

SIMULATION SET 8

SITE DOMAIN — Questions 1–21

1. A telescopic boom crane is being set up at a manufacturing facility for a planned maintenance lift. The surface consists of an epoxy-coated concrete floor that has been in service for 15 years. Beneath the floor slab is an extensive network of buried conduit and cable trays serving the facility's electrical system. What must be confirmed before crane outrigger loading?

- A. Epoxy-coated concrete floors meet all crane operation standards without additional evaluation
- B. The structural capacity of the slab and the routed depth and clearance of the buried conduit must be evaluated — the slab must be confirmed structurally adequate for the crane's point loads, and the buried conduit must be confirmed not to create voids or weak zones in the slab's load path beneath the outrigger positions
- C. Indoor operations on concrete floors do not require any bearing capacity evaluation
- D. The facility's electrical system must be de-energized before any crane setup near buried conduit

2. A crane operator is evaluating a job site where the planned outrigger positions include one location where the surface has subsided — creating a shallow, bowl-shaped depression approximately 5 feet in diameter and 3 inches deep. The surrounding surface is at grade. What does this surface feature most likely indicate?

- A. The depression is caused by freeze-thaw heaving in reverse — the soil contracted during warm weather
- B. Surface settlement in compacted areas is normal consolidation and confirms the soil has reached maximum density
- C. This type of depression in compacted ground is consistent with compaction test results indicating optimal moisture content
- D. A bowl-shaped surface depression in a previously flat area may indicate ongoing subsurface settlement or void development beneath the affected zone — placing an outrigger at this location without investigating the subsurface cause risks accelerating whatever process created the depression under crane loading

3. Under OSHA 1926.1402(c), what action is required when the crane is working near an excavation and the ground adjacent to the excavation has developed visible tension cracks running parallel to the excavation edge?

A. Tension cracks parallel to an excavation edge indicate that the soil mass between the crane outriggers and the excavation face is experiencing shear stress that may be approaching failure — crane operations adjacent to this condition must stop and the ground conditions must be evaluated by a qualified person before any further outrigger loading near the tension crack zone

B. Tension cracks are cosmetic and do not affect bearing capacity until the crack width exceeds 2 inches

C. Tension cracks indicate frost activity and are not related to excavation stability

D. Tension cracks only occur in clay soils and are not a concern in granular materials

4. A crane is set up on a job site where the controlling entity has confirmed the ground is adequate. During setup, the crane operator notices that one of the previous contractor's survey stakes marking an underground fuel storage tank is located only 14 inches from the planned left rear outrigger pad position. What action is required?

A. Continue setup since the survey stake is not directly under the planned pad position

B. Nothing — underground storage tanks are structural elements that increase bearing capacity

C. The survey stake indicates the underground storage tank boundary — the outrigger must be repositioned away from the tank location because loading over an underground storage tank can cause roof collapse and potential catastrophic fuel release; the crane must not be set up over or immediately adjacent to any underground storage tank without engineering confirmation that the tank can support the specific outrigger load

D. The operator may continue if the tank is confirmed empty

5. Under ASME B30.5, what must be true about the ground condition throughout the entire area the crane will occupy — not just at the outrigger positions?

A. The ground condition assessment is only required at the four outrigger positions — the rest of the crane's footprint does not require evaluation

B. The ground must be firm and stable throughout the crane's entire working area — including the area beneath the carrier, beneath the travel path, and throughout the planned operational swing radius —

because ground failure in any of these areas can create a hazard for the crane and personnel regardless of adequate conditions at the outrigger positions

C. Ground conditions between outrigger positions are managed by ensuring adequate outrigger loading — no other ground condition assessment is needed

D. The carrier area beneath the crane is always structurally adequate since the outriggers carry all load during operations

6. A crane is operating when the general contractor reports that the facility's underground irrigation system — which runs through the crane's outrigger spread area — has developed a pressurized leak and is actively spraying water upward through the soil at a location 8 feet from the right rear outrigger pad. What is the required response?

A. Continue operations if the water spray is not reaching the outrigger pads directly

B. Monitor the water flow rate and stop operations only if settlement becomes visible at the outrigger pads

C. Reduce the planned lift capacity to 75% while the irrigation leak is addressed

D. Stop all crane operations immediately — a pressurized water leak in the soil near an outrigger position can rapidly saturate and weaken the soil, erode the support beneath the cribbing, and create sudden unpredictable ground failure; operations must not resume until the leak is stopped and ground conditions are re-evaluated

7. Under OSHA 1926.1408, when a crane operator cannot maintain the applicable minimum safe approach distance from a power line during operations and de-energization of the line is confirmed as not feasible, which specific element of the required encroachment prevention plan must physically stop all crane movement?

A. The dedicated spotter's means of immediately stopping all crane movement — this is a required element of any encroachment prevention plan; the spotter must have a direct, immediate method of stopping the crane the instant any part of the crane or load approaches the MSAD boundary, without relying on radio communication or signaling that could be delayed

B. The rated capacity indicator, which automatically stops the crane when approaching the MSAD

C. The lift director's verbal stop command transmitted by radio

D. The LMI system, which triggers an alarm when the boom approaches a pre-programmed height limit

8. A crane is being set up on a job site adjacent to a city sidewalk where pedestrian traffic is present. The crane's exclusion zone has been established using barrier tape. A pedestrian moves the tape to pass through the zone during the setup process. What is the required response?

- A. Sound the horn to warn the pedestrian and continue setup operations
- B. Allow the pedestrian to cross and replace the tape after they exit
- C. Stop all crane movement until the pedestrian has exited the exclusion zone and the zone boundary is re-established — the exclusion zone boundary has been breached by an unauthorized person; no crane movement may occur with an unauthorized person in the zone regardless of how briefly they are present
- D. The crane setup may continue as long as the pedestrian is walking and not stationary in the zone

9. A crane operator is evaluating the setup area and finds that one planned outrigger position will be on compacted fill that was placed over a buried concrete structure — specifically, a decommissioned underground cistern filled with demolished concrete rubble. The rubble fill was placed 2 years ago without compaction testing. What is the concern with loading over this area?

- A. Decommissioned cisterns filled with concrete rubble provide a stable, rock-like foundation and are the preferred bearing surface for crane outriggers
- B. Concrete rubble fill is compacted by gravity over time and 2 years is sufficient to produce maximum bearing capacity
- C. Rubble fill without compaction testing may have significant void spaces between the concrete pieces that create an unstable, non-uniform bearing condition — the fill may compact suddenly under crane outrigger loading, causing settlement; a qualified engineer must evaluate this condition before outrigger loading
- D. Buried concrete structures always improve bearing capacity and no special consideration is needed

10. Under OSHA 1926.1402, when the controlling entity knows that ground conditions change throughout the day — such as when soil softens during afternoon heat at an asphalt surface — what obligation does this knowledge create?

- A. No obligation exists for conditions that are naturally occurring and outside human control
- B. The controlling entity must post daily weather warnings at the site entrance when ground conditions are expected to change
- C. The controlling entity must inform the crane employer of conditions that may affect crane operations — including predictable daily changes such as heat-induced asphalt softening; the crane employer can

then plan operations to avoid the vulnerable periods or implement controls that address the changing conditions

D. Daily condition changes require a new ground assessment each morning but not during operations

11. A crane is operating on a job site when the operator observes that a small section of the gravel surface beneath the right rear outrigger cribbing has displaced laterally — pushed away from beneath the mat edge — creating a small mound of gravel adjacent to the mat. What does lateral gravel displacement under a loaded mat indicate?

A. Lateral displacement of soil or gravel from beneath a loaded outrigger mat is a sign that bearing capacity at that position is being exceeded — the material is failing in shear and being pushed outward under the concentrated load; operations must stop and the load must be lowered while the ground condition at that position is evaluated

B. Lateral gravel displacement is normal under any loaded outrigger pad and indicates the gravel is consolidating properly

C. The displaced gravel must be replaced in the void area and compacted before continuing operations

D. Lateral displacement only indicates settlement if the mat itself has also moved downward

12. A crane is being operated on a job site when a second crane on the opposite end of the site begins dynamic compaction operations — dropping a heavy weight repeatedly from height to compact soil for a future foundation. Each drop creates significant ground vibration felt throughout the site. What concern does the dynamic compaction create for the operating crane's ground support?

A. Dynamic compaction improves soil density and increases bearing capacity near the operating crane

B. Dynamic compaction creates no meaningful vibration at distances greater than 50 feet

C. The repeated vibration from dynamic compaction can cause progressive densification and settlement of loosely-placed soil, disturb properly-seated outrigger pads, and change the load distribution at cribbing contact points — the operating crane's setup condition must be monitored and re-evaluated if any level change or pad shifting is observed

D. Dynamic compaction vibration only affects the compaction site and has no influence on adjacent crane operations

13. A crane crew is setting up at a refinery where the work area includes several floor drains that connect to an oil-water separator. One planned outrigger position is directly over a drain inlet. What concern does operating over a drain inlet create?

- A. Drain inlets on refinery floors are structural elements reinforced to handle equipment loading
- B. Drain covers can support any construction loading since they are designed for vehicle traffic
- C. Nothing special applies to drain inlets — they are covered with cast iron grates rated for heavy loading
- D. The drain inlet and its connected pipe represent a void in the load path — concentrated outrigger loads can cause the drain cover or box to fail if the structure was not designed for crane loading; the outrigger position must be relocated away from the drain or the drain's structural capacity must be confirmed for the specific outrigger load

14. Under OSHA 1926.1407(b), what action must be taken when the crane operator identifies that a power line exists within the crane's working area but the line has not been positively identified or marked?

- A. The operator must determine the line's voltage by visual inspection of the conductor diameter and pole configuration before operations begin
- B. The 10-foot default MSAD applies whenever a power line's voltage cannot be confirmed by visual inspection
- C. The line's voltage must be determined by contacting the utility operator or by another reliable method — visual estimation of voltage is not sufficient; the operator must know the confirmed voltage to apply the correct MSAD from OSHA Table A before beginning any operations
- D. Operations may begin if the boom will remain at least 30 feet from any unidentified power line

15. A crane is positioned at a job site where the setup area abuts an abandoned railroad spur. The spur has been out of service for 10 years and the tracks are rusted in place. The planned left rear outrigger position is 3 feet from the nearest rail. What concern does the abandoned railroad track present?

- A. The steel rails and underlying ballast provide excellent structural support for crane outriggers positioned near them — rail beds are superior bearing surfaces
- B. Nothing — the 3-foot clearance from the rail is within normal operational tolerances for all crane types

C. An abandoned railroad track and its ballast bed may have different bearing capacity from the surrounding soil — the ballast material may be loose and non-compacted, and the abandoned track infrastructure may include void spaces between railroad ties; the outrigger position must be confirmed stable on the actual surface type present

D. Abandoned railroad tracks are always removed before construction activities begin — the spur must be cleared before any crane operation begins adjacent to it

16. A crane operator has been at the controls for 9 continuous hours and realizes that their response time and decision-making feel impaired due to fatigue. The current lift is at 82% of rated capacity. Under OSHA's general duty clause and professional standards, what is the correct response?

A. The operator should notify the lift director of the fatigue condition and stop operating the crane — the operator must not continue crane operations when they recognize that fatigue has impaired their ability to safely perform the job; this is a personal stop-work obligation that protects both the operator and all personnel in the work area

B. Complete the current lift at minimum speed and then stop for a break

C. Reduce the load to 75% of rated capacity and continue for the remainder of the shift

D. Continue operations until the lift director notices the impairment and directs a stop

17. A crane is operating when the signal person gives the LOWER signal but also simultaneously gives what appears to be a STOP signal with their other hand. The operator is uncertain which signal takes precedence. What is the correct response?

A. The STOP signal takes priority over all other signals — when there is any ambiguity between a directional signal and a stop signal, the operator must treat any possible stop signal as a stop command; all crane movement must immediately cease until the signal person retransmits a clear, unambiguous single command

B. The directional signal takes precedence since it indicates the intended movement

C. The operator should execute the LOWER movement since it is the safer movement between the two

D. Ask the lift director which signal the signal person intended while holding the current position

18. Under OSHA 1926.1416(e), what must the operator confirm regarding the crane's rated capacity before beginning each work shift?

- A. The operator must confirm the rated capacity is displayed on an internal cab placard that matches the load chart
- B. Nothing — the operator's NCCCO certification confirms competency for all capacity-related determinations
- C. The load chart must be confirmed as present in the cab, accessible to the operator, and applicable to the crane's current configuration — the operator must verify the load chart is the correct one for the specific crane before beginning operations
- D. The operator must perform a test lift at 100% of the day's planned maximum capacity to confirm the rated capacity is accurate

19. A crane is performing a lift when the operator hears two horn blasts from another crane operating nearby — the standard signal for "attention." The operator cannot see the source of the horn signal. What is the correct response?

- A. Stop all crane movement immediately and scan the area to identify the source and nature of the hazard being signaled — another crane operator sounding an attention signal indicates they have identified a developing hazard in the work area that requires all nearby crane operators to pause and assess conditions
- B. Continue operations since the attention signal from another crane does not apply to this crane's operations
- C. Sound one horn blast in return to confirm the signal has been heard and continue operations
- D. Contact the lift director to determine whether the other crane's signal applies to the current operation

20. Under OSHA 1926.1424, what determines the specific size and boundaries of the exclusion zone that must be established before crane operations begin?

- A. Exclusion zones are always 25 feet from the crane centerline for all operations
- B. The exclusion zone size is determined by the crane manufacturer and is specified in the operator's manual for each crane model
- C. The exclusion zone must encompass all areas where personnel could be struck by the crane's rotating upper works, counterweights, boom, load, or where they could be injured by a load drop or crane tip-over — the zone is defined by the actual hazard area of the specific crane's configuration and planned operations, not by a standard fixed distance
- D. Exclusion zones are set at the lift director's discretion based on the specific site hazards

21. A crane is operating at a job site in an industrial area where high-pressure steam lines run at grade level in pipe racks adjacent to the setup area. A steam fitting on a rack 15 feet from the crane's right front outrigger position is leaking visibly — steam vapor is escaping at low pressure. What action is required?

- A. Continue operations since the steam fitting is 15 feet from the outrigger and does not directly affect crane support
- B. Reduce the operating radius to keep the load away from the steam leak area
- C. The facility's safety team must evaluate the steam leak and confirm whether the low-pressure escape represents a risk of escalation — steam system failures can escalate without warning from low-pressure leaks to full-line pressure releases; crane operations within the potential steam release zone must pause until the leak is confirmed safe or repaired
- D. Low-pressure steam leaks are routine in industrial facilities and do not require operational response

OPERATIONS DOMAIN — Questions 22–48

22. A crane operator is completing a hoist when the load reaches the planned set height but the signal person has not given a STOP signal — the signal person appears distracted. The load continues to rise because the operator has not released the hoist control. What is the correct response?

- A. Continue hoisting until the ATB activates to prevent over-hoisting
- B. Hoist until the load is 2 feet above the set height and then stop unilaterally
- C. Sound the horn to alert the signal person and continue hoisting slowly
- D. Stop the hoist independently — the operator has direct knowledge that the load has reached the planned set height and should stop hoisting, then use the horn to get the signal person's attention; the operator is responsible for monitoring load height and must not continue hoisting past the planned height regardless of whether a STOP signal has been given

23. A crane is performing a lift when the load passes over a power line that the operator did not know was present — the line was obscured by vegetation and was not shown on the site utility plan. The load line passes within approximately 12 feet of the conductor before the operator is alerted by a spotter. What must happen immediately?

- A. Stop all crane movement and hold the load stationary — investigate the power line's voltage and establish the applicable MSAD before any crane movement continues; the load cannot be moved closer to the line until the voltage is confirmed and the clearance is confirmed to meet the applicable MSAD
- B. Quickly swing the load away from the line at maximum speed to exit the hazard area
- C. Continue slowly to the set location since the load is already past the minimum approach distance
- D. Contact the utility operator and request emergency de-energization before any further movement

24. Under OSHA 1926.1431, when is a "trial lift" required and what specific information does it provide?

- A. Trial lifts are required only for critical lifts above 75% of rated capacity
- B. Nothing — trial lifts are optional quality assurance procedures, not OSHA-mandated operations
- C. A trial lift is required before the first personnel hoisting operation on a project — it must be performed with the unloaded platform at the maximum intended height and over the full arc of intended movement, confirming that all crane functions operate correctly over the complete planned personnel hoisting range before personnel board the platform
- D. Trial lifts are required for all lifts above 50% of rated capacity at any point during a project

25. A crane operator is performing a lift using 4-part line. The signal person gives a sequence of signals: HOIST — brief pause — LOWER — brief pause — HOIST again. The operator executes each signal as given. What communication problem does this signal sequence create?

- A. The alternating sequence requires the operator to reverse drum direction repeatedly, which is prohibited during active lifts
- B. Rapid alternating between HOIST and LOWER creates problems — each direction reversal imposes shock loads on the load line and the boom structure; additionally, repeated reversals can cause the load to oscillate unpredictably; the operator should request a signal communication confirmation before the next reversal if the sequence appears unintentional
- C. Nothing — the operator's role is to execute all commands precisely as given regardless of sequence
- D. The alternating sequence requires the operator to contact the lift director for authorization before each direction reversal

26. Under ASME B30.5, when an operator is performing a lift that requires the boom to travel over a section of the job site where the load would pass over workers, what specific requirement applies to clearing the area?

- A. Workers must be warned by horn signal and may remain in the area as long as they are aware of the overhead load
- B. Workers must move to the perimeter of the exclusion zone — they may remain within the zone as long as they are not directly beneath the load path
- C. The lift director must authorize loads passing over workers when no alternative path is available
- D. All workers must physically clear the area beneath the entire load path before the load is moved over that area — workers may not remain beneath a load path regardless of their awareness or the load's height above them

27. A crane's swing drive fails completely during an active lift — the upper works cannot be rotated by any control input. The load is at 15 feet of height mid-swing, not at the set location. The load is 12,000 lbs and the LMI reads 76% capacity. What is the correct response?

- A. The operator should exit the cab and allow the load to remain suspended while investigating the swing drive failure
- B. Use the hoist function to raise the load above all obstructions and wait for the swing drive to be repaired with the load at height
- C. Sound the emergency horn and lower the load to the nearest stable surface using the hoist — the swing function failure does not prevent controlled vertical lowering; the safest resolution is to lower the load to the closest safe position while warning all personnel, then investigate and repair the swing drive before any additional lifting
- D. Apply the service brake to the swing function and hold the load in position while contacting the lift director for instructions

28. A crane operator is asked to perform a lift at 94% of rated capacity. The pre-lift meeting has been completed. As the operator is about to begin, a supervisor from a different trade contractor approaches the cab and asks the operator to delay the lift by 15 minutes for his crew to complete work in an adjacent area. The operator is uncertain whether the delay affects any time-sensitive rigging conditions. What is the correct response?

- A. Comply with the supervisor's request immediately — all site supervisors have authority to delay crane operations
- B. Contact the lift director to verify whether the delay is operationally safe — at 94% capacity, any additional time that could affect rigging configuration, ground conditions, or wind speed should be reviewed; the lift director must confirm the delay is acceptable before the operator waits or proceeds
- C. Proceed with the lift immediately since the pre-lift meeting has already been conducted
- D. Ask the rigger if the delay affects any rigging conditions and make the decision independently

29. A crane is operating in fog that has reduced visibility to approximately 40 feet. The load must travel 60 feet to the set location and the signal person is positioned at the set location — outside the operator's visibility range. What must be done?

- A. The operator may estimate the signal person's position from the radio communication and proceed at minimum speed
- B. Establish a relay signal person system with at least one intermediate person visible to both the operator and the primary signal person — the operator must maintain continuous visual contact with the nearest relay point, who must maintain contact with the signal person throughout the operation; no movement may occur when the communication chain has a gap
- C. Use radio communication exclusively since fog does not affect radio signal quality
- D. Reduce all crane movements to minimum speed and proceed with radio communication until the fog clears

30. Under OSHA 1926.1416, what specific restriction applies to a crane operator regarding the execution of movements commanded by the signal person?

- A. The operator must execute every signal immediately upon receiving it — delays are prohibited
- B. The operator's duty is to execute signals precisely as given unless an unsafe condition prevents compliance
- C. The operator must refuse any signal that would require exceeding the crane's rated capacity, that would create an unsafe condition, or that the operator is not certain is correct — the operator retains independent authority and responsibility for the crane's safe operation regardless of what signal is given
- D. Operators may refuse signals only when the LMI confirms the movement would exceed 100% capacity

31. Under OSHA 1926.1412(f), what must be performed after a crane undergoes a major repair — such as replacement of a main structural member of the crane's boom?

A. A post-repair inspection by a qualified person, followed by a proof load test as specified by the crane manufacturer or a qualified engineer, before the crane returns to service — a structural repair changes the crane's load path and may affect rated capacity; the inspection and proof test confirm the repair was performed correctly and the crane is safe for its rated loads

B. A post-repair monthly inspection and a 30-day monitoring period before full-capacity operations are permitted

C. The operator must perform a post-shift inspection after the first shift following a structural repair

D. Only the replaced component needs inspection — the rest of the crane does not require reassessment after a structural component is replaced

32. A crane operator is performing a pick-and-carry operation when the crane's right front tire hits an unexpected pothole in the travel path, causing the crane to tilt 4 degrees toward the right front. The pick-and-carry section of the load chart specifies a maximum 3-degree cross-slope. What must happen?

A. Continue travel at reduced speed to minimize the duration of the out-of-tolerance tilt condition

B. Maneuver out of the pothole by steering left while continuing forward travel

C. Stop travel immediately — the crane is in a configuration that exceeds the pick-and-carry section's maximum cross-slope specification; with the load attached, the crane must stop travel until the pothole condition is resolved; the load may need to be set down before the crane can safely navigate out of the uneven area

D. Apply the travel brakes firmly to stabilize the crane in the tilted position

33. A crane operator is performing a lift in an urban environment when a passerby shouts loudly at the operator that there is a person in danger beneath the load. The operator cannot see the area beneath the load from the cab. What is the required immediate response?

A. Stop all crane movement immediately — when any person alerts the operator to a potential person-in-danger situation beneath the load, all movement must stop before the operator can verify or investigate; OSHA 1926.1425 prohibits loads over personnel, and an unverified alert is treated as an emergency until confirmed clear

B. Continue the current movement while asking the signal person to investigate the reported person

- C. Sound the horn three times to warn the reported person and continue the lift
- D. Contact the lift director for authorization to stop before halting crane movement

34. Under OSHA 1926.1427, a crane operator's NCCCO certification expires on September 30. On October 15, the operator has not yet recertified. Their employer has them scheduled for a critical lift. What are the employer's obligations and restrictions?

