PRACTICE EXAM 3: STRUCTURAL STEEL IRONWORKER SIMULATION (100 QUESTIONS)

This practice exam contains 100 questions covering all domains of the NCCER Industrial Ironworker assessment (IRON30_03). Select the single best answer for each question. A minimum score of 75 percent (75 correct) is required to pass. A basic non-printing calculator is permitted. Allow no more than 2 hours to simulate test conditions.

1. A wire rope that has developed a birdcage distortion — where the outer strands spread outward and the inner core protrudes — has experienced which condition, and what is the required action?

A. The rope has been exposed to corrosive chemicals and requires immediate re-lubrication before use

B. The rope has been subjected to sudden removal of a load or a sharp unloading shock; it must be removed from service immediately

C. The rope has experienced normal break-in wear and must be re-socketed at both ends before continued use

D. The rope is overloaded and the outer strands can be re-set by hydraulic press before return to service

2. A master link (oblong link or pear-shaped ring) at the top of a multi-leg sling assembly serves which primary purpose?

A. To equalize the load across all sling legs and provide a single connection point to the crane hook that can accept loads from multiple directions

B. To act as a swivel connection that allows the sling assembly to rotate freely under load without affecting the rated capacity

C. To identify the sling assembly’s working load limit, which is stamped on the master link body

D. To prevent the sling legs from tangling during the pre-lift inspection and initial load pickup

3. A sling angle factor table shows that the tension factor increases significantly as the sling angle decreases. If a sling has a rated capacity of 10,000 pounds in a vertical hitch, and the sling angle from horizontal is 30 degrees, what is the tension factor applied to the sling, compared to a vertical hitch?

A. 0.5 — the tension is reduced to half the vertical capacity at 30 degrees

B. 1.0 — the tension equals the vertical hitch capacity at 30 degrees

C. 2.0 — the tension is doubled compared to the vertical capacity at 30 degrees

D. 1.5 — the tension is 50 percent greater than the vertical capacity at 30 degrees

4. A 6×19 IWRC EIPS wire rope sling has a minimum recommended D/d ratio of 26:1 for maintaining full rated capacity. If the sling has a 1/2-inch diameter, what is the minimum recommended sheave or pin DIAMETER for the supporting surface?

A. 8 in

B. 10 in

C. 11 in

D. 13 in

5. During pre-use inspection of a crane hook, what permanent deformation of the hook throat opening indicates removal from service?

A. Any measurable opening greater than 3 percent beyond the original throat dimension, per ASME B30.10

B. Any crack, gouge, or surface pitting visible to the naked eye in the hook bowl or at the throat

C. A discoloration of the steel indicating heat exposure above 300 degrees Fahrenheit

D. Wear exceeding 10 percent of the hook’s original cross-sectional dimension at the point of wear

6. A synthetic web sling is found to have been stored near a steam pipe, and the sling surface shows heat discoloration. The manufacturer’s rated operating temperature for the sling is 180°F. What action is required?

A. Allow the sling to cool to ambient temperature and inspect visually before returning to service

B. Remove the sling from service and consult the manufacturer’s heat exposure guidance; heat-affected synthetic slings cannot be reliably assessed by visual inspection alone

C. Reduce the sling’s rated capacity by 25 percent for temperatures up to 200°F and use it for light-duty lifts only

D. Inspect the load-bearing eyes for fraying; if the eyes are intact, the sling can return to full rated service

7. During a multi-leg bridle lift, the load’s center of gravity is offset to one side rather than centered between the attachment points. What effect does this have on the sling leg tensions?

A. All sling legs carry equal tension regardless of load center of gravity offset, provided all legs are attached to the same master link

B. The sling leg directly above the center of gravity carries the least tension of all the legs

C. Sling leg tensions in multi-leg bridles are governed by the hook load only and do not change with CG position

D. The sling leg(s) closest to the center of gravity carry proportionally more tension than the legs farther from it, creating unequal loads in the individual sling legs

8. A crane hoist drum brake is required to hold the load at any point in its travel without the operator holding the controls. What is the minimum holding requirement for a crane hoist brake, per ASME B30.2?

A. The brake must hold 100 percent of the maximum rated load at any suspended position without slipping

B. The brake must hold 125 percent of the maximum rated load at any suspended position without slipping

C. The brake must hold 150 percent of the maximum rated load at any suspended position without slipping

D. The brake must hold 75 percent of the maximum rated load; the operator holds the remaining 25 percent through the control

9. When wire rope clips are installed on a wire rope end termination, what minimum 'tail' length of the dead-end rope must extend past the last clip?

A. One rope diameter past the last clip, to prevent the last clip from sliding off the end

B. Two rope diameters past the last clip, as required by ASME B30.9

C. Three rope diameters past the last clip, to allow for any clip retightening

D. Six inches of tail regardless of rope diameter, per the standard installation requirement

10. Wire rope in regular lay has its outer wires twisted in the opposite direction from the strand twist. In lang lay, the outer wires and strands twist in the same direction. Which lay type is more resistant to abrasion and untwisting under load?

A. Regular lay, because the opposing wire direction provides more surface contact points with sheaves

B. Lang lay, because more wire surface is exposed to wear on each wire, distributing abrasion over a larger area and resisting untwisting

C. Both lay types resist abrasion equally because the wire grade, not the lay direction, governs abrasion resistance

D. Regular lay, because the opposing directions create a self-tightening effect that prevents untwisting

11. A block sheave groove is found to be worn so the groove diameter is larger than the wire rope diameter. Why does an oversized sheave groove reduce wire rope service life?

A. An oversized groove allows the rope to slip during loading, which generates heat that degrades the rope core

B. An oversized groove changes the fleet angle, causing the rope to enter the drum at an angle that induces kinking

C. An oversized groove allows the rope to seat too deeply, causing the rope to be pinched rather than supported uniformly, concentrating crushing stress on fewer wires

D. An oversized groove reduces the effective wrap angle on the drum, decreasing braking friction in the drum brake

12. After a wire rope sling assembly is subjected to a shock load that is subsequently controlled without damage to the rigging, what must be done before the sling is returned to service?

A. The sling must be removed from service and inspected by a qualified person before any further use, regardless of apparent condition

B. The sling may be returned to service after visual inspection if no broken wires or distortions are found

C. The sling may be returned to service after re-lubrication, because shock loads primarily damage rope lubrication

D. The sling must be proof-tested at 150 percent of its rated capacity by a certified testing laboratory

13. A lifting magnet is classified as a below-the-hook lifting device per ASME B30.20. What is the primary limitation that the ironworker must consider when using a permanent lifting magnet to hoist structural steel?

A. Permanent lifting magnets must be stored at a minimum distance of 10 feet from electronic instruments

B. Lifting magnet capacity is rated for clean, flat, fully saturated contact; surface irregularities, mill scale, rust, paint, and curved surfaces can significantly reduce the actual holding force below the rated capacity

C. Lifting magnets may only be used for loads below 1,000 pounds because stronger magnets require crane-specific certification

D. Lifting magnets must be re-magnetized after each use at a specialized service center to maintain rated holding force

14. A reeving system on a crane has a fleet angle that is too large. What effect does an excessive fleet angle have on the wire rope?

A. A large fleet angle reduces the mechanical advantage of the block-and-tackle system by adding friction in the sheaves

B. A large fleet angle causes the crane’s rated capacity to decrease proportionally with the angle

C. Large fleet angle causes the rope to rub against the sheave groove side wall rather than track cleanly, accelerating rope and sheave wear

D. A large fleet angle increases the tension in the rope beyond the block’s rated capacity for multi-part line systems

15. A gin pole (timber or steel mast with a block at the top) is used during structural steel erection for which application?

A. As a permanent structural support for long-span roof members in industrial buildings

B. As a temporary formwork support that holds beams in position while connections are made

C. As a fixed survey instrument mounting point for theodolites during column plumbing operations

D. Used to hoist material when a crane cannot access a specific location, using the building frame itself as the anchor point

16. Wire rope used on a crane drum must be inspected periodically for broken wires. Per ASME B30.2, how many broken wires in one lay length of wire rope require removal from service for hoist ropes?

A. Six or more broken wires in one lay length, or three or more in one strand

B. Four or more broken wires in one lay length

C. Two or more broken wires in one lay length

D. Ten or more broken wires in one lay length

17. A structural tee section designated WT5×22.5 is 15 feet long. What is the total weight of this member?

A. 337.5 lb

B. 312.0 lb

C. 360.0 lb

D. 405.0 lb

18. As the sling angle from horizontal decreases below 60 degrees, the sling tension relative to the hook load increases rapidly. At which sling angle does the tension in each leg of a two-leg bridle equal the total hook load?

A. 45 degrees from horizontal

B. 60 degrees from horizontal

C. 15 degrees from horizontal

D. 30 degrees from horizontal

19. Preformed wire rope, compared to unpreformed wire rope, differs in which important practical characteristic?

A. Preformed wire rope is manufactured with a larger core diameter, increasing its rated capacity by 15 percent

B. Preformed wire rope uses swaged end terminations rather than socketed terminations at both ends

C. Preformed wire rope has strands and wires shaped into their helical position before being laid; it does not spring apart when cut and is less prone to kinking during handling

D. Preformed wire rope is constructed from EEIPS grade wire, providing higher breaking strength than standard EIPS rope

20. When a crane load line is reeved with multiple parts of line through a block system, each additional part of line increases the mechanical advantage. What happens to the hook travel speed as parts of line increase?

A. Hook travel speed increases proportionally with each added part of line because the drum turns faster

B. Hook travel speed decreases proportionally as parts of line increase — adding parts increases lifting capacity but reduces hook speed for the same drum rotation rate

C. Hook travel speed remains constant regardless of parts of line because the crane’s hydraulic system compensates

D. Hook travel speed increases until 4 parts are in use, then decreases beyond that point due to friction losses

21. A tower crane must be de-rated or taken out of service when winds at the crane exceed which threshold during lifting operations, per general industry guidance?

