 degrees total included angle) providing electrode access for complete fusion throughout joint depth.

40. D. Small land at joint root before bevel starts Root face is small flat land at joint bottom before bevel begins preventing burn-through while allowing penetration. Typically 1/16 inch for manual welding.

41. A. 1% chromium, 0.3% molybdenum, 0.3% carbon 4130 chrome-moly steel contains approximately 1% chromium, 0.3% molybdenum, 0.3% carbon. Alloying elements provide high strength-to-weight ratio for aircraft structures.

42. C. Engine mount tubes and structural tubing 4130 steel used extensively in aircraft for engine mount tubes, landing gear components, and welded tubular structures requiring high strength with reasonable weight.

43. B. Preheat and post-weld heat treatment consideration Welding 4130 steel requires consideration of preheat (reducing cooling rate) and possible post-weld heat treatment (normalizing or stress relieving) preventing cracking and brittleness.

44. D. 1600-1700°F then air cooling Normalizing 4130 steel involves heating to 1600-1700°F (above transformation temperature) holding briefly then air cooling. Refines grain structure and relieves welding stresses.

45. C. Rotating tube for consistent puddle control Welding round tubing requires rotating tube (or welder position) maintaining consistent puddle position near flat ensuring uniform bead quality around entire circumference.

46. A. Joining outer sleeve to inner tube through holes Rosette welding joins outer sleeve to inner tube by welding through holes drilled in outer member creating plug welds securing sleeve without full-length seam weld.

47. D. 3/4 to 1 inch diameter, spaced 1.5-2 inches apart Rosette weld holes typically 3/4 to 1 inch diameter spaced 1.5-2 inches apart around circumference providing adequate joining strength without excessive heat input.

48. B. Use stepped sequence to control distortion and stress Tube cluster welding uses stepped sequence welding portions of multiple tubes before completing any single tube controlling distortion and residual stresses from uneven heating.

49. C. Four to six times tube outer diameter Inner sleeve splices require sleeve length four to six times tube outer diameter ensuring adequate load transfer through rosette welds without stress concentration.

50. A. Four to six times tube diameter Outer sleeve splices also use sleeve length four to six times tube diameter welded at both ends with proper fishmouth preparation for full-penetration welds.

51. D. Fills dent with weld metal if within limits Landing gear tube dents within specified limits (typically depth less than 10% tube diameter) may be filled by welding after proper preparation restoring original contour.

52. B. Requires evaluation, often requires replacement Cracks in steel tube structures require careful evaluation. Many cracks indicate overstress or fatigue requiring tube replacement rather than attempted welding repair.

53. A. Proper fit for tube-to-tube cluster joints 30-degree fishmouth tube end cut matches round tube surface curvature providing proper fit for cluster joints maximizing weld contact area and joint strength.

54. C. Distortion, grain growth, and weakening Excessive welding heat causes distortion from thermal expansion, grain growth reducing strength and toughness, and possible metallurgical changes weakening material.

55. D. Hold alignment before final welding Tack welds are small temporary welds holding parts in proper alignment during fit-up and final welding. Should be incorporated into final weld or removed.

56. B. Weld metal fuses through entire joint thickness Complete penetration means weld metal fully fuses through joint thickness from top to bottom essential for structural butt joints carrying significant loads.

57. C. Leg length of largest inscribed triangle Fillet weld size measured by leg length of largest isosceles right triangle that can be inscribed within weld cross-section representing theoretical throat dimension.

58. A. Groove melted into base metal at weld toe, weakens joint Undercutting is groove melted into base metal at weld toe creating stress concentration and reducing load-carrying cross-section seriously weakening joint.

59. D. Weld metal lays on surface without fusing Overlap (cold lap) occurs when weld metal flows onto base metal surface without fusing creating inclusion line and stress concentration weakening joint.

60. B. Gas pockets or voids weakening weld Porosity consists of gas pockets or voids in weld metal from entrapped gases (hydrogen, nitrogen, oxygen) or moisture reducing weld strength and ductility.

61. A. Weld metal not fusing with base metal or previous passes Incomplete fusion means weld metal failed to fuse completely with base metal or previous weld passes creating weak planes within joint structure.

62. C. Stress concentration points and added weight Excessive reinforcement (high crown) creates stress concentrations at weld toes, adds unnecessary weight, and may indicate incomplete penetration compensating with height.

63. D. Non-metallic material trapped in weld metal Slag inclusions are non-metallic materials (typically from electrode flux) trapped in weld metal creating weak spots and potential crack initiation sites.

64. B. Most serious defect requiring rejection Cracks are most serious weld defect acting as stress concentrators leading to catastrophic failure. Any crack typically requires weld rejection and removal.

65. C. During solidification at high temperature Hot cracks form during solidification while weld metal still at elevated temperature typically from excessive restraint, high sulfur/phosphorus content, or improper filler selection.

66. A. After cooling, often from hydrogen embrittlement Cold cracks develop after weld cools often hours or days later typically from hydrogen embrittlement in hardenable steels without adequate preheat or low-hydrogen processes.

67. B. At weld end from rapid cooling of crater Crater cracks occur at weld termination where crater solidifies rapidly often forming star-shaped cracks. Prevented by properly filling crater before breaking arc.

68. D. Surface defects, profile, uniform appearance, cracks Visual weld inspection examines surface defects, weld profile and dimensions, uniform appearance, cracks, porosity, undercut, and overall workmanship quality.

69. A. Surface-breaking cracks through capillary action Dye penetrant inspection detects surface-breaking defects by applying liquid penetrant entering cracks through capillary action then using developer to reveal indications.

