

SIMULATION SET 9

SITE DOMAIN — Questions 1–21

1. A mobile crane is being set up at a hospital campus construction project. The planned outrigger zone is on a concrete pad, but the operator discovers that a hospital pneumatic tube system runs at 18 inches of depth directly beneath the planned right front outrigger position. The tube system is 4 inches in diameter and is actively pressurized at 35 psi. What must be confirmed before proceeding?

- A. The tube system must be depressurized before any crane setup above it
- B. Pneumatic tube systems are always structurally adequate for crane loading
- C. The pneumatic tube system's structural capacity under the specific outrigger load must be evaluated — even a small-diameter pressurized tube at 18 inches represents a potential void and failure point; collapse of the tube under outrigger loading could cause sudden settlement and a pressurized release; the outrigger must be repositioned or the tube's structural capacity confirmed by engineering
- D. Hospital utility systems are protected by dedicated structural slabs that always handle crane loads

2. A crane operator is evaluating a setup location on a construction site where the ground surface shows polygonal cracking — a pattern of cracks forming irregular polygon shapes across the surface. The site has experienced several weeks of hot, dry weather following a wet spring. What does polygonal surface cracking most commonly indicate about the soil type and current condition?

- A. Polygonal cracking is characteristic of high-plasticity clay that has shrunk as it dried — the cracks indicate the clay has undergone significant moisture loss and volume change; although the dry surface may appear firm, the cracks represent zones of reduced lateral integrity, and if the crane's outrigger load causes the cracks to reopen or propagate, bearing capacity at the crack zones may be locally reduced
- B. Polygonal cracking indicates the soil has reached maximum compaction and is an excellent crane setup surface
- C. Polygonal cracking is caused by frost activity and has no bearing on warm-weather crane operations
- D. Polygonal surface cracking is a cosmetic weathering pattern with no structural significance

3. A crane is positioned at a job site adjacent to a drainage retention pond. The outrigger on the pond side is positioned 8 feet from the water's edge. Recent maintenance has involved removing the pond's clay liner, exposing the native soil. What concern does this configuration create?

- A. The pond presents an electrical hazard if the crane contacts the water surface
- B. Proximity to standing water requires environmental permits before crane operations
- C. The retention pond is too far from the outrigger to affect bearing capacity
- D. The removal of the clay liner and proximity to the water's edge means the outrigger is near a potentially saturated and unretained soil mass — the pond's bank soil may have significantly higher moisture content than assessed, and the bank may be susceptible to slope failure under the outrigger surcharge load; a geotechnical evaluation of the bank stability under the planned loading is required

4. Under OSHA 1926.1402(d), when the controlling entity has provided documentation showing ground conditions are adequate, but the operator's independent observation reveals conditions that contradict the documentation — such as visible soil moisture inconsistent with the documented "dry, firm" description — what is the operator's obligation?

- A. Accept the documentation since it comes from the controlling entity who bears regulatory responsibility
- B. Stop the setup and notify the crane employer of the discrepancy — the operator's independent observation of conditions inconsistent with the controlling entity's documentation creates a safety concern that must be resolved before setup proceeds; the operator cannot override their direct observation with documentation alone
- C. Proceed with setup at 75% of planned lift capacity to account for the uncertainty
- D. Request a new written assessment from the controlling entity before proceeding

5. A crane is being operated when the operator observes that a large dump truck has dumped a load of crushed stone approximately 15 feet from the right rear outrigger position — creating a new mound approximately 4 feet high and 8 feet in diameter. The mound was not present during the initial site assessment. What concern does the new mound create?

- A. The mound adds beneficial ballast near the outrigger that improves bearing stability
- B. The mound may have been intended as cribbing material but creates no structural concern in its dumped state

C. The sudden addition of a large surcharge load 15 feet from an operating crane's outrigger creates a lateral stress increase in the soil between the mound and the outrigger — this additional lateral pressure may reduce the passive soil resistance available to the loaded outrigger; the crane's operator must stop operations and assess whether the mound placement has changed the bearing conditions at the adjacent outrigger before continuing

D. The mound is far enough from the outrigger to have no effect on bearing conditions

6. Under OSHA 1926.1407(b)(1), when crane operations require working within the minimum safe approach distance from an energized power line and de-energization has been confirmed as not feasible, which person must be specifically assigned and present at all times during the encroachment prevention operations?

A. A dedicated spotter who is specifically assigned to observe the clearance between the crane and the power line, positioned to maintain continuous visual contact with both the closest part of the crane or load and the conductor, and equipped with a direct means of immediately stopping all crane movement

B. A certified electrician positioned at the utility pole to confirm the line remains energized

C. A second crane operator positioned outside the cab to provide an additional safety check

D. The lift director must personally serve as the power line spotter throughout all operations under the encroachment prevention plan

7. A crane is operating on a job site where a geotechnical investigation noted: "Potential for sand boil development in saturated zones." Sand boils occur when upward seepage of groundwater creates localized loss of soil strength. What does this geotechnical finding specifically mean for crane setup?

A. Sand boil potential only affects areas in direct contact with water — no special consideration is needed for crane pads above the waterline

B. Geotechnical warnings about sand boils require only additional monitoring during rain events

C. The crane may operate normally since sand boils only occur in low-lying areas

D. Areas with sand boil potential have zones where upward water seepage can eliminate effective stress in the soil — the soil can liquefy locally, losing all bearing capacity instantly; setup in identified sand boil zones requires specific engineering controls, and the operator must monitor for any signs of ground disturbance, heaving, or sudden settlement throughout operations

8. A crane operator is assessing the outrigger area and observes fresh vehicle tracks in wet mud that cut across one of the planned outrigger positions. The tracks show a vehicle passed through recently, creating depressions approximately 4 inches deep. What does this observation indicate about the bearing conditions at the affected position?

- A. Nothing — vehicle tracks in wet soil indicate normal site conditions requiring no action
- B. The tracks indicate the soil at this position is soft enough to deform under vehicle loading — a condition that confirms the bearing capacity is inadequate for crane outrigger loads at this position without additional investigation or ground preparation
- C. Fresh vehicle tracks confirm the soil is adequately supporting vehicle loads and is therefore adequate for crane operations
- D. The tire tracks indicate the surface is wet but the underlying soil may still be adequate for crane loading

9. A crane is set up and operating when the operator observes that a section of the underground irrigation system has ruptured and water is now flowing visibly from the ground surface adjacent to the setup area in a steady stream. The flow appears to come from directly below the left front outrigger mat position. What action is required?

- A. Increase the outrigger jack extension on the affected side to raise the mat above the water flow
- B. Continue the current lift and monitor the water flow rate before deciding whether to stop
- C. Stop all crane operations immediately — subsurface water flowing from below an outrigger mat position indicates active piping or erosion is occurring in the soil supporting that mat; the soil structure beneath the mat may be collapsing inward toward the flow path, eliminating bearing capacity rapidly and without further visible surface warning; operations must not resume until the leak is stopped and the ground condition at that position is confirmed
- D. Ask the general contractor to stop the irrigation system remotely and continue operations

10. Under OSHA 1926.1408(a), when a crane employer determines that de-energizing a power line before crane operations is technically feasible but the utility operator refuses to de-energize, what option is available?

- A. The crane employer may request OSHA to issue a citation against the utility operator, then proceed with operations under an encroachment prevention plan while the citation is processed

B. Nothing — the crane employer must follow the utility's decision and implement an encroachment prevention plan as the alternative

C. The crane employer may apply for an emergency variance from OSHA that authorizes ignoring the MSAD for the specific project

D. Nothing in OSHA allows the utility's refusal to de-energize to override the safety hierarchy — the crane employer must either establish an encroachment prevention plan as the alternative control, or accept that the crane cannot operate within the applicable MSAD until de-energization occurs; if the utility refuses, the encroachment prevention plan becomes the required control

11. A crane operator is performing a site walk and notices that the planned setup area has a series of parallel cracks running perpendicular to the direction of an adjacent slope — the cracks run across the slope rather than parallel to it. What does a pattern of cracks perpendicular to an adjacent slope indicate?

A. Perpendicular cracks on a slope face are caused by wind erosion and have no structural significance

B. Perpendicular cracks indicate the slope has reached maximum compaction through natural settling

C. Cracks running perpendicular to slope direction indicate the slope is experiencing tensile stress as the upper slope begins to separate — this is consistent with the early stages of rotational or translational slope failure; crane setup near a slope showing perpendicular tension cracks should not proceed without engineering evaluation of slope stability

D. Perpendicular cracks are drainage features that improve groundwater runoff and are beneficial for bearing conditions

12. A crane operator is setting up at a job site when it is discovered that the ground under one planned outrigger position was previously used as a disposal area for clean concrete rubble from a demolition project. The rubble was placed 3 years ago and covered with 12 inches of compacted gravel fill. What concern does the rubble layer create?

A. Nothing — concrete rubble is structurally stable and provides excellent bearing capacity

B. Concrete rubble fill may have significant void spaces between pieces that are not detectable from the surface — under concentrated outrigger loading, the rubble can shift and the voids can collapse suddenly; a 3-year period is insufficient to guarantee the rubble has fully consolidated; the bearing capacity of the rubble zone must be confirmed before outrigger loading

C. Three-year-old rubble fill is always considered consolidated and structurally sound

D. The 12-inch gravel cap distributes the outrigger load uniformly and eliminates any concern about the underlying rubble

13. A crane is operating when an adjacent crane's load line breaks, causing the crane's boom to recoil backward violently — the boom whips upward and contacts a power line behind the crane. The power line is confirmed at 12,000 volts. Personnel in the vicinity scatter. What is the first action the operator of the adjacent crane should take?

A. Call the fire department immediately and remain in the cab until they arrive

B. Run to the fallen crane to assist the operator

C. Stay in the operating cab — in the event a crane has made contact with an energized power line, the safest position for adjacent personnel and the adjacent crane's operator is to remain where they are until the power line is confirmed de-energized; exiting the cab of an adjacent crane near a live wire contact creates a step-potential electrocution hazard on the ground surrounding the crane contact point

D. Drive the crane away from the incident area immediately

14. Under OSHA 1926.1402, what is the crane employer's specific obligation when they receive information from the controlling entity that an underground utility runs through the planned setup area but the utility's exact location has not been positively identified within the tolerance zone?

A. The crane employer must positively locate the utility before any crane setup or operations begin in the area — marking within a tolerance zone is not a positive location; the crane employer must ensure that exact location is determined through hand excavation, ground-penetrating radar, or other positive location method before any outrigger loading in the utility's vicinity

B. The tolerance zone marking is sufficient — the crane employer may proceed as long as outrigger pads avoid the marked centerline

C. The crane employer must call 811 again to request a re-locate before proceeding

D. The utility operator's locate mark satisfies all requirements and no additional positive location is needed

15. A crane is set up at a waterfront pier constructed on timber piles. The site manager confirms the pier was designed for cargo loading of 500 psf. The maximum outrigger reaction load for the planned lift is 110,000 lbs and the outrigger float is 18 inches square (2.25 sq ft). What is the bearing pressure applied to the pier deck and does it satisfy the design loading?

- A. Bearing pressure = $110,000 \div 2.25 = 48,889$ psf — this exceeds the 500 psf design loading by approximately 97 times; the pier cannot support this outrigger point load without a specifically engineered distribution system that spreads the load over a sufficient deck area
- B. The pier's pile foundation always provides adequate support for any crane operation
- C. Bearing pressure = 48,889 psf — within normal range for industrial pier loading
- D. Place additional cribbing to increase the bearing area — no engineering is required for pier loading

16. A crane is set up at a construction site where recent heavy rain has created surface runoff channels across the setup area — small ruts and channels where water flowed across the surface. The ruts are 2 to 3 inches deep. The outrigger mats are in place. What concern do the runoff channels create for the outrigger mats?

- A. Nothing — 2- to 3-inch ruts are too shallow to affect outrigger mat contact
- B. The runoff channels under or near the outrigger mat edges mean portions of the mat may be unsupported — the mat bridges across the channels without contact in the rut areas, reducing the effective bearing area and concentrating load on the supported portions of the mat outside the channels; the ruts must be filled to restore full mat contact before operations begin
- C. Runoff channels always improve drainage and bearing conditions near outrigger positions
- D. The mats will span the small ruts by their own structural rigidity and no special action is needed

17. A crane operator is evaluating a potential setup area and notices that a section of the surface has a slightly different color from the surrounding area — slightly darker and with a distinct boundary at a regular rectangular shape, approximately 10 by 15 feet. No obvious surface feature exists. What does this color anomaly most likely indicate?

- A. Nothing — surface color differences are caused by normal soil moisture variation
- B. The darker rectangular area might indicate recent excavation and backfill — the regular shape is inconsistent with natural soil variation and suggests a human-made disturbance, such as a filled trench, vault removal, or buried structure removal; the filled area may have lower bearing capacity than the surrounding undisturbed soil
- C. The darker area indicates higher organic content that improves soil cohesion and bearing capacity
- D. The color difference indicates a subsurface drainage feature that improves bearing capacity in that zone

18. Under OSHA 1926.1402(c), when a mobile crane is traveling between setup positions on a construction site with the boom in the travel position, what ground condition assessment is required for the travel path?

A. The travel path must be assessed for the same ground condition elements as a setup position — load-bearing capacity, underground hazards, overhead clearances, surface stability, and slope conditions; a crane traveling between positions applies dynamic loads to the travel surface that may be different from static setup loads but are nonetheless significant; travel on inadequate ground can cause the crane to tip, bog down, or damage underground utilities

B. Travel path assessment requires only overhead clearance confirmation — ground condition assessment is only required at the setup positions

C. Travel path assessment is not required since the crane is not lifting during travel

D. The crane manufacturer's travel speed specification is the only requirement for travel path assessment

19. A crane is set up at a job site where the ground surface temperature is 95°F and the surface consists of poured asphalt paving. The planned lift is at 84% of rated capacity. The outrigger pads are placed on the asphalt without cribbing. What specific risk does this combination create?

A. Hot asphalt is not a concern for crane operations — asphalt is rated for all temperature conditions

B. The elevated temperature requirement applies only to crane structural components, not to the setup surface

C. The surface temperature is below the crane's operational limit and no concern applies

D. Asphalt at 95°F surface temperature has significantly reduced stiffness — the binder has softened to a semi-plastic state, allowing the outrigger pad to sink progressively into the asphalt under the sustained load; with no cribbing to distribute the load, the entire outrigger reaction load is applied to a small asphalt area that may be too soft to resist the load without deforming; timber cribbing over the asphalt is required to distribute the load

20. A crane operator observes during a site walk that the planned outrigger zone has an active ant colony in the soil — a large mound approximately 18 inches high with multiple active tunnels visible in the surrounding soil. What specific concern does an established ant colony create for bearing capacity?