A. 40 miles per hour — below this speed, lifting is always permitted

B. The manufacturer’s specified maximum wind speed for the specific crane configuration, which varies by model and jib length

C. 20 miles per hour — all crane work stops at any wind speed above 20 mph

D. 30 miles per hour for all tower crane types and models as a universal OSHA requirement

22. A tower crane must be tied into the building structure above a certain mast height to maintain stability. These tie-in connections are called mast ties or climbing anchors. Who is responsible for designing the tie-in connections?

A. The ironworking crew foreman, based on their experience with the specific crane model

B. The tower crane operator, who specifies the tie-in locations based on the load chart

C. A licensed professional engineer, typically working with the crane manufacturer or the erection contractor

D. The general contractor’s project manager, who coordinates the tie-in schedule with the floor framing

23. A crane load chart is always used in conjunction with the crane’s current configuration. If a crane is used with a jib (fly jib) attached to the main boom tip, which chart must the operator reference?

A. The load chart specific to the main boom plus jib configuration, as the jib changes the crane’s capacity and radius at every position

B. The main boom chart alone, since the jib adds reach without changing the crane’s base structural limits

C. The highest-capacity chart available for the crane, because the jib’s additional reach increases the load moment

D. The crane’s standard chart with a 10 percent derating applied uniformly across all radius positions

24. A pendant line boom (fixed boom with wire pendants running to the boom tip from the mast) differs from a free-swinging lattice boom in which fundamental operational characteristic?

A. Pendant line booms cannot be used for long-distance swings because the pendants restrict the arc of travel

B. Free-swinging booms are limited to lifts of 25,000 pounds or less because they lack the pendant’s structural reinforcement

C. Pendant line booms are available only on crawler cranes, while free-swinging booms are limited to truck crane applications

D. A pendant line boom is a fixed-length boom whose angle is changed by raising or lowering the pendants; a free-swinging lattice boom can add or remove sections for length changes

25. Who is the ‘qualified person’ required by OSHA 29 CFR 1926.1404 to supervise the assembly and disassembly of a crane at a construction site?

A. The crane operator, who is qualified by virtue of their operator certification to oversee assembly

B. A person who, by training, knowledge, or experience, is able to identify and correct hazards associated with assembly and disassembly of that specific crane type

C. An OSHA compliance officer who reviews the assembly plan before the crane arrives on site

D. A crane inspector certified by the National Commission for the Certification of Crane Operators (NCCCO)

26. A personnel hoist platform (man basket or personnel platform) suspended from a crane hook is permitted under OSHA 29 CFR 1926.1431 only when which condition is met?

A. The platform is used only on scaffolding-equipped structures where no other means of access is available

B. The platform can only be used in emergency situations where an injured worker cannot be evacuated by other means

C. All workers in the platform must be certified riggers, and the crane operator must have at least 5 years of experience

D. Use of conventional means of access to a location is not possible or is more hazardous than the crane-suspended platform

27. Which of the following items must be verified during a crane’s pre-shift inspection before lifting operations begin?

A. All safety devices including load indicators, anti-two-block, and boom angle indicators are functional; wire rope condition is acceptable; all controls operate correctly; deficiencies from prior shift are resolved

B. The crane has been test-lifted at maximum rated capacity within the previous 30 days

C. The crane’s annual inspection certificate is posted in the cab and not more than 12 months old

D. The site’s safety officer has reviewed and signed the crane’s pre-shift inspection form prior to the first lift

28. A crane's load block has a minimum number of rope parts required in the reeving to prevent the block from overloading. If the block is rated at 12 tons and the rope is rated at 4 tons per part, what is the minimum number of parts of rope required in the reeving?

A. Two parts of rope

B. Four parts of rope

C. Three parts of rope

D. Six parts of rope

29. An all-terrain crane's outriggers are designed to fully extend for maximum capacity. What happens to the crane's rated capacity in the rear quadrant compared to the side quadrant when the outriggers are fully extended?

A. Capacity is lowest in the rear quadrant because the counterweight contributes less stabilizing moment in that direction

B. Capacity in all quadrants is equal when outriggers are fully extended, because the outrigger geometry is symmetric

C. Capacity may be higher in the rear quadrant over-the-rear position for some crane models because the counterweight directly resists the load moment in that direction

D. Capacity is highest in the side quadrant because the outrigger base width is widest in that direction

30. Two cranes are performing a tandem lift on a single structural assembly. How must the load be distributed between the two cranes?

A. Each crane must carry exactly 50 percent of the load, regardless of the individual crane capacities

B. The load distribution must be determined by a qualified person using a lift plan, and each crane must be operated within its own rated capacity for its share of the load

C. The smaller crane carries the load at its rated capacity, and the larger crane carries the remainder

D. The crane with the longest boom carries the entire load while the second crane provides lateral stability only

31. Wire rope on a crane hoist drum must have a minimum number of wraps remaining on the drum when the hook is at its lowest operating position. What is the purpose of this 'dead wrap' requirement?

A. Dead wraps prevent the rope from becoming entangled in the drum flanges at minimum extension

B. Dead wraps ensure that enough rope remains on the drum to reach the manufacturer's maximum lowering depth

C. Dead wraps provide additional mechanical advantage when the hook is at maximum extension

D. The dead wraps protect the rope's anchor point at the drum from the full hook load, keeping the anchoring force within the drum's structural limits

32. When operating a telehandler from an enclosed cab with a rear-view camera system, the operator may use the camera system to monitor the load path. What is the limitation of relying solely on camera systems for load management?

A. Camera systems may not provide accurate depth perception, making it difficult to judge exact load clearances; the operator must use direct sightlines or a spotter for final load placement in confined areas

B. Camera systems are not OSHA-approved for use in construction and may only be used as a supplemental guide

C. Camera systems require a dedicated technician to operate the camera pan-tilt-zoom controls during load movement

D. Camera systems are only permitted on telehandlers up to 6,000 lb rated capacity; larger machines require direct sightlines

33. A pneumatic-tired rubber-wheeled crane operating on a soft soil site experiences a tire puncture on one front tire during a pick. What is the immediate required action?

A. Continue the pick at reduced speed, monitoring the tire for complete deflation before landing the load

B. Slowly lower the load to the ground while keeping the boom pointed toward the working quadrant, then stop all crane operations and address the tire

C. Rotate the boom to the opposite side to shift the load moment away from the deflating tire

D. Increase the radius of the pick to distribute the load more evenly across the remaining tires

34. A Reduced Beam Section (RBS) connection, sometimes called a 'dog bone' connection, is used in seismic moment frame construction. What is the purpose of intentionally reducing the beam flange width near the column connection?

A. The reduced flange section reduces the beam's dead weight, which decreases the seismic mass of the structure

B. The reduced flange section increases the effective depth of the beam at the connection, providing higher bending capacity adjacent to the column

C. The reduced flange section simplifies the connection detail by eliminating the need for continuity plates inside the column

D. The reduced flange section forces the plastic hinge (yielding location) to form in the beam's span away from the column connection, protecting the more critical column-face weld from the highest inelastic demand

35. AISC Code of Standard Practices establishes column base elevation tolerances. What is the permitted variation in column baseplate elevation relative to the theoretical elevation shown on the drawings?

A. Plus or minus 1/8 inch from the theoretical elevation for columns in building frames

B. Plus or minus 1/4 inch from the theoretical elevation for all column types

C. Plus or minus 3/8 inch from the theoretical elevation for light-framing columns only

D. Plus or minus 1/2 inch from the theoretical elevation, regardless of the column size or building type

36. Safety nets may be used as fall protection for structural ironworkers at heights where guardrails or personal fall arrest systems are not practical. What is the maximum permissible free-fall distance to the safety net, per OSHA 1926.502?

A. 10 feet free fall to the net, as a conservative construction-site limit

B. 20 feet free fall to the net, per OSHA ladder-safety provisions

C. 30 feet free fall to the net per OSHA 1926.502(c) for safety net installation

D. Safety nets have no free-fall limit; only the net impact rating governs

37. OSHA 1926.756(c) governs double connections at columns, where two beams on opposite sides of a column web share the same connection bolt holes. What specific requirement applies when removing bolts from the first beam to make the shared-bolt double connection?

A. All bolts from the first beam must be removed simultaneously and the second beam must be positioned within 30 seconds to prevent column drift

B. At least one bolt with its nut must remain in the shared bolt holes to maintain the first beam's connection until the second beam is secured and the shared bolt is replaced

C. The first beam must be temporarily supported by a wedge or brace inserted between the beam web and column flange before any bolts are removed

D. Double connections are prohibited without a pre-engineered bolt removal sequence stamped by the structural engineer of record

38. A 50-foot steel column is being plumbed using a total station. Per AISC Code of Standard Practices, the column top must not deviate from plumb by more than 1/500 of the column height. What is the maximum permissible deviation in inches?

A. 0.96 in

B. 1.08 in

C. 1.20 in

D. 1.32 in

39. An exclusion zone is established around a crane during lifting operations. What is the purpose of an exclusion zone, and who determines its size?

A. An exclusion zone is required only for lifts exceeding 75 percent of the crane's rated capacity; its size is fixed at 50 feet

B. An exclusion zone limits the crane's swing to a designated arc; it is always exactly equal to the crane's rated working radius

C. An exclusion zone identifies the area where the crane operator has exclusive authority and no other workers may give signals

D. An exclusion zone keeps non-essential personnel away from the area under the crane's hook and load path; its size must be established by a competent person based on the load dimensions, lift height, and potential fall zone

40. In a multi-story steel frame, the typical erection sequence calls for completing each tier of steel before beginning the next tier. What is the principal safety reason for this tier-by-tier sequence?