70. C. Ferromagnetic materials like steel Magnetic particle inspection works only on ferromagnetic materials (steel, iron, nickel) by applying magnetic field and iron particles that collect at flux leakage from defects.

71. D. X-rays or gamma rays to detect internal defects Radiographic inspection uses penetrating X-rays or gamma rays creating images on film or digital detectors revealing internal defects like porosity and incomplete penetration.

72. B. High-frequency sound waves for internal defect detection Ultrasonic testing uses high-frequency sound waves (0.5-25 MHz) transmitted through material detecting internal defects from reflections at discontinuities and boundaries.

73. A. Breaking test samples to evaluate strength and quality Destructive weld testing includes breaking, bending, or sectioning test samples to directly evaluate weld strength, ductility, penetration, and internal quality.

74. C. Notches and breaks weld to examine internal quality Nick-break test notches weld faces then breaks specimen revealing weld cross-section for examination of penetration, porosity, fusion, and slag inclusions.

75. D. Ultimate strength by pulling to failure Tensile test measures ultimate tensile strength of welded joint by applying increasing tensile load until failure determining if weld meets strength requirements.

76. B. Weld ductility and fusion quality by bending Bend tests evaluate weld ductility and fusion quality by bending specimen (face, root, or side bend) to specified angle examining for cracks indicating poor quality.

77. C. Proper PPE including helmet, gloves, protective clothing Welding safety requires proper personal protective equipment including welding helmet with appropriate shade, leather gloves, protective clothing covering skin, and safety shoes.

78. A. #10-14 depending on current Welding helmet shade number should be #10-14 for arc welding depending on amperage and process. Higher currents require darker shades protecting against arc radiation.

79. D. Adequate ventilation and monitoring for fumes Welding in confined spaces requires adequate ventilation removing toxic fumes, atmospheric monitoring ensuring adequate oxygen and absence of hazardous gases, and rescue procedures.

80. B. Toxic metal particles requiring ventilation Welding fumes contain toxic metal particles (manganese, chromium, nickel) and gases (ozone, nitrogen oxides) requiring adequate ventilation and respiratory protection when necessary.

81. A. Monitors for fires for at least 30 minutes after welding Fire watch monitors welding area for fires or smoldering materials for minimum 30 minutes after welding completion with fire extinguisher ready for immediate response.

82. C. Secured upright with caps when not in use Compressed gas cylinders must be secured upright with valve protection caps when not connected preventing falling and valve damage that could release high-pressure gas.

83. D. Slowly, standing to side of regulator Oxygen cylinder valves should be opened slowly while standing to side of regulator preventing injury if regulator fails from sudden high-pressure surge.

84. B. Red colored Acetylene hoses are red colored for easy identification preventing dangerous connection errors. Red indicates fuel gas; green indicates oxygen.

85. C. Green colored Oxygen hoses are green colored distinguishing them from fuel gas hoses. Color coding prevents mixing connections that could cause fires or explosions.

86. A. Electrode is positive (DCEP) Reverse polarity in DC welding means electrode connected to positive terminal (DCEP/DCRP) concentrating heat at workpiece providing deep penetration.

87. D. Electrode is negative (DCEN) Straight polarity in DC welding means electrode connected to negative terminal (DCEN/DCSP) concentrating heat at electrode providing shallow penetration.

88. B. Reduces cracking risk and improves fusion Preheating steel before welding reduces cooling rate lowering cracking risk from rapid quenching, reducing residual stresses, and improving fusion by reducing base metal heat sink effect.

89. A. May be required for stress relief or normalization Post-weld heat treatment on 4130 may be required depending on application, thickness, and cooling rate. Normalizing refines structure; stress relieving reduces residual stresses.

90. C. Temperature maintained between weld passes Interpass temperature is temperature maintained between successive weld passes in multi-pass welding controlled to prevent excessive cooling or overheating affecting weld quality.

91. D. Hammering weld to relieve stress (limited use) Peening involves hammering weld metal while hot to relieve stresses and refine grain structure. Limited application; can cause cracking or work hardening if done improperly.

92. B. Metal droplets expelled during welding, should be minimized Weld spatter consists of metal droplets expelled during welding landing on surrounding surfaces. Should be minimized through proper parameters and technique; indicates inefficiency.

93. C. Shortest distance from root to face Weld throat in fillet welds is shortest distance from joint root to weld face representing effective load-carrying dimension for strength calculations.

94. A. Narrow beads with little to no weaving Stringer beads are narrow weld beads deposited with minimal or no electrode weaving providing good penetration and control often used for root passes.

95. D. Side-to-side motion to cover wider area Weave beads use side-to-side electrode oscillation covering wider area than stringer beads used for fill and cover passes building weld width and height.

96. B. Builds thick welds with multiple layers for strength Multi-pass welding builds thick welds using multiple weld passes (layers) allowing thicker joints while controlling heat input, distortion, and maintaining material properties.

97. A. First pass at joint root providing penetration Root pass is first weld pass at joint root establishing complete penetration through joint critical for strength. Subsequent passes build reinforcement.

98. C. Prevents oxidation on root side during welding Purge gas (typically argon) on weld backside prevents oxidation on root surface during welding essential for stainless steel, titanium, and aluminum maintaining corrosion resistance.

99. D. Tungsten particles in weld causing inclusions Tungsten contamination occurs when tungsten electrode contacts molten weld pool depositing tungsten particles creating dense inclusions visible on radiographs and weakening weld.

100. B. Detailed parameters for qualified welding procedures Welding Procedure Specifications (WPS) provide detailed qualified parameters including materials, filler metals, joint design, welding positions, currents, voltages, travel speeds, and techniques ensuring consistent quality.