A. Nothing — ant colonies are surface features with no bearing on structural soil capacity

B. Established ant colonies in the planned outrigger zone create a network of tunnels throughout the soil at depths up to 10 feet — these tunnels represent voids that reduce the effective bearing area of the soil and create potential for sudden collapse under concentrated crane loading; the outrigger position must be relocated away from the ant colony zone

C. The ant mound creates a surface obstruction that must be removed but has no effect on bearing capacity

D. Ant colony soil is more compacted than surrounding soil and improves bearing capacity due to the ants' excavation activity

21. A crane is set up at a job site when the operator notices water is seeping upward through the soil surface adjacent to the right rear outrigger position — creating a small saturated zone about 18 inches in diameter at the surface. There was no precipitation. What does upward water seepage in dry conditions indicate?

A. Upward seepage without rainfall indicates a broken water main or irrigation line that is pressurizing the subsurface, forcing water upward through the soil — this condition can rapidly undermine bearing capacity at the affected position and the surrounding area; all crane operations must stop until the source is identified and stopped and the ground condition is re-evaluated

B. Upward seepage is caused by capillary rise in fine-grained soils and is a normal condition requiring no action

C. Small saturated zones are common near construction sites and are not a concern for crane operations

D. The saturated zone confirms the soil is actively draining and bearing capacity will improve as the water dissipates

OPERATIONS DOMAIN — Questions 22–48

22. A crane operator is performing a lift at 76% of rated capacity when the lift director instructs the operator to perform a "test hoist" — lifting the load to 2 feet off the ground, holding for 2 minutes, then proceeding with the full lift. During the 2-minute hold, the crane's level indicator shows the crane has tilted 0.3 degrees toward the load side since the load was picked. What does this tilt indicate and what action is required?

A. Nothing — the crane is designed to deflect slightly toward the load during lifts; 0.3 degrees is within normal operational tolerance

B. The 0.3-degree tilt indicates the crane's outrigger jacks have shifted slightly under load — the tilt is within normal range but the operator should note it for monitoring

C. Continue with the full lift and re-check level after the load is set

D. The 0.3-degree tilt toward the load during the hold indicates one or more outriggers is settling under load — this progressive tilt suggests the ground condition may not be adequate for the full planned lift; the load must be lowered and the outrigger positions inspected and re-evaluated before any further lifting

23. A crane is performing a lift at 88% of rated capacity. The signal person has been using hand signals throughout the lift. At the set location, the signal person gives the SET DOWN signal — arms extended outward and downward, palms down, moving the hands downward. Before executing the lowering movement, the operator notices the signal person's back is turned and they appear to be talking to someone nearby. What must the operator do?

A. Execute the SET DOWN signal since it was clearly observed before the signal person turned away

B. Wait for the signal person to turn back and reconfirm the signal with direct eye contact before executing

C. Contact the lift director by radio to confirm the SET DOWN is authorized

D. Stop waiting for the signal person to re-engage and lower at minimum speed since the signal was already given

24. Under OSHA 1926.1416(c), what specific action must the operator take when a fire develops in the crane's engine compartment during operations?

A. Activate the engine compartment fire suppression system and continue monitoring the fire status while maintaining load control

B. Lower the load to the nearest safe surface as quickly and safely as possible, sound the emergency horn, and evacuate the cab — an engine compartment fire can spread rapidly to hydraulic lines and fuel systems; maintaining load control in a burning crane creates a risk of the operator being unable to exit safely as the fire grows

C. Shut down the engine immediately by activating the emergency stop — this cuts fuel to the fire while hydraulic pressure holds the load

D. Continue the lift to the set location and then address the fire — releasing the load mid-lift creates a dropped load hazard that is more dangerous than the fire

25. A crane operator is performing a lift at night with artificial lighting. The illumination is adequate at the pick location but the set location is in a shadow area — the signal person at the set location is visible but the load is not visible when it reaches the set height. What must happen before the load is lowered into the shadow area?

- A. Use the signal person's position as the reference for load placement and proceed at minimum speed
- B. Reduce hoist speed to minimum and proceed with the signal person's guidance
- C. Supplemental lighting must be provided at the set location so the load is visible throughout the lowering into the shadow area, or an observer with clear sight to the load must be positioned at a location where they can guide the placement and relay signals to the operator; proceeding with the load invisible at the set location is not authorized
- D. The signal person's radio confirmation of load clearance is adequate to proceed with final lowering

26. Under OSHA 1926.1416, when an operator receives a STOP signal, how quickly must all crane movement cease?

- A. All crane movement must stop at the earliest safe opportunity — minor deceleration time is allowed to prevent shock loading
- B. All crane movement must stop immediately upon receiving the STOP signal — ASME B30.5 and OSHA 1926.1416 both require that the operator stop all motion immediately when a STOP signal is given; there is no provision for completing a phase of movement before stopping
- C. The STOP signal applies to the current primary function — the operator may continue secondary functions like swing inertia dissipation
- D. The operator may stop at their discretion if they judge the stop to be unsafe due to load momentum

27. A crane is performing a personnel hoisting operation at 38% of rated capacity. The platform has been raised to working height and workers are connecting structural members. After 35 minutes, the lift director radios the operator and asks how much longer the operator can hold. The operator says the crane's hydraulic oil temperature is approaching the yellow zone. What must the operator do?

- A. Inform the lift director of the temperature status and continue the hold until the red zone is reached
- B. The personnel hoisting capacity limit of 50% means the 38% load is well within limits — temperature concerns are secondary to completing the structural connection

C. Continue the hold since the temperature is only approaching — not yet in — the yellow zone

D. Inform the lift director immediately that the hydraulic temperature is approaching the yellow zone and that a controlled lowering of the platform may be required before the temperature reaches critical levels — personnel hoisting requires immediate communication of any developing operational concern, and the lift director must have adequate time to manage the controlled lowering of the platform safely before the temperature forces an emergency response

28. A crane operator is preparing to make a lift when they notice the rigger is attaching the load using a sling configuration that appears different from the lift plan. The rigger is using a choker hitch instead of a basket hitch as specified. The operator cannot determine whether the rigging capacity is adequate from the cab. What must the operator do before picking the load?

A. Accept the rigging as attached since the rigger is qualified and responsible for rigging decisions

B. Wait for the signal person to confirm the rigging is adequate before picking

C. Contact the lift director about the change from the specified rigging configuration before proceeding

D. Nothing — the rigger's qualification confirms the rigging is adequate regardless of the lift plan

29. A crane operator is performing a repetitive series of 15 lifts when the crane's LMI begins making an intermittent alarm tone between lifts — sounding briefly when the crane is moving with no load rather than during the loaded lift. The LMI is not alarming during the actual lifts. What does an intermittent LMI alarm between lifts most likely indicate?

A. Nothing — LMI alarms between lifts are calibration noise that self-corrects when a load is applied

B. The intermittent alarm indicates the LMI has lost power intermittently — replace the battery before continuing

C. An LMI alarm during no-load movement may indicate the load cell is experiencing intermittent signal loss, a calibration offset drift, or an electrical connection issue — even if the alarms are not occurring during loaded lifts, the intermittent condition warrants investigation before continuing operations; a load cell that is functioning intermittently may produce inaccurate readings during loaded operations without triggering the alarm

D. Intermittent alarms between lifts indicate the LMI is working correctly — it is detecting the hook block and rigging weight as a minor load signal

30. Under OSHA 1926.1419, what is the minimum qualification standard for a signal person who will be directing crane operations on a construction site?

A. The signal person must be able to demonstrate knowledge of the applicable ASME B30.5 hand signals, have a means of communicating with the operator, and be evaluated by a qualified evaluator who confirms that they meet the qualification requirements — this may be through an accredited third-party program or an employer qualification program conducted by a qualified evaluator

B. Any job site worker may serve as signal person as long as they have completed a 30-minute orientation

C. Signal persons must hold a current NCCCO signal person certification

D. Signal persons must have a minimum of 5 years of construction experience

31. A crane is performing a critical lift at 93% of rated capacity. During the hoist, the load contacts a piece of temporary scaffolding — the contact is brief and the load deflects slightly before clearing the scaffolding. The LMI momentarily spiked to 101% during contact. The load is now clear and the LMI reads 93% again. What must the operator do?

A. Continue the lift since the load has cleared the obstruction and the LMI is back to 93%

B. Document the contact and LMI spike in the shift log and complete the lift

C. The temporary contact must be noted for end-of-shift documentation

D. Stop all crane movement immediately — the LMI spike to 101% indicates the crane was momentarily overloaded; load contact with the scaffolding created a lateral side load on the crane's structure at the same time as the vertical load was present; the crane must be inspected for structural damage before any further lifting operations

32. A crane operator is asked to perform a lift where the load must be placed through a roof opening that is 6 inches wider than the load on each side — 12 inches total clearance around the load. The load weighs 11,000 lbs and the lift will be performed in 12 mph wind. What is the specific concern with 12 inches of clearance at 12 mph wind?

A. Nothing — the signal person will guide the load through the opening

B. At 12 mph, wind can create lateral load drift of several inches, potentially eliminating the 12-inch clearance and causing the load to contact the roof opening edges; this combination of tight clearance and wind requires confirmation that the actual wind-induced drift at the load is small enough to maintain

clearance throughout the insertion — tag lines must be used to control lateral drift, and operations should pause if wind speed increases

C. 12-inch clearance is always adequate for any industrial lift in wind below 15 mph

D. The signal person must physically hold the load from inside the roof to guide it through the opening

33. Under OSHA 1926.1416(d), what is the required response when the crane operator detects an unusual vibration in the crane's structure during a lift at 82% of rated capacity?

A. Complete the current lift cycle and then investigate the vibration source

B. Reduce the crane's operating speed and continue the lift while monitoring for additional vibrations

C. Stop all crane movement immediately — unusual vibration in a crane's structure during a loaded lift may indicate structural distress, a loose mechanical connection, or impending mechanical failure; any structural vibration that was not present during previous lifts must be treated as a potential warning of developing failure until the source is identified

D. The vibration is caused by the load's dynamic interaction with the crane structure — it is expected at 82% capacity and no special action is required

34. A crane operator is performing a pick-and-carry operation across a job site. The load weighs 4,200 lbs and the pick-and-carry rated maximum for the crane in the current configuration is 5,800 lbs. The travel path includes a section where the road surface has a 6-inch lip — a step up where one section of pavement was placed over another, creating an abrupt height change. What concern does the 6-inch lip create?

A. When the crane travels over the 6-inch pavement lip, the dynamic shock loading can temporarily increase the effective load on the crane beyond the static load — combined with any travel speed, this impact can create a momentary dynamic overload; the travel speed must be reduced to minimum before crossing the lip, or an alternative travel route should be used

B. Nothing — pick-and-carry rated cranes are designed to handle any surface irregularity within the travel path

C. The 6-inch lip only affects the crane's comfort rating — reduce travel speed to 0.5 mph and proceed

D. The pick-and-carry rated load of 4,200 lbs provides a 1,600-lb margin that absorbs all dynamic effects

35. A crane operator is in the middle of a precision placement when the crane's engine stalls unexpectedly — the engine shuts down with the load at 18 feet of height in a position that is not directly over a safe landing surface. The crane is a hydraulic crane with spring-applied brakes. What is the result of the engine stall?

- A. The load will immediately begin lowering as hydraulic pressure drops
- B. The hydraulic system will hold the load indefinitely since hydraulic fluid is incompressible
- C. The crane's control functions will freeze in position — the operator must manually restart the engine
- D. The spring-applied brakes will engage as hydraulic pressure drops from the stalled engine, holding the load in position; the operator must restart the engine and maintain controls, then carefully and deliberately lower the load to a safe position — the spring-applied brake system was specifically designed to hold loads during engine failures to prevent uncontrolled load descent

36. Under OSHA 1926.1431, when a critical lift involves personnel hoisting — where the lift is both above 75% of rated capacity AND involves personnel — which specific requirement has the highest operational priority?

- A. The 75% critical lift threshold supersedes all other requirements when personnel are also involved
- B. The personnel hoisting requirements take precedence over the critical lift calculation — the maximum load for any personnel hoisting operation is 50% of rated capacity, which means any lift involving personnel automatically meets and must comply with the personnel hoisting section regardless of whether the lift would also qualify as a critical lift; a personnel hoisting lift at 76% would violate the 50% personnel hoisting limit regardless of critical lift authorization
- C. Both requirements apply simultaneously — the lift requires a critical lift plan and must also comply with personnel hoisting requirements
- D. When a lift involves both personnel hoisting and a near-critical load percentage, the lift director has authority to authorize the higher percentage for urgent work

37. A crane operator is performing a lift when the rigger on the ground shouts "HOLD!" — not a standard ASME hand signal but a clear verbal command from the rigger. The operator has a radio but the rigger was not speaking into a radio. What is the correct response?

- A. Continue the movement since the rigger is not a designated signal person
- B. Continue while asking the signal person to relay what the rigger is communicating

C. Stop all crane movement immediately — a clear vocal command from any person indicating danger requires immediate compliance; while "HOLD" is not a standard ASME hand signal, it is functionally equivalent to an Emergency Stop command that may be given by any person at any time; all movement must stop until the situation is clarified

D. Ask the rigger to repeat the command by radio before responding

38. A crane operator is completing a shift and is asked by the lift director to make "one more quick lift" after the crane has been in continuous operation for 11 hours. The operator feels their reaction time is slowed and focus is diminished. What is the correct response?

A. The operator should notify the lift director that they believe fatigue has impaired their ability to safely operate the crane and decline to perform the additional lift — operators must not perform crane operations when they recognize that their condition is impaired; this applies regardless of scheduling pressure, lift urgency, or the lift director's authority

B. Perform the lift at minimum speed and at a reduced capacity to compensate for the fatigue

C. Accept the lift and focus harder — professional operators should be able to manage fatigue on extended shifts

D. Ask the lift director to document the fatigue condition in writing before proceeding

39. A crane is performing a lift when the wind speed suddenly increases to 28 mph — the site had been calm throughout the day. The crane's general operational limit is 30 mph and the load is a compact 8,000-pound steel assembly. At 28 mph, what specific concern exists even though the limit has not been reached?

A. Nothing — 28 mph is within the 30 mph operational limit and operations may continue normally

B. Request the lift director to monitor wind speed continuously since the site was calm all day

C. Sound the horn and continue at reduced speed since the wind is below the limit

D. The wind speed is 2 mph below the operational limit — if the wind is increasing rapidly, the limit could be exceeded before the operator can safely complete the current movement; the operator must assess the wind trend and determine whether it is safe to continue the current lift cycle or whether setting the load is the appropriate precautionary action given the rapidly changing conditions

40. A crane operator is working on a project where two cranes are making a tandem lift. During the coordinated hoist, Crane A's hoist rate differs from Crane B's hoist rate — Crane A is hoisting 12 inches

per minute while Crane B is hoisting 9 inches per minute. The load is at 6 feet of height. What is the specific hazard from the unequal hoist rates?

- A. Nothing — minor hoist rate differences are normal in tandem lifts and self-correct as the operators adjust
- B. Unequal hoist rates are only a concern when the load is above 20 feet of height
- C. The lift director must authorize all hoist rate adjustments before either operator changes speed
- D. The differential hoist rate causes the load to tilt — the faster-hoisting crane carries proportionally more load than planned while the other crane carries less; if the rate differential continues, one crane may exceed its rated capacity while the other's slings go slack; both operators must immediately synchronize their hoist rates under the lift director's coordination

41. Under OSHA 1926.1408(b)(4), what must the dedicated power line spotter do if any part of the crane or load comes within the established minimum safe approach distance?