A. Completing each tier before proceeding upward provides the frame with adequate bracing and connection redundancy at that level before additional load is imposed from above

B. Working on a complete tier allows ironworkers to plan crane picks more efficiently by working left-to-right across the floor plate

C. The tier-by-tier sequence ensures the floor deck can be installed at each level before the next tier is started above it

D. Completing each tier allows the structural engineer to review the frame for compliance before continuing erection above

41. OSHA Subpart R requires that column anchor bolts not be modified, bent, or cut in the field without which approval?

A. Written approval from the project structural engineer of record and written notification to the steel erector and the controlling contractor

B. Verbal approval from the site superintendent, documented in the daily foreman's log

C. Approval from the OSHA area director, who must conduct a site inspection before any anchor bolt alteration is permitted

D. Approval from the anchor bolt manufacturer's technical representative, who must provide an alternative installation specification

42. During the erection of a structural steel frame, who is responsible for ensuring that permanent bracing is installed in each bay before erection proceeds to the next tier above?

A. The crane operator, who must confirm the bracing is in place before making any pick above the current tier

B. The steel erector (ironworking contractor), who must provide a site-specific erection plan that sequences permanent and temporary bracing with erection progress

C. The concrete subcontractor, who installs the floor deck and triggering the bracing installation before the next tier begins

D. The project structural engineer, who inspects the frame after each tier is complete before issuing a tier-release notice

43. Purlins and girts are secondary structural members in pre-engineered metal building frames. What structural function do purlins serve in a PEMB roof system?

A. Purlins are the primary lateral bracing members that resist seismic and wind loads in the plane of the roof

B. Purlins are the ridge beam members at the peak of each frame that connect opposing rafter sections

C. Purlins are the horizontal secondary members that span between primary rigid frames, carrying roof panel loads and their own weight to the primary frames

D. Purlins are the vertical members that extend above the roof eave to support parapet wall panels and coping angles

44. If anchor bolt holes in a column baseplate do not align with the installed anchor bolts in the concrete footing, which of the following remediation options requires the engineer of record's approval per OSHA 1926.755?

A. Rotating the column slightly so the bolt holes align with at least two of the four anchor bolts

B. Shimming the baseplate to a tilted position that allows all bolts to engage even if they are slightly off-center

C. Adding supplemental anchor bolts adjacent to the misaligned ones to provide equivalent connection capacity

D. All field remediation options — oversize drilling, reaming, burning, or adding anchor bolts — require the engineer of record's approval before execution

45. In a multi-story moment frame building, an HSS (tube) column at an intermediate floor level receives four beams connecting to it at 90-degree intervals. What detail is typically required inside the HSS column at the beam connection level?

A. A grout-filled HSS tube to develop compression capacity from the beams bearing on the column face

B. Slotted bolt holes in the HSS wall to allow the beam end plates to achieve the required shear capacity

C. External welded brackets on the HSS face to eliminate the need for any penetration of the tube wall

D. Through-plates or stiffener plates welded inside the HSS column at the beam flange levels, providing a direct load path for the flange forces through the column section

46. A W14×48 beam is 26 feet long. What is the total weight of this structural member?

A. 1,056 lb
B. 1,248 lb
C. 1,440 lb
D. 1,536 lb

47. A steel plate is 12 feet long, 5 feet wide, and 5/8 inch thick. Using the plate weight constant of 40.8 lb per square foot per inch of thickness, what is the approximate weight of this plate?

A. 1,224 lb
B. 1,377 lb
C. 1,530 lb
D. 1,683 lb

48. A rectangular erection layout bay measures 45 feet by 30 feet. What is the total perimeter of this bay?

A. 150 ft
B. 135 ft
C. 165 ft
D. 180 ft

49. A shim thickness is given as 3-3/4 inches on the erection drawing. What is this dimension expressed as a decimal?

A. 3.25
B. 3.75
C. 3.33
D. 4.00

50. A block-and-tackle arrangement requires a line pull of 800 pounds to lift a 6,400-pound load. How many parts of line are in the reeving?

A. 4 parts
B. 6 parts
C. 7 parts
D. 8 parts

51. A 3-inch diameter solid steel round bar is 24 inches long. Using a steel unit weight of 0.2833 lb per cubic inch, what is the approximate weight of this bar?

A. 38 lb
B. 43 lb
C. 48 lb
D. 53 lb

52. A trapezoidal gusset plate has parallel sides of 20 inches and 14 inches, with a perpendicular height between them of 8 inches. What is the area of this gusset plate in square inches?

A. 136 sq in
B. 148 sq in
C. 160 sq in
D. 124 sq in

53. A steel column is 36 feet tall. Per AISC Code of Standard Practices, the maximum permissible out-of-plumb deviation is 1/500 of the column height. What is the maximum permissible deviation in inches?

A. 0.72 in
B. 0.78 in
C. 0.86 in
D. 0.96 in

54. A structural member is specified with a slope of 1 inch of rise per 8 inches of horizontal run. What is this slope expressed as a percentage?

A. 10.0 percent
B. 12.5 percent
C. 15.0 percent
D. 20.0 percent

55. A W18×65 beam is 28 feet long. What is the total weight of this structural member?

A. 1,820 lb
B. 1,950 lb
C. 2,080 lb
D. 2,210 lb

56. A steel angle section (L4×4×1/4) weighs 6.6 pounds per linear foot. A length of 22 feet is required. What is the weight of this angle?

A. 120 lb
B. 130 lb
C. 139 lb
D. 145 lb

57. A structural drawing is drawn at a scale of 1/8 inch equals 1 foot. A dimension measured on the drawing is 4.25 inches. What is the actual field dimension?

A. 24 ft
B. 28 ft
C. 31 ft
D. 34 ft

58. Submerged Arc Welding (SAW) is used for fabricating heavy structural members in the shop. What is the primary distinguishing feature of the SAW process compared to SMAW and FCAW?

A. SAW uses a non-consumable tungsten electrode and produces no spatter because the arc does not contact the base metal

B. SAW uses only AC power and produces a very narrow bead width that is ideal for thin-plate structural applications

C. SAW buries the arc completely under a blanket of granular flux, creating a slag-covered weld with no visible arc, minimal spatter, and very high deposition rates suitable for heavy plate welding

D. SAW uses a resistance heating element rather than an arc, fusing the base metal without a consumable electrode or filler metal

59. An E8018 electrode has a higher tensile strength designation than E7018. When would an E8018 electrode be selected over E7018 for a structural weld?

A. E8018 is used for all vertical-down welding applications because its higher strength compensates for the lower penetration of that position

B. E8018 is selected when the steel has minimum yield strength of 60 to 70 ksi, such as A572 Grade 60 or A514, where filler metal must match base metal tensile strength

C. E8018 is used for root passes only; E7018 completes the fill and cap passes

D. E8018 is required for all field welds in seismic design categories D, E, and F

60. Before welding on structural steel that has been previously painted, what surface preparation is required at the weld zone?

A. The paint must be completely removed from the weld zone by grinding, wire brushing, or burning to bare metal before any weld is made, because paint causes porosity and reduced fusion

B. Painting over the weld area after welding is complete is sufficient; existing paint can remain at the root of the joint and does not need to be removed before making the weld

C. Standard alkyd primer compatible with structural welding may remain on the steel surface at the weld zone without special preparation because the arc burns through it without contaminating the weld

D. Water-based latex paints may remain at the weld zone without removal; only oil-based and epoxy-based paints must be fully removed before any weld is made in that area

61. The effective throat of a fillet weld is used to calculate the weld’s shear capacity. For a standard equal-leg fillet weld with a leg dimension of 1/2 inch, what is the effective throat dimension?

A. 0.500 inch — the full leg dimension

B. 0.354 inch — calculated as 0.707 times the leg dimension

C. 0.250 inch — half the leg dimension

D. 0.500 inch — the sum of both leg dimensions divided by the root-of-two

62. Oxyfuel torch tips must be cleaned periodically to remove carbon deposits and spatter from the orifices. What is the correct tool and procedure for cleaning a cutting torch tip?

A. Wire brush the tip face and blow compressed air through each orifice while the gases are flowing

B. Soak the tip in acetone overnight, then blow out the orifices with nitrogen purge gas

C. Use the edge of a grinding disc to clean the flat face of the tip and open the clogged orifices

D. Use a tip cleaner — a set of tapered reamers sized to match each orifice diameter — inserting the appropriate size and rotating gently to clear carbon deposits without enlarging the orifice

63. In FCAW welding, what is the effect of increasing the wire feed speed on the welding parameters?

A. Increasing wire feed speed decreases amperage and reduces heat input, producing a narrower bead

B. Increasing wire feed speed has no effect on amperage; only the voltage setting controls current

C. Increasing wire feed speed increases the amperage (wire burns off faster, requiring more current), which increases heat input and deposition rate

D. Increasing wire feed speed decreases voltage automatically through the machine’s constant-power regulation

64. Acetylene must not be withdrawn from a cylinder at a rate exceeding one-seventh of the cylinder’s content per hour. What risk does excessive withdrawal rate create?

A. Withdrawing acetylene too rapidly draws acetone solvent out of the cylinder along with the acetylene, contaminating the gas supply and creating an unstable flame

B. Exceeding this rate causes the cylinder pressure to drop below the regulator’s minimum input pressure, shutting down the cutting process

C. Excessive withdrawal causes the ambient temperature around the cylinder to drop, condensing moisture on the cylinder valve

D. Excessive withdrawal rate causes the regulator to freeze, preventing safe shut-off in an emergency

65. A cracked structural weld is discovered during inspection. What is the standard repair procedure, per AWS D1.1?

A. Apply weld build-up directly over the cracked zone at twice the normal heat input to re-fuse the cracked section

B. Apply adhesive bonding agent over the crack and allow to cure before applying a weld overlay

C. Notify the OSHA compliance officer and stop all construction until an engineer approves a repair scheme

D. Remove the defective weld and the heat-affected metal by gouging, grinding, or machining to sound metal, then reweld and re-inspect

66. Puddle welds used to fasten metal decking to structural steel are made by welding through the deck sheet to the steel below. What diameter arc spot weld is the recognized standard minimum size for this application?