- A. The employer may allow the operator to perform the critical lift since it is within 30 days of the expired certification
- B. The employer may use the operator for lifts below 75% of rated capacity during the certification lapse
- C. The operator must perform the critical lift under direct supervision of a currently certified operator
- D. The employer is prohibited from having the operator perform crane operations that require certification — the certification is expired and no grace period is provided by OSHA 1926.1427; the employer is in violation of the standard if they allow the operator to perform certified crane operations until the operator recertifies

35. A crane is performing a lift that requires multiple cranes operating simultaneously in adjacent areas. Crane A is performing a lift while Crane B is traveling in the nearby travel lane. Crane B's boom extends over the travel lane during travel. What coordination requirement applies?

- A. Each crane must maintain its own exclusion zone independently — no coordination between cranes is required
- B. Nothing — multiple cranes operating in proximity are each individually responsible for their own safety
- C. The operations of Crane A and Crane B must be coordinated to prevent their booms, loads, or operational envelopes from intersecting — a coordination plan must establish whose crane has priority at any point where their operational envelopes could overlap, and both operators must follow this plan; the control authority for the coordination plan lies with the lift director overseeing both operations
- D. Crane B must stop traveling whenever Crane A is within 50 feet of Crane B's travel path

36. A crane operator is asked to extend the boom to reach a pick point while a load from a previous lift is still suspended on the hook at the set location. The signal person asks the operator to extend the boom without lowering the current load first. What is required?

- A. Boom extension with a suspended load is always prohibited under ASME B30.5
- B. Confirm the current suspended load against the capacity values at the extended boom configuration before executing — the boom extension changes the operating radius and boom length configuration, which changes the applicable capacity; the operator must verify the current load is within the new configuration's capacity before executing any boom extension with a load attached
- C. Proceed with boom extension since the signal person has directional authority
- D. Boom extension with a suspended load requires lift director authorization regardless of capacity

37. A crane is performing a critical lift at 91% of rated capacity when the crane's engine experiences a governor fault — the engine begins running at higher-than-normal RPM without operator input. The load is at 22 feet of height. What must the operator do?

- A. Use the crane's throttle control to manually reduce engine RPM while maintaining the load position
- B. Use the emergency stop function — shut down the crane's engine immediately, allowing the spring-applied brakes to hold the load, and have the engine fault investigated before restarting
- C. Continue operations at minimum function speed while the engine governor resets
- D. Contact the lift director and describe the engine condition before taking any action

38. Under ASME B30.5, what is the operator's responsibility when they observe any deficiency during operations that was not present during the pre-shift inspection?

- A. Document the deficiency in the shift log and address it at the end of the shift
- B. Notify the lift director at the next convenient pause in the lift cycle
- C. Wait until the current critical lift is complete before addressing deficiencies to avoid disrupting an active operation
- D. Immediately report the deficiency to the employer and, depending on its severity, stop operations if the deficiency meets removal-from-service criteria — conditions that develop during operations may escalate rapidly, and the operator must assess whether continued operations are safe

39. A crane operator is using 8-part line for a heavy lift. After completing the lift, the operator observes that the hook block is positioned with only 1.5 wraps remaining on the drum. The next planned lift will require lowering the hook block another 3 feet. What must happen before that next lift?

- A. The crane must be re-rigged with additional rope to ensure a minimum of 2 wraps remain on the drum at the lowest planned operating depth — 1.5 wraps is already below the ASME B30.5 minimum, and lowering further would be a violation; the rope must be lengthened or the maximum lowering depth restricted before any additional lift is performed
- B. The operator may continue since the 1.5-wrap condition was just identified and one additional wrap will remain after 3 more feet of lowering
- C. The minimum 2-wrap requirement only applies to the initial installation and does not apply during operations
- D. Contact the signal person to monitor the drum wrap count during the next lowering operation

40. Under OSHA 1926.1416, what is the specific prohibition regarding modification of the crane's rated capacity?

- A. Rated capacity may be modified with lift director approval for critical lifts that require exceeding the published limit
- B. The rated capacity is established by the manufacturer and may not be exceeded under any operational circumstances — no supervisor, employer, or lift director has authority to authorize operation above the rated capacity; operators who comply with directions to exceed rated capacity assume personal legal and safety responsibility for the resulting condition
- C. Rated capacity may be increased by 10% when a qualified engineer certifies the structural integrity of the crane
- D. Rated capacity modifications require written authorization from OSHA before implementation

41. A crane is performing a lift when the operator observes that the load is spinning about its vertical axis at approximately one revolution every 45 seconds. The load weighs 8,500 lbs and is attached by a four-leg wire rope sling bridle. What action should the operator take?

- A. Stop the hoist at the current height and use a tag line to arrest the rotation before continuing the hoist or any swing movement — slow rotation can progressively unscrew shackle pins, cause sling legs to twist and reduce their effective rated capacity, and make precise placement impossible; the rotation must be stopped before the load is moved further
- B. Continue the hoist — the slow rotation is within acceptable limits for wire rope sling applications
- C. Increase hoist speed to lift the load above the area where air currents cause the rotation
- D. Apply the swing brake in the direction of the load's rotation to create a counter-torque

42. A crane operator is completing a shift and hands the crane over to a relief operator. The relief operator conducts their pre-shift inspection and finds a small crack in the left rear outrigger beam — a hairline crack approximately 3/8 inch long at the weld joint between the beam and the carbody. The outgoing operator did not notice this crack. What must the relief operator do?

- A. Proceed with operations since the crack is only 3/8 inch and has not grown during the previous shift
- B. Document the crack in the log and inform maintenance — operations may continue if the crack appears stable
- C. Monitor the crack at hourly intervals during the first hour of operations to determine if it is propagating
- D. Stop crane operations immediately — any crack in a structural weld of a crane outrigger is a removal-from-service condition; the crane must not be operated until the crack is evaluated by the manufacturer or a qualified engineer and the deficiency is corrected

43. A crane operator has been assigned to a new job site with a different crane from their previous assignment. Both cranes are the same model. The operator's NCCCO TLL certification is current. What must the employer confirm before the operator begins operating the new crane at the new site?

- A. The employer must evaluate and document that the operator is competent to safely operate this specific crane at this specific worksite — even for the same crane model, the new site presents different ground conditions, hazards, and operational challenges; the employer's competency documentation is required before the first lift at the new assignment
- B. No additional evaluation is needed since the NCCCO certification and same crane model confirm full authorization
- C. The operator must perform a supervised orientation lift before being authorized to perform independent lifts
- D. The previous job site's competency documentation transfers to the new site for the same model crane

44. Under OSHA 1926.1431, which of the following is a required element of the pre-personnel-hoisting inspection that must be completed before each day's first personnel lift?

- A. Each occupant must be weighed to confirm the total platform occupant weight is below the 50% capacity limit
- B. The lift director must be present on the ground throughout all personnel hoisting operations

C. The load line, rigging, ATB, brakes, and all crane functions planned for use during personnel hoisting must be confirmed functional — additionally, the crane must be confirmed level and all platform connections must be inspected; this inspection must be performed before each workday's first personnel lift

D. OSHA requires a licensed inspector to certify the personnel platform before each use

45. A crane is performing a lift when the signal person radios that there is a problem with the rigging but cannot clearly describe what the problem is. The load is currently at 8 feet of height. What is the correct response?

A. Continue the lift slowly while the signal person describes the problem in more detail

B. Lower the load to the nearest stable surface immediately — when a rigging problem is reported but cannot be described clearly, the safest response is to lower the load; an incompletely described rigging problem may indicate an imminent rigging failure, and the load must be on the ground before the situation can be safely assessed

C. Hold the load at current height until the signal person describes the problem completely

D. Contact the lift director for guidance on whether to continue or lower the load

46. A crane operator is in the cab when strong odor from combustion — burning insulation or plastic — is detected. The engine gauges are normal and no warning lights are active. What is the required response?

A. Continue monitoring the gauges — if no warning lights activate within 5 minutes, the odor was likely from an external source

B. Reduce all crane functions to minimum speed until the odor source is identified

C. Complete the current lift cycle before investigating the odor source

D. Stop all crane operations, lower the load to the ground, and investigate the odor source immediately — a combustion smell in the cab may indicate an electrical fire beginning in a location not yet monitored by gauges or warning systems; waiting for gauge indication means waiting until a fire is already advanced

47. Under OSHA 1926.1413, when must a crane's wire rope running line be replaced versus when may it continue in service with increased inspection frequency?

- A. Running rope must be replaced on a 12-month schedule regardless of inspection findings
- B. Running rope must be replaced when the condition of the rope falls below the minimum standard established by OSHA 1926.1413 or ASME B30.5 — inspection findings, not time intervals, govern replacement; when the applicable criteria are met, replacement is required immediately, regardless of service time; no increased monitoring substitutes for replacement once removal criteria are identified
- C. Increased inspection frequency is an acceptable alternative to rope replacement for minor deficiencies
- D. Running rope replacement is at the discretion of the qualified inspector based on their professional judgment about remaining service life

48. A crane operator is performing a lift that requires operating near a fully glazed curtain wall on a high-rise building under construction. The load must pass within 6 feet of the glass panels during the swing to the set location. What specific concern does this proximity to the curtain wall create?

- A. No special concern — 6 feet is adequate clearance for all crane operations near building facades
- B. The proximity to the glass panels means that even a small load swing or pendulum oscillation during the lift could cause the load to contact the glass — load contact with a glazed curtain wall creates a risk of glass panel fracture and potential glass fall hazard to personnel below; the lift requires precise pendulum control through the approach using tag lines, minimum swing speed, and confirmed plumb load line before the approach to within 6 feet
- C. Reduce the lift capacity by 20% when operating within 10 feet of any glass facade
- D. The signal person must position themselves at the glass to physically prevent contact

TECHNICAL KNOWLEDGE DOMAIN — Questions 49–70

49. A crane's wire rope has been in service for 14 months and shows no broken wires, no deformation, and no diameter reduction. However, the rope appears dark and dry — the lubrication has dried out and wire-to-wire contact shows evidence of fretting corrosion in small pitting marks. What does fretting corrosion in wire rope indicate and what action is required?

- A. Fretting corrosion in wire rope is caused by micro-movement between adjacent wires under cyclic loading — it removes metal from the wire contact points, reducing wire cross-section at those points without producing visible external wire breaks; the rope's actual tensile capacity is lower than its nominal rated value and the rope must be removed from service and replaced
- B. Fretting corrosion is a surface cosmetic condition that does not affect tensile capacity

- C. Re-lubricating the rope will resolve fretting corrosion and restore the rope to full rated capacity
- D. Fretting corrosion only occurs in improperly lubricated ropes — apply lubricant and return the rope to service

50. Under ASME B30.9, what is the minimum design factor for Grade 100 alloy chain slings in general lifting applications?

- A. 5 to 1 — the same factor as wire rope slings
- B. 4 to 1 — the minimum design factor for both Grade 80 and Grade 100 alloy steel chain slings under ASME B30.9
- C. 3.5 to 1 — a reduced factor reflecting the higher base strength of Grade 100 material
- D. 6 to 1 — a higher factor reflecting the consequences of sudden chain failure in construction applications

51. A crane operator reviewing the pre-shift inspection record finds that the previous operator documented: "Hoist drum — rope layering observed in zone 2, no action taken." The current operator checks the drum and sees that the rope has cross-wound in the second layer, creating an irregular surface. What is the significance of this condition?

- A. Cross-wound rope in the second layer is normal and expected for all multi-layer drum configurations
- B. Nothing — second-layer cross-winding is only flagged for inspection during monthly checks
- C. Second layer cross-winding resolves automatically once the load is applied to the rope
- D. Cross-winding in any drum layer means the rope is not winding in its designed groove path — the rope will be crushed between crossing layers on subsequent winds, creating deformation, accelerated fatigue at the crushed points, and potential for the rope to jump drum flanges; the condition must be investigated and corrected before operations

52. A rigger is preparing a two-leg synthetic web sling bridle at 30 degrees from horizontal for a 12,000-pound load. Each leg has a vertical hitch WLL of 6,000 lbs. What is the maximum load the bridle can carry at this angle?

- A. 12,000 lbs — the two-leg bridle doubles the single-leg WLL regardless of angle

B. 6,000 lbs total — the 30-degree angle so severely degrades the capacity that the bridle cannot carry more than the single-leg WLL

C. Maximum load = $(2 \times 6,000) \times \sin(30^\circ) = 12,000 \times 0.5 = 6,000$ lbs — at 30 degrees from horizontal, the vertical component of each leg is 50% of the leg tension; the maximum load is 6,000 lbs for this configuration

D. 10,392 lbs — applying the 60-degree angle factor for the supplementary angle from vertical

53. A crane's hook block is raised for inspection and the inspector finds that the hook safety latch pin — the small pin that the latch pivots on — is worn to approximately 60% of its original diameter. The latch still closes but with reduced spring force. What action is required?

A. The latch pin wear reduces the spring force but the latch still functions — the block may continue in service with monthly monitoring

B. Nothing — wear of 40% on the latch pin is within acceptable tolerance for hooks in regular service

C. The hook block must be removed from service — the latch pin is a structural element of the safety latch mechanism; a pin worn to 60% of original diameter has 36% of its original cross-sectional area and has lost significant strength; a worn pin can fail suddenly under load, causing the latch to open and the rigging to disengage

D. Replace only the latch pin and return the block to service — the hook body does not require inspection

54. Under OSHA 1926.1413, wire rope must be removed from service if it experiences heat damage. Which of the following is a visible indicator that wire rope has experienced heat damage sufficient to require removal?

A. Rope that has turned from its original bright metallic color to a light amber color from lubricant oxidation

B. Rope that shows discoloration of the wire surfaces from a metallic silver to a dark blue, purple, or black — heat damage sufficient to alter the metallurgical properties of the high-carbon steel wires leaves these distinct discoloration patterns that cannot occur from normal service; any such discoloration requires immediate removal

C. Rope that shows surface rust from weathering in marine environments

D. Rope with lubricant that has dried to a dark brown residue from solar heating

55. A crane's slewing ring gear teeth are inspected during the annual comprehensive inspection. The inspector measures the backlash between the swing pinion and the ring gear and finds it is 0.018 inches — the manufacturer's specification allows a maximum of 0.015 inches. What does excessive gear backlash indicate and what action is required?

- A. The slewing ring gear backlash must be removed from service and the crane evaluated by the manufacturer or a qualified engineer — excessive backlash indicates the gear teeth have worn beyond specification, allowing too much free play between the pinion and ring gear; this excess play creates impact loading during swing direction reversals that accelerates further wear and can cause tooth fracture
- B. Excessive gear backlash of 0.003 inches is within calibration tolerance and requires no action
- C. Backlash can be reduced to specification by adjusting the swing pinion mounting position
- D. Nothing — backlash is self-correcting as the teeth wear to a new mating geometry

56. A rigger is preparing to lift an irregularly shaped structural component using a below-the-hook lifting beam. The lifting beam is marked with a rated capacity of 20 tons. The load weighs 17 tons. Three attachment points on the beam will be used, spaced asymmetrically. What must be confirmed before the lift proceeds?

- A. The beam's 20-ton capacity confirms adequacy for the 17-ton load — no further evaluation is needed
- B. Nothing — below-the-hook lifting devices are always rated conservatively enough for any load within their marked capacity
- C. The rigging geometry with three asymmetric attachment points must be confirmed — asymmetric attachment can create concentrated loads on individual beam attachment points or internal beam bending moments that exceed the beam's design loading assumptions; the lift must be confirmed by the beam manufacturer or a qualified engineer for the specific asymmetric loading configuration
- D. The lifting beam must receive a proof load test at 125% of the planned load before use with asymmetric rigging

57. A crane inspector is performing the annual inspection and finds that the LMI load cell — the device that measures the load on the hoist line — is reading 8% lower than the actual load when tested against a calibrated reference load. What is the practical safety implication of this miscalibration?

A. An LMI reading 8% low means the operator will see a lower percentage than actual — a lift at 87% actual capacity will display as 80%; the operator believes more margin exists than actually does, potentially proceeding with lifts that are closer to or at the rated capacity without being aware; the LMI must be recalibrated before use

B. An 8% LMI error is within the instrument's stated accuracy tolerance and requires no corrective action

C. The LMI error results in excessive conservatism — the operator will stop lifts before they reach the actual capacity limit

D. The LMI error only affects the displayed percentage, not the crane's actual structural capacity

58. A crane is operating when the operator notices that the boom tip sheave on the auxiliary hoist has developed a visible flat spot — an area approximately 2 inches long where the sheave's circular profile has been worn flat. The primary hoist uses a different sheave path. What concern does the flat spot create for the auxiliary hoist rope?

A. A flat spot on a boom tip sheave requires only increased lubrication to prevent further flat spot development

B. The rope will ride normally over the flat spot since the load holds the rope against the sheave bottom regardless of profile

C. The sheave is marked for removal — auxiliary hoist operations should avoid using the affected sheave

D. A flat spot on a sheave means the rope experiences an impact as it enters and exits the flat zone during each hoist cycle — this creates a repetitive shock loading at the rope's contact point that produces accelerated fatigue wire breaks at that location; both the sheave and the rope must be replaced before auxiliary hoist operations continue

59. Under OSHA 1926.1430, who bears the responsibility for ensuring that workers who regularly work around cranes but who are not crane operators receive crane-related safety training?

A. The crane operator is responsible for briefing all adjacent workers at the start of each shift

B. The signal person is responsible for orienting all personnel who will work within the exclusion zone

C. Nothing — OSHA 1926.1430 only requires training for operators and signal persons, not general site workers

D. The employer is responsible for ensuring that all affected employees receive training in crane hazard recognition, the requirements of Subpart CC, and safe work practices related to crane operations before they are exposed to crane-related hazards

60. A crane operator discovers during the pre-shift inspection that the anti-two-block (ATB) weight — the weight hanging on the ATB cable below the boom tip sheave — has been removed from the system. The cable is present but there is no weight attached. What is the compliance issue?

A. The ATB weight is an optional component — the ATB can function based on cable tension alone without the weight

B. Nothing — the ATB cable itself provides two-blocking protection by detecting contact between the hook block and the cable

C. The ATB system is non-functional without the weight — the weight is required to keep the ATB cable taut and positioned so it is physically contacted by the rising hook block before the block reaches the boom tip sheave; without the weight, the system will not detect hook proximity and will not interrupt the hoist function; the crane must not be operated until the ATB weight is reinstalled and the system is tested

D. The missing ATB weight reduces the system's sensitivity but the system remains functional at reduced reliability

61. A crane's wire rope is being replaced. After the new rope is installed and the crane is tested, the operator notices the rope produces a clicking sound as it passes over the main block sheave during each hoist cycle — the sound is regular and consistent with each pass. What does this indicate?

A. Nothing — clicking sounds from rope passing over sheaves are normal break-in sounds that resolve after the first few loading cycles

B. Regular clicking as a rope passes over a sheave indicates the rope is jumping slightly as it enters or exits the sheave groove — possible causes include a groove profile mismatch between the new rope's diameter and the sheave groove, or a damaged groove edge; this must be investigated before full-load operations since jumping rope can cause accelerated wear and potential disengagement

C. The clicking indicates the rope needs lubrication — apply rope lubricant and the sound will cease

D. The clicking sound indicates the rope lay is incompatible with the sheave direction — reverse the rope installation direction

62. A crane operator is reviewing the load line before a critical lift and finds a section of rope approximately 6 inches from a wedge socket end attachment where 4 wires have broken within a 2-inch section — all breaks are on the same strand. Under ASME B30.5 and OSHA 1926.1413, what is the removal criterion for this condition?

A. 4 broken wires in 2 inches does not meet any removal criterion — the threshold is 6 broken wires in one lay length

B. The 4 broken wires on the same strand near the end attachment require removal — ASME B30.5 specifies removal when 3 or more broken wires in one strand within one lay length occur in running rope; additionally, concentrated breaks near end attachments independently require evaluation and removal; this condition meets multiple criteria simultaneously

C. The 4 broken wires in 2 inches meets removal criteria only if the 2-inch section falls within one lay length — measure first

D. The 4 wires are on the same strand near an attachment — this pattern requires manufacturer evaluation but not immediate removal

63. A crane's hydraulic hoist motor is making a high-pitched whining sound during operation that was not present in previous shifts. The hoist functions normally with no apparent reduction in speed or force. What does high-pitched whining from a hydraulic motor typically indicate?

A. High-pitched whining from a hydraulic motor is typically associated with hydraulic fluid cavitation or the early stages of internal bearing wear — both conditions indicate a problem that will progressively worsen; the crane must be evaluated before continuing operations, since cavitation can cause rapid pump and motor damage leading to sudden loss of hoist function

B. High-pitched motor sounds are normal during cold starts and resolve when the system reaches operating temperature

C. The whining sound indicates the motor is operating at its maximum efficiency point — no action is required

D. High-pitched whining from a hydraulic motor requires only a filter change — contaminated fluid causes noise

64. Under ASME B30.9, when a wire rope sling is to be used for a lift where the load's attachment points are angled — meaning the sling legs do not hang vertically but are pulled toward the center at an angle — what specific geometric measurement determines the applicable capacity derating?

- A. The sling's effective length between attachment points determines the required derating factor
- B. The derating is determined by the included angle at the top of the bridle — the angle between sling legs at the master link or hook; however, the standard bases capacity on the angle each leg makes from the vertical (the sling angle from horizontal), since this determines the actual tension each leg carries relative to the vertical load component
- C. The derating is determined by the horizontal distance between load attachment points
- D. The load weight divided by the number of sling legs determines the per-leg tension without requiring an angular calculation

65. A crane operator discovers that the crane's boom hoist rope has a kink located approximately 4 feet from the dead end of the rope — in the section that normally remains on the drum and never passes over the sheaves. The kinked section appears to be within the minimum two-drum-wraps safety zone. What action is required?

- A. The kinked section remains on the drum and never loads the sheaves — it is a cosmetic condition that does not affect operational safety
- B. Nothing — kinks in the dead wraps section of the rope are not subject to removal criteria since that section carries no load
- C. Inspect the kink location during monthly inspection and remove from service if the kink progresses
- D. The rope must be removed from service — any kink in a wire rope is an absolute removal condition regardless of its location; even kinks in the drum-retained dead wraps portion represent permanent structural damage to the rope that would become a dangerous stress concentration if the rope ever needed to be extended to its full length during an emergency

66. A crane is operating in a marine environment where high humidity and salt spray are present. After 6 months of service, the load line wire rope shows no visible broken wires but has a light surface rust on approximately 30% of the outer wire surfaces. What must be evaluated?