- A. The spotter must immediately alert the lift director and wait for the lift director's instruction
- B. The spotter must immediately warn the operator verbally via radio and continue monitoring
- C. The spotter must immediately use their means of stopping the crane — activating whatever direct stop mechanism is available — regardless of any other consideration; the stop must be immediate and does not require consultation with the lift director or confirmation of the situation before acting
- D. The spotter must warn surrounding personnel and take cover before stopping the crane

42. A crane operator is performing a lift in a confined space between two buildings when the signal person loses line-of-sight to the hook block and cannot confirm the load's clearance below a structural overhang. The signal person can see the operator and the load's approximate position but cannot verify clearance at the overhang. What is required?

- A. Establish a relay observer with clear sight to the load and the overhang clearance — the relay confirms clearance to the signal person, who relays to the operator; no crane movement in the restricted area may occur without confirmed clearance at all obstacle points; the operator cannot proceed based on the signal person's estimate of clearance they cannot directly see
- B. The signal person may estimate clearance from experience with the load dimensions and proceed
- C. The operator may use the LMI radius display to infer clearance at the overhang

D. Continue at minimum speed while the signal person moves to a better position

43. A crane operator has been operating correctly throughout a shift when a relief operator takes over. The relief operator begins the shift without performing a pre-shift inspection, stating that the outgoing operator confirmed the crane is in good condition. Under ASME B30.5, is this acceptable?

A. Acceptable — the outgoing operator's verbal confirmation satisfies the pre-shift inspection requirement

B. Acceptable — the pre-shift inspection was completed at the start of the previous shift

C. Acceptable if the relief operator performs a visual walkout inspection without documented findings

D. Not acceptable — each operator must perform their own pre-shift inspection before operating the crane; a pre-shift inspection is operator-specific and shift-specific; the outgoing operator's assessment cannot substitute for the incoming operator's independent inspection, since conditions may have changed and the incoming operator must verify crane condition firsthand

44. Under OSHA 1926.1425, what specific burden of proof applies when a crane operator is directed to swing a load over occupied areas — who bears the responsibility for confirming personnel have cleared the area?

A. The signal person bears sole responsibility for confirming the load path is clear before directing the operator

B. All persons working in the load path area are individually responsible for their own clearance

C. The load path must be cleared and confirmed clear before the operator swings the load over it — this responsibility rests with the lift director to direct clearance and the signal person to confirm it; the operator must not execute a swing over an occupied area until they have confirmed, through the signal person or their own direct observation, that the area is clear; operators cannot assume clearance without confirmation

D. The crane operator has exclusive responsibility for confirming all load paths are clear before any movement

45. A crane is performing a lift when the load contacts the edge of a steel beam being placed in its structural seat — the load swings slightly and strikes the beam. The contact is brief and the load weight is 22,000 lbs. No obvious damage is visible to either the load or the beam. What must happen?

- A. Nothing — brief contact between a load and a structural member is normal during precision placement and does not require any response
- B. Continue the placement — the brief contact indicates the load is very close to the final position
- C. Stop the lift and allow a qualified person to inspect the rigging, load, and structure for damage from the contact — even a brief impact between a 22,000-pound load and a structural member can cause deformation or damage that is not immediately visible; the rigging may have shifted, the slings may have been notched, and the structural member may have been deflected; inspection must precede continued operations
- D. The rigger must confirm verbally that no damage occurred before the lift continues

46. A crane operator receives a signal from the signal person to boom up — but the operator knows that booming up will raise the hook block to within approximately 3 feet of the boom tip based on the current rope length and hook position. What must the operator do before executing the boom-up command?

- A. Execute the boom-up command as directed — it is the operator's role to follow signals
- B. Contact the lift director before executing any boom-up command when the hook is at an elevated position
- C. The ATB system will protect against two-blocking, so boom-up may be executed without operator assessment
- D. Execute the boom-up only if the operator can confirm the ATB system is functional and the hook block will not reach the boom tip sheave at the planned new boom angle — or lower the hook block first to create adequate clearance before executing the boom-up command; executing boom-up when the hook is already near the tip is a two-blocking risk that the operator must assess independently of the ATB's backup protection

47. A crane is operating at a job site when a gas line rupture occurs 40 feet away — a visible flame is present and the fire is spreading. The crane operator has a load at 12 feet of height. What is the correct sequence of actions?

- A. Immediately drop the load and evacuate — a gas fire emergency takes priority over load control
- B. Continue to hold the load in position and await emergency response instructions
- C. Call the fire department before taking any crane action

D. Lower the load to the nearest stable surface as quickly as safely possible using controlled movement, sound the emergency horn, and evacuate the crane following the site's emergency procedures — gas fires can escalate rapidly and the operator must secure the load before evacuating; releasing the load in free-fall is not authorized even in an emergency since the dropped load creates an additional hazard for evacuating personnel

48. Under ASME B30.5, when is an operator permitted to leave the crane cab during an active lift with a load suspended?

A. The operator may leave the cab briefly to communicate with the rigger during a hold

B. The operator is never permitted to leave the cab while a load is suspended — the operator must remain at the controls throughout the entire lift from pick to set; if operational circumstances require the operator to be away from the crane, the load must first be safely set on a stable surface with the crane brakes engaged

C. The operator may leave if the drum pawl is engaged and the lift director confirms the pause

D. The operator may leave briefly when the load is at a stable set location but before final rigging disconnection

TECHNICAL KNOWLEDGE DOMAIN — Questions 49–70

49. A crane's wire rope inspection reveals a section where the rope's helical lay appears tighter than normal — the strand pitch is compressed and the rope diameter in the affected section is approximately 6% larger than the nominal diameter. What does localized diameter increase in wire rope indicate?

A. A localized increase in rope diameter with compressed lay indicates internal core failure — the fiber core or wire strand core has collapsed, allowing the strands to move inward at the core failure point and outward elsewhere; this produces the bird-cage or pouch appearance that represents a catastrophic structural change in the rope; the rope must be removed from service immediately

B. Localized diameter increase indicates the rope has been properly tensioned and the strands have seated

C. A 6% diameter increase is within the normal variance for new rope during break-in

D. Localized diameter increase indicates the rope has been operating correctly and approaching maximum stretch

50. Under ASME B30.26, what is the specific derating requirement for a shackle used in a configuration where the load is applied at a 90-degree angle from the intended in-line loading direction?

A. A 90-degree off-axis load reduces the shackle's capacity to approximately 70% of its rated straight-pull WLL based on ASME B30.26's angular loading provisions

B. A 90-degree off-axis load voids the shackle's rating entirely — shackles may not be used in any configuration where the load is applied perpendicular to the in-line direction without manufacturer's written authorization

C. No derating is required for shackle bow loading up to 90 degrees if the shackle pin is secured with a cotter pin

D. A 90-degree off-axis shackle load reduces the rated WLL to approximately 25% of the straight-pull rating under ASME B30.26 angular loading tables

51. A crane operator is reviewing the manufacturer's maintenance schedule and finds that the crane's hydraulic return line filter has never been replaced — the crane is 3 years old with 2,400 hours of service. The manufacturer's recommended change interval is 500 hours. What is the significance of a return line filter operating 1,900 hours beyond its change interval?

A. Return line filters are low-pressure components with extended service lives — 2,400 hours without replacement is within normal operating range

B. Nothing — hydraulic filters degrade gradually and the crane will show symptoms when the filter needs replacement

C. The filter service life has been significantly exceeded — an overloaded return line filter allows hydraulic contamination to circulate through the entire system, accelerating wear on pumps, motors, valves, and cylinders; at 1,900 hours beyond the change interval, internal contamination damage may already have occurred; the filter must be replaced and a hydraulic fluid analysis performed to assess system contamination levels

D. The filter only affects return flow and has no effect on the crane's load-holding capacity

52. A rigger is using a nylon web sling to lift a load that is 165°F — a steel fabrication that was pre-heated for a welding operation. The sling's rated working temperature is listed as a maximum of 180°F. What is the concern with this application at 165°F?

A. Nothing — 165°F is below the 180°F maximum rated temperature

B. The nylon sling may be used at 165°F without capacity reduction — a 15°F margin confirms safe operation

C. Nothing — sling temperature ratings provide a specific maximum with no derating required below that limit

D. Nylon web slings experience capacity reduction at temperatures above 194°F but require derating beginning at lower temperatures — many manufacturers specify derating factors for temperatures significantly below the stated maximum; the operator must consult the manufacturer's temperature derating table to confirm what capacity reduction applies at 165°F before using the sling on this application

53. A crane is operating in an industrial plant where hydraulic oil mist from a nearby failed hydraulic fitting has coated the crane's load line over approximately 30 feet of rope length. The oil contamination is heavy and the coated section passes over the boom tip sheave during operations. What concern does oil contamination of the rope create beyond lubrication effects?

A. Nothing — oil on a wire rope is always beneficial as a lubricant

B. The oil contamination improves the rope's corrosion resistance and requires no action

C. Heavy oil contamination from an external source can wash out the rope's original internal lubricant and allow environmental contaminants to enter the rope's internal spaces — this external oil may attract and trap abrasive particles; additionally, oil on the rope reduces friction between the rope and the drum/sheaves, potentially affecting brake holding and fleet angle behavior; the contaminated section should be examined and the situation addressed

D. The coated section must be cleaned with solvent before any further use since oil contaminates the load cell sensor accuracy

54. Under ASME B30.9, what is the specific maximum choke angle below which a wire rope sling in a choker hitch must be derated, and what is the derating factor at 90 degrees?

A. Derating applies below 120 degrees; at 90 degrees, the choker hitch capacity is reduced to 70% of the standard choker WLL based on the ASME B30.9 derating table for choke angles

B. Derating applies at all angles below 180 degrees; at 90 degrees, capacity is reduced to 50%

C. Derating applies below 90 degrees only; at exactly 90 degrees, full choker WLL capacity applies

D. Nothing applies below 120 degrees since ASME B30.9 only rates choker hitches at angles above 120 degrees

55. A crane inspector is performing the annual inspection and finds that the boom's hydraulic extension cylinder rod has a score mark — a linear scratch running along the rod's polished surface that is approximately 6 inches long and clearly scratched into the surface rather than being a surface contamination. What does a scored hydraulic cylinder rod indicate and what action is required?

A. Surface marks on cylinder rods from contact with debris are normal — apply hydraulic oil to the rod and continue service

B. The score mark must be polished smooth with a fine abrasive and the rod returned to service

C. Rod score marks must be monitored at monthly intervals — remove from service only if additional scores develop

D. A scored hydraulic cylinder rod will damage the rod seal every time the rod passes through the seal — each stroke of the cylinder draws the score mark through the seal, cutting the seal material and progressively destroying the rod-to-seal contact surface; the cylinder must be removed from service and the rod either replaced or professionally re-finished before operations

56. A crane operator is reviewing the wire rope inspection record and finds that the last inspection noted: "Some corroded wires in section 3 — monitor." The inspection was performed 6 months ago. Today's pre-shift visual inspection reveals the same section shows pitting on the corroded wires. What must the operator do?

A. Continue monitoring since the inspection record established a monitoring protocol

B. The pitting on corroded wires must be assessed by a qualified person — pitting represents material loss from the wire cross-section that reduces tensile capacity without creating wire breaks; since the condition has been known for 6 months and has progressed to visible pitting, the rope requires immediate qualified person assessment against ASME B30.5 and OSHA 1926.1413 removal criteria; the operator must not assume the monitoring protocol remains adequate

C. Apply rust inhibitor to the affected section and continue monitoring

D. The monitoring protocol is still valid — document the pitting in the inspection record and continue operations

57. A rigging crew is using a 4-leg chain sling in a basket hitch configuration to lift a concrete slab. After the pick, the rigger notices the chain links in contact with the slab's edge have a series of bright, shiny nicks — the slab edge has cut into the chain link surface. What does notching of chain links indicate and what action is required?

A. Nothing — minor surface marks on chain links are normal and do not affect rated capacity

- B. Continue the current lift and inspect the slings at the end of the shift before returning to storage
- C. Chain link notching from contact with sharp edges requires immediate removal from service — notches create stress concentration points in the chain link material at the exact locations where the chain must carry its maximum tension; under subsequent loading, these stress concentrations can initiate fracture at loads well below the chain's rated capacity; the chains must be set down and the slings replaced before any additional lifting
- D. Use electrical tape to wrap the notched areas and continue operations

58. Under ASME B30.5, what is the required action when a crane's load line has been subject to a shock load during operations — specifically, when the load suddenly drops approximately 2 feet due to a momentary hoist brake slip before the brake re-engages?

- A. The rope and all rigging must be removed from service for destructive testing — shock loads always require destructive assessment before re-use
- B. The lifting operations may continue if the load is confirmed undamaged and the brake is functioning correctly after re-engagement
- C. The brake slip incident must be reported to OSHA within 24 hours as an equipment malfunction
- D. The rope and rigging must be inspected by a qualified person for kinks, deformation, and geometric changes from the shock load before any further operations — a 2-foot sudden drop creates a dynamic impact load many times the static load weight when the brake re-engages; this impact can cause deformation, wire breaks, or internal damage not visible without qualified inspection

59. A crane operator is asked about the purpose of the "rated speed" specification in the crane's operator manual. Which statement correctly describes rated speed?

- A. Rated speed is the maximum speed at which the crane's hoisting functions may operate at any load — it applies equally to all loads from zero to maximum
- B. Rated speed is the engine's rated RPM at which maximum hydraulic output is achieved
- C. The purpose of rated speed is to set a maximum operational limit — it does not mean the operator should always hoist at maximum speed; near-capacity lifts should be performed at minimum controlled speed to reduce dynamic loading, improve control precision, and minimize the impact loads that occur during acceleration and deceleration
- D. Rated speed is the manufacturer's recommended operating speed for normal daily operations — deviating from rated speed reduces the crane's efficiency but not its safety

60. A crane operator is performing a lift when the hoist brake engages partially during lowering — the load decelerates abruptly without any operator input. The load is at 8 feet of height and weighs 16,000 lbs. After the partial engagement, the brake releases and normal lowering resumes. What does this unexpected brake event indicate and what action is required?

- A. Nothing — partial brake engagement during lowering is a normal function of the brake modulation system
- B. The partial brake engagement is caused by the load's inertia interacting with the brake system — it is expected at heavier loads and requires no action
- C. This should be documented and reported to maintenance but does not require stopping operations
- D. An unexpected partial brake engagement during lowering without operator input indicates a hoist brake malfunction — the brake may be engaging from internal causes such as contamination, wear, or hydraulic control issues; this unpredictable brake behavior must be investigated before any further lifting since an uncontrolled brake engagement at height with a heavier load could cause damage or injury

61. Under OSHA 1926.1413, when must the crane's running rope be replaced after it has been exposed to electrical contact with an energized conductor?