A. 5/8-inch minimum diameter arc spot weld through the deck to the supporting structural steel

B. 3/8-inch minimum diameter arc spot weld through the deck

C. 1/2-inch minimum diameter arc spot weld through the deck

D. 3/4-inch minimum diameter arc spot weld through the deck

67. Heat input during welding, expressed in kilojoules per inch (kJ/in), affects both weld quality and base metal mechanical properties. What happens to the heat-affected zone (HAZ) grain structure as heat input increases?

A. Higher heat input refines the HAZ grain structure, improving toughness and reducing the susceptibility to hydrogen cracking

B. Higher heat input has no effect on HAZ grain structure; only the electrode type affects grain size

C. Higher heat input causes grain coarsening in the HAZ, which can reduce toughness and increase susceptibility to brittle fracture, particularly in notch-sensitive steels or low-temperature applications

D. Higher heat input refines the weld metal grain but causes grain coarsening only in the base metal beyond the heat-affected zone

68. GPS (Global Positioning System) layout instruments and robotic total stations both locate column positions on large sites. What is the primary limitation of GPS-based layout in urban or partially enclosed structural steel erection environments?

A. GPS instruments require two operators to function: one at the receiver and one transmitting at a base station

B. GPS accuracy can be significantly degraded in urban environments due to multipath interference from nearby buildings and structures blocking satellite signals, making optical total stations more reliable for precise layout

C. GPS instruments are limited to horizontal (plan) coordinate measurement and cannot determine elevation

D. GPS surveys must be submitted to the local municipality for approval before they can be used for structural layout on public works projects

69. A column grid offset is established when the actual column line cannot be accessed directly (for example, when it falls in the middle of an existing structural element). An offset line is set parallel to the column line at a measured distance. When using an offset, what documentation is essential to prevent errors?

A. Recording the offset distance, the direction of offset from the column line, and any points where the offset was transferred back, so all measurements are traceable to the original design intent

B. Photographing each offset mark with a smartphone to create a digital record for the project file

C. Having the structural engineer of record personally witness the establishment of each offset mark on the structure

D. Using only red ink for offset marks and black ink for primary grid marks to prevent confusion during erection

70. To check that a structural bay layout is square, an ironworker measures both diagonals from corner to corner and finds they are not equal. The bay is 40 feet × 30 feet. What is the correct diagonal for a true square bay?

A. 48 ft
B. 42 ft
C. 50 ft
D. 36 ft

71. For plumbing very tall columns (greater than 100 feet), a plumb bob and tape can be subject to significant sway from air currents and is difficult to read accurately. Which instrument provides the most reliable plumb check for very tall columns?

A. An optical plumb laser aligned manually at the column base and projected to a target at the column top
B. A pendulum-type digital inclinometer clamped to the column web at approximately mid-height of the column
C. A hand-held electromagnetic level sensor applied sequentially to each column flange face at 10-foot intervals
D. An electronic theodolite or total station set up at known reference points and sighting to column targets at multiple heights, providing a geometry-based plumb measurement independent of air movement

72. A laser distance meter (LDM) is used to measure the distance between two column lines across a structural bay. The instrument has an accuracy of ±1/16 inch. If the design dimension is 30 feet 0 inches, what is the acceptable range of measured values?

A. 29 feet 11-3/8 inches to 30 feet 0-5/8 inches
B. 29 feet 11-15/16 inches to 30 feet 0-1/16 inches
C. 29 feet 11 inches to 30 feet 1 inch
D. 29 feet 10 inches to 30 feet 2 inches

73. What is the ideal angle that a cable guy should make with the column being guyed to develop the maximum lateral restraining force per unit of tension in the guy cable?

A. The most effective guy angle is 45 degrees from the column (45 degrees from vertical), as this maximizes the horizontal component of the guy tension relative to the total tension in the cable

B. A perfectly vertical angle is most effective because the guy's full tension acts horizontally

C. The most effective guy angle is 60 degrees from the column axis, which provides more horizontal stabilizing force than a 45-degree angle

D. Guy cables should be as steep as possible (nearly vertical) to minimize the horizontal force component and protect the column base

74. A builder's level is set up and the height of instrument (HI) is determined to be 106.50 feet by a back-sight to a known benchmark. A rod reading of 4.25 feet is taken at a column anchor location. What is the elevation of the anchor?

A. 110.75 ft

B. 102.25 ft

C. 97.75 ft

D. 108.50 ft

75. A column is plumbed and found to be within AISC tolerance in the north-south direction but 0.5 inches out of plumb toward the east in the east-west direction. Rather than re-hoisting, the ironworker adjusts the guys. What determines whether the east guy alone can correct the deviation, versus needing to also loosen the west guy?

A. The east guy alone is always sufficient if the deviation is less than 1/2 inch; larger deviations require loosening the west guy as well

B. Only the west guy should be loosened, never the east guy, because tightening a guy can over-stress the baseplate anchor bolts

C. Both guys must always be adjusted simultaneously to prevent inducing a new out-of-plumb in the north-south direction

D. The required adjustment depends on the current tension in both guys; if the west guy is already slack, loosening it further does nothing and only tightening the east guy will work

76. Column grid intersection marks are typically set using offset marks on adjacent floor beams or slab edges rather than directly on the column position. What is the standard offset distance used for column grid marks in structural ironworking?

A. The offset distance is always 12 inches from the column face, regardless of column size or project

B. The offset distance is 1 foot, 2 feet, or some other even measurement specified in the project's erection plan so that all column positions can be found by measuring back from the offset

C. The offset distance equals the column flange width, so the mark aligns with the outside face of the column flange

D. No fixed offset distance is used; the ironworker marks where the column centerline falls without regard to offset

77. A weld symbol has a small circle at the junction of the reference line and the arrow. What does this circle indicate?

A. The weld is to be made as an intermittent weld with spacing shown by the number inside the circle

B. The weld must be made by a CWI-certified welder, identified by their certification number inside the circle

C. The weld is required all around the joint — a full circumferential weld on a pipe, tube, or any closed perimeter connection

D. The circle identifies a plug weld through a hole in the connecting plate rather than a fillet or groove weld at the joint edge

78. A weld symbol has a flag at the bend of the arrow (where the reference line meets the arrow). What does this flag indicate?

A. The weld requires a flux backing bar on the root side before welding begins

B. The weld is to be inspected by radiographic testing (RT) rather than visual inspection

C. The weld is a prequalified weld joint that does not require a procedure qualification test record

D. The weld is a field weld — to be made in the field during erection, not in the fabrication shop

79. A structural drawing column schedule lists column marks such as C1, C2, C3. What information is typically provided in a column schedule on a structural framing plan?

A. The column mark, the column section size, the column height at each level, and any special connection or base condition for each unique column type used in the structure

B. The column schedule lists the total number of bolts installed in each column during erection and the torque values used

C. The column schedule specifies the concrete mix design, reinforcement bar size, and form tie layout for each concrete-filled column

D. The column schedule provides the material test report (MTR) heat numbers for each column section delivered to the site

80. A structural drawing note reads 'TYP.' What does 'TYP.' mean and how does it affect the application of a detail or dimension?

A. TYP. means the detail or dimension is tentative (not finalized) and is subject to revision without a formal drawing update

B. TYP. means 'Typical' — the condition shown applies to all similar situations on the project unless a specific, different detail is shown elsewhere

C. TYP. means the tolerances shown are typical (average) values and may be exceeded by up to 20 percent without notification

D. TYP. means the connection is a temporary detail used during erection that must be replaced with permanent hardware before occupancy

81. The AISC Steel Construction Manual provides standard connection types (such as single-plate shear connections and double-angle connections). When a structural drawing connection detail matches an AISC standard connection and is labeled 'AISC STD,' what does this mean for the field?

A. The ironworker may make minor field modifications to the standard connection without engineering approval, as the standard is conservative by design

B. The connection dimensions, bolt patterns, and weld sizes have been pre-engineered by AISC and are acceptable as drawn; no additional engineering analysis is required if constructed exactly as specified

C. The AISC standard connection must be fabricated using only AISC-licensed fabricators who have been specifically authorized for that connection type

D. The AISC standard designation means the connection is under AISC’s product warranty; any field modification voids the warranty and requires a custom engineering analysis

82. The difference between erection drawings and shop drawings in structural steel construction is that erection drawings show what, while shop drawings show what?

A. Erection drawings show detailed bolt patterns and weld symbols; shop drawings show only the overall structural layout

B. Erection drawings show the final as-built conditions; shop drawings show the design intent before construction changes

C. Erection drawings are prepared by the ironworking crew; shop drawings are prepared by the structural engineer

D. Erection drawings show field assembly of structural members, connection details, and sequence; shop drawings show fabrication details for each member including exact dimensions, cuts, and connection elements

83. An AISC standard hole is a bolt hole drilled or punched with a standard diameter equal to the bolt diameter plus 1/16 inch (for bolts up to 1 inch diameter). An oversized hole is larger than a standard hole. In which connection type are oversized holes specifically prohibited?

A. Oversized holes are prohibited in all bearing-type connections where the bolt shear capacity is the governing limit state

B. Oversized holes are prohibited in moment-resisting connections because the additional hole clearance reduces the effective bolt bearing area

C. Oversized holes are prohibited in double-shear connections used in lateral bracing members of seismic-resistant frames

D. Oversized holes are prohibited in A490 bolt connections due to the bolt's high strength and the risk of nut pull-through

84. The SJI requires that bar joists have bridging anchored to a bridging terminus point (BTP) before the joist system is loaded. What is a bridging terminus point, and why is it critical?

A. A BTP is the first and last joist in each bay; it must be installed before any bridging can be connected to intermediate joists

B. A BTP is a supplemental rafter added at the ends of a joist run to carry concentrated loads from bridging

C. A BTP is the structural connection point where the end of the bridging run terminates and transmits accumulated lateral forces into the main structure; without a BTP, bridging provides no effective lateral restraint

D. A BTP is the bolted mid-span connection point where two rows of horizontal bridging rods overlap and are fastened together with a standard clip angle

85. A K-series bar joist must be attached to its supporting steel member at both ends by bolting or welding before any load is placed on it, per OSHA 1926.757. When the ends are welded rather than bolted, what minimum weld length is required by the SJI for each end of a K-series joist?