- A. Light surface rust covering 30% of the rope surface is within acceptable limits for marine environment ropes
- B. The surface rust is cosmetic and does not affect tensile strength — apply lubricant and continue service
- C. The rust must be evaluated for depth — if it has caused surface pitting, the affected wires may have reduced cross-section and fatigue resistance below their nominal ratings even without visible wire

breaks; the rope's service history, external diameter, and pit depth should be assessed by a qualified inspector

D. Nothing — marine ropes are manufactured with stainless steel outer wires that do not require evaluation for surface rust

67. A crane's wire rope is being installed from a reel. During installation, the operator feeds the rope off the reel incorrectly, causing several loops of rope to come off the reel in a coiled pile on the ground rather than paying off the reel in a controlled straight line. When the slack is taken up, the affected section shows several spiral twists. What must be done?

A. The spiral twists will straighten under load tension — proceed with full load operations to seat the rope

B. Cut out the twisted section and re-splice the remaining rope ends before installation

C. Nothing — spiral twists from installation are normal and self-correct after 10 to 15 hoist cycles

D. The rope must be removed from the crane and the twisted section evaluated — twists introduced during installation permanently alter the helical geometry of the rope strands; if the twists cannot be removed without creating a kink, the rope must be replaced; proceeding with installation of a twisted rope will cause uneven load distribution and premature wire breaks

68. Under ASME B30.5, what is the minimum number of wraps that must remain on the hoist drum when the hook block is at its lowest operational position?

A. One wrap minimum — the dead end anchor at the drum provides backup if the rope pays out completely

B. Three wraps minimum — personnel hoisting operations require extra margin

C. Two wraps minimum — this ensures the dead end anchor at the drum never experiences the operational hook load; the anchor attachment point is not the rated load-bearing element of the drum-rope connection

D. The minimum wrap count is determined by the rope manufacturer and varies by rope diameter and construction

69. A crane's hydraulic system uses an accumulator to maintain system pressure during brief engine stalls. During maintenance, the technician finds that the accumulator's pre-charge pressure is 40% below the manufacturer's specification. What is the operational consequence of this low pre-charge pressure?

- A. Low accumulator pre-charge pressure increases system responsiveness — control inputs are more sensitive at reduced pre-charge
- B. Nothing — accumulators are supplementary components and have no effect on primary crane function
- C. The accumulator with low pre-charge pressure will have reduced energy storage capacity — during a brief engine stall, the crane's hydraulic system will lose load-holding pressure faster than designed, potentially causing brakes to engage prematurely or load drift to occur before the engine restarts; the accumulator must be recharged to specification before operations
- D. Low pre-charge pressure only affects the crane's travel functions — lifting and swinging operations are not dependent on the accumulator

70. A crane operator is reviewing the inspection record and finds that the annual inspection 11 months ago noted: "Boom chord pitting corrosion — approximately 15% section loss estimated at one location on lower chord section 3." No corrective action was documented. What is the current status of this finding?

- A. The 15% section loss is within the acceptable tolerance for non-critical boom members — no action is needed
- B. The 11-month-old finding may be used as the baseline — re-measure at the next annual inspection
- C. Continue operations while scheduling a repair during the next maintenance window
- D. The undocumented corrective action for a 15% estimated cross-section loss in a boom chord member is a serious concern — a structural member with 15% section loss has significantly reduced load-carrying capacity; if no corrective action was taken, the boom has been operating with a documented structural deficiency for 11 months; the crane must be removed from service until the chord section is re-evaluated and confirmed structurally adequate or repaired

LOAD CHARTS DOMAIN — Questions 71–95

71. A crane's load chart for the 100-foot boom at full outrigger extension shows: 30 ft = 38,600 lbs; 35 ft = 30,400 lbs; 40 ft = 23,800 lbs. The planned operating radius is 36 feet. The hook block weighs 2,000 lbs, slings weigh 600 lbs, and hardware weighs 240 lbs. The payload weighs 25,000 lbs. Using the conservative approach, does the lift proceed?

- A. Conservative capacity at 40 ft = 23,800 lbs; total suspended weight = 27,840 lbs; 27,840 exceeds 23,800 — the lift cannot proceed
- B. Conservative capacity at 40 ft = 23,800 lbs; the lift cannot proceed since 27,840 lbs exceeds this value; the operator must reduce the load or reconfigure to achieve higher capacity at the actual operating radius
- C. Conservative capacity at 35 ft = 30,400 lbs; total suspended weight = 27,840 lbs; 27,840 lbs is within 30,400 lbs — lift proceeds
- D. The operator should use the interpolated capacity at 36 ft for a more accurate value before deciding

72. A crane load chart section note reads: "For lifts involving loads with a projected wind area exceeding 200 square feet, apply a 15% capacity reduction to all values in this section." The planned load is a precast concrete wall panel 25 feet wide and 10 feet tall. What is the projected wind area and does the reduction apply?

- A. Projected wind area = 250 sq ft; the 250 sq ft area exceeds the 200 sq ft threshold; a 15% capacity reduction applies to all capacity values in this section for this lift
- B. Wind area only applies to hollow or sail-type loads — solid concrete panels are exempt from wind area calculations
- C. Projected wind area = 250 sq ft; the reduction applies only when wind speed exceeds 15 mph
- D. The 15% reduction applies only to the capacity value at the specific planned operating radius, not to all values in the section

73. A crane's on-outrigger full-extension section shows a maximum rated radius of 50 feet for the 100-foot boom. The operator plans a pick at 47 feet and needs to swing the load 180 degrees to a set location at 45 feet of radius. During the swing, the boom passes through positions at 0 degrees (over front), 90 degrees (over side), and 180 degrees (over rear). The crane does not have a separate over-front or over-rear section — only an all-directions section. What single capacity value governs throughout this lift?

- A. The operator must apply different capacity values for the over-front, over-side, and over-rear positions as the boom passes through each position during the swing
- B. The 360-degree all-directions section provides a single capacity value applicable to all boom positions throughout the swing — the operator uses the capacity value corresponding to the operating radius at each point along the swing arc, but all within the same 360-degree section

C. The over-front and over-rear capacity values are automatically reduced by 15% from the all-directions section during those directional transitions

D. The pick radius capacity (47 ft) governs for the entire swing since it is the maximum radius encountered

74. A crane load chart shows a section titled: "ON OUTRIGGERS — 75% EXTENSION — MAXIMUM COUNTERWEIGHT — RESTRICTED SECTOR: BOOM MUST NOT OPERATE IN 270°–360° (REAR-LEFT QUADRANT)." The planned lift requires the boom to pass through 320 degrees — directly within the restricted sector. What must the operator do?

A. The operator may pass through the restricted sector at reduced swing speed of 0.3 rpm or less

B. Reduce the planned lift load to 50% when passing through the restricted sector

C. Contact the manufacturer for authorization to pass through the restricted sector for this specific lift

D. The restricted sector specification is a binding configuration condition — the boom must not enter the 270–360 degree sector in this configuration; the crane must be repositioned or the configuration changed to one that permits 360-degree operation before the 320-degree position can be used

75. A crane is configured with a 120-foot boom at full outrigger extension. The load chart shows: 50 ft = 13,600 lbs; 55 ft = 10,400 lbs; 60 ft = blank. A critical lift is planned at 52 feet of radius with a total suspended weight of 11,800 lbs. Using the conservative approach, does the lift proceed?

A. Conservative capacity at 55 ft = 10,400 lbs; total suspended weight (11,800 lbs) exceeds the conservative capacity — the lift cannot proceed in this configuration

B. Interpolated capacity at 52 ft = 12,240 lbs; the 11,800-lb load is within this capacity — lift proceeds

C. Conservative capacity at 50 ft = 13,600 lbs; total suspended weight (11,800 lbs) is within capacity — lift proceeds

D. The blank at 60 ft limits the maximum radius to 55 feet; since 52 ft is within the rated envelope, the lift proceeds

76. A crane load chart note reads: "These capacities are valid only when operating on outriggers with all outrigger pads confirmed as solidly supported — no pad may be over any depression, void, or soft zone." The operator has verified three pads are solidly supported, but the fourth pad is positioned partially over a shallow depression approximately 1 inch deep under the pad's leading edge. Does this note affect the operator's use of the section?

- A. Nothing — the three solidly supported pads provide more than adequate stability for the fully loaded crane
- B. Partial depression contact under one pad edge reduces the effective mat area but is within acceptable tolerance
- C. The note's condition is not fully met — one pad has partial contact with a depression that may affect load distribution; the operator must either fill the depression to achieve solid contact or relocate the pad before these capacity values can be used; using these values without satisfying the note's confirmed solid support condition means operating under capacity values that assume a condition not present
- D. The depression is only 1 inch deep and does not trigger the note's requirements

77. A crane's load chart shows that the 100-foot boom at full outrigger extension has the following values shaded as structural-limited: 20 ft = 56,200 lbs and 25 ft = 44,600 lbs. At 30 feet = 34,800 lbs, the value is unshaded (stability-limited). A lift at 23 feet is planned at 92% of the structural-limited capacity. What operational requirement applies?

- A. Nothing additional — structural and stability limits provide equivalent safety margins
- B. The lift must be delayed until a structural engineer reviews the planned lift configuration
- C. Structural-limited lifts at 92% must use maximum counterweight regardless of the current counterweight configuration
- D. Structural-limited lifts near 100% require exceptionally smooth crane movements with no sudden starts, stops, or swing accelerations — dynamic loading from abrupt control inputs adds structural stress to the already near-limit static structural load and risks exceeding the design capacity of the affected structural members

78. A crane load chart note reads: "Rated capacities in this section are based on maximum recommended line pull per part not being exceeded." The crane's rope has a maximum single-line pull rating of 14,000 lbs. The crane is rigged with 6-part line. What is the maximum hook load the reeving can theoretically produce, and how does the load chart's structural limit relate to this reeving capacity?

- A. Maximum theoretical hook load = $6 \times 14,000 = 84,000$ lbs; the load chart's structural limit is always higher than the reeving capacity
- B. Maximum theoretical hook load = 84,000 lbs (before efficiency losses); the load chart's structural and stability limits may show lower capacity values at certain radii — when the chart shows less than 84,000 lbs, the structural or stability limit governs; when the rope capacity is the limiting factor, it governs; the governing limit is always the more restrictive of the two

C. Maximum hook load = $6 \times 14,000 \times 0.96$ efficiency = approximately 80,640 lbs

D. The 6-part reeving capacity is irrelevant — only the load chart governs crane capacity in all circumstances

79. A crane load chart shows the following values for the on-outrigger full extension, all-directions section with a 100-foot boom: 25 ft = 44,800 lbs; 30 ft = 35,600 lbs; 35 ft = 28,200 lbs. All three values are stability-limited. After interpolating between 30 and 35 feet, the estimated capacity at 32 feet is approximately 31,640 lbs. The total suspended weight is 30,000 lbs. The lift percentage based on the interpolated capacity is 94.8%. What does the stability-limited designation specifically require the operator to verify before beginning this near-capacity lift?

A. Verify the load chart section used is for the correct boom type only

B. No additional verification — the load chart values already include the required stability margin

C. Nothing specific to stability-limited cells — the load chart covers all required safety considerations

D. The stability-limited designation specifically requires verifying that the crane is level within the manufacturer's specified tolerance, that no out-of-level drift has occurred since setup, and that all planned crane movements will be performed smoothly to avoid adding centrifugal load displacement or swing inertia that could push the effective overturning moment beyond the tipping threshold

80. A crane load chart for an all-terrain crane with outriggers deployed shows: 80-foot boom at 30 ft = 42,400 lbs; 100-foot boom at 30 ft = 36,200 lbs. The operator is configured with a 100-foot boom. An operator reasons that using the 80-foot boom column at 30 feet provides a more conservative and therefore safer capacity reference. What is the fundamental error?

A. Nothing is wrong — using a more conservative capacity value is always acceptable regardless of the crane's actual boom length

B. The 80-foot boom column may be used as long as the operating radius matches

C. Using a higher-capacity column from a shorter boom configuration while operating with a longer boom is incorrect — the 80-foot boom creates different structural loading on the crane's components than the 100-foot boom; applying 80-foot values to a 100-foot boom does not represent conservatism — it applies capacity values from a fundamentally different structural configuration

D. The 100-foot boom column must be used only if the boom is pinned at exactly 100 feet

81. A crane load chart contains a section labeled: "TELESCOPING BOOM — ON OUTRIGGERS — EXTENDED — ALL POSITIONS PINNED." The crane's boom is currently extended to 85 feet with all extension positions properly pinned. The previous section in the chart was for "BOOM AT 80 FT FIXED." The 85-foot configuration falls within the "TELESCOPING BOOM" section's coverage. What must the operator confirm about the LMI configuration before using the telescoping boom section's capacity values?

- A. The LMI must be confirmed as showing the same percentage as the previous 80-foot section
- B. The LMI configuration input must be updated to reflect the current 85-foot boom length so it calculates capacity from the correct column values — using the 80-foot LMI configuration while operating at 85 feet means the LMI is displaying capacity based on a different boom length than what is physically extended
- C. Nothing — the LMI automatically detects boom length through the extension position sensors
- D. Update the LMI only when the boom length changes by more than 10 feet from the configured value

82. A crane load chart shows a note: "When the total suspended weight exceeds 90% of gross capacity at any radius in this section, a written load moment calculation must be provided by a qualified engineer before the lift may begin." A planned lift will be at 93% of gross capacity. No engineer is on site and none can be reached. What are the operator's options?

- A. The operator may proceed with the lift director's written authorization in lieu of engineer confirmation
- B. The operator's NCCCO certification qualifies them to perform the required load moment calculation
- C. The note is a requirement that cannot be waived — the options are: (1) reduce the total suspended weight to below 90% of gross capacity so the note's threshold is not triggered, or (2) obtain the required written load moment calculation from a qualified engineer before proceeding; proceeding at 93% without the required engineering confirmation violates the load chart's binding conditions
- D. Contact the crane manufacturer and request a verbal exemption from the note's requirement

83. A crane is performing a lift at 30 feet of operating radius with a 100-foot boom. The gross capacity is 38,400 lbs and the total suspended weight is 35,700 lbs — a lift percentage of 92.9%. During the hoist, the boom deflects under load, increasing the actual operating radius from 30 feet to 32 feet. At 35 feet, the chart shows 30,400 lbs. Using the conservative approach, what is the capacity at 32 feet and is the lift still within capacity?

- A. Conservative capacity at 35 ft = 30,400 lbs; total suspended weight (35,700 lbs) exceeds this value — the lift is no longer within rated capacity at the actual 32-foot radius after boom deflection
- B. The original 30-foot measurement governs — boom deflection-induced radius changes do not affect the applicable capacity value
- C. The 10% dynamic load allowance covers the boom deflection-induced radius increase
- D. Conservative capacity = 38,400 lbs at 30 ft governs since that was the planned radius — only intentional boom movements change the applicable capacity value

84. A crane load chart shows that in the maximum counterweight section, the rated capacity at 40 feet of radius is identical to the capacity in the standard counterweight section at the same radius — both show 22,400 lbs. A note explains that all cells in the 40-foot column and beyond are structural-limited in both sections. Why does maximum counterweight provide no additional capacity beyond the structural limit?

- A. Counterweight affects stability but not structural capacity — when structural limits govern, the same structural limit applies regardless of how much counterweight is installed; maximum counterweight cannot increase the structural capacity of the boom, slewing ring, or other structural components
- B. The identical values are a printing error — maximum counterweight should always show higher capacity than standard counterweight
- C. Maximum counterweight has no effect on rated capacity at any radius in this crane's configuration
- D. The structural limit equals the stability limit at 40 feet, making counterweight configuration irrelevant

85. A crane's load chart shows the following in the 80-foot boom, 50% outrigger extension section: 25 ft = 28,400 lbs; 30 ft = 22,600 lbs; 35 ft = 17,800 lbs. The planned lift at 28 feet has a total suspended weight of 23,500 lbs. After applying the conservative approach, is the lift within capacity?

- A. Nothing — the 50% extension section is always insufficient for critical lifts
- B. Conservative capacity at 30 ft = 22,600 lbs; total suspended weight (23,500 lbs) exceeds the conservative capacity — the lift cannot proceed using the conservative approach in the 50% extension configuration; the crane must be reconfigured for full extension to achieve higher capacity at 28 feet
- C. Conservative capacity at 25 ft = 28,400 lbs; total suspended weight (23,500 lbs) is within this value — lift proceeds
- D. Interpolated capacity at 28 ft = 25,360 lbs; 23,500 lbs is within this — lift proceeds

86. A crane's load chart shows a gross capacity of 34,600 lbs at 35 feet with a 100-foot boom. The total suspended weight is 32,000 lbs. The lift percentage is 92.5%. A load chart note states: "In this section, lifts above 90% of gross capacity require use of a crane scale to verify the actual suspended load weight during the initial pick." The crane does not have a crane scale installed. What options does the operator have?

- A. The operator may use the LMI's load reading during the initial pick as a substitute for the crane scale
- B. The lift director may authorize proceeding without the crane scale by signing a written exemption
- C. Nothing — the note's requirement for a crane scale is advisory for lifts at this capacity level
- D. The operator's options are to install a crane scale to satisfy the note's requirement, to reduce the total suspended weight to below 90% of gross capacity so the note is not triggered, or to use a different crane configuration with sufficient capacity that the planned weight is below 90% of gross

87. A crane load chart shows a "PICK AND CARRY" section specifying: "BOOM AT 30 FT ONLY — OVER FRONT — 0 TO 15 DEGREES EACH SIDE — MAXIMUM LOAD 7,200 LBS — MAXIMUM SPEED 1 MPH — FIRM, LEVEL SURFACE." The operator needs to travel with a 6,800-pound load but the terrain has a slight 1.5-degree slope. What prevents the pick-and-carry from proceeding as described?

- A. The load of 6,800 lbs is within the 7,200-lb maximum and the pick-and-carry may proceed on 1.5-degree terrain
- B. The 1.5-degree slope exceeds the "level surface" condition specified in the pick-and-carry section — "level" in this context means flat or near-flat; a 1.5-degree slope changes the crane's stability geometry during travel and is outside the rated pick-and-carry condition even though the slope seems minor; the load must be set down and the crane repositioned rather than carrying on the sloped terrain
- C. Reduce the planned pick-and-carry load by 20% to compensate for the slope and proceed
- D. Travel speed should be reduced to 0.5 mph to compensate for the slope condition

88. A crane is performing a jib pick at 50 feet of radius. The jib section of the load chart shows: 45 ft = 11,200 lbs; 50 ft = 8,600 lbs; 55 ft = blank. The jib head block weighs 380 lbs, rigging weighs 520 lbs, and the payload weighs 7,400 lbs. The total suspended weight is 8,300 lbs. The operator is at exactly 50 feet of radius. Is this lift within the tabulated jib capacity?

A. The lift is at exactly the tabulated 50-foot value — the total suspended weight of 8,300 lbs is within the 8,600-lb tabulated gross capacity; the lift may proceed

B. Conservative capacity at 55 ft = blank (maximum rated radius = 50 ft); the 50-foot value of 8,600 lbs applies at exactly 50 feet; 8,300 lbs is within capacity — but the blank at 55 feet means the crane is operating at its maximum rated radius, which requires careful attention to any radius increase

C. The blank at 55 feet means the operator must use 75% of the 50-foot value as a conservative margin

D. The lift cannot proceed since any actual radius variation beyond exactly 50 feet would exceed the maximum rated radius

89. A crane is operating with a 100-foot boom at 40 feet of radius. The operator is directed to boom down to 47 feet of radius to position the load at the set location. The load chart shows 23,800 lbs at 40 feet and 17,400 lbs at 50 feet. The total suspended weight is 20,500 lbs. Using the conservative approach at 47 feet, does the lift complete?

A. Conservative capacity at 40 ft = 23,800 lbs governs since the pick was confirmed at that radius

B. Conservative capacity at 50 ft = 17,400 lbs; total suspended weight (20,500 lbs) exceeds this value — the boom-down movement cannot be completed as planned without reducing the load or reconfiguring for higher capacity at 47 feet

C. Interpolated capacity at 47 ft = 19,890 lbs; total suspended weight (20,500 lbs) exceeds even the interpolated value — confirming the lift cannot proceed

D. The set radius of 47 feet uses the intermediate capacity — conservative = 17,400 lbs; 20,500 exceeds 17,400 — the set cannot be reached

90. A crane load chart section note reads: "At radii greater than 35 feet, the crane must not be rotated more than 15 degrees per second." During a lift at 40 feet of radius, the signal person requests a rapid swing to beat an approaching weather system. The LMI shows 72% capacity. What is the compliance issue?

A. At 72% capacity with a note-specified rotation limit, the operator may exceed the 15 degrees per second limit for brief periods

B. The note is advisory for weather-related emergency situations — the lift director may authorize exceeding the rotation limit

C. The note is advisory and does not restrict operations when the LMI confirms the crane is below 85% capacity

D. The 15 degrees per second rotation limit is a binding note condition that applies at radii greater than 35 feet — operating at 1.4 rpm swing speed at 40 feet exceeds this limit regardless of the LMI reading or weather urgency; the operator must maintain the specified rotation rate or contact the manufacturer for capacity values at the higher rotation rate

91. A crane load chart shows a note: "The gross capacity in this section includes a pre-deducted standard hook block weight of 1,200 lbs. Net payload = gross capacity minus all additional rigging." The planned hook block weighs 1,200 lbs. The gross capacity at the planned configuration is 28,600 lbs. The rigging weighs 880 lbs. What is the maximum payload?

A. Maximum payload = $28,600 - 880 = 27,720$ lbs — the 1,200-lb hook block is already pre-deducted from gross capacity; only the additional rigging (880 lbs) must be deducted from the gross value to determine maximum payload

B. Maximum payload = $28,600 - 1,200 - 880 = 26,520$ lbs — deducting the hook block and all rigging from gross

C. Maximum payload = 28,600 lbs — the note indicates all deductions have been pre-made

D. Maximum payload = $28,600 - (1,200 + 880) = 26,520$ lbs — the note requires confirmation that the deduction was made by the manufacturer, not by the operator

92. A crane is performing a series of lifts using the on-outrigger full extension, all-directions section. The operator confirms the correct section is being used for each lift. Between the 8th and 9th lift, the crane operator re-levels the crane because it has drifted 0.3% out of level — within the manufacturer's 0.5% tolerance. Before the 9th lift, what additional verification is required beyond re-leveling?