- A. After 24 hours have elapsed and a qualified person confirms no visual damage is present
- B. After a qualified inspector performs magnetic particle testing on the entire rope length
- C. Immediately — any rope that has been in contact with an energized conductor must be immediately removed from service and replaced; electrical current passing through wire rope can fuse wires, alter the metallurgical properties of the high-carbon steel, and create invisible damage that dramatically reduces tensile capacity; there is no inspection method that can reliably confirm a rope's structural integrity after electrical contact
- D. After the rope is confirmed free of visible wire breaks or geometric deformation from the electrical contact

62. A crane's wire rope is found to have the following conditions in a 1-foot section: 4 broken crown wires, 1 valley break, and visible abrasion reducing the rope's diameter by 1/32 inch from nominal. The rope is 3/4-inch diameter. Under OSHA 1926.1413 and ASME B30.5, does this section require removal?

- A. Yes — 5 total broken wires in a 1-foot section (within approximately 1 lay length for 3/4-inch rope) combined with diameter reduction from abrasion meets multiple removal criteria simultaneously; the rope must be removed from service
- B. No — 5 broken wires in 12 inches does not meet the criterion of 6 broken wires in one lay length
- C. Only the valley break criterion applies — valley breaks are always a removal condition
- D. The 1/32-inch diameter reduction is the only criterion met — monitor the wire breaks at the next inspection

63. A crane operator notices that during a swing movement, the crane's upper works makes a low-frequency "clunking" sound at one specific point in the rotation — the sound occurs consistently when the boom passes through approximately 270 degrees of rotation. The sound is not present at other positions. What does a position-specific sound during rotation most likely indicate?

- A. Nothing — position-specific sounds during rotation are caused by normal hydraulic pressure variations in the swing motor circuit
- B. A random mechanical harmonic — the crane structure resonates at specific rotation speeds
- C. The crane's swing brake is dragging slightly at that position in the rotation
- D. A sound that occurs at only one specific rotational position is consistent with a discrete physical condition at that location — a damaged gear tooth on the slewing ring passing through the drive pinion contact zone, an obstruction on the rotation path, or a structural anomaly at that bearing position; this condition requires immediate investigation to identify the source before it progresses to a more serious failure

64. A crane is operating when the operator notices that the boom's tip section appears to deflect more than usual under the current load — visually, the boom seems to bend more noticeably than it did for similar loads earlier in the shift. What does increased boom deflection compared to previous lifts at similar loads indicate?

- A. Nothing — boom deflection varies naturally with load weight; comparing deflection between lifts is not meaningful since load weights vary slightly
- B. Increased deflection at similar loads may indicate reduced structural stiffness from a developing chord deficiency, a damaged or missing brace, or a failure in a critical boom section; the operator must stop the lift and report the unusual deflection to the employer for evaluation — changes in expected structural behavior are an early warning sign of impending structural failure
- C. Increased boom deflection at similar loads indicates the boom is warming up during the shift — thermal expansion causes greater deflection in warm conditions

D. The increased deflection is caused by the outrigger settling during operations — re-level the crane and continue

65. Under ASME B30.10, what is the requirement for hook inspection frequency for a crane that performs 50 or more lifts per day in normal service?

A. Monthly inspection is adequate for all hooks regardless of daily lift frequency

B. Weekly inspection is required for hooks performing 50 or more lifts per day

C. Daily inspection is required — for cranes in heavy service (50 or more lifts per day), a qualified person must inspect the hook daily before the first lift; this frequency reflects the accelerated wear and fatigue accumulation from high-cycle service that can progress a hook from serviceable to a removal condition within a single day

D. Annual inspection plus the operator's daily visual check is required regardless of daily use

LOAD CHARTS DOMAIN — Questions 71–95

71. A crane load chart shows the following values for the on-outrigger full extension section with a 100-foot boom: 25 ft = 44,400 lbs; 30 ft = 35,200 lbs; 35 ft = 27,800 lbs. The planned operating radius is 31 feet. The hook block weighs 1,600 lbs, slings weigh 480 lbs, and hardware weighs 120 lbs. The payload weighs 28,000 lbs. Using the conservative approach, what is the governing capacity and is the lift within this capacity?

A. Nothing — 30,200 lbs total suspended weight within 35,200 lbs conservative capacity at 35 ft

B. Conservative capacity at 35 ft = 27,800 lbs; total suspended weight = 30,200 lbs; 30,200 exceeds 27,800 — the lift cannot proceed

C. Conservative capacity at 35 ft = 27,800 lbs; total suspended weight = $28,000 + 1,600 + 480 + 120 = 30,200$ lbs; 30,200 lbs exceeds the conservative capacity of 27,800 lbs — the lift cannot proceed as planned

D. Conservative capacity at 30 ft = 35,200 lbs; total suspended weight = 30,200 lbs; lift proceeds

72. A crane's load chart for the "ON OUTRIGGERS — 75% EXTENSION" section shows: 80-foot boom at 30 ft = 22,600 lbs and at 35 ft = 17,800 lbs. A planned lift at 32 feet has a total suspended

weight of 19,400 lbs. Using the conservative approach, is the lift within capacity, and what is the lift percentage based on the conservative capacity?

A. Conservative capacity at 35 ft = 17,800 lbs; 19,400 lbs exceeds this capacity — the lift cannot proceed; lift percentage = 109% — the conservative approach confirms this is not a viable lift in this configuration

B. Conservative capacity = 22,600 lbs; lift proceeds; lift percentage = 85.8%

C. The conservative approach is to interpolate between the tabulated values — not use the next larger radius

D. The lift proceeds using the 30-ft tabulated value — the conservative approach selects the closest tabulated radius

73. A crane load chart section note reads: "In this section, all capacities assume the swing speed does not exceed 1.5 rpm. For operations requiring swing speeds above 1.5 rpm, multiply all capacities in this section by 0.85." The operator needs to swing the load at 2.0 rpm to meet the project schedule. The tabulated gross capacity at the planned configuration is 28,400 lbs. What is the applicable derated capacity?

A. The operator cannot exceed 1.5 rpm regardless of schedule requirements

B. Nothing — swing speed notes are advisory and the operator may exercise professional judgment

C. Derated capacity = $28,400 \times 0.85 = 24,140$ lbs; the note authorizes operations above 1.5 rpm with the 0.85 derating factor applied to all capacity values in the section; the total suspended weight must be within 24,140 lbs for operations at 2.0 rpm swing speed

D. The 0.85 factor applies only to lifts above 80% of the tabulated capacity when swing speed exceeds 1.5 rpm

74. A crane load chart shows: 100-foot boom at full outrigger extension: 30 ft = 38,400 lbs; 35 ft = 30,200 lbs; 40 ft = 23,600 lbs. The rate of capacity decrease per foot: 30–35 ft = 1,640 lbs/ft; 35–40 ft = 1,320 lbs/ft. A lift is planned at 33 feet. Using linear interpolation between 30 and 35 feet, what is the estimated capacity at 33 feet?

A. Interpolated capacity at 33 ft = $38,400 - (3 \times 1,640) = 38,400 - 4,920 = 33,480$ lbs

B. Interpolated capacity at 33 ft: drop from 30 to 35 ft = 8,200 lbs over 5 ft = 1,640 lbs/ft; at 33 ft (3 ft beyond 30 ft): $38,400 - (3 \times 1,640) = 38,400 - 4,920 = 33,480$ lbs

- C. Interpolated capacity = 35,520 lbs using average of the two tabulated values
- D. Interpolated capacity = 34,300 lbs using the midpoint estimation method

75. A crane load chart section specifies: "FOR USE WITH MANUFACTURER'S STANDARD JIB ONLY. DO NOT USE WITH FIELD-FABRICATED ATTACHMENTS." A contractor has constructed a custom jib from pipe sections to extend the crane's reach by 15 feet. The custom jib is attached to the boom tip. What action is required?

- A. Use a 20% derating on the capacity values to account for the non-standard jib attachment
- B. Nothing — field extensions are common and the operator may use the standard jib section with the field fabrication
- C. Contact the crane manufacturer for authorization to use field-fabricated attachments before any lifting
- D. The field-fabricated jib attachment must be removed before the crane is used — ASME B30.5 prohibits modifications to the crane unless approved by the manufacturer; a field-fabricated pipe jib has not been analyzed for structural adequacy, load path compatibility, or safety; operating the crane with this attachment is prohibited and the standard jib section capacity values do not apply

76. A crane is configured with a 100-foot boom at full outrigger extension. The load chart shows a maximum rated radius of 55 feet with a note: "At 55 feet maximum rated radius, total suspended weight must not exceed 9,800 lbs." The planned total suspended weight is 10,200 lbs at 53 feet of radius. Using the conservative approach, the governing capacity at the 55-foot tabulated entry is 9,800 lbs. Does the lift proceed?

- A. Nothing — the 9,800 lbs is only a limit at exactly 55 feet; at 53 feet the note does not apply
- B. Conservative capacity = 9,800 lbs at 55 ft; total suspended weight (10,200 lbs) exceeds the conservative capacity — the lift cannot proceed in this configuration at the 53-foot radius using the conservative approach
- C. The note's 9,800-lb limit is a guidance value only — the actual tabulated capacity governs
- D. The conservative approach uses the next-smaller tabulated radius — look up the 50-foot value instead

77. A crane load chart note reads: "This section requires a minimum of 4 outrigger pads be in place with solid contact. If only 3 outrigger pads are available, multiply all capacity values by 0.60." At a job site, the fourth outrigger cannot be extended due to a physical obstruction, and only 3 pads can be deployed. The tabulated capacity at the planned configuration is 32,600 lbs. What is the applicable capacity?

- A. Nothing — a 3-outrigger configuration is not rated and no crane operations may proceed
- B. The 3-outrigger derated capacity = $32,600 \times 0.60 = 19,560$ lbs; the operator must use this derated value for all lifts in this configuration; the note provides the manufacturer's specific derating for a 3-outrigger setup, making it a rated configuration subject to the reduced capacity
- C. Apply a 25% derating as the standard ASME reduction for non-standard outrigger configurations
- D. Contact the manufacturer for site-specific authorization before operating with 3 outriggers

78. A crane is operating with the following configuration: 80-foot boom, full outrigger extension, standard counterweight. The load chart shows 26,800 lbs at 35 ft and 21,200 lbs at 40 ft. A planned lift at 37 feet uses the interpolated capacity of 24,520 lbs. The total suspended weight is 23,600 lbs. The lift percentage based on interpolated capacity is 96.2%. What does this lift percentage require?

- A. A written critical lift plan and pre-lift meeting are required since 96.2% exceeds the 75% critical lift threshold — the lift must be confirmed with a pre-lift meeting that reviews all lift parameters, confirms crew qualifications, establishes communication protocols, and identifies emergency procedures
- B. Nothing additional — the 96.2% is based on interpolated capacity and critical lift threshold applies only to tabulated capacity values
- C. The LMI must be set to maximum sensitivity mode for all lifts above 90%
- D. OSHA requires manufacturer sign-off for all lifts above 90% of rated capacity

79. A crane load chart section shows that all cells in the 100-foot boom column at radii between 15 and 25 feet are shaded gray (structural-limited). The planned lift at 20 feet is at 97% of the structural-limited capacity. The lift director has approved the lift. What is the specific operational requirement that cannot be waived by the lift director's approval?

- A. The lift director's approval satisfies all operational requirements — no additional restrictions apply
- B. The lift requires manufacturer certification before any structural-limited lift above 90% capacity
- C. OSHA requires a post-lift inspection for all lifts above 95% of structural-limited capacity
- D. At 97% of structural-limited capacity, the crane's structural members are at near-design-limit stress — all crane movements throughout the lift must be performed with exceptional smoothness; no simultaneous multi-function operation, no abrupt starts or stops, no boom side-loading, and no dynamic loading from swing acceleration; these are binding operational requirements that apply regardless of lift director approval

80. A crane load chart shows a section titled "ON OUTRIGGERS — FULL EXTENSION — 360 DEGREES." At 30 feet radius with a 100-foot boom, the capacity is 36,400 lbs. The operator is performing a lift that requires the boom to pass through the over-front sector. A note in the section reads: "These values apply for all boom positions including over front." Does a higher-capacity over-front section exist that the operator should consult?

- A. The operator should always check for a directional section that may provide higher capacity
- B. The note explicitly confirms these values apply to all positions including over-front — consulting a separate over-front section is not necessary since the note establishes the 360-degree section as the authoritative section for all positions in this crane's configuration; the note prevents ambiguity about whether to switch sections during a multi-directional swing
- C. The over-front section always exists as a supplementary section in every crane's load chart
- D. The operator must use the most conservative available section regardless of directional notes

81. A crane's load chart for the on-outrigger full extension, all-directions section shows: 35 ft = 26,800 lbs; 40 ft = 21,200 lbs; 45 ft = 16,600 lbs; 50 ft = blank. A critical lift is planned at 42 feet of radius. The total suspended weight is 18,400 lbs. Using the conservative approach, does the lift proceed?

- A. Interpolated capacity at 42 ft = 19,240 lbs; the load (18,400 lbs) is within capacity — lift proceeds
- B. Nothing — the blank at 50 ft limits the maximum radius to 45 feet; 42 feet is within the rated envelope
- C. Conservative capacity at 45 ft = 16,600 lbs; total suspended weight (18,400 lbs) exceeds conservative capacity — the lift cannot proceed in this configuration using the conservative approach
- D. Conservative capacity at 40 ft = 21,200 lbs; 18,400 lbs is within capacity — lift proceeds

82. A crane's load chart contains the following note: "When the total suspended weight is between 90% and 100% of gross capacity, a second person must independently verify the total suspended weight calculation before the lift begins." A lift is planned at 92% of gross capacity. The original total suspended weight calculation was performed by the lift director. Is the lift director's calculation sufficient?

- A. Yes — the lift director's calculation satisfies the verification requirement since the lift director is the responsible person for lift planning

- B. The note requires a second, independent verification — the lift director's original calculation cannot be verified by the same person who performed it; a second qualified person must independently calculate the total suspended weight and confirm it matches the lift director's value before the lift proceeds; this second check provides the independent confirmation the note requires
- C. The operator's review of the lift director's numbers satisfies the independent verification requirement
- D. A second verification is only required when the total suspended weight includes multiple components

83. A crane is performing a jib lift at 50 feet of radius. The jib section load chart shows: 45 ft = 10,800 lbs; 50 ft = 8,200 lbs; 55 ft = blank. The jib head block weighs 360 lbs, rigging weighs 440 lbs, and the payload weighs 7,200 lbs. The total suspended weight is 8,000 lbs. The operating radius is exactly 50 feet. What is the lift percentage and what does the blank at 55 feet confirm about the operator's radius management during this lift?