A. A minimum weld length of 1 inch each side of the seat angle, with a minimum throat of 1/8 inch

B. A minimum weld length of 1-1/2 inches each side or a single weld of equal length across the full seat

C. The minimum weld dimension is 1/8-inch fillet weld, 1 inch long on one side of the joist seat

D. The SJI requires the weld to be specified by the engineer of record; there is no standard minimum

86. In a bar joist system, diagonal bridging is installed at an angle between the top and bottom chords of adjacent joists. Vertical bridging is installed vertically between the bottom chords of adjacent joists. What is the primary structural function that DIAGONAL bridging provides that VERTICAL bridging alone cannot?

A. Diagonal bridging increases the load-carrying capacity of the top chord in the vertical direction

B. Diagonal bridging transfers deck load from heavily loaded joists to adjacent less-loaded joists through shear transfer

C. Diagonal bridging connects the bottom chords of multiple joists into a continuous tension member for uplift resistance

D. Diagonal bridging provides the critical X-bracing action between joists that transfers accumulated lateral forces from horizontal bridging into the BTP; vertical bridging alone cannot develop these horizontal transfer forces

87. OSHA 1926.757(a)(3) specifies the maximum allowed unsupported top chord span before the first row of bridging must be installed during joist erection. For K-series joists, what is this maximum unsupported distance?

A. The maximum unsupported top chord distance is stated in the SJI standard bridging table for each specific joist designation, based on the joist depth and top chord size

B. The maximum unsupported distance is always 20 feet, regardless of joist depth or designation

C. The maximum unsupported distance is the full joist span divided by four, rounded to the nearest foot

D. The maximum unsupported distance is 12 feet for all K-series joists, as a universal conservative limit

88. When bar joists are delivered to the project site, each bundle contains a joist identification tag. What critical information must the ironworker verify from the tag before the joists are unloaded and set in position?

A. The ironworker must verify the bundle weight matches the crane’s lift plan for the scheduled pick time

B. The ironworker must verify that joist marks on the tag match the designations on the erection drawings for the specific bay, and that the joist spacing matches the drawing

C. The ironworker must verify the paint color on the joist matches the project’s specified color code for that floor level

D. The ironworker must verify the joist manufacturer’s certification number is on the AISC approved fabricator list

89. After turn-of-nut tightening is complete, how is the final bolt pretension verified if the inspector was not present during the actual tightening?

A. Each bolt is re-torqued using a calibrated torque wrench; if the bolt turns under the applied torque, it was not fully tightened and must be re-tightened

B. Bolts are inspected visually for head marking alignment and nut rotation marks before accepting the connection

C. A random sample of bolts is loosened completely and re-tightened by the turn-of-nut method with the inspector present

D. The inspector performs a verification check by applying the snug-tight torque to each bolt to confirm the bolt has not loosened; if the nut does not rotate at that torque level, pretension is confirmed

90. How is 'snug tight' defined in the AISC Specification for Structural Steel Buildings for high-strength bolted connections?

A. Snug tight is defined as a specific torque value of 25 foot-pounds, applied with a calibrated torque wrench

B. Snug tight is the condition achieved by the full effort of an ironworker using a standard spud wrench, or several impacts of a pneumatic impact wrench, until all plies are in firm contact

C. Snug tight is defined as two full turns of the nut from the first contact of the nut with the connection plate

D. Snug tight is defined as the tightness produced by one full impact of an air wrench, regardless of the nut rotation achieved

91. Punched bolt holes and drilled bolt holes both produce holes of the correct diameter, but they differ in which quality characteristic that affects the connection?

A. Drilled holes produce a clean, uniform hole with minimal cold work; punched holes introduce hardened, cold-worked material around the hole perimeter that can reduce the plate's ability to deform plastically at the edge

B. Drilled holes are 1/16 inch larger in diameter than punched holes of the same nominal size, which reduces bearing capacity

C. Punched holes produce a smoother hole surface than drilled holes, improving the frictional resistance in slip-critical connections

D. Drilled holes can only be made in steel up to 3/4 inch thick; thicker plates must use punched holes

92. Tension-control (TC) bolt sets include a bolt, a heavy hex nut, and a hardened washer. How must TC bolt sets be stored on the project site?

A. TC bolt sets may be stored in any dry location because the splined tail protects the thread from corrosion

B. TC bolt sets may be left exposed to the weather on the structure because the galvanized coating provides full corrosion protection

C. TC bolt sets must be stored in a dry, protected environment in closed containers; moisture-contaminated lubricant on the threads or nut bearing surface changes the torque-to-tension relationship, causing the sets to break off at incorrect pretension levels

D. TC bolt sets must be stored at elevated temperature (minimum 70°F) to prevent the lubricant from congealing and causing premature tool break-off

93. A hydraulic torque wrench provides a specific calibrated torque to structural bolts without requiring the impact shock of a pneumatic impact wrench. When is a hydraulic torque wrench preferred over a pneumatic impact wrench for structural bolting?

A. Hydraulic torque wrenches are preferred when a specific calibrated torque must be applied and verified, such as in turn-of-nut tightening where snug-tight torque must be precisely controlled and measured

B. Hydraulic torque wrenches are always preferred because they produce less noise than pneumatic impact wrenches

C. Hydraulic torque wrenches are preferred for all A490 bolt connections because impact wrenches are prohibited on high-strength alloy bolts

D. Hydraulic torque wrenches are used exclusively for M12 and smaller metric bolts that cannot fit in standard impact wrench sockets

94. After chipping slag from a multi-pass SMAW or FCAW weld, a wire brush is used to clean the weld between passes. What is the purpose of wire brushing between passes?

A. Wire brushing between passes pre-heats the previous weld bead, preventing cold lapping on the next pass

B. Wire brushing lubrication prevents the electrode from sticking to the previous pass at arc strike

C. Wire brushing removes loose slag particles, spatter, and surface oxide that would otherwise be incorporated into the next weld pass as inclusions, reducing weld mechanical properties and causing inspection failures

D. Wire brushing between passes scores the weld surface so the next electrode can visually align itself along the previous bead centerline

95. A chain block (chain hoist) and a lever hoist (come-along) both provide mechanical advantage for lifting or pulling. How does the mechanical advantage of a chain block with 4 falls of chain on the load hook compare to a lever hoist at the same load?

A. Both provide the same pull-to-lift ratio because they are both gear-driven mechanical advantage devices

B. The lever hoist provides greater mechanical advantage because the lever arm multiplies force beyond what a chain block can achieve

C. The chain block with 4 falls provides 4:1 mechanical advantage, while the lever hoist’s advantage depends on its gear ratio and may be higher or lower than 4:1

D. The chain block always provides more mechanical advantage than any lever hoist at the same load because the chain is longer and can reach farther

96. A come-along (lever hoist) is rated at 3 tons for a single fall of chain (single purchase). If the same lever hoist is converted to two falls of chain (double purchase) by reeving through a separate lower hook block, what is the new maximum load capacity?

A. 3 tons — the rated capacity does not change with double purchase; only the stroke distance changes

B. 6 tons — the second fall of chain doubles the rated lift capacity with the same lever effort

C. 1.5 tons — the rated capacity is halved because the chain must travel twice as far for the same lift height

D. 4.5 tons — the rated capacity increases by 50 percent for each additional fall beyond the first

97. Metal deck sidelap fasteners connect adjacent deck sheets along their overlapping side edges. What is the primary structural purpose of sidelap fasteners?

A. Sidelap fasteners prevent adjacent deck sheets from separating during construction loads and transfer in-plane shear forces between sheets so the deck diaphragm can resist lateral loads

B. Sidelap fasteners are used only to prevent wind uplift on roof decks during construction before the roofing membrane is installed

C. Sidelap fasteners replace puddle welds at deck ends when the deck is installed parallel to the beam span

D. Sidelap fasteners transfer gravity loads from one deck sheet to the adjacent sheet so that the structural members below can be spaced farther apart

98. Through-deck stud welding (welding headed shear studs through the metal deck to the beam flange below) is more difficult than welding to bare steel. What material condition on the deck or beam flange requires the most caution when through-deck stud welding?

A. Hot-dip galvanized decking requires special stud welding procedures because zinc burns off during the arc and the zinc vapors can be toxic; additionally, galvanized deck-to-flange contact may require special ferrule types to manage the zinc contamination of the weld pool

B. Organic rust on the beam flange below the deck must be removed with acid etching before stud welding through the deck

C. Composite deck with embossments requires a larger ferrule than flat-bottom deck to account for the increased gap at the stud base

D. Primer paint on the beam flange must be specifically a welding primer; other primer types cause the stud to bond to the primer rather than to the steel flange

99. Metal decking is installed starting from one end of a bay and progressing to the other. When decking sheets are placed over a structural beam, the uphill sheet laps over the downhill sheet at the beam (for sloped roofs). For level floor decks, the overlap direction convention is established to ensure which condition?

A. For level floor decks, the direction of deck placement is specified in the project documents so that all puddle welds at the overlap are accessible from the top of the deck rather than from below

B. For level floor decks, the lap direction is not structurally significant and may be changed freely at any point during installation

C. For level decks, laps must always run parallel to the direction of concrete placement to prevent the deck from separating under concrete weight

D. For level decks, the overlapping sheet must always face the direction of concrete pour to allow the concrete vibrator to seat the deck uniformly

100. After metal decking installation is complete and before concrete is placed on a composite deck system, what final inspection should be performed to verify the deck is ready for concrete?