A. No additional verification — re-leveling within tolerance satisfies all requirements before the 9th lift

B. The cause of the 0.3% level drift must be investigated — progressive drift between lifts may indicate continuing outrigger settlement that could affect all subsequent lifts, and simply re-leveling without understanding why the crane moved compromises the safety of the 9th and all subsequent lifts

C. The operator must re-read the load chart for the 9th lift configuration regardless of whether the parameters have changed

D. A full pre-shift inspection sequence must be repeated after any crane re-leveling during operations

93. A crane load chart shows that for a 100-foot boom at full outrigger extension, the maximum counterweight configuration provides 12% more capacity than the standard counterweight at 45 feet of

radius. The crane has maximum counterweight installed. The maximum counterweight capacity at 45 feet is 20,800 lbs. A planned lift has a total suspended weight of 19,200 lbs — 92.3% of maximum counterweight capacity. What is this lift's percentage based on standard counterweight capacity?

A. Using standard counterweight capacity: $20,800 \div 1.12 = 18,571$ lbs standard counterweight capacity; total suspended weight (19,200 lbs) exceeds standard counterweight capacity — confirming the maximum counterweight section must be used and the standard counterweight configuration cannot support this lift

B. Nothing changes — the crane has maximum counterweight installed and only the maximum counterweight capacity applies

C. The standard counterweight capacity calculation is not required when maximum counterweight is confirmed installed

D. Standard counterweight capacity = $20,800 \times 0.88 = 18,304$ lbs; total suspended weight (19,200 lbs) exceeds standard counterweight capacity — this confirms maximum counterweight is not just beneficial but required for this lift; if the counterweight were inadvertently reduced, the lift would exceed capacity

94. A crane's load chart shows the following in the on-outrigger full extension, all-directions, standard counterweight section: 35 ft = 28,200 lbs; 40 ft = 22,400 lbs; 45 ft = 17,600 lbs; 50 ft = blank. The rate of capacity decrease per foot is: 35–40 ft: 1,160 lbs/ft; 40–45 ft: 960 lbs/ft. The capacity decrease rate is declining, meaning the curve is flattening. How does this flattening curve affect radius measurement precision requirements?

A. A flattening capacity curve means radius measurement errors have less capacity impact at longer radii — precision requirements decrease as radius increases toward the maximum

B. A flattening curve is irrelevant — radius measurement precision should always be the same regardless of the curve shape

C. A flattening curve makes interpolation more accurate at longer radii since the capacity changes less per foot

D. The flattening curve means the capacity drop per foot is decreasing — but this does not reduce the requirement for precise radius measurement; at longer radii approaching the maximum rated radius, even a 1-foot error in radius measurement could push the lift beyond the maximum rated radius where no capacity exists; precision is equally or more important near the maximum

95. A crane is performing a critical lift at 89% of rated capacity. The lift plan specifies the operating radius as 38 feet. After the load breaks ground, the LMI shows 94% capacity. The operator stops the hoist at 5 feet of height. The capacity at 40 feet is 22,400 lbs and at 45 feet is 17,600 lbs. The operator

calculates that a 94% LMI reading at the confirmed load weight implies an effective radius of approximately 41 feet. What is the most likely cause and the required action?

A. Boom deflection under load has increased the effective operating radius from the planned 38 feet to approximately 41 feet — the operator must confirm the actual operating radius is still within the rated capacity by checking the load chart at 41 feet (using the conservative 45-foot capacity of 17,600 lbs conservatively), confirming the total suspended weight is within this value, or adjusting the configuration to bring the effective radius within confirmed capacity

Core Exam 8 Answer Key and Full Explanations

1. B — Indoor concrete floors often contain buried conduit, cable trays, or other embedded systems that create voids or weak zones in the slab's load path. The slab must be structurally confirmed adequate for the crane's concentrated outrigger point loads, and the buried conduit routing must be confirmed not to compromise the slab's structural integrity beneath the outrigger positions. Industrial floor slabs designed for forklift traffic are not automatically adequate for crane outrigger loading.

2. D — A bowl-shaped depression in a previously flat surface is not random settling — it indicates that material beneath the surface is moving downward, creating a void or consolidating under forces that have not yet reached equilibrium. Placing a crane outrigger at this location adds the most concentrated load possible to a zone already exhibiting active subsidence. The subsurface cause must be identified before any crane loading accelerates the process.

3. A — Tension cracks running parallel to an excavation edge are a geotechnical failure precursor — they indicate the soil mass between the surface load and the excavation face is being placed in tension as the slope approaches its stability limit. A crane outrigger operating in this zone adds surcharge loading directly to the soil wedge that is already stressed. This combination can trigger sudden slope failure, and crane operations must stop until a qualified person evaluates the condition.

4. C — Underground storage tanks represent significant structural and safety hazards for crane setup. The tank roof is not designed for concentrated crane outrigger point loads and can collapse under them. If the tank contains or previously contained fuel, a roof collapse could rupture the tank and create a fire or explosion hazard. The outrigger must be repositioned or the tank's structural capacity confirmed by engineering before any loading near the tank boundary.

5. B — ASME B30.5 requires ground conditions to be firm and stable throughout the crane's entire working area, not just at the four outrigger positions. Ground failure beneath the crane's carrier during

operations, or soft spots in the travel path during repositioning, can destabilize the crane even if outrigger positions are adequate. The assessment must cover the complete zone of the crane's occupation and movement.

6. D — A pressurized irrigation leak actively pumps water into the soil, saturating the zone around the leak point rapidly. Unlike slow surface drainage, pressurized leaks can destroy bearing capacity within minutes by filling pore spaces and reducing effective stress. The proximity to the outrigger means the saturated zone can reach the bearing surface under the cribbing very quickly, creating a sudden bearing failure risk with no visible surface warning.

7. A — OSHA 1926.1408(b)(4) requires the dedicated power line spotter to have a means of immediately stopping all crane movement. This must be a direct, physical means — not a radio relay that requires transmission, reception, and acknowledgment. The spotter's immediate stop capability is the final line of defense against encroachment and must function without communication delay. This is a specific regulatory requirement, not a general safety recommendation.

8. C — OSHA 1926.1424 requires that the exclusion zone prevent unauthorized persons from entering the hazard area during crane operations. Once the boundary has been breached and an unauthorized person is inside the zone, no crane movement may occur. The zone boundary must be physically re-established after the person exits before operations resume. Allowing the person to simply pass through while moving the crane creates exactly the struck-by hazard the exclusion zone is designed to prevent.

9. C — Concrete rubble fill placed without compaction testing has unpredictable void content — the angular rubble pieces can stack with large voids between them that provide no bearing support. When a concentrated crane outrigger load is applied, these voids can compress suddenly, causing dramatic instantaneous settlement. A qualified engineer must assess the void content and load distribution capacity of the rubble fill before any crane loading.

10. C — OSHA 1926.1402 requires the controlling entity to provide information about conditions that could affect crane operations — including predictable daily changes in ground conditions. Asphalt softening in afternoon heat is a predictable condition that the controlling entity can anticipate and must communicate. The crane employer can then schedule operations to avoid vulnerable periods or implement cooling measures, but only if informed about the predictable change in advance.

11. A — Lateral displacement of material from beneath a loaded outrigger mat is direct physical evidence of bearing capacity failure in progress. When bearing capacity is exceeded, the soil shears along a failure surface and the displaced material moves laterally outward as the mat begins to sink into

the failing zone. This is not consolidation — it is active shear failure that will progress to sudden complete bearing failure if loading continues.

12. C — Dynamic compaction creates strong ground vibration that travels through the soil as seismic waves to adjacent areas. This vibration can cause loosely-placed materials to consolidate suddenly (causing settlement), disturb the load distribution contact between outrigger pads and cribbing, and change the stress state of the soil supporting adjacent outriggers. The operating crane's setup must be actively monitored for any level change or pad movement during dynamic compaction operations nearby.

13. D — Industrial floor drains are structural elements designed for pedestrian and vehicle loading, but the drain box, cover, and connected pipe represent a discontinuity in the floor slab that may not carry concentrated crane outrigger loads safely. The drain box itself may be cast-iron or pre-cast concrete without structural capacity for point loads, and the pipe creates a void in the load path below grade. The outrigger must be relocated away from the drain or the drain's structural capacity confirmed for the specific outrigger load.

14. C — OSHA 1926.1407(b) requires that the line's voltage be determined before any operations near it — visual estimation of voltage from wire diameter, pole type, or structure height is not a reliable method and is not authorized. The voltage must be confirmed through contact with the utility operator or other authoritative sources. Without confirmed voltage, the correct MSAD from Table A cannot be established, and all power line safety planning is based on an assumption rather than a confirmed fact.

15. C — Abandoned railroad ballast beds consist of loosely placed crushed stone that was stabilized by the weight and vibration of repeated train traffic over decades. Without ongoing compaction from train loading, this ballast gradually destabilizes. The track structure may include void spaces between ties, and the ballast may shift under concentrated crane outrigger loads. The surface type at the planned outrigger position must be confirmed stable before loading.

16. A — An operator who recognizes that fatigue has impaired their ability to safely perform crane operations has a professional and safety obligation to stop immediately. OSHA's General Duty Clause requires employers to provide a workplace free from recognized hazards — including fatigue-impaired crane operation. The operator's self-recognition of impairment triggers an immediate stop-work obligation to protect both themselves and all personnel in the work area.

17. A — ASME B30.5 establishes that a stop signal takes priority over all other signals at all times. When the operator cannot clearly determine whether a stop signal is being given, the safe interpretation

is that a stop signal was given — all movement must cease. This conservative interpretation protects against the worst case: failing to respond to an emergency stop when one was given.

18. C — OSHA 1926.1417 requires the load chart to be in the cab, accessible to the operator, and applicable to the crane's current configuration before operations begin. The operator must verify the chart is the correct one for the specific crane and its current configuration — a chart from a different serial number or configuration is not valid for the crane being operated. This confirmation is a pre-shift operational requirement.

19. A — Two horn blasts from another crane is the standard attention signal indicating the operator has identified a developing hazard in the work area. This signal is addressed to all nearby crane operators — when heard, all crane operators in the area must stop and assess conditions before continuing. The unknown source of the signal increases rather than decreases the urgency of stopping to investigate, since the hazard source cannot be assessed from the current position.

20. C — OSHA 1926.1424 requires the exclusion zone to encompass the actual hazard area of the specific crane's configuration and planned operations — not a standard fixed distance. The zone must protect against all hazards the crane creates: rotating upper works, counterweight, boom, load path, and tip-over envelope. The zone boundaries depend on the crane's actual configuration, which may change between lifts.

21. C — A low-pressure steam leak from a fitting can rapidly escalate to a full-system pressure release if the fitting fails progressively. The zone around the fitting represents a potential sudden high-temperature, high-pressure steam release zone. Crane operations must pause and the steam system must be confirmed safe or repaired before operations resume within the potential release zone — steam releases in industrial facilities can cause severe burns and equipment damage over significant distances.

22. D — The operator has direct positional knowledge that the load has reached its planned set height even without receiving a STOP signal. Continuing to hoist past the planned position risks over-hoisting to the ATB. The operator has independent authority and responsibility to stop hoisting when they know the load has reached the planned height — then use the horn to alert the signal person to the situation rather than waiting for a missed signal.

23. A — When a previously unknown power line is discovered during a live operation with the load already partially past it, all movement must stop immediately. Moving the load in any direction without knowing the line's voltage means the operator cannot confirm the MSAD for any subsequent movement.

The voltage must be confirmed and the applicable MSAD established before any crane movement — including movement away from the line — can be planned and executed safely.

24. C — OSHA 1926.1431 requires a trial lift with the unloaded platform before the first personnel hoisting operation on any project. The trial confirms that all crane functions — hoist, swing, and any planned boom movements — work correctly over the full intended range of motion. If a crane malfunction is discovered during the trial, it is found with an empty platform rather than with personnel suspended. This trial is a project-start requirement, not a periodic or as-needed procedure.

25. B — Rapid alternating between HOIST and LOWER imposes shock loads on the load line and boom structure during each direction reversal — the rope must absorb the inertial energy of the reversing load at each direction change. Additionally, the alternating movements can induce pendulum oscillation in the suspended load that is difficult to control. The operator should confirm with the signal person that the sequence is intentional before executing each reversal.

26. D — OSHA 1926.1425 is unconditional — all workers must physically clear the area beneath the load path before the load moves over it. There are no exceptions for worker awareness, hard hat use, or the load's height above the workers. The prohibitions applies to workers on the ground, in excavations, on structures, or in any position beneath the load's planned travel path.

27. C — A swing drive failure does not impair the hoist function, which can still lower the load vertically to the nearest safe position. With 12,000 lbs suspended at 15 feet of height, the priority is to get the load on the ground safely before investigating the swing drive. The hoist's controlled lowering capability provides the solution — lower the load to the nearest safe surface while warning all personnel with the emergency horn, then address the mechanical failure.

28. B — At 94% capacity, any unexpected variable — a slight load weight increase, a marginal radius increase from wind, ground condition change, or wind gust on a large load — can push the lift to or beyond 100% of capacity. A 15-minute delay introduces the possibility that these variables change. The lift director must confirm the delay is operationally acceptable, confirming that ground conditions, wind, rigging configuration, and all lift parameters remain within the planned parameters before the operator waits or proceeds.

29. B — Radio communication provides audio-only information — it does not confirm the signal person's direction signals or the operator's ability to verify load position visually. With only 40 feet of visibility in a 60-foot travel distance, the load and signal person cannot both be simultaneously visible.

A relay signal person chain with each person in visual contact with the adjacent person in the chain is the OSHA-compliant solution that maintains continuous confirmed communication without gaps.

30. C — OSHA 1926.1416 grants the operator independent authority to refuse any signal that would create an unsafe condition, would exceed rated capacity, or that the operator is uncertain about. The operator is not a passive executor of signals — they retain active safety responsibility for the crane's operation regardless of what signals are given. This authority cannot be overridden by the signal person, lift director, or any other party.

31. A — After a major structural repair, the crane's load path has changed — the repaired component may have different properties, welding residual stresses, and material characteristics than the original. OSHA 1926.1412(f) requires post-repair inspection and a proof load test as specified by the manufacturer or a qualified engineer to confirm the repair was performed correctly and the crane's rated capacity remains valid after the repair.

32. C — The pick-and-carry section's 3-degree maximum cross-slope is a hard configuration limit derived from stability analysis. At 4 degrees with a load attached, the crane's center of gravity has shifted further toward the downhill side than the rated condition assumed. With a load at height and the crane tilted 4 degrees laterally, the tipping resistance is reduced below what the section's rated capacity assumes. The load must be safely placed before the crane navigates out of the pothole.

33. A — OSHA 1926.1425 prohibits loads over personnel. When any person alerts the operator to a potential person beneath the load, the operator must treat this as an emergency stop situation — stopping all movement while the load's position is confirmed clear. The operator cannot verify the area beneath the load from the cab; the report must be treated as an emergency until the area is confirmed clear by someone with visual access to the area below the load.

34. D — OSHA 1926.1427 requires a current, valid certification for the operator to perform crane operations. There is no grace period — the certification expiration is the operational limit. An employer who knowingly allows an operator with an expired certification to perform certified operations is in violation of the standard and assumes regulatory liability for the resulting non-compliance.

35. C — When multiple cranes operate in areas where their booms, counterweights, or loads could intersect, the risk of collision creates a hazard that neither crane can individually manage. A coordination plan must define the priority and movement authority at each potential overlap point. Both operators must follow this plan — one crane pausing while the other completes a movement through the shared zone — to prevent simultaneous occupation of the same airspace.

36. B — A suspended load attached to the hook changes the boom's loading when the boom is extended. The boom extension changes the operating radius, which changes the applicable capacity value in the load chart. The load must be confirmed within the capacity at the new extended boom configuration and resulting radius before any extension is made with the load attached. Confirming capacity only at the original configuration does not authorize the extended configuration.

37. B — A governor fault causing the engine to run at higher-than-normal RPM is a mechanical failure requiring immediate attention. Operating with an uncontrolled engine speed affects all crane functions simultaneously and may prevent controlled load management. The emergency stop function engages the spring-applied brakes through loss of hydraulic pressure, safely holding the load while the engine fault is investigated — this is the safest response when engine control is compromised.

38. D — ASME B30.5 requires that deficiencies discovered during operations be reported immediately to the employer. Conditions that meet removal-from-service criteria require stopping operations — deficiencies that develop during operations may escalate rapidly, and the operator must assess whether continued operation is safe based on the current condition rather than waiting for a convenient pause. The operator's inspection duty does not end at shift start.

39. A — ASME B30.5 requires a minimum of two wraps on the hoist drum at all times during operations. With 1.5 wraps remaining after the completed lift, the minimum has already been violated. Lowering further would reduce wraps to below 1, placing the rope's dead-end anchor at risk of carrying the operational load — a condition the anchor was not designed for. The rope must be lengthened or maximum lowering depth restricted before any further lifting.

40. B — The crane's rated capacity is an engineering limit established by the manufacturer through structural and stability analysis. OSHA 1926.1417 and ASME B30.5 both prohibit exceeding this limit under any operational circumstances. No supervisor, employer, or lift director has authority to authorize exceeding the manufacturer's rated capacity — and an operator who complies with such direction assumes personal responsibility for the resulting condition.

41. A — Slow rotation of a load under a multi-leg wire rope bridle can cause sling legs to twist, progressively reducing their effective rated capacity through bending. More critically, slow rotation can cause shackle pins to unscrew if they are loaded in the rotation direction — even "locked" screw pins can back off under sustained rotation. The rotation must be stopped with a tag line before any further vertical or horizontal movement is made.

42. D — Any crack in a structural weld of a crane outrigger is an absolute removal-from-service condition under ASME B30.5. The outrigger beam weld carries the full outrigger reaction load — a

crack indicates fatigue or overloading that has already compromised the weld's structural integrity. The crack can propagate catastrophically under subsequent loading. No monitoring period or documentation substitutes for immediate removal from service.

43. A — OSHA 1926.1427 requires the employer to evaluate and document operator competency for each specific crane at each specific worksite. Even for the same crane model, a new site presents different ground conditions, hazards, overhead restrictions, and operational challenges that require assessment. The previous site's competency documentation covers only the conditions at that site.

44. C — OSHA 1926.1431 requires a thorough pre-lift inspection before each workday's first personnel hoisting operation. This inspection confirms the load line, rigging, ATB, brakes, and all planned crane functions are operational. The platform connections must also be visually confirmed before each day's first lift — personnel hoisting is the highest-consequence crane operation, and the daily verification requirement reflects this elevated risk.

45. B — When a rigging problem is reported but cannot be clearly described, the operator cannot assess whether the problem is critical or minor from the cab. An undescribed rigging problem may mean a shackle pin is backing off, a sling is cut, or a component is cracked — any of which could lead to sudden load drop. The only safe response is to lower the load to the ground where the rigging can be visually examined and the problem identified.

46. D — A combustion smell — burning insulation or plastic — indicates that an electrical fire may be developing somewhere in the crane's electrical system, potentially in a location not yet monitored by gauges. Electrical fires in crane cabs can escalate rapidly once oxygen reaches the burning material. Waiting for gauge confirmation means waiting until the fire is already advanced. The load must be on the ground before the operator can evacuate.

47. B — OSHA 1926.1413 establishes specific removal criteria based on the rope's inspected condition — not on time intervals. When any criterion in 1926.1413 or ASME B30.5 is met, the rope must be removed immediately regardless of how recently it was installed or how few hours it has accumulated. No increased monitoring frequency substitutes for replacement once a removal condition is identified.

48. B — Load contact with a glazed curtain wall panel creates a risk of panel fracture from impact — glass panels are brittle and fracture at relatively low contact forces. Glass panel fracture at height sends broken glass falling to the ground and work areas below. The combination of minimum swing speed, confirmed plumb load line above the target, and tag line rotation control eliminates the primary causes of load contact with adjacent glass panels during precision placement.

49. A — Fretting corrosion results from the micro-movement of adjacent wires rubbing together under load cycling — each small movement removes metal particles from the wire contact surfaces. The removed metal reduces the wire's cross-sectional area at these contact points without creating visible broken wires. The rope's actual tensile capacity at the fretted locations is lower than its nominal rating, creating an unsafe condition that cannot be quantified by visual inspection.

50. B — ASME B30.9 specifies a 4:1 minimum design factor for both Grade 80 and Grade 100 alloy steel chain slings. The higher breaking strength of Grade 100 material compared to Grade 80 produces higher Working Load Limits at the same chain size, but the design factor ratio remains 4:1 for both grades. This factor ensures adequate reserve capacity above the rated WLL for dynamic loading and safety margin.

51. D — Cross-winding on the drum occurs when the rope departs from its designed groove path and wires onto an adjacent section, crossing previous wraps at an angle. The crossing creates a pressure point where the rope is crushed between the crossing layer and the drum surface below it. This crushing deforms the rope's cross-section, accelerates wire fatigue at the deformation points, and can cause the rope to jump the drum flange during operations.

52. C — At 30 degrees from horizontal, the sine of the angle ($\sin 30^\circ = 0.5$) represents the efficiency of the sling's vertical force component. Maximum load = $(2 \text{ legs} \times 6,000 \text{ lbs WLL}) \times \sin(30^\circ) = 12,000 \times 0.5 = 6,000 \text{ lbs}$. The basket hitch doubles the single-leg capacity, but the 30-degree angle reduces the vertical load-carrying efficiency by 50%, exactly canceling the basket hitch benefit — resulting in the same maximum load as a single vertical hitch.

53. C — The hook safety latch pin is the structural pivot element of the latch mechanism. A pin worn to 60% of its original diameter retains only 36% of its original cross-sectional area (area scales as diameter²), dramatically reducing its shear strength. Under load, latch pins can experience significant forces from rigging weight and dynamic loading — a severely undersized pin can fracture, causing the latch to open and the rigging to disengage the hook.

54. B — Heat damage to high-carbon steel wire rope alters the metallurgical temper of the steel wires, reducing both tensile strength and ductility. The characteristic signature of heat damage is blue, purple, or black discoloration of the wire surface — these colors result from oxide film formation at specific temperature ranges. This discoloration cannot be produced by normal oxidation, UV exposure, or lubricant degradation and unambiguously indicates thermal damage requiring removal.

55. A — The manufacturer's backlash specification represents the maximum allowable clearance between gear teeth that still ensures proper load sharing and contact. Excessive backlash — 0.003 inches

above specification in this case — creates free play that generates impact loading during swing direction reversals as the teeth slam together after the free travel. These repeated impacts accelerate tooth wear and fatigue, progressing toward tooth fracture without visible warning.

56. C — A lifting beam's rated capacity is established for specific loading configurations — typically with symmetrically placed loads or specific asymmetric arrangements analyzed during the beam's design. Three asymmetric attachment points create bending moments and attachment force concentrations that may differ from the design loading. The beam's 20-ton capacity marking may not cover the specific force distribution produced by asymmetric loading; engineering confirmation is required.