- A. Nothing about the blank at 55 feet affects the operator's behavior during this lift
- B. The blank at 55 feet indicates the crane's jib section has additional capacity beyond 50 feet that is not yet published
- C. Lift percentage = $8,000 \div 8,200 \times 100 = 97.6\%$; the blank at 55 feet confirms 50 feet is the maximum rated radius for this jib configuration — the operator is at the rated envelope's outer boundary; any radius increase beyond 50 feet (from boom deflection, centrifugal displacement, or any other cause) moves the lift outside the rated envelope where no capacity exists; exceptionally precise radius management is required throughout this lift
- D. Lift percentage = 97.6%; the blank at 55 feet is a printing error — all jib sections extend beyond the maximum boom radius

84. A crane load chart section note reads: "These capacities apply only when the crane is level within 0.3% of grade in all directions." After leveling, the crane reads 0.2% in the fore-aft direction and 0.28% in the lateral direction. What is the combined resultant out-of-level and does it satisfy the note?

- A. Nothing — each axis independently satisfies the 0.3% requirement and no combined calculation is needed
- B. Nothing — the note's 0.3% limit applies to each axis independently; both axes are within 0.3% individually and the crane satisfies the requirement
- C. Combined resultant = $\sqrt{(0.2^2 + 0.28^2)} = \sqrt{(0.04 + 0.0784)} = \sqrt{0.1184} = 0.344\%$; the resultant exceeds the 0.3% note requirement — the crane must be re-leveled to bring the combined out-of-level resultant within 0.3% before these capacity values can be used

D. The 0.28% lateral reading governs since it is the larger of the two axis readings; 0.28% is within the 0.3% limit and the crane satisfies the requirement

85. A crane's load chart shows capacity values organized by boom angle rather than radius. At 65 degrees of boom angle, the gross capacity is 38,400 lbs. At 60 degrees, the gross capacity is 31,200 lbs. The planned lift requires the boom at 63 degrees. Using the conservative approach for a boom-angle-organized chart, what capacity governs?

A. Conservative capacity = 38,400 lbs at 65 degrees — the next larger boom angle has more capacity since capacity increases with angle

B. Nothing — boom angle charts are always used with interpolation, not the conservative approach

C. Conservative capacity at the next smaller boom angle = 31,200 lbs at 60 degrees — in a boom-angle chart where capacity increases with angle, the conservative approach uses the next smaller tabulated angle (lower capacity) rather than the next larger angle (higher capacity); this ensures the estimate is on the safe side of uncertainty

D. Interpolated capacity at 63 degrees = 35,280 lbs governs for boom-angle organized charts

86. A crane load chart shows the following for the 100-foot boom section, on-outrigger full extension: the 30-foot radius cell shows 38,600 lbs with a footnote reference "(1)." Footnote (1) at the bottom of the section reads: "Structural capacity limited. See engineer's note on page 47 before using this cell." The operator has no access to page 47. What must happen before this cell can be used?

A. Nothing — footnote references are supplementary information; the tabulated value governs

B. The engineer's note on page 47 must be located, read, and complied with before this cell may be used — footnotes are binding conditions of the capacity values; a footnote directing the user to an engineer's note means that note contains specific restrictions, conditions, or requirements that modify the use of that capacity value; proceeding without reading the note means using a capacity value without meeting all its stated conditions

C. The footnote reference may be disregarded if the operator confirms the LMI reads below 90% during the lift

D. Contact the lift director to authorize the cell's use without the engineer's note

87. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — MAXIMUM COUNTERWEIGHT": at 40 ft = 26,400 lbs; at 45 ft = 21,200 lbs; at 50 ft = 16,800 lbs. A planned lift at 43 feet has a total suspended weight of 22,000 lbs. The conservative capacity at 45 ft is 21,200 lbs. The

total suspended weight of 22,000 lbs exceeds the conservative capacity. What options does the operator have to complete this lift?

- A. Use the interpolated capacity — if the interpolated value at 43 ft (23,936 lbs) supports the load, proceed without applying the conservative approach
- B. There are no compliant options — the lift cannot be completed in any configuration
- C. The operator may apply a 5% emergency safety factor to extend the conservative capacity to 22,260 lbs to accommodate the 22,000-lb total suspended weight
- D. Options include: (1) reposition the crane to bring the operating radius to 40 feet or less where the conservative capacity (21,200 lbs at 45 ft... wait — at 40 ft = 26,400 lbs) supports the load; (2) reduce the total suspended weight to below 21,200 lbs; or (3) reconfigure the crane to a longer boom configuration that may have higher capacity at 43 feet

88. A crane's on-outrigger full extension section shows a note: "For operations using a single-part line, the maximum hook load is limited to 14,000 lbs regardless of the tabulated gross capacity." The tabulated gross capacity at the planned configuration is 28,600 lbs. The operator is using 2-part line with a total suspended weight of 22,000 lbs. Does the single-part line note affect the planned lift?

- A. Nothing — the note's 14,000-lb limit supersedes all other capacity values including for 2-part line
- B. The single-part line note applies to all reeving configurations when the total suspended weight exceeds the single-part limit
- C. Yes — the maximum load applies to all reeving configurations at this configuration
- D. The note specifically applies to single-part line operations — with 2-part line, the note's limitation does not apply; the tabulated gross capacity of 28,600 lbs governs for 2-part line operations and the planned 22,000-lb total suspended weight is within this capacity

89. A crane load chart for an all-terrain crane shows capacity in the "ON OUTRIGGERS — FULL EXTENSION" section for 3 different counterweight configurations. Each configuration shows different capacity values at the same radius. The operator has the medium counterweight installed. What must the LMI be configured to before operations begin?

- A. Configure the LMI to the maximum counterweight configuration to provide the most conservative capacity display

B. Configure the LMI to the standard (minimum) counterweight configuration to ensure conservative operation

C. The LMI must be configured to match the actual installed counterweight configuration — medium counterweight; using the maximum counterweight LMI configuration would display lower percentages than actual for the medium counterweight capacity, masking the true proximity to the capacity limit; using minimum counterweight configuration would display higher percentages and may trigger alarms prematurely; only the matching configuration produces accurate percentage displays

D. The LMI does not need counterweight configuration — it automatically detects counterweight mass through the load cell

90. A crane load chart shows the following gross capacity values for the 80-foot boom, full outrigger extension: 20 ft = 52,400 lbs; 25 ft = 41,800 lbs; 30 ft = 33,200 lbs. These cells are all stability-limited. A lift is planned at 22 feet with a total suspended weight of 48,000 lbs. Using conservative interpolation, what capacity governs?

A. Conservative capacity at 25 ft = 41,800 lbs; total suspended weight (48,000 lbs) exceeds this — the lift cannot proceed using the conservative approach in this configuration

B. The 20-ft entry of 52,400 lbs governs; 48,000 lbs is within capacity — lift proceeds

C. Nothing — the conservative capacity at 25 feet (41,800 lbs) must be checked; since 48,000 lbs exceeds it, the lift cannot proceed using the conservative approach

D. Interpolated capacity at 22 ft = 47,992 lbs — the load just barely exceeds this; the lift cannot proceed

91. A crane is operating with a 100-foot boom at 45 feet of radius. The gross capacity is 18,200 lbs. The total suspended weight is 17,100 lbs — a lift percentage of 94%. The operator makes a boom-down movement that increases the radius from 45 feet to 52 feet. The load chart shows 14,400 lbs at 50 ft and blank at 55 ft. Using the conservative approach, what is the compliance status after the boom-down?

A. The conservative capacity at 55 ft = blank; the maximum rated radius is 50 feet; since 52 feet exceeds the maximum rated radius, the boom-down has moved the crane outside its rated operating envelope; the crane must immediately boom back up to return within the rated envelope

B. Conservative capacity at 50 ft = 14,400 lbs; 17,100 lbs exceeds this — but the primary concern is that 52 feet exceeds the maximum rated radius entirely

C. The blank at 55 feet is irrelevant — the conservative value at 50 feet governs at 52 feet

D. The conservative capacity at 50 feet (14,400 lbs) applies to the 52-foot radius since 50 feet is the next smaller tabulated value

92. A crane's manufacturer load chart shows that the on-outrigger section for the 120-foot boom configuration includes a note: "Before beginning any lift in this section, confirm boom is free of any ice accumulation." Operations are occurring in winter conditions with an air temperature of 28°F and light drizzle. The operator visually inspects the boom from the ground and cannot see ice due to the boom's height and distance. What must happen before operations begin?

A. The note does not apply in light drizzle conditions — only in heavy precipitation

B. The operator's visual inspection from the ground satisfies the note's confirmation requirement

C. The note requires confirmation that the boom is free of ice — if the operator cannot verify this condition from the ground, the boom must be inspected from a position where ice accumulation can actually be confirmed; ice on the boom increases the boom's self-weight, changes its structural loading, and can fall off during operations creating a struck-by hazard; a ground-level visual inspection is not adequate confirmation in these conditions

D. The note is advisory — operations may proceed at the operator's discretion in light drizzle conditions

93. A crane load chart shows: "MAXIMUM PICK AND CARRY — LEVEL SURFACE — OVER FRONT ONLY — BOOM AT 30 FT — LOAD: 6,400 LBS." A different section shows "STATIONARY LIFTS — OVER FRONT — BOOM AT 30 FT — 25 FT RADIUS: 12,800 LBS." Both sections use the same boom configuration. Why is the pick-and-carry rated load approximately 50% of the stationary lift rating?

A. Pick-and-carry ratings include a 50% safety factor that stationary lifts do not require

B. The pick-and-carry section uses a higher design factor — 5:1 compared to 3:1 for stationary lifts

C. The pick-and-carry section accounts for reduced stability during travel — when the crane is moving, dynamic forces from acceleration, deceleration, uneven surfaces, and turning create additional overturning moments beyond the static lift condition; the 50% reduction reflects the stability margin required to safely carry the load through the dynamic travel environment without risking tip-over

D. The pick-and-carry section uses shorter boom lengths that require a 50% capacity reduction

94. A crane load chart shows a section for: "ON OUTRIGGERS — FULL EXTENSION — OVER SIDE — BOOM AT 100 FT — WITH LUFFING JIB AT 40 FT — 30° OFFSET." The crane is

configured with a 100-foot boom, 40-foot luffing jib, and 30-degree offset. During a lift the jib angle is changed from the rated 30 degrees to 25 degrees to raise the hook height. This changes the operating radius. What must the operator confirm before making any further picks at the new jib angle?

- A. The operator may continue using the 30-degree offset section since the boom configuration is unchanged
- B. Nothing — the jib angle change only affects hook height, not capacity
- C. Changing the jib offset angle changes the operating configuration — the 30-degree offset section no longer applies; the operator must locate the section that covers 25-degree offset, confirm it exists and applies to the current configuration, and re-verify that the planned total suspended weight is within the capacity of the 25-degree section at the new operating radius before any further lifts; if no 25-degree section exists, the manufacturer must be consulted
- D. The operator may apply a proportional interpolation between the 30-degree and any available lower-angle section to estimate capacity at 25 degrees

95. A crane's load chart for the on-outrigger full extension section shows: 100-foot boom at 35 feet = 26,800 lbs. The total suspended weight is 25,100 lbs — a lift percentage of 93.7%. The operator has confirmed the crane is level within 0.2%, the actual radius is confirmed at 35 feet, and all crane conditions match the section parameters. A strong gust of wind pushes the load 2 feet laterally during a slow swing. What specific risk does this 2-foot lateral displacement create at this configuration?

- A. Nothing — lateral displacement from wind does not affect the LMI reading or capacity
- B. The lateral displacement only affects the signal person's line of sight and is not a structural concern
- C. The lateral displacement requires the operator to slow the swing speed below 0.5 rpm
- D. The 2-foot lateral displacement increases the effective operating radius from 35 feet to approximately 37 feet — at 37 feet using the conservative approach, the capacity drops to the 40-foot tabulated value; at 93.7% of the 35-foot capacity, the total suspended weight is near the capacity level; if the effective radius reaches 40 feet, the conservative capacity may be significantly lower than the total suspended weight; the operator must immediately reduce swing speed to minimize further centrifugal and wind-induced displacement

Core Exam 9 Answer Key and Full Explanations

1. C — A pressurized pneumatic tube at 18 inches of depth represents both a structural void risk and a pressurized release hazard. Under concentrated outrigger loading, the tube can collapse — causing sudden settlement — and release pressurized air into the soil structure. The outrigger must be

repositioned or engineering must confirm the tube's structural capacity for the specific point load before any setup proceeds.

2. A — Polygonal cracking is the classic surface indicator of high-plasticity (expansive) clay that has dried and shrunk. The cracks represent volumetric contraction zones where lateral soil integrity is reduced. Although the dry clay surface may feel firm, the crack zones have reduced resistance to lateral shear, and re-wetting from outrigger-induced pore pressure changes can cause rapid localized bearing capacity reduction.

3. D — A retention pond with its clay liner removed exposes the native soil to direct water contact, maintaining the bank soil at elevated moisture content. The combination of high moisture content in the bank soil and the proximity of the outrigger surcharge load creates a risk of bank slope failure. Under the additional lateral stress from the outrigger, the saturated bank soil may shear toward the open water face.

4. B — The operator's direct, contemporaneous observation of conditions inconsistent with the documentation creates a safety conflict that cannot be resolved by accepting the documentation. Documentation describes conditions at the time of assessment — if conditions have changed, the documentation is no longer valid. The operator's stop-work authority applies to setup decisions and the discrepancy must be resolved before any crane loading.

5. C — A large surcharge load placed close to an operating crane's outrigger introduces lateral stress into the soil between the mound and the outrigger. This additional lateral earth pressure acts against the passive resistance zone that the outrigger depends on for stability. If the mound's surcharge reduces the passive resistance below what is required to support the outrigger load, a shear failure in the supporting soil mass could occur.

6. A — OSHA 1926.1408(b)(4) requires the dedicated power line spotter to be positioned for continuous visual contact with the closest part of the crane or load to the conductor, and to have a direct means of immediately stopping all crane movement. The immediate stop capability is the operative requirement — it must be direct and instantaneous, not relayed through the signal person or lift director. This specific assignment and capability are both required elements.

7. D — Sand boil potential identifies zones where upward groundwater seepage can exceed the critical gradient — at which point effective stress between soil particles drops to zero and the soil loses all bearing capacity in a liquefaction-like failure. This can happen rapidly and without visible surface

warning. Operations in sand boil zones require specific engineering controls since the soil can transition from apparently adequate to completely failed almost instantly.

8. B — Vehicle tire loads produce bearing pressures that are typically far lower per unit area than crane outrigger loads. If the soil was soft enough to deform under the vehicle's relatively distributed load — producing 4-inch ruts — it is almost certainly inadequate for the much higher concentrated bearing pressures from a crane outrigger. The tire tracks are direct physical evidence of soft soil conditions at the exact outrigger position.

9. C — Subsurface water flowing from below an outrigger mat indicates that piping or erosion is actively occurring in the soil at that position — water is moving through the soil and carrying soil particles with it. This process creates an expanding internal void beneath the mat. The bearing capacity of the soil directly beneath the mat is being actively destroyed by the water flow, and failure can occur without further visible surface changes.