A. Verify all headed shear studs are installed with ferrules removed, all puddle welds and sidelap fasteners complete at specified spacing, all penetrations covered, and deck surface clear of debris and construction materials

B. Verify only that the deck sheets are properly lapped and that no sheets are missing from the bay area

C. Verify the deck is structurally sound by loading each sheet with 500 lb of sand bags for 10 minutes before the concrete pour

D. Verify that the deck color matches the approved project material specification and that all mill certifications are on file

Practice Exam 3: Answer Key and Explanations

1. B — A birdcage distortion occurs when wire rope is subjected to a sudden unloading shock — the tension releases rapidly, causing the outer strands to spring outward and the core to protrude. This

indicates the rope has been damaged internally beyond what visual inspection can quantify. Birdcaged rope must be removed from service immediately and cannot be repaired.

2. A — A master link at the top of a multi-leg sling assembly equalizes the load distribution across all attached sling legs and provides a single connection point to the crane hook. Its pear or oblong shape is designed to accept loads from multiple angles, unlike a D-shackle, which is designed for in-line loading only.

3. C — At 30 degrees from horizontal, the tension factor in a sling is 2.0 — each leg of a two-leg bridle carries twice the load it would carry in a vertical hitch. The formula T = Load / (2 × sin 30°) = Load / (2 × 0.5) = Load produces one leg tension equal to the full hook load.

4. D — Minimum sheave diameter = D/d ratio times rope diameter = 26 times 0.5 = 13 inches. The D represents the supporting surface diameter, not the radius. Option A (8 in) reflects a 16:1 ratio; B (10 in) reflects 20:1; C (11 in) reflects 22:1. All three fall below the 26:1 minimum required for this rope construction.

5. A — ASME B30.10 specifies that a hook must be removed from service when the throat opening has increased by more than 15 percent from the original dimension, or when any crack, nick, or gouge is visible. A 3 percent opening increase is an often-cited early inspection threshold, not the removal criterion. However, any permanent deformation beyond normal wear warrants removal.

6. B — Heat exposure beyond a synthetic sling's rated temperature degrades the polymer fibers in ways that cannot be assessed by visual inspection. The sling may appear intact while its load-bearing capacity has been significantly reduced. When a sling shows heat discoloration from exposure at or above the rated temperature, the manufacturer must be consulted; removal from service is typically required.

7. D — In a multi-leg bridle, sling leg tension is proportional to each leg's proximity to the load's center of gravity. The leg closest to the CG supports more of the offset mass and carries proportionally higher tension. This unequal load distribution must be accounted for when selecting sling rated capacity for lifts where the CG is not centered between attachment points.

8. C — ASME B30.2 requires the hoist drum brake to hold 150 percent of the maximum rated load at any point in the travel range without slipping. This 50 percent overload factor provides a safety margin against dynamic loads during load pickup A brake holding only 100 percent of rated load provides no overload margin.

9. D — Per ASME B30.9 and manufacturer requirements, a minimum of six inches of tail (dead-end rope extension past the last clip) must extend beyond the last wire rope clip. This tail length ensures the last clip has adequate rope engagement and prevents the rope end from pulling back through the last clip under load.

10. B — Lang lay rope has both the individual wires and the strands twisted in the same direction (both clockwise or both counter-clockwise). This places more wire surface area in contact with sheave and drum surfaces compared to regular lay, distributing abrasion over a larger area per wire. Lang lay rope also resists untwisting under load better than regular lay.

11. C — A properly sized sheave groove supports the rope uniformly, distributing the rope's cross-sectional load across many wires. An oversized groove allows the rope to seat too deeply, concentrating crushing pressure at the groove edges rather than distributing it. This concentration accelerates wire fatigue at those contact lines and shortens rope life significantly compared to a correctly sized groove.

12. A — A shock load imposes dynamic forces that can significantly exceed the static hook load. Even if no broken wires or visible distortion are apparent after a shock load, internal damage such as micro-fractures or wire fatigue may have occurred. ASME B30 ASME B30.9 requires removal from service and inspection before any further use.

13. B — A lifting magnet's rated capacity is established under ideal conditions: clean, flat, fully saturated contact with the magnet face against the steel. Surface conditions that break magnetic contact — mill scale, rust, paint, weld spatter, dirt, or curved surfaces — can reduce the actual holding force to a small fraction of the rated capacity.

14. C — Fleet angle is the angle between the wire rope entering a sheave and the centerline of the sheave groove. When this angle is too large, the rope rubs against the sheave groove's side wall rather than seating cleanly in the groove bottom This abrasion shortens the service life of both rope and sheave significantly.

15. D — A gin pole is a temporary lifting device secured to the structure that hoists material to locations where the main erection crane cannot reach. The building frame provides the anchor and a small hoist provides the lift power Gin poles require engineering analysis of anchor loads imposed on the structure.

16. A — ASME B30.2, which governs overhead and gantry cranes (and is referenced for construction cranes), specifies removal of hoist rope when six or more broken wires are found in one rope lay length, or three or more broken wires are found in one strand within one rope lay length. A lay length is approximately equal to six to eight rope diameters.

17. A — A WT5×22.5 designation means the tee weighs 22.5 pounds per linear foot. Total weight = 22.5 × 15 = 337.5 lb. The WT (tee) designation uses the same weight-per-foot convention as W-shapes — the number after the × symbol is the weight per foot. Option B (312) uses 20.8 lb/ft; C (360) uses 24 lb/ft; D (405) uses 27 lb/ft.

18. D — At 30 degrees from horizontal, T = Load divided by (2 x sin 30 degrees) = Load divided by (2 x 0.5) = Load divided by 1.0 = Load. Each leg of a two-leg bridle carries exactly the full hook load at 30 degrees Below 30 degrees each sling leg carries more than the full hook load.

19. C — Preformed wire rope has its strands and wires shaped into their helical geometry during manufacturing before being laid together. This means the rope doesn't spring apart or birdcage when cut, handles more easily, and is less susceptible to kinking during reeving. Unpreformed rope's strands try to spring straight after cutting, making handling and reeving more difficult and potentially unsafe.

20. B — Adding parts of line to a block-and-tackle system increases mechanical advantage (reducing required line pull) but decreases hook speed for the same drum rotation rate. With 4 parts of line, the

drum must turn four feet of rope for every one foot of hook travel. With 8 parts, it must turn eight feet of rope per foot of hook travel.

21. B — No single universal wind speed governs all tower crane types. Different crane models have different structural properties and jib configurations that determine maximum operating wind speed. The manufacturer publishes maximum wind speed limits for each configuration in the operating manual Operators must apply the manufacturer's specific wind speed limit for each configuration.

22. C — Tower crane mast tie-in connections transfer lateral forces from the mast into the building structure. These connections must be designed by a licensed professional engineer who analyzes the mast forces and the building's capacity to accept those forces. The PE works with the crane manufacturer's specifications and the structural engineer's drawings to produce an acceptable tie-in design for each project.

23. A — Every crane configuration has its own load chart. Adding a fly jib changes the boom length, the center of gravity of the boom system, and the reach at every boom angle. Using the main boom chart when a jib is installed would give incorrect and potentially unconservative capacity values for the combined configuration.

24. D — A pendant line boom has wire pendant ropes running from the boom tip back to the mast, fixing the boom at a set length and angle. Changing boom length requires adding or removing sections with pendants disconnected. Free-swinging lattice booms can be set at any angle and lengths changed more readily.

25. B — OSHA 29 CFR 1926.1401 defines a qualified person for crane assembly and disassembly as one who, by recognized degree, certificate, professional standing, or extensive knowledge, training, and experience, has demonstrated the ability to solve problems related to the subject matter. The qualification is task-specific — not a single credential that covers all crane types and configurations.

26. D — OSHA 1926.1431 permits crane-suspended personnel platforms only when conventional means of access are not possible or are more hazardous than the suspended platform alternative. The regulation lists specific requirements for platform design, rigging, inspection, trial lift, and operational restrictions. The use must be pre-planned and employer-authorized; it is not an ad-hoc substitution for a man-lift or ladder.

27. A — A pre-shift crane inspection per OSHA 1926.1412 must verify that all safety devices are functional, wire rope condition is acceptable, all controls operate correctly, and any prior-shift deficiencies have been resolved. This inspection protects against overnight equipment failures and ensures the crane's first lift is not the discovery moment for a critical safety deficiency that had not yet been addressed.

28. C — Minimum parts of rope = total load divided by rope rating per part = 12 tons divided by 4 tons = 3 parts. Three parts provide exactly the minimum required capacity without exceeding the rope's per-part rating Option A, 2 parts, would allow each rope to carry 6 tons, exceeding the 4-ton rating.

29. C — For mobile cranes that carry a counterweight, over-the-rear capacity is often higher because the counterweight directly resists the forward load moment in the rear quadrant. As the crane swings to the side, the counterweight contributes less stabilizing moment for the same radius, reducing side quadrant capacity Operators must use the correct quadrant chart for each actual swing direction.

30. B — In a tandem lift, the load distribution between the two cranes is determined by a qualified person based on the load's weight, dimensions, and the geometry of the attachment points relative to the load's CG. Each crane operates within its own load chart limits for its assigned portion of the load.

31. D — The dead wraps (minimum three, per ASME B30.2) on the hoist drum protect the rope's anchor attachment point from carrying the full hook load. The total load on the drum anchor point is divided by the number of dead wraps plus the live reeving, reducing the force at the drum anchor to a manageable fraction of the full hook load.

32. A — Camera systems in telehandlers improve situational awareness but present a two-dimensional image that lacks depth perception and may have blind spots or image lag For precise final placement of loads in confined areas or near existing structure, the operator must use direct sightlines or position a spotter with clear visibility.

33. B — A tire puncture on a loaded wheeled crane creates an immediate stability hazard because the machine's weight shifts asymmetrically as the tire deflates. The crane must stop, and the load must be lowered to the ground under controlled conditions while the boom is pointed toward the normal working quadrant (not laterally, which would maximize the moment on the deflating side).

34. D — In seismic design, plastic hinging must occur in a ductile location where the frame can undergo inelastic deformation without fracture. Welded moment connections at the column face are vulnerable to brittle fracture in the heat-affected zone. The RBS relocates hinging to the weakened beam section, protecting the column-face weld from peak seismic demands.