57. A — An LMI that consistently reads 8% lower than actual causes the operator to believe lifts are safer than they are — the displayed percentage understates the actual load moment on the crane. A lift at 87% actual capacity would display as 79%, suggesting 21% of remaining margin when only 13% actually exists. This systematic under-reading removes the operator's ability to make accurate capacity management decisions.

58. D — A flat spot on a sheave creates a surface profile discontinuity — the rope transitions from the curved groove profile to the flat zone and back with each revolution of the sheave. This transition imposes a repetitive bending and unbending cycle at the flat spot's edges, creating fatigue cracks in the wires at the precisely consistent location where this transition occurs. The regular pattern of fatigue impacts makes flat-spot damage a particularly severe accelerator of rope fatigue.

59. D — OSHA 1926.1430 places the training responsibility squarely on the employer. Workers exposed to crane hazards — including workers adjacent to active crane operations who are not themselves crane personnel — must receive training from their employer before exposure. The training requirement covers hazard recognition, the requirements of Subpart CC, and safe work practices. This broad scope reflects the wide exposure of construction workers to crane hazards.

60. C — The ATB weight serves two critical functions: it keeps the ATB cable taut and hanging in the correct position below the boom tip sheave, and it is the physical element that the rising hook block contacts to activate the ATB switch. Without the weight, the cable may hang loosely and not be in the correct position to detect hook proximity, or may not contact the hook block until the hook block is already at the sheave — potentially too late to prevent two-blocking. The system is non-functional without the weight.

61. B — When a rope makes a clicking sound as it passes over a sheave on each hoist cycle, it indicates the rope is not following a smooth, continuous path through the groove. The rope may be jumping or catching at a specific point, consistent with a groove diameter mismatch between the rope and sheave, or a groove profile irregularity such as a chip, crack, or wear pattern. Jumping rope creates impact loads at the jump point that accelerate fatigue and may cause the rope to disengage from the sheave during heavy loading.

62. B — ASME B30.5 specifies removal when 3 or more broken wires occur in one strand within one lay length for running rope. The inspection found 4 broken wires all on the same strand within a 2-inch section — this meets the "3 or more in one strand" criterion. Additionally, concentrated breaks near end attachments independently indicate that the rope's condition at the fitting interface is compromised. Both removal criteria are triggered simultaneously.

63. A — High-pitched whining from a hydraulic motor is a diagnostic sign of cavitation — the formation and collapse of vapor bubbles within the fluid caused by inadequate fluid supply to the pump inlet. Cavitation erodes internal pump and motor surfaces rapidly and can cause sudden motor failure. High-pitched bearing noise can also produce this sound pattern. Both conditions indicate progressive degradation that will lead to sudden function loss during operations if not addressed.

64. B — ASME B30.9 bases capacity calculations on the angle each sling leg makes with the horizontal (the sling angle from horizontal). This angle directly determines the vertical component of each leg's tension — the tension each leg must carry to support its share of the load. The sling angle from horizontal (not the included angle at the top of the bridle, which is the supplement) is the geometric measurement used in all standard capacity calculations.

65. D — Any kink in a wire rope is an unconditional removal condition under ASME B30.5 and OSHA 1926.1413 — there are no exceptions for kinks in specific locations, minimal use, or apparent stability. A kinked rope has permanently distorted wire geometry that creates stress concentrations throughout the kinked section. The "dead wraps" designation is operational — it describes normal usage conditions, not an exemption from structural requirements.

66. C — Light surface rust in a marine environment warrants evaluation for pitting depth because corrosion that has reached the wire surface may have also reduced the wire cross-section at the pit locations. External wire cross-section reduction reduces tensile capacity below the nominal rating without producing visible wire breaks. A qualified inspector should assess pit depth and extent against the removal criteria for diameter reduction and surface corrosion to determine whether replacement is required.

67. D — Twists introduced during rope installation cannot be removed by applying tension — they become permanent helical deformations. These twists create unequal strand tensions and altered wire-to-wire contact geometry throughout the affected section. Even if the twists could be partially straightened, the permanent geometric alteration creates stress concentrations that will produce premature wire breaks under operational loading.

68. C — ASME B30.5 requires a minimum of two wraps to remain on the hoist drum at all times when the hook block is at its lowest operational position. Two wraps ensure the rope's dead-end drum anchor never experiences the operational load — the anchor is a weaker point than the rope body and is not designed to carry operational hook loads. Reducing below two wraps places the anchor at risk of becoming the load-bearing element.

69. C — A hydraulic accumulator stores pressurized fluid for use during brief system pressure loss events such as engine stalls. At 40% below pre-charge specification, the accumulator has less stored energy and will release its stored pressure more quickly, providing less time for the engine to restart before system pressure drops below the minimum required for brake holding. This means brake engagement may be incomplete and load drift or sudden load descent could occur during an engine stall.

70. D — A documented 15% estimated cross-section loss in a boom chord member with no documented corrective action is a serious active deficiency. Boom chord members carry the primary compressive load during all lifting operations — a 15% section loss reduces both the compressive capacity and the buckling resistance of the affected member proportionally. Operating for 11 months with this known deficiency without repair or engineering review constitutes operating a crane with a documented structural deficiency.

71. C — Conservative approach: capacity at the next larger tabulated radius (35 ft) = 30,400 lbs. Total rigging = 2,000 + 600 + 240 = 2,840 lbs. Total suspended weight = 2,840 + 25,000 = 27,840 lbs. Since 27,840 lbs is less than 30,400 lbs, the lift is within the conservative capacity.

72. A — The projected wind area = 25 ft × 10 ft = 250 sq ft. The note's 200 sq ft threshold is exceeded by 50 sq ft. The note therefore requires applying the 15% capacity reduction to all values in this section for this lift. Derated gross capacity = original gross × 0.85 for this load. The operator must use the reduced values for capacity planning throughout this lift.

73. B — A 360-degree all-directions section provides capacity values applicable at any boom orientation — this is precisely the section designed for lifts that require the boom to pass through multiple angular positions. The operator uses the capacity at each operating radius encountered along the swing arc, all

from the same 360-degree section. The section's design purpose is to provide a single consistent capacity reference for multi-direction operations.

74. D — A restricted sector specification in a load chart section header is a binding configuration condition of those capacity values — it defines the angular positions where those values apply and where they do not. The boom must never enter the 270–360 degree restricted sector while in this configuration, regardless of any operational urgency or planned path. The crane must either be repositioned or reconfigured to a section that permits 360-degree operation.

75. A — Conservative approach: capacity at the next larger tabulated radius (55 ft) = 10,400 lbs. Total suspended weight = 11,800 lbs. Since 11,800 lbs exceeds 10,400 lbs by 1,400 lbs, the lift cannot proceed at 52 feet using the conservative approach. The blank at 60 feet defines the maximum rated radius as 55 feet — but the conservative capacity at 55 feet is still insufficient for the planned load, making the 52-foot lift non-compliant.

76. C — The note is an explicit binding condition requiring confirmed solid support under all four pads. A pad with partial contact over a depression does not satisfy this condition — the unsupported section of the pad provides no bearing contribution, effectively reducing the bearing area and increasing the pressure on the supported section. The depression must be filled to achieve uniform contact or the outrigger position must be relocated before these section values can be applied.

77. D — Structure-limited capacities at 92% mean the boom's structural members are near their design stress limits under static loading. Any dynamic loading added to this near-limit condition — from sudden swing starts or stops, from load oscillation, or from simultaneous multi-function operation — adds structural stress above the static design limit. The specific operational precaution is smooth, controlled movements throughout the lift with no abrupt control inputs.

78. B — The theoretical maximum hook load from 6-part reeving = $6 \times 14,000 = 84,000$ lbs. The load chart's capacity values at various radii reflect structural and stability limits that may be less than or greater than this reeving capacity depending on the radius and configuration. At short radii where structural limits are high, reeving capacity may be the governing limit. At long radii where structural/stability limits are lower, those limits govern. The more restrictive limit at any specific configuration is the operative governing capacity.

79. D — The stability-limited designation means the crane's rated capacity at this configuration is set at a percentage of its theoretical tipping load. At 94.8% of a stability-limited capacity, the effective load moment is very close to the tipping threshold. The operator must verify level condition before the lift

because even a small out-of-level condition shifts the crane's center of gravity toward the load, increasing the effective load moment and bringing the actual tipping threshold below the tabulated value being used.

80. C — Using a shorter boom section's capacity values for a longer boom is not conservatism — it is configuration mismatch. A 100-foot boom creates different compressive loading profiles, different pendant angles, different slewing ring forces, and different boom foot loading than an 80-foot boom. The 80-foot section's capacity values were derived for an 80-foot structural system. Applying them to a 100-foot configuration applies values from a different structural analysis to a different structural condition.

81. B — The LMI configuration determines which column's capacity values it uses for calculations and displays. If the LMI is set for 80 feet while the boom is at 85 feet, it is calculating capacity percentages using the 80-foot column values — which may show different capacity than the 85-foot column at the same radius. The operator must update the LMI to 85 feet to ensure displayed percentages accurately reflect the actual 85-foot boom's rated capacity.

82. C — A load chart note requiring written engineering confirmation for lifts above 90% is a binding condition of those capacity values. The options are to either satisfy the condition (obtain written engineering confirmation) or change the situation so the condition is not triggered (reduce the load below 90% of gross capacity). Proceeding without engineering confirmation while using capacity values that explicitly require it violates the load chart's stated requirements.

83. A — Using the conservative approach for the 32-foot actual radius: next larger tabulated value is 35 feet with 30,400 lbs capacity. Total suspended weight = 35,700 lbs. Since 35,700 lbs exceeds 30,400 lbs, the lift is no longer within rated capacity at the actual 32-foot radius caused by boom deflection. The operator must either boom up to restore the original radius, accept the reduced capacity at the deflected radius, or lower the load. Boom deflection is a real, physically significant radius change.

84. A — Maximum counterweight improves stability by increasing the crane's restoring moment — the force that resists tipping toward the load. When structural limits govern (shaded gray cells), the boom's structural members are at their design stress limits regardless of stability margin. Adding more counterweight increases stability reserve but cannot increase the structural capacity of the boom chords, pinion, or slewing ring. Both configurations reach the same structural limit, producing identical capacity values.

85. B — Using the conservative approach: capacity at the next larger tabulated radius (30 ft) = 22,600 lbs. Total suspended weight = 23,500 lbs. Since 23,500 lbs exceeds 22,600 lbs by 900 lbs, the lift cannot proceed in the 50% extension configuration using the conservative approach. The crane must be reconfigured to full extension to access higher capacity values at 28 feet of radius.

86. D — The load chart note requires a crane scale specifically because at lifts above 90% of capacity, the accuracy of the load weight is critical — even small discrepancies can push the lift to or beyond rated capacity. The note cannot be waived by the lift director or by using the LMI as a substitute. The operator's compliant options are: install a crane scale, reduce the load below the 90% threshold, or select a crane configuration where the planned weight falls below 90% of gross capacity.

87. B — The pick-and-carry section specifies a "firm, level surface" as a condition of the rated configuration. A 1.5-degree slope changes the crane's stability geometry during travel — the lateral component of the crane's weight shifts toward the downhill side, reducing the tipping margin in the downhill direction compared to the level-surface analysis. The load must be set down and the crane repositioned rather than carrying on terrain outside the rated surface condition.

88. B — The operating radius is exactly 50 feet — one of the tabulated values. The total suspended weight of 8,300 lbs is directly compared against the tabulated 8,600 lbs gross capacity at exactly 50 feet. Since $8,300 < 8,600$, the lift is within gross capacity. The blank at 55 feet confirms that 50 feet is the maximum rated radius for this jib configuration — the operator is at the rated envelope boundary and must manage any radius increase with extreme care.

89. B — Using the conservative approach at 47 feet: next larger tabulated radius = 50 feet with 17,400 lbs. Total suspended weight = 20,500 lbs. Since 20,500 lbs exceeds 17,400 lbs, the boom-down movement to 47 feet cannot be completed as planned. The load was within capacity at 40 feet but becomes non-compliant before reaching the 47-foot set position. The lift plan must be revised.

90. D — A load chart note specifying a maximum rotation rate is a binding condition of those capacity values. The condition was established because dynamic centrifugal forces at higher rotation rates create additional lateral loading on the crane's structure that was not included in the capacity analysis for this section. Operating above the specified rotation rate while using these capacity values means using them outside the conditions for which they were derived. Weather urgency does not override binding note conditions.

91. A — The note states the gross capacity already has the standard 1,200-lb hook block pre-deducted. The 28,600 lbs therefore represents the capacity remaining after the hook block is already accounted for

— it is available for additional rigging and payload. Since the operator is using the standard 1,200-lb block (matching what was pre-deducted), no additional hook block deduction is needed. Only the 880-lb rigging weight must be deducted: $28,600 - 880 = 27,720$ lbs maximum payload.

92. B — A 0.3% level drift that occurred between lifts indicates something changed between the 8th and 9th lifts — one or more outrigger positions may be experiencing progressive settlement. Re-leveling corrects the symptom but not the cause. If progressive settlement is occurring under the near-capacity loads, the crane will drift again during the 9th lift, potentially reaching or exceeding the tolerance mid-lift at 92%+ capacity. The cause of the drift must be confirmed before proceeding.

93. D — Working backward: standard counterweight capacity = maximum counterweight capacity \div 1.12 = $20,800 \div 1.12 = 18,571$ lbs. The total suspended weight of 19,200 lbs exceeds the 18,571-lb standard counterweight capacity. This means if the maximum counterweight were inadvertently removed or the wrong section were used, the lift would be operating approximately 3.4% above the applicable rated capacity. The maximum counterweight section is therefore not merely beneficial — it is required for this lift.

94. D — The flattening capacity curve means each additional foot of radius produces a smaller capacity decrease as radius increases. However, this does not reduce the importance of precise radius measurement — at radii approaching the maximum, even a 1-foot measurement error could push the operating radius to or beyond the maximum where no rated capacity exists. The blank cell at 50 feet represents an absolute boundary, and the narrow capacity range near the maximum requires the most precision, not less.

95. A — The most common cause of an unexpected LMI reading increase from 89% to 94% at confirmed load weight is boom deflection under load increasing the actual operating radius beyond the planned value. At 92.9% of the 40-foot capacity, a 3-foot radius increase to 41 feet produces a significantly lower rated capacity that explains the higher percentage. The operator must verify the actual operating radius and confirm the total suspended weight is within the conservative capacity at the actual radius before proceeding.

Specialty Exam Simulation 8 — 65 Questions

65 Questions — Timed: 60 Minutes

SITE DOMAIN — Questions 1–15

1. A telescopic boom crane is being set up at a job site where the surface consists of a reinforced concrete slab on grade, 6 inches thick, with rebar at 12-inch centers. The slab was designed for 300 psf live loading. The maximum outrigger reaction load for the planned lift is 84,000 lbs. The operator has 4-foot × 4-foot timber mats (16 sq ft). What is the bearing pressure under the mat and does the slab's 300 psf design capacity provide adequate support?

A. The bearing pressure is 5,250 psf — well above the slab's 300 psf design rating; a structural engineer must evaluate whether the slab can support the concentrated point load before this setup proceeds

B. The bearing pressure is acceptable since the slab is reinforced concrete

C. Bearing pressure = $84,000 \div 16 = 5,250$ psf — this dramatically exceeds the slab's 300 psf design live load, indicating the slab is being subjected to approximately 17.5 times its design load; a structural engineer must evaluate the slab for the specific crane outrigger point loads before setup proceeds

D. The mat distributes the load across the reinforced concrete and the system is adequate for any outrigger load up to the crane's rated capacity

2. A crane operator is performing a site assessment for a planned lift adjacent to an occupied historic masonry building. The soil report shows 3,200 psf bearing capacity. The maximum outrigger reaction load is 76,000 lbs. What is the minimum cribbing contact area required, and what additional concern does proximity to the historic building create?

A. Minimum cribbing area = $76,000 \div 3,200 = 23.75$ sq ft — round up to 24 square feet minimum contact area; additionally, the historic masonry building may be susceptible to vibration-induced damage from crane operation, and the structural load transfer from the outrigger through the soil to the building's foundation must be evaluated before operations begin

B. Minimum cribbing area = 23.75 sq ft; the historic building creates no additional concern beyond standard proximity regulations

C. Minimum cribbing area = $76,000 \div 3,200 = 23.75$ sq ft; the historic designation requires an environmental permit before crane operations

D. The proximity to a historic building requires a minimum 50-foot setback for crane outrigger positions

3. Under OSHA 1926.1407, a crane is operating near a 46 kV distribution line. The applicable MSAD from OSHA Table A for a 46 kV line is 10 feet. The crane's boom tip at maximum planned reach comes within 14 feet of the nearest conductor. Which of the following correctly assesses this situation?

- A. The 14-foot clearance is adequate since it exceeds the 10-foot MSAD — no additional controls are needed
- B. A dedicated spotter is always required within 20 feet of any energized power line regardless of MSAD compliance
- C. The crane is outside the required 15-foot minimum for distribution lines — a new MSAD calculation is needed
- D. The 14-foot clearance exceeds the required 10-foot MSAD for 46 kV lines; however, the operator must confirm that no part of the crane, load line, or suspended load will come within 10 feet of any conductor at any point during operations — the 14-foot static clearance at maximum reach must be verified throughout all planned crane movements, not just at the single maximum reach position

4. A crane is set up for a lift and the operator notices that one of the outrigger pads has been placed on the edge of a concrete sidewalk curb — half the mat is on the concrete and half is on the adjacent unpaved soil. What concern does this split bearing surface create?

- A. Split bearing surfaces are acceptable as long as the combined capacity of the concrete and soil exceeds the outrigger load
- B. The two surfaces — concrete and soil — have very different stiffness characteristics; under load, the soil side will compress more than the concrete side, causing the mat to tilt and concentrating the entire outrigger load on the soil edge of the mat at a much higher pressure than calculated from the full mat area; the outrigger must be repositioned so it bears entirely on one consistent surface type
- C. The concrete sidewalk always provides the primary bearing and the soil side contribution is negligible
- D. Split bearing surface conditions are resolved by using two overlapping mats

5. A crane operator is asked to set up at a location where a large industrial fan exhaust duct exits the building at grade level, 6 feet from the planned left rear outrigger position. The duct passes beneath the surface at this location. What concern does the buried duct create?

- A. Industrial ductwork is structural steel and provides a rigid foundation element beneath the outrigger
- B. The buried duct should be avoided but is not a safety concern if the outrigger pad is more than 3 feet from the duct centerline

C. The buried duct represents a subsurface void in the load path — the soil above and beside the duct may be inadequately supported; under concentrated outrigger loading, the soil may shear toward the duct void, causing sudden pad settlement; the outrigger must be repositioned outside the duct's zone of influence or the duct's structural capacity confirmed for the outrigger loading

D. Buried ductwork always increases bearing capacity by providing a rigid frame beneath the soil surface

6. Under OSHA 1926.1402, when a crane is operating on a construction site adjacent to an active public roadway, what minimum controls are required to protect both the crane operation and roadway users?

A. Traffic control measures — including flaggers, temporary lane closures, or physical barriers — must be established to protect both crane operations and the traveling public from each other; the specific controls depend on the proximity of the crane's working envelope to the roadway, applicable local traffic control requirements, and whether the crane's load path passes over the roadway

B. A minimum 25-foot setback from the roadway edge is required for all crane operations

C. Standard job site exclusion zone tape is sufficient to protect both the crane and the roadway

D. No specific controls are required unless the crane's load must travel over the active roadway

7. A crane is set up at a job site where the soil has been confirmed at 4,200 psf bearing capacity. During the first lift of the day, the operator notices that rain has begun and has been falling steadily for 25 minutes. The soil is a silty sand. What does 25 minutes of rainfall on silty sand create for crane setup concerns?

A. Twenty-five minutes of rainfall has no meaningful effect on bearing capacity in silty sand — meaningful saturation requires at least 6 hours of continuous rainfall

B. Silty sand is self-draining and rainfall cannot reduce its bearing capacity

C. Twenty-five minutes of steady rainfall on silty sand can introduce enough water to begin reducing the soil's effective stress and bearing capacity — the change may not be uniform, and the continued rainfall will progressively worsen conditions; the operator should monitor the outrigger positions for any signs of settlement and stop operations if any pad sinking or level change is observed

D. Rainfall automatically voids the soil bearing capacity assessment, and all lifts must stop until a new assessment is performed

8. A crane operator is evaluating a potential setup location on a job site. The surface shows vehicle tire tracks from previous equipment usage. In an area adjacent to the planned outrigger zone, the tire tracks show lateral displacement patterns — soil has been pushed sideways rather than simply compressed by the tire loads. What does lateral soil displacement from tire traffic indicate about the bearing conditions?

A. Lateral displacement from tire loading is a positive sign indicating the soil has been compacted to maximum density

B. Lateral soil displacement under vehicle tire loads indicates the soil was experiencing near-failure bearing conditions under those vehicle loads — a condition called "plastic flow"; since crane outrigger loads produce higher bearing pressures per unit area than vehicle tires, the soil at this location may be unable to support crane loading without failure

C. Lateral displacement only occurs in clay soils and is not relevant to silty or sandy ground conditions

D. Tire track lateral displacement is caused by turning movements and does not indicate anything about bearing capacity

9. Under OSHA 1926.1402, what must the crane operator do when directed to set up the crane at a location that the operator believes has inadequate ground conditions — even if the controlling entity has declared the location suitable?

A. Follow the controlling entity's direction since they bear regulatory responsibility for ground preparation

B. The operator must reduce the planned lift to 75% of rated capacity and proceed with setup

C. The operator must refuse to set up at the location until the ground condition concern is resolved — the operator has an independent obligation to not set up the crane in a location they believe to be unsafe, regardless of the controlling entity's declaration; the operator's stop-work authority regarding unsafe conditions applies to setup decisions as well as operational decisions

D. Proceed with setup and document the ground condition concern for post-incident reference

10. A crane is operating on a job site when the operator observes that a forklift has just driven across one of the outrigger pad positions adjacent to the crane — driving over the mat and the ground next to it. The forklift was loaded with approximately 8,000 lbs. What must the operator do before the next lift?

A. The forklift's loading was light compared to crane outrigger loads — no special action is required

B. Nothing — the mat protects the soil beneath it from forklift traffic

C. Nothing — the forklift confirmed the soil was adequate by crossing it without visible distress

D. The operator should visually inspect the mat and the soil at that position to confirm the mat has not shifted, the soil contact is still uniform, and no settlement or surface disturbance has occurred before proceeding with the next lift — the forklift's passage may have disturbed the mat's seating or the underlying soil condition

11. A crane setup area has been prepared with compacted crushed stone. The original bearing capacity assessment found 5,800 psf in the native soil below the stone layer. After 3 weeks of heavy construction traffic across the setup area, the crushed stone has been mixed with native soil and the surface appears degraded. What must be done before the next crane setup at this location?