10. D — OSHA 1926.1408(a) does not give the utility's refusal to de-energize priority over the required safety hierarchy — it requires that de-energization be evaluated first, and if not feasible, an encroachment prevention plan becomes the required control. When de-energization is technically feasible but the utility refuses, the crane employer must implement the encroachment prevention plan as the next required control. The utility's refusal shifts the control method but does not eliminate the employer's obligation to protect workers.

11. C — Cracks perpendicular to slope direction are tension cracks that form when the upper slope mass begins to separate from the stable material below — the primary mechanism in early-stage rotational or translational slope failure. These cracks indicate the slope has already begun moving and that the resistance forces are decreasing. Crane setup near a slope exhibiting these features without engineering evaluation risks triggering complete slope failure under the additional surcharge.

12. B — Concrete rubble fill has inherent void content between the irregular angular pieces — voids that cannot be detected from the surface. These voids can close suddenly under concentrated loading, creating instantaneous settlement. Three years of gravity consolidation is insufficient to guarantee the rubble has reached a stable configuration, particularly for the much higher contact stresses produced by crane outrigger loading compared to the overburden weight of 12 inches of gravel.

13. C — When a crane or nearby structure contacts an energized power line, the ground surrounding the contact point becomes energized through step potential — voltage gradients extend outward from the contact point through the soil. Walking on this energized ground creates a voltage difference between a

person's feet that can cause fatal electrocution. Remaining inside the cab of the adjacent crane protects personnel from this step potential hazard until the line is de-energized.

14. A — A utility locate mark with a tolerance zone identifies the approximate centerline within ± 24 inches — the actual pipe could be anywhere within that zone. Using a tolerance zone mark as the positive location basis means the outrigger could be placed directly over the utility. OSHA requires positive location — the actual pipe position confirmed within a few inches — through hand excavation or ground-penetrating radar before outrigger loading near any utility.

15. A — Bearing pressure = $110,000 \div 2.25 \text{ sq ft} = 48,889 \text{ psf}$ — approximately 97 times the pier's 500 psf design loading. A timber pier on piles was designed for distributed cargo loads, not concentrated point loads. The pier deck slab and the piles beneath the outrigger position would both be subjected to loads dramatically beyond their design intent. An engineered timber mat or structural distribution system must be designed to spread the outrigger load across enough piles to stay within their rated capacity.

16. B — Runoff channels create voids beneath the outrigger mat where the mat bridges over the channel rather than bearing on the soil. The bearing area is reduced to only the portions of the mat that are actually in contact with the soil, concentrating the full outrigger load on a smaller area. This elevated bearing pressure at the contact zones may exceed the soil's capacity even if the full mat area would have been adequate. Filling the ruts restores full uniform contact.

17. B — A regular rectangular color anomaly in soil is inconsistent with natural soil variation, which is irregular. Regular shapes indicate human-made disturbances — trench backfill, removed vault or tank, buried structure, or filled excavation. All of these backfilled areas can have significantly lower bearing capacity than the surrounding undisturbed soil and require investigation before outrigger loading.

18. A — OSHA 1926.1402 requires ground conditions to be adequate throughout the crane's entire working area, and this includes the travel path between positions. During travel, the crane applies dynamic loads that may differ from static setup loads — the moving crane creates variable contact pressures, and the load path direction relative to the travel surface changes constantly. Underground utilities, overhead hazards, slopes, and surface bearing capacity along the travel path must all be assessed.

19. D — Asphalt is a thermoplastic material whose load-bearing stiffness is highly temperature-dependent. At 95°F ambient temperature, the asphalt surface temperature can reach 140°F or higher, making the binder viscous and easily deformed under sustained concentrated loading. Without cribbing

to distribute the load over a larger area, the outrigger pad bearing pressure on the hot asphalt will cause progressive sinking throughout the lift.

20. B — Established ant colonies — particularly of carpenter ants or fire ants — create tunnel networks extending to depths of 5 to 10 feet, with multiple branching galleries throughout the soil. These tunnels create voids that reduce the effective bearing area and create potential for sudden collapse. A large, well-established colony in the direct outrigger zone should prompt the operator to relocate the outrigger position to avoid the tunnel network.

21. A — Upward water seepage through the soil in dry conditions indicates that a pressurized subsurface source is forcing water upward — a broken main, pressurized irrigation line, or other pressurized source. This active pressurization is saturating the soil in the outrigger bearing zone from below, eliminating the soil's effective stress and bearing capacity in the affected area. This condition requires immediate operational stoppage and leak identification before any crane operations can resume.

22. D — A 0.3-degree progressive tilt toward the load during a 2-minute static hold is not normal structural deflection — structural deflection occurs immediately at pick and does not continue during a static hold. Progressive tilt during a hold indicates that the soil beneath one or more outriggers is consolidating or failing under the load. This is a precursor to potential bearing capacity failure and requires immediate load lowering and ground assessment.

23. B — Signal communication requires the signal person to be actively giving the signal and to have confirmed eye contact with the operator's response. A signal that was given and then the signal person turned away has not been completed — the signal person has not confirmed the operator saw it, and the signal person cannot monitor the resulting crane movement. The operator must wait for the signal person to re-engage with direct eye contact before executing any command.

24. B — An engine compartment fire in a hydraulic crane threatens both the fuel system and the hydraulic lines that route adjacent to the engine. As the fire grows, hydraulic hoses melt, releasing fluid that accelerates the fire dramatically. The window to lower the load and evacuate safely narrows rapidly — the operator must lower the load as the first action, then evacuate, not complete additional phases of the lift. The risk of being trapped in a burning cab exceeds the dropped load hazard.

25. C — Visual monitoring of the load throughout the lift is an operational requirement, not a preference. When the load enters a shadow area, the operator loses the ability to detect contact with obstacles, rigging disengagement, load tilt, or position inaccuracy. Supplemental lighting or a relay observer with clear sight to the load resolves the visibility gap while maintaining full operational

control. Using the signal person's general guidance without direct load visibility is not an authorized substitute.

26. B — OSHA 1926.1416 and ASME B30.5 both require immediate compliance with the STOP signal. There is no provision for completing a phase, dissipating momentum as a separate action, or exercising discretion about timing. The STOP signal requires immediate cessation of all movement — the operator's job is to stop as quickly as the mechanical system allows, not to evaluate whether a more graceful stop is possible.

27. D — Hydraulic oil temperature is a real-time operational constraint that directly affects the crane's ability to continue safe operations. Yellow zone temperature is a warning that must be communicated immediately to the lift director so they can plan a controlled descent before the temperature reaches the critical red zone. Personnel in a suspended platform cannot self-rescue — they depend entirely on the operator's ability to lower them safely, which may be compromised if the hydraulic system reaches critical temperature.

28. C — The lift plan specifies rigging configurations based on capacity calculations for each hitch type. A choker hitch has lower capacity than a basket hitch at the same sling angle and may reduce the applicable lifting capacity significantly. Changing from the specified rigging without confirming the new configuration's capacity against the planned load creates an unverified lift condition. The lift director must evaluate whether the choker hitch configuration is adequate before picking.

29. C — An LMI that functions intermittently is an unreliable safety device regardless of the pattern of malfunction. A load cell experiencing intermittent signal loss may produce inaccurate readings during critical loaded operations without triggering visible alarms. The pattern of alarms between lifts suggests a developing electrical or sensor issue that must be investigated and corrected before relying on the LMI for loaded operations.

30. A — OSHA 1926.1419 requires signal persons to be evaluated by a qualified evaluator who confirms they possess the required knowledge and skills — including knowledge of the applicable signal system, proper signal procedures, and safe communication protocols. This can be satisfied through an accredited third-party program or through an employer qualification program conducted by a qualified evaluator. The standard specifies performance-based qualification, not a specific credential type.

31. D — A momentary 101% LMI spike during load contact with the scaffolding indicates the crane was overloaded — the load contact created a lateral force on the crane simultaneously with the vertical hook load, producing a combined structural stress exceeding 100% of rated capacity. Structural damage can

occur in fractions of a second under overload conditions and may not be visually apparent. The crane must be inspected for damage before any further lifts.

32. B — Wind creates lateral force on the load that can cause it to drift in the direction of the wind or parallel to it, depending on the load's shape and orientation. At 12 mph, a load can experience several inches of lateral drift, which at 12 inches of total clearance represents a significant fraction of the available space. Tag line control is essential to maintain the load's lateral position during the approach and insertion.

33. C — ASME B30.5 grants the operator authority and responsibility to stop operations whenever an unusual condition is detected during a loaded lift. Unusual structural vibration during a lift is exactly the warning sign that precedes some catastrophic failures — a loose structural connection, a damaged chord, or an impending mechanical failure can all manifest as vibration before complete failure. Continuing while monitoring risks completing only part of the remaining time before failure.

34. A — When a crane traveling with a load passes over a 6-inch pavement lip, the impact creates a dynamic shock load on the crane's structure, tires, and the load path — the effective load can momentarily exceed the static load by a significant factor depending on travel speed. Even within the pick-and-carry rated load, the dynamic multiplier from the impact can push the actual structural loading above what the rated configuration assumes. Minimum speed and consideration of an alternative path are the correct responses.

35. D — Hydraulic cranes are equipped with spring-applied, hydraulically released brakes on all load-bearing functions. When the engine stalls and hydraulic pressure drops, the springs engage the brakes automatically — this is the design intent for exactly this failure scenario. The brakes hold the load stationary, allowing the operator to restart the engine and then carefully and deliberately lower the load to a safe landing position rather than experiencing an uncontrolled load descent.

36. B — OSHA 1926.1431 limits all personnel hoisting to a maximum of 50% of rated capacity. This limit is absolute — it cannot be exceeded regardless of whether the lift would also qualify as a critical lift under the 75% threshold. The personnel hoisting section's 50% limit supersedes any other capacity calculation for lifts involving personnel. A personnel hoisting lift at 76% of rated capacity would violate OSHA 1926.1431's explicit 50% maximum.

37. C — OSHA 1926.1419 and ASME B30.5 both establish that any person may give an Emergency Stop signal at any time and that the operator must comply immediately. A rigger shouting "HOLD!" represents a person communicating an urgent stop condition from within the working area — this is

functionally an emergency stop and requires immediate compliance regardless of whether the rigger is the designated signal person or using an official ASME signal.

38. A — Self-recognized fatigue impairment is a stop-work condition under OSHA's general duty clause and professional standards. An impaired operator creates a recognized hazard for all personnel in the work area — this is the highest-consequence safety decision the operator will make in their shift. The lift director's authority does not extend to directing an operator to continue when the operator has identified their own impairment.

39. D — A wind speed that increases from calm to 28 mph — approaching the operational limit — in a short period indicates an unstable atmospheric condition where further increases are plausible. The time available to complete a crane movement may be shorter than the time needed to complete it before the limit is exceeded. The operator must assess whether setting the load immediately is the safer choice compared to committing to a movement that may be caught mid-execution by a wind speed exceedance.

40. D — In a tandem lift, the load sharing between the two cranes is determined by the rigging geometry and the relative heights of each crane's attachment point. When one crane hoists faster, its attachment point rises relative to the other crane's point, shifting load toward the faster crane. The overloaded crane may exceed its rated capacity while the other crane's slings go slack — at which point the entire load transfers to one crane, instantly creating a severe overload condition.

41. C — The dedicated power line spotter's entire purpose is to provide a final barrier against power line contact. When the MSAD boundary is approached, the spotter must act immediately with their direct stop mechanism — not radio the lift director, not warn surrounding personnel, and not take any preparatory action before stopping the crane. The immediacy of the stop is the design intent and the requirement. Any delay in activating the stop increases the probability of contact.

42. A — Signal communication requires confirmed visibility of the load throughout all phases of the lift. When the signal person cannot verify clearance at a specific obstacle point, they cannot safely direct the load through that point. A relay observer specifically positioned to confirm clearance at the overhang provides the missing visual information and restores the confirmed communication chain. Operating on estimated clearance that the signal person cannot directly verify is not authorized.

43. D — ASME B30.5 requires each operator to perform a pre-shift inspection before operating the crane. This is an operator-specific, shift-specific requirement. Conditions can change between operators within a shift — components can loosen, leaks can develop, and ground conditions can change. The incoming operator must independently verify the crane's condition because they bear operational responsibility for it during their shift and cannot assume the previous operator's assessment is current.

44. C — OSHA 1926.1425 places the operational burden on everyone in the lift team — the lift director directs clearance, the signal person confirms it, and the operator must have confirmation before swinging. The operator cannot assume clearance without it — confirmation must be received through the signal person or through the operator's own direct observation before any movement over potentially occupied areas. Shared responsibility means no single party can waive the others' verification.

45. C — A 22,000-pound load swinging into contact with a structural beam creates an impact force that can be many times the load's static weight, depending on the swing velocity at the moment of contact. Rigging may have shifted, sling legs may have been notched by the contact, and the structural beam may have been deflected or cracked. Visual inspection by a qualified person is required before continuing because invisible damage from the impact may be present.

46. D — A boom-up command when the hook block is already near the boom tip creates a two-blocking risk — the increasing boom angle shortens the rope path from drum to tip, causing the hook block to rise without any hoist input. The operator must independently assess the hook block's height relative to the boom tip before executing any boom-up command, and must either confirm adequate clearance or lower the hook block first. The ATB provides backup protection, not primary protection, and should not be relied upon as the primary safeguard.

47. D — A gas fire near crane operations creates an escalating hazard — gas fires can quickly involve the crane's hydraulic fluid and fuel system. The operator must lower the load to the nearest safe surface in a controlled manner before evacuating. Dropping the load in free-fall is not authorized because evacuating personnel may be below the load path. Controlled lowering then evacuation is the correct sequence that protects both the operator and all personnel in the area.

48. B — ASME B30.5 requires the operator to remain at the controls at all times while a load is suspended. There are no exceptions — not for brief communication needs, not when the load appears stable, not when the drum pawl is engaged. The operator is the active safety control for the suspended load; their presence at the controls is required to respond immediately to any change in load condition, equipment malfunction, or environmental change during the hold.

49. A — A localized increase in rope diameter with compressed lay is the diagnostic indicator of fiber core failure — the core collapses at the failure point, allowing the outer strands to move inward and displacing material outward. This creates a pouch or bird-cage effect with an enlarged, distorted rope cross-section. This condition represents catastrophic internal structural damage requiring immediate removal.

50. A — ASME B30.26 Table provides angular loading reduction factors for shackles where the load is applied off the intended in-line axis. At 90-degree loading, the load acts perpendicular to the intended straight-pull direction, creating bending at the bow-pin interface and dramatically reducing the shackle's effective load capacity. The 70% reduction figure represents the capacity reduction from the rated straight-pull WLL that the angular loading produces.

51. C — A return line filter operating 1,900 hours beyond its change interval has been allowing contaminated hydraulic fluid to recirculate through the entire system. Hydraulic contaminants — metal particles from internal wear, seal fragments, and oxidation products — accumulate progressively and accelerate wear on every precision hydraulic component. At this level of filter overdue status, the fluid should also be analyzed to assess contamination levels that may indicate existing component damage.