35. A — AISC Code of Standard Practices Section 7.5.4 specifies that column baseplate elevations must be within plus or minus 1/8 inch of the theoretical elevation for building frame columns. This tight tolerance ensures that beams connecting at all sides of the column can be shimmed to their design elevations without accumulating errors through the structure.

36. C — OSHA 1926.502(c) specifies that safety nets must be installed with sufficient clearance underneath to prevent contact with the surface or structure below in the event of a fall. Safety nets must be installed as close as practicable under the work surface but never more than 30 feet below the working surface.

37. B — OSHA 1926.756(c)(1) requires that when two structural members share bolt holes in a double connection, at least one bolt with its nut must remain connecting the first member at all times until the second member is bolted in Removing all bolts leaves the first member unsecured and subject to displacement or fall.

38. C — Column plumb tolerance = column height (inches) / 500 = 50 × 12 / 500 = 600 / 500 = 1.20 inches. Option A (0.96) is for a 40-foot column (480/500). Option B (1.08) is for a 45-foot column (540/500). Option D (1.32) would require a column approximately 55 feet tall (660/500 = 1.32).

39. D — An exclusion zone defines the area under and around a crane pick where non-essential workers must not be present, protecting them from dropped loads and rigging gear failure. The zone size must be established by a competent person based on the load dimensions, lift height, and potential fall zone The zone size must be assessed for each pick.

40. A — Completing each tier of a multi-story frame before proceeding upward ensures the structure has adequate stability and connection redundancy at each completed level before additional load is imposed from above. A tier with all beams connected and permanently braced creates a stable platform for the next tier Jumping tiers creates an unstable frame that can rack or collapse.

41. A — OSHA 1926.755(b) requires that the controlling contractor provide written notification to the steel erector before anchor rod modification, and that the modification be approved by the project structural engineer of record in writing. This requirement exists because anchor rods are structural elements designed to transfer specific loads from the column to the foundation.

42. B — The steel erector (ironworking contractor) is responsible for developing the site-specific erection plan required by OSHA 1926.752(e). This plan must address the sequence of erecting, plumbing, and connecting structural members, and must ensure that permanent and temporary bracing is installed to maintain stability as erection progresses tier by tier. The erector bears responsibility for bracing sequencing during erection.

43. C — Purlins are the horizontal secondary framing members in a PEMB roof system that span between the primary rigid frames. They carry roof panel loads, insulation, and applied loads and transfer these to the primary frames at connection points. Purlins do not resist lateral loads (the primary frame's role) nor are they ridge beams, bracing members, or primary lateral load-resisting elements.

44. D — OSHA 1926.755(b)(1) requires written notification to the steel erector from the controlling contractor before anchor rod modification, and written approval from the structural engineer of record. This covers all remediation — burning, drilling, reaming, bending, or adding supplemental bolts — because each modification changes the engineered load path for the column base connection.

45. D — At a multi-beam HSS column connection, the tube wall alone cannot transfer concentrated beam flange forces without localized buckling or punching failure. Through-plates or continuity stiffener plates welded inside the HSS at the beam flange levels create a direct load path through the column cross-section, distributing flange forces into the column walls rather than concentrating them at the tube face.

46. B — A W14×48 designation means the beam weighs 48 pounds per linear foot. Total weight = 48 × 26 = 1,248 lb. Option A (1,056) uses approximately 40.6 lb/ft; C (1,440) uses 55.4 lb/ft; D (1,536) uses 59.1 lb/ft. The weight per linear foot is always the number after the × symbol in W-shape designations.

47. C — Plate weight = length × width × thickness × 40.8 = 12 × 5 × 0.625 × 40.8 = 60 × 0.625 × 40.8 = 37.5 × 40.8 = 1,530 lb. Option A (1,224) uses 0.5-inch thickness; B (1,377) reflects a calculation error in one factor; D (1,683) uses 0.6875 inches (11/16). Convert 5/8 inch to 0.625 decimal before multiplying.

48. A — Perimeter = 2 × (length + width) = 2 × (45 + 30) = 2 × 75 = 150 feet. Options B (135), C (165), and D (180) result from errors in the formula: B uses 2 × (45 + 22.5), C uses 2 × (45 + 37.5), and D uses 2 × (45 + 45).

49. B — 3-3/4 expressed as a decimal: 3 + 3/4 = 3 + 0.75 = 3.75. Option A (3.25) would be 3-1/4; C (3.33) would be 3-1/3; D (4.00) would be 4. Converting mixed numbers to decimals is required when entering dimensions into a calculator or when comparing measurements taken in decimal inches to dimensions shown in inch-fractions on the drawing.

50. D — Parts of line = load / line pull = 6,400 / 800 = 8 parts. With 8 parts supporting the lower block, the mechanical advantage is 8:1, so 800 lb of line pull can lift 6,400 lb. Option A (4 parts) requires 1,600 lb pull; B (6 parts) requires 1,067 lb; C (7 parts) requires 914 lb.

51. C — Volume = $\pi \times r^2 \times$ length = 3.14159 × 1.5^2 × 24 = 3.14159 × 2.25 × 24 = 169.65 in^3. Weight = 169.65 × 0.2833 = 48.06 ≈ 48 lb. The radius is half the diameter (1.5 in). Option A (38) uses an incorrect radius; B (43) uses 0.254 lb/in^3; D (53) uses 0.313 lb/in^3.

52. A — Area of a trapezoid = (sum of parallel sides / 2) × height = (20 + 14) / 2 × 8 = 34/2 × 8 = 17 × 8 = 136 sq in. Option B (148) uses an incorrect height; C (160) uses 20 × 8 (rectangle only); D (124) uses (20 + 14) / 2 × 7.3.

53. C — Column plumb tolerance = column height in inches / 500 = 36 × 12 / 500 = 432 / 500 = 0.864 in, rounded to 0.86 in. Option A (0.72) is for a 30-foot column (360/500); B (0.78) corresponds to approximately 32.5 feet; D (0.96) is for a 40-foot column (480/500).

54. B — Slope percentage = (rise / run) × 100 = (1/8) × 100 = 12.5 percent. Option A (10%) corresponds to a 1:10 slope; C (15%) corresponds to a 1:6.67 slope; D (20%) corresponds to a 1:5 slope. A 1:8 slope means for every 8 inches of horizontal run, the member rises 1 inch.

55. A — A W18x65 designation means the beam weighs 65 pounds per linear foot. Total weight = 65 x 28 = 1,820 lb. Option B (1,950) uses approximately 69.6 lb/ft; C (2,080) uses approximately 74.3 lb/ft; D (2,210) uses approximately 78.9 lb/ft The number after the designation symbol is always the weight per linear foot.

56. D — Weight = 6.6 lb/ft x 22 ft = 145.2 lb, rounded to 145 lb. Option A (120) uses 5.45 lb/ft; B (130) uses 5.91 lb/ft; C (139) uses 6.32 lb/ft. The weight per linear foot is given directly in the problem For angle sections the weight per foot is found in AISC section property tables.

57. D — At a scale of 1/8 inch = 1 foot, each 1/8 inch on paper equals 1 foot in the field. To find actual dimension: 4.25 inches ÷ (1/8 inch/foot) = 4.25 × 8 = 34 feet. Option A (24 ft) corresponds to 3.0 inches; B (28 ft) to 3.5 inches; C (31 ft) to approximately 3.875 inches.

58. C — In Submerged Arc Welding (SAW), the arc is completely buried under a blanket of granular flux. The flux melts in the arc zone, creating a slag that covers and protects the weld pool from atmospheric contamination No visible arc, no spatter, and high deposition rates make SAW ideal for heavy plate structural members fabricated in the shop.

59. B — E8018 is a high-strength low-hydrogen electrode with a minimum tensile strength of 80 ksi, making it suitable for welding higher-strength steels such as ASTM A572 Grade 60, A913 Grade 65, or A514 (T-1 steel). AWS D1.1 requires that the filler metal's minimum tensile strength match or exceed that of the base metal.

60. A — Paint and coatings at the weld zone must be completely removed before welding because paint combustion products introduce hydrogen, carbon, and other contaminants into the molten weld pool. These contaminants cause porosity, reduced fusion, and can promote hydrogen-induced cracking in the heat-affected zone. AWS D1 AWS D1.1 requires weld zones to be cleaned to bare metal before welding begins.

61. B — The effective throat of a standard equal-leg fillet weld is the perpendicular distance from the root to the weld face. For equal-leg fillet welds: effective throat = 0.707 × leg size = 0.707 × 0.5 = 0.354 inch. This value is used in shear capacity calculations because it represents the cross-sectional area resisting shear at the theoretical weld failure plane.

62. D — Torch tip orifices are cleaned using tip cleaners — sets of tapered reamers or files sized to fit each orifice without enlarging it. Each tip size has a corresponding cleaner size that matches the orifice diameter. The cleaner is inserted and rotated gently to remove carbon deposits and hardened spatter.

63. C — In FCAW, wire feed speed controls the welding amperage. Faster wire feed means more wire is delivered to the arc per second, which requires more electrical current to melt it — amperage rises proportionally with wire feed speed in constant-voltage FCAW machines. Higher amperage produces more heat input, which increases the deposition rate (pounds of weld metal per hour).

64. A — Acetylene is stored dissolved in acetone inside porous material within the cylinder. Drawing gas too rapidly causes the acetone to be carried out of the cylinder along with the acetylene vapor. Acetone in the gas supply contaminates the fuel stream, produces an unstable, irregular flame, damages the regulator, and can create unpredictable combustion behavior.

65. D — AWS D1.1 requires that cracked welds be completely removed to sound metal by arc gouging, grinding, or machining before rewelding. Welding over a crack is never acceptable because the crack remains in the final weld and continues to propagate under service loads After rewelding, the joint is re-inspected to confirm the repair is defect-free.

66. A — The standard minimum puddle weld diameter for fastening metal decking to structural steel is 5/8 inch per the Steel Deck Institute standard. This minimum diameter provides the required shear transfer capacity between the deck and the structural steel below Smaller puddle welds do not develop adequate strength for diaphragm shear transfer.