A. Nothing — the original 5,800 psf assessment remains valid since no construction work occurred within the stone layer itself

B. The contaminated crushed stone layer must be re-evaluated — mixing with native soil changes its bearing characteristics, and the degraded surface may transmit load differently to the native soil below; a new bearing capacity assessment is required for the current state of the prepared surface

C. Replace the crushed stone layer and immediately use the original 5,800 psf assessment

D. The original soil assessment applies regardless of what has happened to the stone overlay layer

12. A crane operator is setting up at a site that has a subsurface drainage system — a network of 6-inch perforated drain pipes running at 18 inches of depth throughout the planned outrigger area. The drains were installed to lower the water table for construction. What concern do the perforated drain pipes create for outrigger support?

A. Perforated drain pipes are always adequate for crane outrigger loading since they are designed for deep soil conditions

B. The network of 6-inch perforated pipes at 18 inches of depth creates a grid of voids and weakened zones throughout the planned outrigger area — concentrated outrigger loads can cause soil to shear toward the pipe voids or the pipes to collapse under point loading; the pipe network density and depth must be evaluated relative to the outrigger reaction loads before setup

C. Perforated drain pipes improve bearing capacity by lowering the water table and drying out the soil

D. The 18-inch depth places the pipes below the zone of influence for crane outrigger loads

13. A crane is operating on a job site when an adjacent excavation being performed by a different contractor deepens from 8 feet to 14 feet during the same workday — within 12 feet of the crane's setup position. This excavation deepening was not in the original site plan. What must the operator do?

A. Continue operations — the excavation is at least 12 feet away and within the safety margin for crane operations

B. Sound the crane's horn to warn the excavation crew and continue operations with reduced outrigger extension

C. Stop crane operations immediately and have a qualified person evaluate whether the deepened excavation has reduced the passive soil resistance and bearing capacity at the crane's adjacent outrigger positions — deepening an excavation near an operating crane can suddenly eliminate the confining soil that was supporting the outrigger-loaded soil wedge, creating risk of sudden bearing failure

D. Reduce the planned lift load to 80% of rated capacity as a precaution while the excavation deepens

14. Under OSHA 1926.1407(a), before crane operations begin near power lines, what is the specific sequence of actions the employer must complete?

A. Before beginning operations near power lines, the employer must: (1) determine the voltage of all power lines within the crane's working radius; (2) determine the applicable MSAD from OSHA Table A; (3) determine whether de-energizing and grounding is feasible; and (4) implement either de-energization or an encroachment prevention plan — this sequence must be completed before operations begin, not after the crane is already positioned

B. The employer may begin setup while simultaneously contacting the utility to determine voltage

C. Determining the MSAD is the only required pre-operational step — de-energization is optional

D. The employer must contact OSHA to obtain authorization before beginning operations near any power line

15. A crane operator is evaluating a potential setup location where a recently completed deep injection grouting program was performed — a soil improvement technique that injected grout under pressure to densify and strengthen the underlying soil. The grouting was completed 5 days ago. What concern does this recent grouting create?

A. Deep injection grouting always provides superior bearing capacity and recent completion only improves the results

- B. Nothing — 5-day-old grouted soil is cured and ready for any loading condition
- C. Deep injection grouting introduces pressurized grout into the soil mass, temporarily changing the pore pressure and stress conditions; within 5 days of completion, the grout may still be curing, the grout-to-soil bond strength may not be fully developed, and the modified stress state may not have equilibrated; the grout designer or geotechnical engineer must confirm that the grouted zone has achieved adequate strength for the planned crane loads before setup proceeds
- D. The grouted soil has been improved and requires no additional evaluation before crane use

OPERATIONS DOMAIN — Questions 16–30

16. A crane operator is performing a lift when the LMI reading increases from 82% to 91% during the hoist, even though no configuration change has been made and the load weight is confirmed. What is the most likely physical explanation and what must the operator do?

- A. The 9% increase is within LMI calibration variance — continue the lift with no action
- B. The most likely cause is boom deflection under the increasing load moment as the load is raised — as the boom deflects, the effective operating radius increases, increasing the load moment and decreasing the rated capacity; the operator must stop the hoist and verify the actual operating radius under load before continuing
- C. The LMI increase is caused by the load rising in elevation, which increases its gravitational potential energy as measured by the LMI sensor
- D. The increase indicates a system voltage drop affecting the LMI accuracy — have the electrical system checked before the next lift

17. A crane is completing a shift when the operator notices that the hydraulic fluid in the return line sight glass has air bubbles visible — the fluid appears foamy during operation. What does aeration of hydraulic fluid indicate and what action is required?

- A. Foamy hydraulic fluid is normal during the first 30 minutes of cold-weather operations
- B. Air in the hydraulic return line is caused by insufficient hydraulic pressure in the return circuit — increase system pressure and the aeration will stop
- C. Aerated hydraulic fluid — containing significant air bubbles — indicates that air is entering the hydraulic system through a suction leak, reservoir cap seal failure, or low fluid level; aerated fluid has reduced lubrication effectiveness and can cause pump cavitation; the crane must be evaluated to identify the air entry point and the condition corrected before operations continue

D. Aerated hydraulic fluid only affects the hydraulic cooler efficiency and does not affect crane function

18. Under OSHA 1926.1416, when an operator believes a safety device has malfunctioned — but has not confirmed the malfunction — during an active lift, what is the correct response?

A. Stop all crane functions, hold the load at current position, and investigate the potential device malfunction before resuming — an unconfirmed malfunction of a safety device during a live operation must be treated as a confirmed malfunction until proven otherwise; the cost of a pause to investigate is vastly smaller than the consequence of a safety device failure during a near-capacity lift

B. Continue the lift while monitoring the device to determine if it malfunctions again

C. Complete the current pick-and-set cycle and then investigate the device at the end of the lift

D. Contact the lift director for authorization to continue with a potentially malfunctioning safety device

19. A crane operator is performing a complex multi-phase lift that requires simultaneous operation of the hoist, swing, and boom up functions. The LMI shows 88% capacity at the start of the combined movement. What specific risk does simultaneous multi-function operation create at near-capacity?

A. Simultaneous operation of multiple functions is not permitted by ASME B30.5 for any lift above 75% capacity

B. Nothing special applies — each function operates independently and their simultaneous use does not change the total load moment

C. Simultaneous multi-function operation is efficient and always preferred at near-capacity lifts

D. Each crane function adds dynamic loading that is additive — simultaneous hoist, swing, and boom movement combine inertial forces, centrifugal displacement, and boom momentum into a combined dynamic load that exceeds the static capacity assumption; at 88%, any combination of these dynamic additions can push the effective load moment beyond rated capacity; smooth, sequential function operation is required at near-capacity

20. A crane is performing a lift when the signal person gives a STOP signal. The operator applies the swing brake, which stops the upper works but the load continues to oscillate in a 4-foot arc pendulum motion. The signal person is waiting for the oscillation to stop before giving the next command. What is the operator's best technique to dampen the oscillation?

A. Apply the swing brake firmly in alternating directions to mechanically force the oscillation to stop

- B. Use gentle counter-swing impulses timed to oppose the load's natural pendulum motion — applying brief opposing swing inputs at the extreme points of each oscillation progressively removes energy from the pendulum and reduces amplitude
- C. Hoist the load as quickly as possible to reduce the pendulum length
- D. Lower the load toward the ground to create additional air resistance that will dampen the oscillation

21. A crane operator is performing a jib lift when a sudden increase in wind speed occurs — a gust estimated at 30 mph hits the job site. The crane's general limit is 35 mph and the jib lift configuration requires the load to be positioned in a narrow slot between two structural members. What operational consideration must the operator make beyond the general wind limit?

- A. The general limit governs — since 30 mph is within the 35 mph limit, the lift may proceed
- B. Wind speed must be measured at the hook point rather than at grade before proceeding
- C. The combination of a narrow slot placement and 30 mph wind creates a specific risk: wind loading on the jib and load can create lateral displacement that could cause the load to contact the structural members during placement even at speeds below the general limit — the operator must evaluate whether the wind-induced lateral movement of the load in this specific configuration exceeds the available clearance before proceeding
- D. The lift director must confirm the gust was not above 35 mph before operations continue

22. Under OSHA 1926.1427, an operator with a valid TLL (Telescopic Boom, Swing Cab) certification is assigned to operate a fixed-cab telescopic boom crane (TSS designation) on a project. What must the employer confirm before the operator begins work?

- A. Whether the NCCCO TLL certification covers the TSS type under OSHA's framework, and regardless of certification type coverage, the employer must evaluate and document that the operator is competent to safely operate the specific TSS crane at the specific worksite
- B. The TLL certification covers all telescopic boom cranes and no additional evaluation is required
- C. The operator must obtain a separate TSS endorsement from NCCCO before operating fixed-cab cranes
- D. Fixed-cab cranes are exempt from OSHA 1926.1427 certification requirements

23. A crane is performing a lift at 87% of rated capacity when a structural bolt falls from the structure being built and lands 3 feet from the signal person. No one is injured. The signal person signals the operator to continue the lift. What must happen before operations resume?

- A. Continue the lift as directed by the signal person since no one was injured
- B. The lift director must document the falling object incident before operations continue
- C. Sound the horn to warn surrounding personnel and continue at reduced speed
- D. Stop the lift and investigate how the bolt fell before resuming — falling objects indicate that the work area above is not adequately controlled; continuing without investigation could expose all personnel to a repeated falling object event; the source and cause must be identified and controlled before crane operations and other work in the area resume

24. A crane operator completes a shift with 14 lifts performed at configurations ranging from 78% to 91% of rated capacity. During shift turnover, the relief operator discovers that the LMI had been configured for a 90-foot boom throughout the shift when the actual boom length was 100 feet. What does this configuration error mean?

- A. Nothing — LMI configuration errors are within the instrument's stated accuracy tolerance
- B. The LMI was computing capacity percentages using 90-foot boom values, which typically show higher capacity at the same radius than 100-foot boom values — meaning the displayed percentages understated the actual load percentage; some or all of the 14 lifts may have been performed at higher actual percentages than displayed, and a post-incident investigation is required to determine whether any lifts exceeded the crane's 100-foot boom rated capacity
- C. The 90-foot configuration is more conservative and all lifts were therefore within a safe margin
- D. The LMI error affects only the display — the crane's structural capacity is unchanged by the configuration error

25. A crane is performing a lift when the operator receives a BOOM DOWN signal from the signal person. Before executing this movement, what specific check must the operator perform?

- A. Confirm the signal person is the designated person before executing any boom movement command
- B. Nothing — boom down is a standard movement that requires no pre-execution check
- C. The operator must check the hook block height relative to the boom tip before executing any boom-down movement — lowering the boom increases the boom-to-tip rope path distance, which consumes

rope from the drum side and causes the hook block to rise; if the hook block is near the top of its travel, a boom-down movement can drive it into two-blocking regardless of no hoist command being given

D. Contact the lift director to confirm the boom-down movement is required before executing it

26. Under OSHA 1926.1424, which specific element of the exclusion zone requirement is often overlooked in practice but remains a mandatory control?

A. The exclusion zone must encompass the full swing arc of the counterweight tail swing — not just the boom and load path; many exclusion zones are set based on the boom's reach but fail to account for the counterweight swinging in the opposite direction; personnel struck by the counterweight represent a significant portion of crane-related fatalities that proper counterweight swing zone exclusion would prevent

B. The exclusion zone must be established with flagging at 5-foot intervals along its perimeter

C. All exclusion zones must be marked with red barrier tape rather than any other color

D. The exclusion zone must be surveyed and documented by a licensed land surveyor before any crane operation

27. A crane is performing a lift when the operator observes that a freshly placed concrete pour is occurring directly below the load's planned travel path to the set location. Workers are finishing the concrete surface. What must happen?

A. Continue the lift since the workers are performing concrete finishing which requires them to be in that location

B. Reduce the swing speed to minimum when passing over the concrete finishing crew

C. Sound the horn to warn the finishing crew and proceed at minimum speed since they are ground-level workers in a necessary work position

D. Stop the swing movement — all workers must be cleared from beneath the load path regardless of the work they are performing and regardless of the load's height above them; OSHA 1926.1425 prohibits loads from passing over personnel without exception

28. A crane operator is performing a lift at 89% of rated capacity. The lift plan was developed based on a load weight of 42,000 lbs. During the pre-lift rigging check, the rigger reports that the load weighs 44,600 lbs — 2,600 lbs more than planned. The crane's net capacity at the planned radius is 46,200 lbs. What must happen?

- A. The 44,600-lb load plus all rigging must be re-evaluated against the crane's gross capacity — recalculate the total suspended weight with the confirmed 44,600-lb load and all rigging weights, compare this to the gross capacity, and confirm the configuration is still within rated capacity before proceeding; the original 89% calculation is no longer valid
- B. The lift may proceed since 44,600 lbs is still below the 46,200-lb net capacity
- C. A 2,600-lb difference is within the 5% tolerance for load weight estimation and the lift proceeds
- D. The lift must be rescheduled until the exact load weight can be certified by the load manufacturer

29. A crane is performing personnel hoisting when the lift director asks the operator to move the platform laterally by booming down 2 degrees to reposition the workers closer to the structural connection point. The current platform load is 46% of the crane's rated capacity. What must the operator verify before executing the boom-down movement?

- A. Nothing — 46% is below the 50% personnel hoisting limit and the boom-down is authorized
- B. The operator must confirm the 2-degree boom-down will not increase the operating radius to a point where 46% of rated capacity at the new radius exceeds the crane's capacity at that configuration — boom-down increases the radius, and the rated capacity at the new radius may produce a different load percentage than at the current position
- C. The signal person must physically guide the boom with a tag line during the repositioning
- D. Personnel hoisting boom movements require the platform to be lowered to within 3 feet of the ground before any boom movement is executed

30. Under ASME B30.5, what is the minimum requirement for securing a crane when it must be left unattended with no load suspended?

- A. Lower the hook block to the ground, shut off the engine, and leave the cab — no formal securing procedure is required without a suspended load
- B. The crane may be left unattended in any configuration when no load is suspended
- C. Nothing beyond shutting off the engine is required for cranes without suspended loads
- D. All functions must be secured with brakes engaged, the machine must be protected against unauthorized operation, and the hook block must be positioned at a safe working height — these requirements apply regardless of whether a load is suspended; an unsecured crane with an unsecured hook block can cause damage or injury if the brakes release or if unauthorized persons access the controls

TECHNICAL KNOWLEDGE DOMAIN — Questions 31–42

31. A crane's wire rope shows a section where alternate strands appear to be bunching — some strands are tighter and more prominent while others appear looser. This non-uniform strand appearance runs along approximately 18 inches of rope length. What does non-uniform strand loading in a running rope indicate?

- A. Non-uniform strand appearance is a normal variation in wire rope appearance that occurs during break-in
- B. Nothing — running ropes naturally develop variations in strand prominence during service
- C. The rope may have adequate tensile capacity based on total wire count
- D. Non-uniform strand loading indicates the rope's internal geometry has been disrupted — possibly from a kink that was subsequently pulled through a sheave, from a shock load that altered the strand pitch, or from fiber core failure that caused the strand arrangement to shift; the affected section cannot carry load uniformly across all strands and has reduced actual tensile capacity; the rope must be removed from service

32. A rigger is using a wire rope sling in a basket hitch configuration at 45 degrees from horizontal. The sling's vertical hitch WLL is 12,000 lbs. The total load is 16,000 lbs. Using standard sling angle calculations, is this application within the sling's rated capacity?

- A. Nothing — the sling cannot carry any load in a basket hitch below 60 degrees
- B. Maximum basket load at 45 degrees = $(2 \times 12,000) \times \sin(45^\circ) = 24,000 \times 0.707 = 16,968$ lbs; the 16,000-lb load is within the 16,968-lb maximum capacity at 45 degrees in a basket hitch — the application is within capacity with 968 lbs of margin
- C. Maximum basket load at 45 degrees = $12,000 \text{ lbs} \times \sin(45^\circ) = 8,485$ lbs — the load exceeds this value
- D. The basket hitch doubles the WLL at all angles — the maximum is 24,000 lbs regardless of angle

33. A crane's hydraulic system has been operating for 6 hours on a warm day. The operator observes that the hydraulic fluid temperature is consistently 15°F above the manufacturer's recommended maximum operating temperature. The crane continues to function normally. What is the consequence of sustained operation at this elevated temperature?

- A. Operating 15°F above the maximum recommended temperature accelerates oxidative degradation of the hydraulic fluid, reduces fluid viscosity below the minimum required for adequate lubrication, accelerates seal deterioration, and increases internal leakage rates — sustained operation at this temperature can cause pump and motor damage and eventual loss of load-holding capacity; operations must be interrupted to allow the system to cool
- B. A 15°F exceedance above maximum is within the instrument's stated accuracy — the true temperature is likely within specification
- C. Elevated hydraulic temperatures only affect travel functions — lifting and hoisting are not impacted by temperature
- D. The crane may continue operating as long as no visible smoke or burning odor is detected

34. Under ASME B30.9, what is the specific removal criterion for a synthetic web sling that has been subjected to a chemical exposure that the operator cannot identify?

- A. The sling may continue in service if no visible chemical damage — discoloration, stiffness, or surface degradation — is present after the exposure
- B. The sling must be identified as potentially compromised — if the chemical cannot be identified, its effect on the sling material cannot be confirmed; under ASME B30.9, slings exposed to conditions that may affect their strength must be removed from service until the chemical is identified and confirmed not to affect the sling material, or a qualified person confirms the sling is unaffected
- C. The sling must be tested by applying a proof load at 100% WLL before returning to service
- D. Chemical exposure only affects the outer surface of synthetic web slings — the inner fibers remain at full capacity as long as the outer weave is intact

35. A crane operator is asked about the function of the crane's hydraulic counterbalance valves installed on the boom hoist cylinder. Which statement correctly describes their function?

- A. Counterbalance valves limit the maximum hydraulic pressure in the boom hoist circuit to protect the cylinder from overloading
- B. Counterbalance valves bypass flow around the hoist cylinder to prevent excessive lowering speed
- C. Counterbalance valves allow free flow of hydraulic fluid when commanded but require positive hydraulic pilot pressure to open for load-releasing movements — they prevent the boom from lowering due to gravity or external load without a positive hoist-down command from the operator; if the hoist

cylinder loses pressure from a seal failure, the counterbalance valve remains closed and prevents uncontrolled boom lowering

D. Counterbalance valves redirect hydraulic flow to the auxiliary hoist when the main hoist pressure exceeds the rated limit

36. A rigger is inspecting a Grade 80 chain sling after it was used for a lift that the supervisor estimated may have exceeded the sling's rated capacity. The chain appears visually normal — no visible elongation, cracking, or surface damage. What action does ASME B30.9 require?

A. Nothing — if no visible damage is present, the chain may return to service without restriction

B. The sling must be removed from service and inspected by the manufacturer or a qualified inspector — when a sling is known or suspected to have been subjected to loads exceeding its rated capacity, visual inspection alone is not sufficient to confirm its condition; internal damage, deformation below the visual threshold, and hardness changes from overloading may not be visible but represent real reductions in the chain's remaining capacity and fatigue life

C. Test the sling at 110% of its rated capacity to confirm it can still carry loads above its WLL

D. Document the potential overload and return the chain to service with a 25% capacity reduction for the next five uses

37. Under ASME B30.5, when is the crane operator required to communicate a deficiency that was observed during operations to the next shift's operator?

A. Deficiencies are only required to be communicated if they triggered a removal-from-service condition during the shift

B. Deficiencies that cannot be immediately repaired must be documented and communicated to the next operator before any further operations — the incoming operator cannot perform a meaningful pre-shift inspection without knowing what conditions were already identified; communication of deficiencies is mandatory regardless of whether the outgoing operator believes the condition is minor

C. Deficiencies may be documented in the maintenance log at the end of the shift without verbal communication to the relief operator

D. The maintenance department, not the incoming operator, must be notified of any deficiencies before shift changes

38. A rigging crew is preparing a four-leg wire rope sling bridle for a 68,000-pound structural steel lift. All four legs will be at 50 degrees from horizontal. Each leg has a vertical hitch WLL of 22,000 lbs. What is the tension on each leg and is the configuration within the rated WLL?

A. Each leg tension = $(68,000 \div 4) \times (1 \div \sin 50^\circ) = 17,000 \times 1.305 = 22,185$ lbs — this exceeds the 22,000-lb WLL by 185 lbs; the configuration is marginally over capacity and must not be used; the sling angle must be increased or higher-capacity slings must be used

B. Each leg tension = 17,000 lbs — within the 22,000-lb WLL; the configuration is adequate

C. Each leg tension = 22,185 lbs — exceeds the 22,000-lb WLL; use slings with higher WLL or increase the sling angle to reduce the tension per leg

D. The four-leg bridle distributes load over four legs — the maximum capacity is $4 \times 22,000 = 88,000$ lbs regardless of sling angle

39. A crane inspector finds that the hook block's main sheave will not rotate — the sheave is seized and does not turn when the rope moves through it. The rope slides over the seized sheave. What is the specific hazard created by a seized sheave in a hook block?

A. Nothing — load capacity is unaffected by whether the sheave rotates or slides

B. The rope is properly constrained in the groove regardless of sheave rotation

C. The sheave being seized only affects hoist speed — not safety

D. A seized sheave causes the rope to slide over the sheave surface rather than rolling — this creates friction-induced rope abrasion at the sheave contact point, rapidly degrading the crown wires on one side of the rope at that location; additionally, a seized sheave concentrates all bending wear at the sliding contact point rather than distributing it; the block must be removed from service and the sheave repaired or replaced

40. Under OSHA 1926.1413, which of the following conditions specifically triggers immediate removal of a crane's wire rope from service without any further inspection or assessment?

A. Any surface oxidation on the rope beyond a light rust patina

B. Any evidence of heat damage including discoloration from blue to black on any wires, any evidence of electric arc damage including fused wires, or any kink that has created a permanent deformation in the rope's geometry — these conditions each independently require immediate removal with no remediation option

C. Any contact between the rope and a power line regardless of whether the line was energized

D. Any instance where the rope has been loaded within 10% of the manufacturer's stated breaking force

41. A crane's load line is being replaced. The new rope has been confirmed as the correct diameter, grade, and construction per the manufacturer's specification. After installation and before first use, what procedure is required?