52. D — Synthetic web sling materials — particularly nylon — lose significant tensile strength at elevated temperatures below the stated maximum rating. The maximum rated temperature is the absolute upper limit, not a point below which no derating applies. Manufacturer temperature derating tables typically show capacity reductions beginning at temperatures well below the maximum. At 165°F with a 180°F maximum, the actual derating table must be consulted to confirm the correct reduced capacity.

53. C — External oil contamination from a fitting failure introduces an unknown oil formulation onto the rope — one that may not be compatible with the rope's factory lubrication and may have different viscosity, film strength, and contamination-trapping properties. This external oil can flush out the factory internal lubricant that was applied to protect interior wire surfaces. The contaminated section should be examined and the source addressed before continued operations.

54. A — ASME B30.9 specifies that choker hitch derating begins when the choke angle decreases below 120 degrees from the body of the sling. At 90 degrees, the derating table specifies a capacity reduction to 70% of the standard choker WLL. This derating reflects the increased bending of the rope at the choke point, the greater force required to tighten the choke, and the reduced effective tensile capacity of the sling leg under these geometric constraints.

55. D — A score mark on a hydraulic cylinder rod is a repeating damage mechanism that destroys the rod seal on every stroke. The hardened metal edge of the score mark cuts the seal material as the rod passes through, creating a progressive leak that worsens with each cycle. Once the seal is cut, hydraulic fluid escapes past it, reducing the cylinder's holding capacity. The rod must be removed and professionally re-finished before the cylinder can be returned to service.

56. B — Pitting on previously corroded wires indicates that the corrosion has progressed from surface oxidation to metal removal — the wire's cross-section has been reduced at the pit locations. A monitoring protocol established 6 months ago at the initial "some corroded wires" finding must be upgraded to a qualified person assessment now that pitting is confirmed, because pitting is a specific removal criterion indicator under OSHA 1926.1413 and ASME B30.5.

57. C — Chain link notching creates stress concentration points where the chain must carry its maximum tension during loading. The notch acts as a crack initiation site — when the chain is loaded, the stress at the notch bottom is amplified by the notch geometry and can exceed the material's fracture toughness at loads well below the chain's nominal rated capacity. Chain links with notches must be removed from service immediately.

58. D — A sudden 2-foot load drop and re-arrest creates an impact load many times the static load weight — the dynamic force = load × (drop distance factor). This impact is transmitted through every component in the load path from the payload to the boom tip. Kinks, wire breaks, deformation, and internal strand damage may have been created in a fraction of a second. A qualified inspector must assess the rope and rigging before operations continue.

59. C — Rated speed defines the maximum allowable operating speed — it does not imply this is the appropriate speed for all operations. Near-capacity lifts benefit significantly from minimum controlled speeds, which reduce dynamic loading during acceleration and deceleration, improve the operator's precision of control, and minimize the impact loads when the load's movement is arrested. Maximum speed at maximum capacity creates the highest dynamic loads in the system.

60. D — An uncontrolled brake engagement during lowering without operator input indicates the hoist brake is responding to an internal condition rather than operator command — potentially contamination causing brake drag, a failing hydraulic brake release circuit, or a worn brake component that partially engages from self-energization. This behavior is unpredictable and can escalate — at a heavier load or greater height, an uncontrolled brake engagement could cause structural shock loading or abrupt load deceleration creating personnel hazards.

61. C — OSHA 1926.1413 requires immediate removal of any rope that has been in contact with an energized conductor. Electrical current passing through high-carbon steel wire rope heats the steel and can alter its metallurgical temper, reduce ductility, fuse wires together at contact points, and create invisible internal damage. No inspection method can reliably confirm structural integrity after electrical contact — replacement is the only authorized response.

62. A — For 3/4-inch rope, one lay length is approximately 4.5 to 5 inches — the 4 crown wires and 1 valley break total 5 broken wires within approximately a 12-inch section, which likely contains 2-3 lay lengths. Even if not all 5 breaks are within a single lay length, valley breaks are an independent removal criterion — any valley break requires removal from service regardless of total break count. Multiple criteria are triggered simultaneously by this combined condition.

63. D — A sound occurring at only one specific rotational position rules out continuous mechanical causes like bearing noise or hydraulic pressure variation, which would be uniform throughout rotation. A position-specific sound indicates a discrete physical condition at that angular location — most likely a damaged gear tooth on the slewing ring that produces an impact each time it contacts the swing drive pinion. This requires investigation before the condition progresses to tooth fracture and sudden swing drive failure.

64. B — Increased boom deflection at similar loads indicates the boom's structural stiffness has decreased — which can only occur if a structural element has been compromised. Damaged chord members, missing or broken lateral bracing, or a failed pin connection all reduce the boom's moment of inertia and increase deflection at equivalent loads. This is a critical early warning of developing structural failure that must be investigated before the next lift.

65. C — ASME B30.10 defines heavy service as 50 or more lifts per day and requires daily inspection of hooks at this frequency. High-cycle usage accelerates fatigue accumulation in hook material — a hook experiencing 50 or more lifts daily accumulates the fatigue equivalent of weeks of normal service in a single day. Daily inspection by a qualified person ensures that fatigue-initiated cracks or deformations are caught before they progress to fracture.

66. A — OSHA 1926.1416 requires that the crane's rated capacity information be confirmed available and applicable before beginning operations. The correct load chart must be in the cab, readable, and specific to the crane's serial number and current configuration. A chart from a different serial number or a previous configuration is not valid even if it appears similar.

67. D — A crane's load line passing within the MSAD of an unconfirmed power line without first establishing the applicable MSAD is a direct OSHA 1926.1407 violation. The operator must stop all movement and confirm the voltage before any crane movement relative to the conductor. Even the movement needed to withdraw from the area must be planned based on the confirmed MSAD.

68. B — When a lift plan changes during execution — including rigging configuration changes — the change must be evaluated by the lift director before proceeding. The lift plan's rigging specification was

part of the capacity calculation; a different hitch type may have different capacity and changes the load's orientation. The operator's role is to ensure the change is authorized and confirmed adequate before picking.

69. C — An LMI alarm during no-load movement is an anomaly that indicates a developing instrumentation issue. The LMI's reliability during loaded operations cannot be confirmed when it is showing abnormal behavior between lifts. Crane operations that rely on the LMI for capacity confirmation must not continue with a demonstrably malfunctioning LMI.

70. A — OSHA 1926.1419 requires signal persons to be evaluated by a qualified evaluator who confirms they possess knowledge of hand signals, proper signal procedures, and the ability to direct crane operations safely. The evaluation may be conducted through an accredited third-party program or through an employer-conducted program led by a qualified evaluator. The standard focuses on demonstrated competency rather than mandating a specific credential format.

71. C — Conservative approach: next larger tabulated radius beyond 31 feet = 35 feet, capacity = 27,800 lbs. Total suspended weight = $28,000 + 1,600 + 480 + 120 = 30,200$ lbs. Since 30,200 lbs exceeds 27,800 lbs, the lift cannot proceed using the conservative approach at 31 feet of radius. The operator must either reduce the total suspended weight or reconfigure the crane to achieve higher capacity at 31 feet.

72. A — Conservative approach: next larger tabulated radius beyond 32 feet = 35 feet, capacity = 17,800 lbs. Total suspended weight = 19,400 lbs. Since 19,400 lbs exceeds 17,800 lbs, the lift cannot proceed in the 75% extension configuration using the conservative approach. Lift percentage = $19,400 \div 17,800 \times 100 = 109\%$ — confirming the lift is 9% above the conservative capacity limit.

73. C — The note provides an explicit derating factor (0.85) for swing speeds above 1.5 rpm — meaning the manufacturer has specifically analyzed and authorized this configuration with the reduced capacity. Derated capacity = $28,400 \times 0.85 = 24,140$ lbs. This is not a prohibition but a binding derating condition that establishes what the crane may carry at the higher swing speed.

74. A — Linear interpolation between 30 and 35 feet: capacity decrease = $38,400 - 30,200 = 8,200$ lbs over 5 ft = 1,640 lbs/ft. At 33 ft (3 ft beyond 30 ft): $38,400 - (3 \times 1,640) = 38,400 - 4,920 = 33,480$ lbs. This is confirmed interpolated capacity. The conservative approach would use 30,200 lbs at 35 ft, but when interpolation is specifically used, the 33,480-lb value applies.

75. D — ASME B30.5 prohibits crane modifications unless approved by the manufacturer. A field-fabricated pipe jib represents an unapproved modification that has not been structurally analyzed for load path compatibility, deflection behavior, or structural adequacy. The load chart section cannot apply to this attachment since it was derived for the manufacturer's standard jib only. The attachment must be removed before any crane operations.

76. B — Conservative approach: next larger tabulated radius beyond 53 feet = 55 feet (the maximum rated radius), capacity = 9,800 lbs. Total suspended weight = 10,200 lbs. Since 10,200 lbs exceeds the conservative capacity of 9,800 lbs by 400 lbs, the lift cannot proceed using the conservative approach in this configuration at 53 feet of radius. The conservative approach uses the 55-foot entry even for a 53-foot operating radius.

77. B — The note explicitly provides a derating factor (0.60) for 3-outrigger configurations, making it a manufacturer-rated alternative configuration rather than an unauthorized setup. Derated capacity = $32,600 \times 0.60 = 19,560$ lbs. All lifts must stay within this derated value. The note transforms what would otherwise be an unrated configuration into a rated one with specific capacity limits.

78. A — Any lift exceeding 75% of rated capacity is a critical lift under OSHA 1926.1408. At 96.2% of rated capacity — regardless of whether the capacity was tabulated or interpolated — a written critical lift plan and pre-lift meeting are required. The 75% threshold applies to the actual capacity being relied upon for the lift, and 96.2% clearly exceeds it.

79. D — Structural-limited cells at near-design-limit stress require that dynamic loading be minimized because structural limits do not include reserve for dynamic loading the way stability limits do. At 97%, only 3% of structural reserve exists for dynamic additions. No crane function — not boom up, not swing acceleration, not combined multi-function operation — should create additional structural stress on top of the near-limit static load. This is not a preference — it is a binding operational requirement.

80. B — The note explicitly states the 360-degree section values apply for all boom positions including over front. This eliminates the ambiguity about whether to switch to a different directional section during the swing. Following the note prevents operators from mid-lift section changes that could create capacity inconsistencies. The note is a binding clarification of section applicability.

81. C — Conservative approach: next larger tabulated radius beyond 42 feet = 45 feet, capacity = 16,600 lbs. Total suspended weight = 18,400 lbs. Since 18,400 lbs exceeds 16,600 lbs by 1,800 lbs, the lift cannot proceed using the conservative approach in this configuration. The blank at 50 feet defines the maximum rated radius as 45 feet — and even that value doesn't support the planned load.

82. B — The note's requirement for independent verification specifically means a second person performing their own calculation — not reviewing the first person's work. Independent verification requires starting from the individual component weights and calculating the total separately. The lift director who performed the original calculation cannot verify their own work as "independent." A second qualified person must produce a matching result before the lift may begin.

83. C — Lift percentage = $8,000 \div 8,200 \times 100 = 97.6\%$. The blank at 55 feet confirms 50 feet is the absolute maximum rated radius — there is no capacity beyond this boundary. At 97.6% with no rated envelope extension available, any radius increase during the lift immediately moves the operation outside all rated capacity values. Centrifugal displacement, boom deflection, or wind can each create a 1-2 foot radius increase, making precise radius management critical throughout this lift.

84. C — When the crane is out-of-level in two perpendicular axes simultaneously, the resultant out-of-level is the vector combination: $\sqrt{(0.2^2 + 0.28^2)} = \sqrt{(0.04 + 0.0784)} = \sqrt{0.1184} = 0.344\%$. The resultant 0.344% exceeds the note's 0.3% requirement. Each axis individually appearing within tolerance is not sufficient — the combined effect in the diagonal direction produces the actual maximum out-of-level condition that the note's limit is designed to control.

85. C — In a boom-angle organized load chart where capacity increases with angle, the conservative approach uses the next smaller tabulated angle — the angle with lower capacity. At 63 degrees (between 60° and 65° entries), the conservative bounding value is the 60-degree capacity of 31,200 lbs. This ensures that any angle measurement error or actual angle below 63 degrees will not push the lift beyond a confirmed tabulated capacity.

86. B — A footnote directing the user to an engineer's note is a binding condition attached to that specific capacity value. The engineer's note may contain structural restrictions, additional confirmation requirements, or operational limitations that modify how or when the value may be used. Using the capacity value without reading the note means using it without satisfying all its stated conditions — the engineer's note must be located and complied with before the cell can be used.

87. D — The compliant options when conservative capacity is insufficient are: (1) reduce the operating radius to a position where the conservative capacity supports the total suspended weight — at 40 feet the conservative capacity is 26,400 lbs (using 40 ft itself), well above the 22,000 lb total; (2) reduce the total suspended weight to below 21,200 lbs; or (3) use a longer boom configuration that may show higher capacity at 43 feet. None of these involve ignoring or extending the conservative limit.

88. D — The single-part line note specifically limits hook loads for single-part line configurations — it does not apply to 2-part line operations. With 2-part line, the applicable capacity is the tabulated gross capacity of 28,600 lbs. The 22,000-lb total suspended weight is well within this capacity. Notes that specify their application by reeving configuration apply only to that configuration.

89. C — The LMI must be configured to match the actual installed counterweight because it uses the counterweight configuration as the input to select the appropriate capacity values for percentage calculations. The maximum counterweight LMI configuration would show lower capacity values than the actual medium counterweight capacity, displaying higher percentages than the actual situation warrants and potentially stopping operations prematurely. Only the matching configuration provides accurate real-time capacity percentage information.

90. A — Conservative approach: next larger tabulated radius beyond 22 feet = 25 feet, capacity = 41,800 lbs. Total suspended weight = 48,000 lbs. Since 48,000 lbs exceeds 41,800 lbs by 6,200 lbs, the lift cannot proceed using the conservative approach in this configuration. The stability-limited designation means this configuration is already at the tipping threshold at the tabulated value, making the conservative approach's lower bound critically important.

91. A — The blank at 55 feet establishes the maximum rated radius as 50 feet. After the boom-down moves the operating radius to 52 feet, the crane has exceeded its maximum rated radius — there is no capacity value at 52 feet. The crane must immediately boom back up to return within the 50-foot rated envelope. The conservative capacity at 50 feet (14,400 lbs) is also insufficient for the 17,100-lb load — a compound problem confirming the boom-down was not authorized.

92. C — The load chart note requires confirmation that the boom is free of ice — a specific verified condition, not a general visual check. Ice on a boom at height in winter conditions is real and common, and the consequences include additional structural loading from ice weight and sudden falling ice hazards. A ground-level visual inspection at night or in poor visibility cannot confirm the absence of ice on a 100-foot boom. A physically adequate inspection must be performed.