67. C — High heat input means slow travel speed and high current, keeping the weld zone at elevated temperature longer. Extended elevated temperature causes grain growth in the heat-affected zone (HAZ), producing coarser grain structure with lower fracture toughness. Low-temperature applications and notch-sensitive steels are particularly affected by HAZ grain coarsening, which is why heat input is controlled in critical welding procedures.

68. B — GPS accuracy in open-sky environments can be excellent with survey-grade equipment. However, in urban environments, signals are reflected off nearby buildings, creating multipath signals that degrade positioning accuracy. For structural layout requiring sub-1/8-inch accuracy, conventional optical total stations are preferred in urban building construction environments where GPS multipath interference is significant.

69. A — Column grid offsets introduce a reference line parallel to the intended column line at a known distance from it. The critical documentation is the offset distance and direction, because all measurements must account for the offset Without clear documentation of the offset distance and direction, workers may set structure on the offset line rather than at the correct column position.

70. C — The diagonal of a 40-foot by 30-foot rectangle: $c = \sqrt{(40^2 + 30^2)} = \sqrt{(1{,}600 + 900)} = \sqrt{2{,}500} =$ 50 feet. This is a 3-4-5 right triangle scaled by 10 (30 = 3×10, 40 = 4×10, 50 = 5×10). Both diagonals must measure exactly 50 feet for the bay to be square.

71. D — An electronic theodolite or total station provides a geometry-based plumb measurement that is not affected by air movement. The instrument sights to prism targets mounted on the column at multiple heights. The horizontal deviations of the column top target from the column base target are measured as angular differences, which are converted to linear deviations.

72. B — With an accuracy of ±1/16 inch, the acceptable range is 30 feet 0 inches ± 1/16 inch. Converting: 30’-0” = 360 inches. Range: 360 − 1/16 to 360 + 1/16 = 359-15/16 to 360-1/16 inch = 29 feet 11-15/16 inches to 30 feet 0-1/16 inch. Option A applies a wider ±5/8-inch range; C applies ±1-inch; D applies ±2-inch.

73. A — A cable guy at 45 degrees from the column develops horizontal component = tension × sin 45° = tension × 0.707. A steeper guy (closer to vertical) has less horizontal component per unit of tension, providing less restraint. A shallower guy provides more horizontal component but requires a longer anchor distance.

74. B — Elevation = HI − rod reading = 106.50 − 4.25 = 102.25 ft. The rod reading represents how high above the target the instrument's horizontal line of sight passes. Subtracting it from the HI gives the target elevation. Option A (110.75) adds the rod reading to the HI; C (97.

75. D — Whether tightening the east guy alone or also loosening the west guy is needed depends on the current state of both guys. If the west guy is already slack (not under tension), it cannot contribute to restraint in either direction, and loosening it further has no effect. In that case, only the east guy tightening corrects the eastward lean.

76. C — Column grid offset marks are most useful when set at a consistent, clearly defined distance from the column centerline, specified in the project's erection plan or layout drawings. Common values are 1 foot, 2 feet, or the column half-depth, selected so that measuring back from the mark gives the column centerline directly.

77. C — The all-around symbol (a small circle at the junction of the reference line and arrow) indicates that the weld is to be made continuously around the entire perimeter of the connection. This is used for pipe-to-plate connections, tube stub connections, and any configuration where the weld must be continuous around a closed perimeter.

78. D — A flag at the bend of the weld symbol arrow indicates the weld is a field weld, to be made in the field during erection and not in the fabrication shop. This distinction is critical for planning and inspection requirements Field welds require field inspection and position-qualified welding procedures during erection.

79. A — A column schedule lists every unique column designation in the structural frame, providing the column mark, section size, column height or story heights spanned, and any special conditions such as moment connection requirements, splices, or special base conditions. It allows the ironworker and fabricator to confirm the correct column section is used at each location without checking every plan dimension.

80. B — TYP. is the standard abbreviation for Typical. In structural drawings, 'TYP.' means the dimension, detail, or condition shown applies to all similar instances throughout the project, unless a specific override is shown at a particular location. If a detail labeled 'TYP.' is shown at one connection, all connections of the same type use that detail.

81. B — AISC standard connections are pre-engineered connections that have been analyzed by AISC for a range of loading conditions and tabulated in the Steel Construction Manual. When a connection detail conforms exactly to an AISC standard and is labeled as such, the structural engineer has incorporated those standard dimensions, bolt patterns, and weld sizes into the project without re-deriving them.

82. D — Erection drawings show how structural members are assembled in the field — their layout, connection points, and field-connected details. Shop drawings show the fabrication details for each individual piece: exact dimensions, material, cuts, cope depths, weld sizes, and shop-installed connection hardware that the fabricator must produce before shipment. Both types must be reviewed and approved before fabrication and erection begin.

83. A — AISC specification restricts oversized holes in bearing-type connections where bolt shear is the governing limit state. In a standard bearing connection, the hole fits snugly around the bolt so the bolt bears against the hole edge at its full shear capacity An oversized hole increases connection slip and reduces effective bolt shear area.

84. C — A bridging terminus point (BTP) is the structural element — a column, wall, or other stable anchor — at the end of a row of bridging where accumulated lateral forces transfer into the main

structure Without a properly anchored BTP at each end, bridging forms a floating chain that can rock laterally as a unit, providing no actual lateral restraint.

85. C — The SJI Standard Specification requires a minimum 1/8-inch fillet weld, 1 inch long, on one side of the joist seat when the end connection is welded rather than bolted. This minimum weld secures the joist against lateral displacement during erection. Longer welds or welds on both sides may be specified by the engineer for heavier loading conditions.

86. D — Diagonal bridging forms an X-pattern between joist top and bottom chords, providing the critical load path for transferring accumulated lateral forces from horizontal bridging rows into the BTP at each end Vertical bridging cannot develop the diagonal force component needed to move lateral bridging loads into the structure at the bridging terminus points.

87. A — OSHA 1926.757(a)(3) requires the ironworker not to stand on the joist until bridging is installed per the SJI standard bridging table. The maximum unsupported top chord distance before the first bridging row is specific to each joist designation and is found in the SJI table The maximum unsupported distance is joist-specific, found in the SJI bridging table.

88. B — Before placing any bar joist, the ironworker must verify that the joist designation on the delivery tag matches the designation shown on the erection drawings for that specific bay and position Installing the wrong joist size creates a structural deficiency invisible once deck and concrete are placed above it and cannot be easily corrected.

89. D — If an inspector was not present during turn-of-nut tightening, verification is performed by applying the snug-tight torque to each bolt with a calibrated torque wrench. If the nut does not rotate under that load, the bolt has been tightened beyond snug-tight, confirming pretension If the nut rotates, the bolt must be re-tightened with an inspector present.

90. B — Snug tight is defined as the condition achieved by the full effort of an ironworker using a standard (not extended) spud wrench, or a few impacts of a pneumatic impact wrench, sufficient to bring all plies of the connection into firm contact. It is not a specific torque value, nor a specific nut rotation.

91. A — Punching introduces cold work into the material around the hole perimeter, creating a hardened and potentially microcracked zone. Under high tensile stress or fatigue loading, this cold-worked zone can become the initiation point for crack propagation. AISC specification may require punched holes to be reamed to remove the cold-worked zone for connections subject to tension fatigue or high stress concentrations.

92. C — TC bolt sets rely on precisely formulated lubricants on the thread and nut bearing surfaces to achieve the required pretension when the spline shears off. Moisture absorption, freezing, or contamination changes the friction coefficient and thus the torque-to-tension relationship — the spline may shear at a lower or higher pretension than intended.

93. A — A hydraulic torque wrench applies a measured, controllable torque without the shock of an impact wrench. It is used when the exact torque applied must be controlled and measured — for

example, when snug-tight torque must be precisely established before beginning the turn-of-nut sequence, or when torque control tightening is specified for specific connection types.

94. C — Between weld passes in multi-pass welds, chipping and wire brushing remove slag residue and loose spatter that remain on the previous bead surface. If left in place, these contaminants become trapped in the next weld pass as slag inclusions — non-metallic particles embedded in the weld metal that reduce ductility, toughness, and tensile strength.

95. D — A chain block with 4 falls of chain provides exactly 4 to 1 mechanical advantage, so the hand effort to lift the load is one-fourth of the load weight. A lever hoist's mechanical advantage depends on its internal gear ratio, which varies by model and manufacturer Common lever hoists may provide 30 to 1 mechanical advantage, much higher.

96. B — Adding a second fall of chain through a lower hook block doubles the lever hoist's rated lift capacity. A 3-ton lever hoist in single purchase can lift 3 tons; reeved in double purchase (two falls through the lower block), the same lever pull now supports 2 falls and can lift 6 tons.

97. D — Sidelap fasteners — screws, button punches, or side welds — connect adjacent deck sheets along their overlapping edges. Their primary structural function is to transfer in-plane shear forces between sheets so the assembled deck can act as a rigid horizontal diaphragm that transfers lateral loads to the vertical lateral load resisting system.

98. A — Hot-dip galvanized deck contains a zinc coating on both faces. When a stud is welded through galvanized deck, the arc burns through the zinc at the stud contact point, generating zinc vapor that is hazardous and requires ventilation or respiratory protection Zinc contamination causes porosity; special qualification testing is required for galvanized deck.

99. B — For level floor decks, the direction of deck lapping is specified in the project documents so that puddle welds at deck ends are always accessible from the top surface. If sheets lap the wrong direction, the end of the lower sheet may be inaccessible for welding, preventing the required end-bearing weld from being made properly.

100. C — A pre-pour deck inspection verifies that all required structural attachments are complete: stud welds inspected and ferrules removed, puddle welds at all required locations, sidelap fasteners at specified spacing, and all openings protected All construction debris must be removed from the deck surface so the concrete placement crew has a safe, clear work area and concrete places at the correct.