- A. Nothing additional — a correctly specified new rope is ready for immediate full-load operations
- B. The new rope must receive a proof load test at 125% of the crane's rated capacity at maximum reach
- C. The new rope must be run through its full travel range under no-load or light-load conditions for several cycles to allow the rope to seat properly against the sheave grooves and drum before being subjected to full operational loads — this break-in procedure reduces the risk of premature wire breaks from unequalized internal stresses in the new rope
- D. The new rope must be inspected by an NCCCO-certified inspector within 24 hours of installation before the crane may be used

42. Under OSHA 1926 Subpart CC, what must a qualified person do when they identify a condition that meets removal-from-service criteria during a periodic inspection?

- A. Document the finding in the inspection report for the employer to act upon within 30 days
- B. Nothing — the employer makes all removal-from-service decisions based on the qualified person's recommendation
- C. The crane must be taken out of service immediately — a qualified person who identifies a removal-from-service condition has the authority and obligation to remove the crane from service at that time; they do not need to wait for employer direction or give the operator time to complete a current shift before acting on removal criteria
- D. The condition must be re-confirmed by a second qualified person before removal from service is executed

MANUFACTURER LOAD CHARTS DOMAIN — Questions 43–65

43. A crane load chart shows: 100-foot boom at full outrigger extension, 35 ft = 26,800 lbs; 40 ft = 21,200 lbs. The planned operating radius is 37 feet. Total suspended weight = 19,400 lbs. Using the conservative approach, what is the capacity governing the lift?

- A. Conservative capacity = 26,800 lbs at 35 ft; but the conservative approach uses the NEXT LARGER tabulated radius (40 ft), not the next smaller

- B. Conservative capacity = 26,800 lbs at 35 ft; 19,400 lbs is within this capacity — lift proceeds
- C. Conservative capacity = 26,800 lbs using the 35-foot value since 37 feet is closer to 35 feet
- D. Conservative capacity at the next larger tabulated radius (40 ft) = 21,200 lbs; total suspended weight (19,400 lbs) is within this value — the lift proceeds conservatively with 1,800 lbs of margin

44. A crane's load chart note reads: "Capacities in this section are based on the crane being equipped with the manufacturer's standard counterweight at 18,000 lbs. If counterweight mass differs by more than 500 lbs in either direction, these capacities do not apply." The crane has 17,200 lbs of counterweight installed — 800 lbs less than the standard. Does this section apply?

- A. Yes — 17,200 lbs is close enough to the standard and the difference is minor
- B. No — the installed counterweight of 17,200 lbs is 800 lbs below the standard 18,000 lbs, which exceeds the 500-lb permitted deviation; this section does not apply to the current configuration; the operator must either add 300 lbs or more of counterweight to bring it within 500 lbs of standard, or find a chart section that applies to the actual installed counterweight configuration
- C. The 500-lb tolerance only applies to counterweight in excess of standard — underweight counterweight always produces a conservative configuration
- D. Yes — the note only applies when counterweight exceeds the standard, not when it is less

45. A crane load chart section shows capacity values for a "MAIN BOOM — 140 FT — OVER SIDE — ON CRAWLERS — MAXIMUM COUNTERWEIGHT" configuration. The crane has a superlift attachment installed on it during this lift. The superlift section has separate capacity values. Which section applies?

- A. The main boom section applies since the load will hang from the main hook, not the superlift
- B. The superlift configuration changes the structural geometry and load path of the crane significantly — the superlift section must be used when the superlift is installed, regardless of which hook carries the load, because the superlift's physical presence affects the main boom's structural loading and stability
- C. The operator may choose either section and use the one that shows higher capacity
- D. The main boom section applies when the superlift counterweight cart is not carrying any load during the lift

46. A crane is performing a lift at 30 feet of radius. The load chart shows 42,400 lbs at 30 feet and 33,800 lbs at 35 feet. During the lift, the operator must swing the load while simultaneously raising the

load's height. The LMI shows 88% throughout the movement. At what point should the operator evaluate whether the swing has increased the effective radius beyond the planned 30 feet?

- A. The operator should evaluate the effective radius only if the LMI exceeds 90%
- B. The operator should continuously monitor the LMI throughout all combined movements — any climb in the LMI reading during the simultaneous hoist and swing indicates the effective radius is increasing from centrifugal displacement; if the LMI approaches 95%, the operator must reduce swing speed or stop the swing to prevent the effective radius from increasing further; continuous monitoring during combined movements is essential
- C. Radius increases during simultaneous movements are automatically compensated by the LMI
- D. Combined movements never create effective radius increases — only single-function swing movements create centrifugal displacement

47. A crane load chart shows two separate sections: "BOOM 100 FT — ALL SECTIONS PINNED" and "BOOM 80–100 FT TELESCOPING." The crane's boom is currently at 95 feet with all sections fully pinned. Which section applies?

- A. The "BOOM 80–100 FT TELESCOPING" section applies since 95 feet falls within that range
- B. The "BOOM 100 FT FIXED" section is closest and should be used conservatively
- C. The "80–100 FT TELESCOPING" section applies to intermediate non-pinned positions; the "100 FT ALL SECTIONS PINNED" section applies when the boom is at exactly 100 feet with all sections pinned; at 95 feet with all sections pinned, neither section exactly covers this configuration — the operator must contact the manufacturer for capacity at 95 feet pinned, or extend the boom to 100 feet fully pinned to use the available section
- D. The "BOOM 80–100 FT TELESCOPING" section covers all positions from 80 to 100 feet including pinned positions

48. A crane's load chart shows that the on-outrigger full extension section has a maximum rated radius of 60 feet. A planned lift requires setting the load at 62 feet of radius. The operator considers reducing the total suspended weight to 80% of the 60-foot capacity and proceeding to 62 feet. What is wrong with this approach?

- A. Nothing — reducing load to 80% of the last tabulated capacity provides adequate margin for 2 feet beyond the maximum rated radius

B. The maximum rated radius represents the boundary of the crane's rated operating envelope — no capacity value exists at 62 feet regardless of how much the load is reduced; reducing to 80% of the 60-foot value does not create a valid capacity for 62 feet; the crane must be repositioned or reconfigured to bring the set location within the rated envelope

C. The 80% reduction is acceptable for lifts within 5 feet of the maximum rated radius

D. The operator must obtain manufacturer written authorization for operations beyond the maximum rated radius

49. A crane load chart for a telescopic boom crane shows the following in the "ON OUTRIGGERS — FULL EXTENSION — 360° — MAXIMUM COUNTERWEIGHT" section: all values are identical to the "STANDARD COUNTERWEIGHT" section at radii of 20 feet and shorter. Beyond 25 feet, the maximum counterweight section shows higher values. What principle does this pattern confirm?

A. The identical values at short radii confirm a printing error — maximum counterweight should always show higher values

B. Nothing — the counterweight section values are always equal to the standard section values regardless of configuration

C. At short radii where structural limits govern the rated capacity, maximum counterweight provides no additional benefit — structural limits are independent of counterweight mass; the capacity at these cells is set by the boom's structural capacity, not by stability; beyond 25 feet where stability limits take over, the greater restoring moment from maximum counterweight produces higher rated values

D. The maximum counterweight section always matches the standard section at all radii for this crane model

50. A crane's manufacturer load chart shows: on-outrigger, full extension, 100-foot boom: 25 ft = 44,200 lbs. This cell is shaded indicating structural limitation. The operator plans a critical lift at 92% of this structural-limited capacity. The lift director says this is within the rated capacity and may proceed. What additional operational considerations apply specifically because the cell is structural-limited?

A. Structural-limited cells require manufacturer on-site support for all critical lifts at or above 85% of the tabulated value

B. Nothing additional — structural limits include the same operational requirements as stability limits

C. Nothing — the lift director's confirmation is sufficient authorization for structural-limited critical lifts

D. Structural-limited cells at near-100% capacity require that all crane movements be executed with exceptional smoothness — no sudden hoist starts or stops, no abrupt swing direction changes, and no simultaneous multi-function operation that adds dynamic loading to the already near-design-limit structural stress; boom side-loading must also be avoided

51. A crane load chart shows a note in the jib configuration section: "Jib capacities are based on the jib being used with the jib erected at the specified offset angle. Changing the jib offset angle during a lift is prohibited." An operator begins a jib pick with the jib at 20 degrees of offset. During the lift, the load needs to be raised slightly higher, which the operator believes requires increasing the jib offset to 25 degrees. What must the operator do?

A. Slowly increase the jib angle to 25 degrees while monitoring the LMI

B. Contact the lift director for authorization to change the jib angle during the lift

C. Nothing — the note only prohibits changing the offset angle while the load is at maximum height

D. The note prohibits any change to the jib offset angle during a lift — changing it while the load is suspended is explicitly not authorized; the load must be lowered to the ground before the jib angle can be adjusted; once the angle is changed to 25 degrees, the applicable jib section for that angle must be used and the capacity re-confirmed before re-picking the load

52. A crane load chart has a note: "For this configuration, the crane must not be operated within 15 feet of any structure, pile, wall, or other obstruction." The planned lift has one outrigger positioned 12 feet from a concrete block retaining wall. Does the note apply?

A. The note applies to the crane's working envelope (boom and load path) — not to the outrigger positions

B. The note is a binding configuration condition — the 12-foot outrigger-to-wall clearance does not meet the 15-foot minimum required by the note; the crane must be repositioned to achieve 15 feet of clearance from the wall on all sides, or a different configuration must be used whose applicable section does not have this clearance restriction

C. The 15-foot requirement is measured from the crane's centerline of rotation, not from the outriggers

D. The note only applies when the structure creates a hazard to the crane's operational envelope

53. A crane operator is using the load chart to plan a lift at 42 feet of radius. The chart shows: 40 ft = 22,400 lbs; 45 ft = 17,800 lbs. After computing both the interpolated capacity (20,560 lbs) and the

conservative capacity (17,800 lbs at 45 ft), the operator confirms the total suspended weight is 16,200 lbs. Both approaches confirm adequacy. The lift percentage based on the conservative capacity is approximately 91%. What additional requirement does the 91% figure trigger?

- A. Nothing additional — the 91% figure is only informational
- B. Any lift exceeding 90% of the conservative capacity value requires the operator to perform a direct horizontal tape measurement of the operating radius rather than relying solely on the LMI radius display
- C. Nothing — lift percentage thresholds only apply to gross capacity, not conservative capacity
- D. The lift director must review all lifts above 85% of capacity before they begin

54. A crane's load chart for a specific telescopic boom configuration shows a note: "These capacities require a minimum of 5 full outrigger pad contact with the ground across all four positions." During setup, one outrigger pad on the right rear is confirmed as having approximately 65% ground contact — the remaining 35% is over a slight depression in the ground surface. Does this note affect operations?

- A. The note's 5 full contact requirement means any outrigger with less than full ground contact fails the note's condition — the right rear pad with 65% contact does not satisfy the note; the depression must be filled to achieve full pad contact before these capacity values can be used
- B. 65% contact is adequate for the 5 full contact requirement
- C. The note applies only to soft soil conditions — on a prepared surface, partial contact is acceptable
- D. The note's minimum contact requirement is advisory — use engineering judgment to assess adequacy

55. A crane is performing a lift using the 360-degree section at 88% of gross capacity. The operator is then directed to swing the boom into a position where the section's header would change from "360-DEGREE" to a directional "OVER FRONT" section if the operator were using a different chart section. The operator continues using the 360-degree section throughout the swing. Is this approach correct?

- A. The operator should switch to the over-front section when the boom enters the over-front sector to access higher capacity values
- B. The operator should switch to the over-front section immediately when the boom enters the sector
- C. Nothing changes — the operator stays in the same section throughout the same lift
- D. The 360-degree section was selected before the lift and applies throughout the entire swing arc — the operator does not switch sections mid-lift to access a different section's capacity values; the section

selected before the lift applies consistently from pick through set regardless of directional changes during the swing

56. A crane load chart shows a note: "Capacities in this section assume that the crane is NOT equipped with any attachment, tool, or device on the boom tip other than the manufacturer's standard tip components." The crane has a camera monitoring system mounted on the boom tip by field technicians for remote observation during the lift. Does this attachment affect the operator's use of the section?

A. A lightweight camera mounting would have negligible effect on boom tip loading and the section applies normally

B. The camera mounting is a non-standard addition to the boom tip — it adds weight, potentially creates wind loading, and changes the boom tip's mass distribution relative to the condition under which the section's capacity values were derived; the note's condition is not met, and the manufacturer must be consulted before using this section's values with the camera attachment

C. Electronic monitoring equipment is exempted from load chart tip attachment restrictions

D. The note only applies to heavy attachments above 50 lbs — a camera system is exempt

57. A crane is configured with a 100-foot boom and a 20-foot fixed jib at 15 degrees of offset. The jib section shows 9,600 lbs at 45 feet. The main boom-only section shows 28,400 lbs at 45 feet without jib. The load is 8,200 lbs and will be suspended from the main hook. The jib head block weighs 360 lbs and rigging weighs 440 lbs. Total = 9,000 lbs. With the jib physically attached, which section and capacity govern?

A. The main boom section (28,400 lbs) governs since the load hangs from the main hook below the boom tip, not from the jib hook

B. The operator may choose either section based on which is more favorable for the planned lift

C. The jib section (9,600 lbs) governs regardless of which hook the load hangs from — the jib is physically on the boom tip, adding a concentrated tip load that changes the boom's structural loading; the jib-installed section must be used because it accounts for this additional tip loading; 9,000 lbs is within the 9,600-lb jib section capacity

D. Nothing in ASME B30.5 requires the jib section to be used when the load hangs from the main hook

58. A crane is configured with full outrigger extension and standard counterweight. The load chart shows 34,600 lbs at 30 ft and 26,800 lbs at 35 ft. A lift is planned at 31 feet. After computing the interpolated capacity (32,840 lbs) and the conservative capacity (26,800 lbs at 35 ft), the total suspended

weight is 24,600 lbs. The operator uses the interpolated value. The lift percentage based on interpolated capacity is approximately 74.9%. Is this a critical lift?

- A. Yes — any lift at or above 75% of any calculated capacity value is a critical lift; 74.9% is just below this threshold and is not a critical lift; however, if the actual radius is even slightly greater than 31 feet, the recalculated percentage may exceed 75%, making the lift a critical lift
- B. No — 74.9% is below the 75% threshold; the lift does not require a critical lift plan
- C. Yes — any lift with a total suspended weight above 20,000 lbs is automatically a critical lift
- D. Critical lift determination requires the conservative capacity as the denominator — $24,600 \div 26,800 \times 100 = 91.8\%$; the lift is a critical lift

59. A crane load chart shows that the superlift counterweight section has three sub-sections based on the superlift counterweight cart position: 15 ft, 25 ft, and 35 ft from the crane centerline. The crane has the superlift counterweight at 20 feet from the centerline. What must the operator do?

- A. Use the 25-foot cart position section as it is the next larger position, which is conservative
- B. Interpolate between the 15-foot and 25-foot sections to estimate capacity at 20 feet
- C. Use the 15-foot cart section since it is the most conservative bounding value below the actual position
- D. The 20-foot cart position is not a rated configuration — it falls between the 15-foot and 25-foot sections which are the only rated positions; the crane's superlift counterweight must be repositioned to either the 15-foot or 25-foot rated position before any lift; no intermediate position may be used without manufacturer authorization

60. A crane load chart shows: 120-foot boom, full outrigger, all directions: 45 ft = 14,200 lbs; 50 ft = 10,800 lbs; 55 ft = 8,200 lbs. A planned lift at 47 feet has a total suspended weight of 12,600 lbs. Conservative capacity = 10,800 lbs at 50 ft. Since 12,600 lbs exceeds the conservative capacity of 10,800 lbs, the lift cannot proceed with the 120-foot boom at 47 feet using the conservative approach. What is the operator's best option to complete this lift?

- A. Use the interpolated capacity at 47 feet (13,040 lbs) — it exceeds the 12,600-lb load and the lift proceeds
- B. Reposition the crane closer to the pick point to bring the operating radius to 45 feet where the conservative capacity (14,200 lbs at 50 ft) would still limit operations — actually reposition to bring actual radius below 45 feet where the 45-ft conservative entry supports the load

- C. Reduce to an 80-foot boom that shows higher capacity at 47 feet
- D. Contact the manufacturer to request an authorization to exceed the conservative capacity by 16.7%

61. A crane load chart shows a note: "When the boom tip is used for guiding operations — where the boom tip contacts a guide rail or structure — add a 15% derating factor to all capacities in this section." A planned lift involves the boom tip being used to stabilize the load against a guide channel during the final 6 feet of lowering. The base capacity is 18,400 lbs and the total suspended weight is 14,800 lbs. With the 15% derating applied, is the lift within the derated capacity?

- A. Interpolated capacity at this radius = 15,640 lbs — above 14,800 lbs; lift proceeds
- B. Nothing in this note affects lifts below 80% of the base capacity
- C. Derated capacity = $18,400 \times 0.85 = 15,640$ lbs; total suspended weight (14,800 lbs) is within the 15,640-lb derated capacity; however, the derated capacity must be used throughout the guiding operation, not just during the initial pick; the operator must confirm the total suspended weight including all rigging remains below 15,640 lbs
- D. The 15% derating should be applied only during the 6 feet of actual contact — not to the entire lift

62. A crane load chart shows: 80-foot boom at full outrigger extension: all cells in the 20-foot and 25-foot radius columns are shaded gray (structural-limited) while cells at 30 feet and beyond are white (stability-limited). The transition from structural to stability limits occurs between 25 and 30 feet. What operational implication does this transition zone create for a lift at exactly 28 feet?

- A. At 28 feet, the stability limit governs since 28 feet is closer to 30 feet than to 25 feet
- B. Nothing — the conservative interpolation approach provides accurate capacity regardless of which limit type governs
- C. At 28 feet the transition between structural and stability limits means the operator cannot easily determine which limit type governs; using the conservative capacity (capacity at 30 ft, which is stability-limited) and planning accordingly is the safest approach; the operator should be aware that at 28 feet, structural limits may still be in play and smooth operations that avoid dynamic loading are appropriate regardless of whether the conservative value reflects structural or stability limits
- D. At 28 feet, the structural limit always governs since the next shaded cell (25 ft) is structural-limited

63. A crane's load chart shows a "PICK AND CARRY — MAXIMUM LOAD 5,800 LBS — BOOM AT 30 FT AND 0°–10° EACH SIDE OF FRONT — LEVEL SURFACE." The crane is traveling 25 feet to the set location. The load is 5,600 lbs. The surface is confirmed as level. However, the crane must

make a 90-degree turn during travel. What concern does the 90-degree turn create for pick-and-carry operations?

- A. The 90-degree turn is within standard pick-and-carry operating parameters
- B. Pick-and-carry operations are only permitted in a straight line — any turns require setting down the load
- C. Nothing special applies during the turn since the boom is within the 10-degree front sector
- D. A 90-degree turn during pick-and-carry travel moves the load from directly over the front to a position where the load is carried over the side during the turn — during the turn, the effective load direction relative to the crane changes continuously; if the pick-and-carry section only rates over-front operations (0–10 degrees each side), the turn takes the load outside the rated front sector during the turn, requiring the load to be set down before the crane turns

64. A crane load chart for a telescopic boom shows two capacity sections: "ON OUTRIGGERS — FULL EXTENSION — STANDARD GANTRY" and "ON OUTRIGGERS — FULL EXTENSION — RAISED GANTRY." At 50 feet of radius with a 140-foot boom, the raised gantry shows 15,600 lbs and the standard gantry shows 13,200 lbs. The crane is equipped with a raised gantry. The operator uses the standard gantry section, reasoning it is more conservative. What is the error?

- A. Nothing — using the lower capacity value is always acceptable regardless of crane configuration
- B. The operator should use the raised gantry section since it matches the crane's actual configuration — using the standard gantry section while operating with a raised gantry applies capacity values from a different structural geometry; the raised gantry changes pendant angles and boom suspension loads; applying the standard gantry values is incorrect even if they appear conservative because they don't reflect the actual structural loading of the crane being used
- C. The operator may use either section as long as they stay within the lower value
- D. The standard gantry section applies to all gantry configurations as the universal baseline

65. A crane operator is confirming a planned lift at 35 feet of radius. The load chart shows 28,200 lbs at 35 feet for the 100-foot boom at full outrigger extension. The hook block weighs 1,800 lbs. Four slings weigh 840 lbs total. Six shackles weigh 60 lbs each. A spreader beam weighs 3,200 lbs. The payload weighs 21,000 lbs. What is the total suspended weight, lift percentage, and does the lift qualify as a critical lift?

- A. Total = 21,000 + 1,800 + 840 + 360 + 3,200 = 27,200 lbs; lift percentage = $27,200 \div 28,200 \times 100 = 96.5\%$; this exceeds the 75% critical lift threshold — a written critical lift plan and pre-lift meeting are required before this lift proceeds
- B. Total = 27,200 lbs; lift percentage = 96.5%; the lift is within gross capacity and not a critical lift
- C. Total = 27,200 lbs; lift percentage = 96.5% — a critical lift requiring written plan and pre-lift meeting; the 360-lb shackle total (6×60) must be confirmed included in the calculation
- D. Total = 27,560 lbs; lift percentage = 97.7%; the total suspended weight exceeds the gross capacity

Specialty Exam 8 Answer Key and Full Explanations

1. C — A 6-inch slab designed for 300 psf live loading is an occupancy floor load, not a structural crane pad. Bearing pressure = $84,000 \div 16 \text{ sq ft} = 5,250 \text{ psf}$ — approximately 17.5 times the slab's design rating. Applying this load without engineering review risks punching shear failure of the slab, which can occur suddenly and without warning under concentrated point loads.
2. A — Minimum cribbing area = $76,000 \div 3,200 = 23.75 \text{ sq ft}$, requiring at least 24 square feet of contact area. Historic masonry buildings are particularly vulnerable to vibration damage and differential settlement — crane outrigger loads transmitted through the soil can induce lateral surcharge on the building's foundation, potentially cracking or destabilizing masonry that lacks the ductility of modern reinforced structures.
3. D — The 14-foot static clearance at maximum planned reach exceeds the 10-foot MSAD for 46 kV. However, the MSAD must be maintained throughout all crane movements — not just at the single maximum-reach position. During swing, hoist, and boom movements, different parts of the crane and load approach the conductor at different distances, and the operator must confirm the 10-foot clearance is maintained throughout all planned positions.
4. B — Concrete and soil have dramatically different compressive stiffness — concrete is essentially rigid while soil compresses elastically under load. When a mat bridges both surfaces, the soil side deflects more under load, causing the mat to tilt progressively and shift all load concentration to the soil edge. The result is a much higher bearing pressure at the soil contact edge than the mat area calculation would predict, potentially exceeding the soil's capacity at that point.
5. C — A buried exhaust duct creates a void or near-void in the load path at the duct's location. The soil surrounding and above the duct has reduced lateral confinement on the duct side — under concentrated

outrigger loading, the soil can shear toward this void. The zone of influence from the outrigger load extends laterally, meaning even a 6-foot separation between the outrigger center and the duct edge may not place the outrigger outside the duct's influence.

6. A — Crane operations adjacent to active public roadways create hazards in both directions — the crane's swing and load path may encroach on the roadway, and vehicle traffic may enter the crane's exclusion zone. Traffic control measures appropriate to the specific proximity and load path geometry are required. The specific controls vary based on whether the load path crosses the roadway, the speed of the roadway, and the local jurisdiction's traffic control requirements.

7. C — Silty sand is particularly sensitive to moisture changes. Silt particles have limited natural cohesion and rely on effective stress from grain-to-grain contact for bearing capacity. As rainfall introduces water, it fills the pore spaces and reduces the effective stress between particles. Twenty-five minutes of steady rain can begin reducing bearing capacity in silty sand, and continued rainfall progressively worsens conditions — the operator must monitor outrigger positions for any sign of settlement.

8. B — Lateral soil displacement under tire loading — where soil squeezes sideways rather than simply compressing — is a direct visual indicator that the soil experienced near-failure shear stress under the vehicle wheel load. This is called "plastic flow" and occurs when the applied stress approaches the soil's shear strength limit. Since crane outrigger loads create higher bearing pressures per unit area than vehicle tires, soil that was at near-failure under tire loads will likely fail under crane loading.

9. C — OSHA 1926.1402 requires that crane operations not proceed when ground conditions are unsafe. The operator has an independent stop-work obligation that is not overridden by the controlling entity's declaration. The operator's first-hand assessment of ground conditions carries independent weight — if the operator believes conditions are inadequate, they must refuse setup until the concern is resolved, regardless of who bears regulatory responsibility for ground preparation.

10. D — A loaded forklift crossing an outrigger mat can disturb the mat's seating, push the mat laterally, or change the soil contact condition beneath the mat through the dynamic loading of the forklift's passage. These changes may not be visually obvious from the cab. A brief visual inspection of the mat position, contact condition, and surrounding soil confirms the setup integrity before the next near-capacity lift.

11. B — The original 5,800 psf assessment was performed on undisturbed native soil below the stone layer — it does not apply to the current state of the contaminated, degraded stone surface. The mixed

stone-and-soil surface has different load transfer characteristics than either clean crushed stone or native soil alone. The current prepared surface must be re-evaluated in its current state to establish a valid bearing capacity for crane setup.

12. B — A grid of 6-inch perforated pipes at 18-inch depth creates a network of voids and disturbed soil zones throughout the outrigger area. Each pipe represents a point where the soil was excavated and replaced with the pipe structure — typically with granular bedding that has lower bearing capacity than the surrounding native soil. Concentrated outrigger loads can cause the soil to migrate into the perforated pipe openings or the pipes to collapse, both of which create sudden settlement.

13. C — The passive soil resistance supporting the crane's loaded outrigger positions comes from the soil mass between the outrigger and any free face. When the adjacent excavation deepens from 8 to 14 feet within 12 feet of the crane, this passive resistance zone is significantly reduced. The confining soil that was preventing shear failure in the bearing zone has been partially removed, potentially making the soil mass susceptible to failure at loads that were previously safe.

14. A — OSHA 1926.1408(a) establishes a mandatory pre-work sequence: determine voltage, determine MSAD, determine de-energization feasibility, and implement the appropriate control option. All four steps must be completed before operations begin. Starting operations while still completing this sequence means the crane may be positioned near lines without confirmed controls in place — the assessment must precede positioning, not occur simultaneously.

15. D — Deep injection grouting is a soil improvement technique whose full benefit requires complete grout curing and equilibration of the modified stress state. At 5 days after completion, the grout may still be in the active curing phase for deep-penetrating grout mixtures, and the injected soil zones may not have yet developed their designed strength. The geotechnical engineer who designed the grouting program must confirm adequate strength development before crane loading.

16. B — As a crane lifts a load, the boom deflects slightly under the increasing load moment, increasing the effective horizontal distance from the rotation axis to the hook — the effective operating radius. This radius increase reduces the rated capacity at the new effective radius while the load weight remains unchanged, producing a higher LMI percentage. Stopping and verifying the actual radius under load confirms whether the radius has increased beyond the planned value.

17. C — Air entering a hydraulic system can originate from a suction-side seal failure, a loose fitting on the pump inlet, or a reservoir fluid level that has dropped below the inlet port. Foamy, aerated hydraulic fluid has degraded lubrication properties and can cause cavitation in the pump, leading to pump erosion.

The air entry source must be found and corrected — running the system on aerated fluid accelerates internal damage.

18. A — A safety device malfunction during a live operation — even an unconfirmed one — must be treated conservatively. Safety devices protect against the highest-consequence failure modes on a crane. An unconfirmed malfunction creates uncertainty about whether the protection is present. The load must be held and the device investigated before continuing, not after completing additional crane movements that rely on the potentially compromised device.

19. D — Each active crane function generates dynamic forces: hoisting creates vertical inertia when the drum starts or stops; swing creates centrifugal displacement and inertia; boom movement creates structural moment changes. When all three occur simultaneously at 88% capacity, their combined dynamic effects add to the static load moment simultaneously. The resulting combined structural stress can exceed the crane's structural design limits even though no single function individually would do so.

20. B — Pendulum oscillation follows simple harmonic motion — applying an opposing force at the moment of maximum displacement, when the pendulum's velocity is momentarily zero, most efficiently extracts energy from the oscillation. Counter-swing impulses timed to this moment progressively reduce the oscillation amplitude with each cycle. Abrupt brake application transfers shock loads into the swing drive without effectively reducing oscillation energy.

21. C — The crane's general wind limit applies to compact loads where wind force scales predictably with the limit. A jib lift into a narrow slot involves a load whose effective wind area and the tolerance for lateral displacement are specific to that placement. Even at 30 mph — well below the 35 mph general limit — wind-induced lateral movement may exceed the available clearance in a narrow slot placement. The operator must evaluate whether the specific lateral displacement under these wind conditions is compatible with the available clearance.

22. A — OSHA 1926.1427 certification by equipment type requires the employer to confirm that the specific certification covers the crane type being operated. The TLL and TSS designations represent different operator positions (swing cab vs. fixed cab), which can affect the operator's perspective, controls, and operational technique. Regardless of certification type coverage, the employer must independently evaluate and document competency for the specific machine at the specific worksite.

23. D — A falling bolt from the structure above is a falling object hazard indicating the overhead work area is not adequately controlled. Continuing crane operations exposes everyone in the area — including the signal person, riggers, and operator — to a recurring falling object risk. The source must be

identified and the overhead area secured before crane operations and all other work in the potential drop zone resume.

24. B — The 90-foot LMI configuration typically shows higher capacity values than the 100-foot configuration at the same radius, because shorter booms are generally stronger structurally at equivalent radii. Using the 90-foot column for a 100-foot boom means the LMI displayed lower percentages than the actual load moment warranted — the operator believed more safety margin existed than actually did. A post-incident review must determine whether any of the 14 lifts exceeded the 100-foot boom's rated capacity.

25. C — When the operator executes a boom-down command, the boom-to-tip rope path increases, consuming rope from the drum. This causes the hook block to rise relative to the boom tip even without any hoist command. If the hook block is near the upper limit of its travel, this involuntary hook block rise from the boom-down movement can cause two-blocking. The operator must verify hook block height before executing any boom-down movement to ensure clearance exists for the hook block's involuntary rise.

26. A — Counterweight tail swing creates a significant struck-by hazard that is frequently overlooked because personnel focus on the load and boom path rather than the counterweight's opposite rotation. The counterweight swings in the opposite direction from the boom and can strike personnel behind the crane. OSHA 1926.1424 requires the entire counterweight sweep area to be effectively barricaded — this requirement is as mandatory as protecting the load path but receives far less practical attention.

27. D — OSHA 1926.1425 prohibits loads from passing over personnel without exception. Workers performing concrete finishing are personnel under this prohibition regardless of their work requirements or the productivity impact of stopping operations. The concrete finishing work must stop and the workers must physically clear the area beneath the entire load path before the swing can continue. There are no exceptions for necessary work positions.

28. A — The original lift percentage of 89% was calculated using the 42,000-lb load. With the confirmed weight of 44,600 lbs, every calculated value must be recomputed from scratch — new total suspended weight (44,600 + all rigging), new comparison to gross capacity, new lift percentage. The original 89% calculation is invalid. The lift can only proceed if the recomputed values confirm adequacy.

29. B — A boom-down movement during personnel hoisting increases the operating radius. The crane's rated capacity at the new, larger radius is lower than at the current radius. If the current load is already at 46% of the current configuration's capacity, booming down may push the load to a higher percentage at

the new configuration — potentially above the 50% personnel hoisting limit. The operator must confirm the new configuration maintains the total load below 50% of the crane's capacity at the new radius.

30. D — ASME B30.5 securing requirements apply to the crane in any condition — not just when a load is suspended. An unsecured crane with released brakes can roll or shift, and an unsecured hook block hanging freely represents a struck-by hazard from wind or other movement. Protection against unauthorized operation prevents untrained persons from starting the crane and moving the upper works, which can cause serious injury even without a load attached.

31. D — Wire rope strands are manufactured to carry load as an integrated system with each strand contributing an equal share. Non-uniform strand prominence — some strands bunching tighter while others loosen — indicates the rope's internal geometry has been permanently disrupted. This disruption causes unequal load sharing among strands, with the tighter strands carrying disproportionately higher loads. The rope's actual tensile capacity at the affected section is below its nominal rating.

32. B — Maximum basket hitch capacity at 45 degrees = $(2 \text{ legs} \times 12,000 \text{ lbs WLL}) \times \sin(45^\circ) = 24,000 \times 0.707 = 16,968 \text{ lbs}$. The 16,000-lb load is within this capacity with 968 lbs of margin. The formula correctly combines the basket hitch's doubling effect with the angle efficiency factor — both are applied simultaneously, not sequentially.

33. A — Hydraulic fluid has a maximum rated operating temperature above which its viscosity drops below the minimum required for adequate lubrication and seal integrity. At 15°F above maximum, the fluid is being continuously degraded through oxidation and thermal cracking, seals are being subjected to temperatures that accelerate their deterioration, and internal leakage increases as viscosity drops. The cumulative damage from sustained operation at this temperature will lead to premature failure of hydraulic components.

34. B — Synthetic web sling capacity depends on the integrity of the synthetic fibers — polyester, nylon, or polypropylene. Different chemicals attack these materials differently and with dramatically varying severity. An unidentified chemical may be completely harmless or may have already destroyed 90% of the fiber's tensile capacity with no visible evidence. ASME B30.9 requires removal when exposure conditions may have compromised strength and those conditions cannot be confirmed safe.

35. C — Counterbalance valves are load-holding valves installed on cylinders that carry loads which could lower by gravity. They require positive hydraulic pilot pressure — a specific command from the operator — to open for any load-releasing movement. Without an operator command, the valve remains closed regardless of cylinder pressure loss from seal failure or hose rupture. This prevents uncontrolled load lowering from hydraulic component failures downstream of the valve.

36. B — ASME B30.9 requires that slings known or suspected to have been overloaded be removed from service for inspection by the manufacturer or a qualified inspector. Visual inspection alone cannot detect the internal changes that overloading causes in alloy chain: reduction in hardness, increase in brittleness, reduction in impact resistance, and microstructural changes that reduce fatigue life. The sling may appear identical while having permanently reduced load-carrying capability.

37. B — The pre-shift inspection performed by an incoming operator depends on that operator knowing the crane's history from the previous shift. Conditions that developed during the previous shift — sounds, slight movements, minor deficiencies not meeting removal criteria — provide critical context for interpreting the current inspection. Communication of these observations is mandatory because the incoming operator cannot detect a deteriorating condition that began before their shift without this information.

38. A — Each leg tension = $(68,000 \div 4) \times (1 \div \sin 50^\circ) = 17,000 \times (1 \div 0.766) = 17,000 \times 1.305 = 22,185$ lbs. The 22,185-lb per-leg tension exceeds the 22,000-lb WLL by 185 lbs — the configuration is marginally over rated capacity. Even though the excess is small, it constitutes operating above the rated capacity of every sling leg simultaneously; the sling angle must be increased or higher-capacity slings used.

39. D — A rope sheave is designed to allow the rope to roll through it without sliding, distributing the rope's bending wear across the sheave's circumference as the sheave rotates. When the sheave is seized, the rope slides over the stationary surface, concentrating all abrasion on the same small contact area of the rope's crown wires on every hoist cycle. This creates a localized wear zone that reaches removal criteria in a fraction of the time a properly rotating sheave would produce.

40. B — OSHA 1926.1413 specifies these as absolute removal conditions requiring no further assessment: heat damage evidenced by blue, black, or purple wire discoloration; electric arc damage including any fused wires; and kinks with permanent geometric deformation. Each condition independently represents damage that has altered the metallurgical properties or structural geometry of the rope in ways that cannot be evaluated by visual inspection and cannot be remediated by maintenance.

41. C — New wire rope has internal stress from the manufacturing process — the wires and strands have not yet seated against each other or the sheave grooves in their operational geometry. Running the rope under light load for several cycles allows the strands to equalize their pitch and the wires to seat in the sheave grooves, reducing stress concentrations that would cause premature fatigue breaks during the first full-load operations. This break-in is a standard industry procedure recommended by ASME B30.5.

42. C — A qualified person performing an inspection has the authority and responsibility to remove a crane from service when they identify a removal condition — they do not need to wait for employer

direction or give advance notice. Waiting delays, the protection the removal criterion is intended to provide and creates a gap period where the crane continues operating in a known deficient condition. The removal takes effect at the time the qualified person identifies and acts on the finding.

43. D — The conservative interpolation approach requires using the capacity at the next larger tabulated radius — not the closest tabulated value. At 37 feet, the next larger tabulated radius is 40 feet with a capacity of 21,200 lbs. Total suspended weight = 19,400 lbs, which is within 21,200 lbs. The lift proceeds conservatively with 1,800 lbs of margin. Using the 35-foot value (the next smaller tabulated radius) is NOT the conservative approach — it overstates the applicable capacity.

44. B — The note establishes a ± 500 -lb counterweight tolerance as a binding configuration condition. The installed counterweight of 17,200 lbs is 800 lbs below standard — exceeding the permitted 500-lb deviation. Counterweight mass directly affects stability calculations; less than standard counterweight reduces the restoring moment below what the capacity analysis assumed, potentially reducing actual tipping resistance below the tabulated values. The deviation exceeds the note's tolerance and the section does not apply.

45. B — The superlift attachment physically changes the crane's structural load path, mass distribution, and stability characteristics whether or not it carries load during a specific lift. The superlift section was developed specifically for the crane configuration with the superlift installed — the main boom section assumes no superlift is present. Using the main boom section while the superlift is physically on the crane applies capacity values from a structurally different configuration.

46. B — Centrifugal displacement of the suspended load during swing creates an effective radius increase that is continuous and proportional to swing speed. During simultaneous hoisting and swinging at 88% capacity, the operator must maintain continuous awareness of any LMI reading increase that signals the effective radius is growing. The LMI is the real-time instrument that detects this change — continuous monitoring throughout combined movements is the essential tool for preventing an unexpected capacity exceedance.

47. C — The "BOOM 100 FT ALL SECTIONS PINNED" section applies to the specific configuration of the boom at exactly 100 feet with all sections pinned. The "80–100 FT TELESCOPING" section covers intermediate configurations that are not yet at the full 100-foot position with all sections pinned. At 95 feet with all sections pinned, neither section exactly covers this configuration — it is a non-standard configuration requiring manufacturer consultation or extension to the rated 100-foot position.

48. B — The maximum rated radius is not a soft boundary that can be extended by reducing load. It represents the absolute outer limit of the crane's rated operating envelope — there is no capacity value at any radius beyond the maximum, regardless of load reduction. The approach of using 80% of the last tabulated value creates an unofficial capacity where none exists in the manufacturer's analysis. The crane must be physically repositioned or reconfigured.

49. C — At short radii where structural limits govern, the rated capacity is determined by the crane's structural design strength — the boom chords, pins, and slewing ring — not by stability. Counterweight affects the restoring moment against tipping, not the structural capacity of these members. Beyond 25 feet where stability tipping governs, the greater restoring moment from maximum counterweight directly increases the load that can be carried before the crane tips, producing higher rated values.

50. D — A structural-limited cell at 92% of capacity means the boom's structural members are carrying 92% of their design load capacity under static conditions. Dynamic loading from sudden hoist starts or stops, abrupt swing changes, or simultaneous multi-function operation adds additional structural stress on top of this near-limit static load. The operational requirement for exceptional movement smoothness is specific to structural-limited cells at near-capacity — it is not merely a general good practice.

51. D — Jib offset angle changes during a lift are explicitly prohibited by the note because the jib's structural geometry, pendant loading, and boom tip forces all change with offset angle. The capacity values in each jib section are derived for the specific offset angle shown in that section's header. Changing the angle mid-lift means the structural loading changes in ways not covered by the section being used, creating an unrated condition. The load must be on the ground before any jib angle adjustment.

52. B — The note establishes 15 feet as a binding minimum clearance from any obstruction as a condition of the capacity values in this section. The outrigger at 12 feet from the retaining wall does not satisfy the note's requirement. The load chart note may exist because the configuration's stability analysis assumed no nearby structures that could limit the available swing arc or create constraint loading on the outrigger; using these values without satisfying the clearance condition means operating under an unmet configuration requirement.

53. B — When the conservative capacity (17,800 lbs at 45 ft) produces a lift percentage above 90% for the planned load, the operator should verify the operating radius by direct physical measurement rather than relying solely on the LMI's computed radius display. The reason is that at 91% of conservative capacity, any radius measurement error has significant consequence — a 1-foot error in a conservative bound translates to using a lower tabulated value that may not support the load. Direct measurement eliminates the LMI radius display as a potential error source.

54. A — The note specifically requires all four pads to have full ground contact — not "substantial" or "majority" contact. One pad at 65% contact fails this explicit condition. The reason full contact is required is that partial contact reduces the effective bearing area, concentrating the outrigger load on only the contacting portion and producing higher bearing pressures than calculated from the full pad area. This concentration can exceed the soil's capacity locally even when the average pressure appears adequate.

55. D — When an operator selects a load chart section before a lift, that section applies throughout the entire lift from pick to set. The operator does not switch between sections during the swing because the load is continuously suspended and the lift is a single operation. Switching to the over-front section mid-lift to access higher capacity would be using a different section's values for the same lift, which is not authorized. The conservative 360-degree section was correctly selected and applies throughout.

56. B — The note establishes the absence of non-standard boom tip attachments as a configuration condition. A field-mounted camera system adds weight to the boom tip — changing the structural load distribution — and may create aerodynamic effects during operations in wind. The capacity values were derived assuming the standard tip configuration without this addition. The manufacturer must be consulted to confirm whether the camera system's weight and characteristics are within the design margins before these capacity values can be used.

57. C — When a jib is physically installed on the boom tip, its weight acts as a concentrated tip load that increases the bending moment in the boom and changes the structural loading throughout the boom's length. The jib section was developed specifically for this configuration — it accounts for the jib's tip loading in its capacity values. The main boom section assumes no jib is present; using it while the jib is installed applies capacity values from a structurally different condition that understates the actual loading on the boom.

58. A — Using the interpolated capacity at 31 feet (32,840 lbs), lift percentage = $24,600 \div 32,840 \times 100 = 74.9\%$. This is below the 75% critical lift threshold. However, the conservative capacity produces $24,600 \div 26,800 \times 100 = 91.8\%$, which is above 75%. Which denominator governs the critical lift determination is the key question — the operator must use the capacity value being relied upon for the lift as the basis for critical lift assessment. If using the interpolated value, 74.9% applies, and it is not a critical lift — but this is a very close call requiring careful radius confirmation.

59. D — Superlift counterweight cart positions are rated configurations — the manufacturer performed specific analysis for the 15, 25, and 35-foot positions. The cart's distance from the crane centerline directly determines the restoring moment it provides. An intermediate position of 20 feet has not been analyzed and has no associated capacity values. The conservative approach of using the 15-foot section

understates the actual restoring moment, creating an artificially conservative bound — but the correct solution is to move the cart to a rated position.

60. B — The most practical solution when the conservative capacity at a given radius is insufficient is to reposition the crane closer to the pick point to reduce the operating radius to one where the conservative capacity supports the load. If the crane moves closer to bring the actual operating radius to 44 feet or less, the conservative value at 45 feet (14,200 lbs) would support the 12,600-lb load. Changing to a shorter boom without evaluating that boom's capacity at 47 feet does not guarantee an improvement.

61. C — The derated capacity = $18,400 \times 0.85 = 15,640$ lbs. Total suspended weight (14,800 lbs) is within 15,640 lbs. The lift proceeds using the derated values. The important operational note is that the derating applies throughout the guiding phase — not just at the moment of contact. The operator must plan the entire lift using the derated capacity values whenever the boom tip guiding condition applies.

62. C — At exactly 28 feet, the transition zone between structural and stability limits means neither a clear structural nor stability analysis governs the capacity calculation without precise interpolation. Using the conservative capacity at 30 feet (stability-limited) is the safest approach since it is the tabulated value and reflects actual tested conditions. The operator should apply smooth operation practices appropriate for structural-limited lifts since the load is near the 25-foot structural-limited zone.

63. D — The pick-and-carry rating specifies 0–10 degrees each side of front center as the authorized boom position. During a 90-degree turn, the boom's orientation relative to the direction of travel changes continuously — at some point during the turn, the load is effectively being carried in a non-front position. If the load path passes outside the 10-degree sector during the turn, the pick-and-carry rating is exceeded during the turn. The load must be set down, the crane turned to the new heading, and then the load re-picked.

64. B — Using the standard gantry section for a raised gantry crane applies capacity values derived from a different structural geometry. The raised gantry changes the pendant angles and boom suspension forces — the structural load path through the crane's mast, gantry, and boom support system is different from the standard gantry configuration. Applying the standard values to the raised gantry configuration does not represent conservatism — it applies a different structural analysis to a different physical crane condition.

65. C — Total suspended weight: 21,000 (payload) + 1,800 (hook block) + 840 (slings) + 360 (6 shackles \times 60 lbs) + 3,200 (spreader beam) = 27,200 lbs. Lift percentage = $27,200 \div 28,200 \times 100 = 96.5\%$. Since 96.5% exceeds the 75% critical lift threshold, this requires a written critical lift plan and a

pre-lift meeting with all lift team members. The 360-lb shackle contribution (6×60) must be confirmed included — omitting hardware weights from the total suspended weight calculation is a common error that understates the actual load percentage.