93. C — The pick-and-carry capacity is reduced from the stationary lift capacity to account for the additional overturning moments created during travel. When the crane moves, acceleration and deceleration create inertial forces, uneven surfaces create dynamic tilting, and turning creates centrifugal effects — all of which add to the overturning moment beyond the static lift condition. The 50% reduction provides the stability margin needed to survive these dynamic travel loads without tip-over.

94. A. Changing the jib offset angle from 30 to 25 degrees changes the operating configuration — the 30-degree offset section was derived for the 30-degree geometry and its capacity values do not apply at 25 degrees. The operator must find the applicable 25-degree section and re-verify capacity before any further lifts. Using the 30-degree section for a 25-degree configuration applies capacity values from a different structural geometry.

95. D — A 2-foot lateral displacement from 35 feet increases the effective operating radius to approximately 37 feet. Using the conservative approach at 37 feet, the governing capacity is the 40-foot tabulated value. At 93.7% of the 35-foot capacity, the load is near the capacity level — if the effective radius reaches or exceeds 40 feet, the conservative capacity at that point may not support the total suspended weight. Immediate swing speed reduction minimizes further centrifugal and wind-induced displacement before the effective radius reaches the critical boundary.

Specialty Exam Simulation 9 — 65 Questions

SITE DOMAIN — Questions 1–15

1. A crane operator is evaluating a setup location at a power generation facility. The planned outrigger area is on a reinforced concrete equipment pad that was designed for turbine generator loading — distributed loads of 800 psf. The maximum outrigger float is 18 inches × 18 inches (2.25 sq ft) and the maximum outrigger reaction load is 96,000 lbs. What is the bearing pressure and what does the comparison to the 800 psf design rating reveal?

A. Bearing pressure = 42,667 psf — adequately distributed by the reinforced concrete pad structure

B. The reinforced concrete pad handles all point loads up to the crane's rated capacity without special consideration

C. Bearing pressure = 42,667 psf — the generator turbine load rating of 800 psf is adequate since it was engineered for heavy equipment

D. Bearing pressure = $96,000 \div 2.25 = 42,667$ psf — this is approximately 53 times the 800 psf design loading; this dramatically exceeds the pad's design capacity for the small outrigger contact area; a structural engineer must evaluate whether the reinforced pad can redistribute this concentrated point load before crane setup proceeds

2. A crane is being positioned at a construction site when the operator discovers that a temporary shoring system — steel soldier piles and lagging — has been installed directly beneath the planned right rear outrigger position to support an adjacent excavation wall. The shoring extends from the ground surface

to 20 feet of depth at 2-foot intervals. What concern does the shoring system create for outrigger support?

- A. Temporary shoring systems are structural elements that improve bearing capacity at any adjacent outrigger position
- B. The outrigger load applied above the shoring system will be transferred into the shoring piles — the shoring was designed for lateral earth pressure loads, not for the vertical and lateral loads from a crane outrigger; if the shoring system is not designed to carry crane loads, its structural adequacy may be exceeded; the shoring designer must evaluate the proposed outrigger loading before setup proceeds
- C. The shoring system creates a rigid bearing surface that is ideal for crane outrigger support
- D. A minimum 10-foot setback from any temporary shoring system is required for all crane outrigger positions

3. Under OSHA 1926.1402, when a crane will operate on a site that has previously been identified in the subsurface investigation as having contaminated soil requiring remediation, what specific obligation applies to the crane employer?

- A. The crane employer must obtain information from the controlling entity about the extent and nature of soil contamination, any remediation work performed, and whether the remediated areas have been confirmed adequate for crane loading — remediated soil may have different bearing capacity than native soil and the crane employer cannot assume the pre-remediation soil assessment applies to post-remediation conditions
- B. The crane employer must obtain an environmental clearance permit before operating on contaminated or remediated soil
- C. The crane employer has no specific obligation regarding soil contamination — only the environmental contractor bears responsibility for contaminated site conditions
- D. The crane employer must avoid all areas within 50 feet of any contaminated soil designation

4. A crane operator is evaluating a setup area where the surface is a membrane-covered ballasted roof. The building roof is accessible for the crane setup, and the roof membrane is covered with 4 inches of ballast gravel over insulation board over the structural roof deck. What concern does this rooftop setup create?

A. Membrane roofs are always adequate for crane outrigger loading since they are designed for maintenance equipment

B. Nothing — the 4 inches of gravel ballast provides adequate distributed support for crane outriggers

C. The layered rooftop system — ballast over insulation over membrane over deck — has multiple components that must be evaluated; the insulation board provides essentially no structural contribution; the structural roof deck carries the load; the outrigger must be positioned over a structural support point (beam or column) and the deck must be confirmed adequate for the point load; a structural engineer must review the rooftop loading before any crane setup proceeds

D. Nothing — rooftop cranes are exempt from OSHA 1926.1402 ground condition requirements since they operate above grade

5. A crane is set up and operating when a foundation contractor begins driving sheet piles 30 feet from the crane's left front outrigger using a hydraulic hammer. The sheet pile driving has been ongoing for 2 hours and the crane has been operating without issue during this time. After a particularly hard blow, the operator observes that the crane's level indicator has shifted 0.2% toward the pile driving side. What does this level change indicate and what action is required?

A. A 0.2% level change is within normal operational tolerance — no action is required

B. The level change confirms the pile driving vibration has densified the soil and the crane has fully consolidated — monitoring only is required

C. The level change is caused by wind loading on the boom and is not related to the pile driving

D. The 0.2% level shift after the hard blow indicates that the pile driving vibration has caused ground movement or outrigger settlement adjacent to the driving operation — even if still within the manufacturer's 0.5% tolerance, a progressive level change during operations warrants investigation; the crane must be re-leveled and the outrigger conditions at all positions confirmed before continuing

6. Under OSHA 1926.1407, what must happen before crane operations can begin on a new day at a job site where power lines were positively identified and the applicable MSAD was established on the previous day?

A. Nothing — the previous day's power line assessment remains valid throughout the project

B. Before beginning crane operations each day, the operator must re-verify that the conditions established in the previous day's power line assessment still apply — specifically confirming the power line locations have not changed, the MSAD controls are still in place, and all control measures from the previous day's plan remain active and functional

- C. A new utility contact is required every morning to re-confirm line voltage
- D. A new written encroachment prevention plan must be completed each morning before operations begin

7. A crane is being set up on a construction site when the ground crew confirms that a dewatering system has been running for 3 days to lower the water table in the setup area. The original water table was at 3 feet below the surface; after 3 days of dewatering, the water table has been drawn down to 12 feet. What effect does this dewatering have on bearing capacity?

- A. Lowering the water table increases the effective stress in the soil above the water table level — as the water table drops, the soil previously subject to buoyancy forces must now carry its own weight without water pressure reduction; this typically increases bearing capacity in the dewatered zone by increasing effective confining stress; however, the dewatering system's continued operation must be confirmed before and during crane operations
- B. Dewatering reduces bearing capacity by removing the water that supports soil particle bonding
- C. The dewatering only affects the area immediately around the dewatering wells — no significant change in bearing capacity occurs at the crane setup positions
- D. The bearing capacity improvement from dewatering is temporary — it must be re-evaluated every 24 hours

8. A crane is operating on a paved parking structure — the second level above grade. The structure was built in 2005 and the original design drawings are available showing the structural design. What specific information from the drawings must be confirmed before crane setup?

- A. The crane can operate on any level of any parking structure as long as the crane's total weight does not exceed the posted vehicle weight limit
- B. Nothing specific from the drawings is needed — the structure's age and code compliance confirm adequacy
- C. The structural drawings must be used to confirm the rated floor loading capacity at the specific bay locations where the outriggers will be positioned, the locations of structural beams and columns that can carry the outrigger point loads, and whether the deck's beam-and-column system was designed for the concentrated crane outrigger loads; a structural engineer may need to evaluate the drawings to confirm the deck can safely carry the specific outrigger reaction loads
- D. The parking structure's posted vehicle weight limit is the only required confirmation before crane operations begin

9. A crane is set up at a construction project when a flash flood warning is issued for the area. The site is in a low-lying location near a creek. The current weather shows no rain but the storm is 15 miles upstream. What action should the operator take?

- A. Continue operations since no rain is currently falling at the site
- B. Sound the horn to alert site personnel and continue monitoring the weather forecast
- C. The flash flood warning is an advisory — wait for an official evacuation order before stopping operations
- D. Stop crane operations, lower all loads, and move the crane to higher ground immediately if possible — a flash flood warning for an upstream area means rapidly rising water can arrive at the site with little or no warning; the crane on a low-lying site can be swept away or have its outrigger support undermined within minutes of water arrival; evacuation is the only safe response

10. Under OSHA 1926.1402, what does the term "firm, drained, and graded" mean for ground conditions, and which condition is often inadequately evaluated at construction sites?

- A. "Firm" means visible compaction, "drained" means no standing water visible, and "graded" means the surface is level — these are visual standards that any observer can confirm without special knowledge
- B. "Firm" means confirmed bearing capacity adequate for the specific crane loads; "drained" means the soil water table and moisture content do not reduce the capacity below what is required; "graded" means sufficient slope to drain surface water away; the drainage condition is most frequently inadequately evaluated because operators often confirm absence of standing water without verifying that the drainage path remains intact and that subsurface moisture content is acceptable
- C. "Firm, drained, and graded" is a general description that applies only to natural soil — paved and engineered surfaces are exempt from this requirement
- D. These conditions only apply at the initial site setup — ground condition monitoring during operations is not required under OSHA 1926.1402

11. A crane is set up on a job site when the operator notices that the surface of the ground under the left rear outrigger mat has changed color from a light tan to a darker brown over the course of the shift. The surface has not been wet from precipitation. What does progressive darkening of the soil surface under a loaded mat during a dry shift most likely indicate?

- A. The color change is caused by the mat compressing the soil and improving its density — darker color indicates higher compaction

B. Progressive darkening of dry soil under a loaded mat during a dry shift may indicate that pore water is being squeezed upward from depth under the load's pressure — this indicates the soil is under stress approaching its capacity and the load may be approaching or exceeding the soil's long-term bearing capacity; the mat position should be inspected and the condition evaluated before continuing operations

C. The color change is caused by the mat shading the soil from sunlight — no bearing capacity concern is implied

D. The darker color indicates the soil is drying out and improving its bearing capacity as operations continue

12. A crane is operating near a river bank. The operator has confirmed the bank soil is dense silty clay with 3,600 psf bearing capacity 8 feet from the water's edge. During operations, the river level rises 2 feet due to an upstream release from a dam 6 miles away. What does the 2-foot river level rise create for the bank soil conditions?

A. A 2-foot rise in river level has negligible effect on the bearing capacity of dense silty clay at 8 feet from the water's edge

B. Nothing — dam releases are controlled events and the water level rise is predictable

C. The 2-foot rise in river level increases the water pressure acting on the bank soil from the river side — this increase in hydrostatic pressure reduces the effective stress in the bank soil and can significantly reduce its shear strength and bearing capacity; the bank bearing capacity of 3,600 psf that was assessed at the previous water level may no longer apply; operations must stop for re-evaluation

D. Dense silty clay is impermeable and water level changes do not affect its bearing capacity

13. Under OSHA 1926.1402, who bears the controlling entity's ground preparation obligation when the controlling entity is also the crane owner — when the same company owns both the construction site and the crane?

A. The obligations of crane owner and controlling entity are separate even if held by the same company — the company must fulfill both roles' requirements; as controlling entity, it must provide ground preparation and information; as crane owner, it must ensure the crane is in proper condition; being the same company does not eliminate or combine these separate regulatory obligations

B. When the same company is both controlling entity and crane owner, only the crane owner obligations apply

C. When the same company owns both the site and the crane, all regulatory obligations rest with the operator

D. When the controlling entity is also the crane owner, the obligation transfers entirely to the crane operator

14. A crane operator is setting up at a job site and the superintendent states: "We just finished compacting the subgrade for the new driveway — you can set up anywhere in that area." The subgrade compaction was completed 3 hours ago. What must the operator confirm before relying on the newly compacted subgrade?

A. Ask the superintendent if the compaction was done by a certified contractor

B. The compaction test results — including compaction level achieved, soil type, and target density — must be confirmed by a qualified source, and these results must show the compacted subgrade meets the bearing capacity required for the specific crane outrigger loads; verbal assurance from a superintendent is not a ground condition confirmation under OSHA 1926.1402

C. Accept the superintendent's assurance since they bear the controlling entity responsibility

D. Wait 24 hours after compaction before allowing any crane loading on newly compacted subgrade

15. A crane is set up at a job site adjacent to a recently completed underground parking garage. The roof of the parking garage runs beneath the setup area at 4 feet of depth. The roof was designed for 300 psf loading based on a future landscaped park on top of it. The maximum outrigger reaction load is 88,000 lbs and the outrigger float is 18 × 18 inches (2.25 sq ft). What must be done?

A. The parking garage roof structure is designed for significant loads and can support any crane operation

B. Nothing — underground structures at 4 feet of depth are outside the influence of surface crane loads

C. Place the maximum available cribbing thickness above the garage roof to bridge over the structure and spread the load

D. A structural engineer must evaluate whether the parking garage roof — designed for 300 psf distributed landscape loading — can support the concentrated outrigger point load of $88,000 \div 2.25 = 39,111$ psf; this is over 130 times the roof's rated distributed load; no crane operation may proceed over the garage roof without specific engineering confirmation that the roof structure can carry the outrigger point load

OPERATIONS DOMAIN — Questions 16–30

16. A crane operator is performing a lift when the crane's swing function slows significantly but does not stop — the swing speed drops to approximately 20% of normal without any operator input change. The load is at 18 feet of height mid-swing. What does sudden unexplained loss of swing speed indicate and what action is required?

- A. The swing motor is experiencing a normal load-response reduction — increase the swing control input to compensate
- B. Nothing — swing speed variations during crane operations are expected in changing wind conditions
- C. Sudden swing speed reduction without operator input suggests a hydraulic issue in the swing circuit, a swing motor problem, or a mechanical resistance in the swing drive — the operator must stop the swing immediately and investigate the cause; completing the swing at reduced speed masks the developing problem and prevents proper evaluation; the load must be set in the nearest safe position
- D. The reduced swing speed indicates the LMI is limiting swing speed due to the operating radius — continue at the reduced speed

17. Under OSHA 1926.1431, what must the crane operator do if, during a personnel hoisting operation, the operator observes that the load line is twisting under the suspended platform while personnel are aboard?

- A. Nothing — minor load line twist during personnel hoisting is a normal operational condition
- B. Lower the platform to the nearest available landing and address the twist before resuming
- C. Continue the operation while contacting the lift director about the twist condition
- D. Stop the hoist immediately and lower the personnel platform to the ground at the earliest safe opportunity — load line twist during personnel hoisting indicates torsional loading in the rope that can unscrew hardware, rotate the platform into obstacles, and accumulate stored rotational energy that releases suddenly; personnel must be returned to the ground before operations continue

18. A crane operator is performing a tandem lift with another crane. During the coordinated pick, the lift director radios both operators simultaneously: "HOLD — do not move." Both operators apply their respective holds. After 12 minutes of holding, the lift director instructs the operators to slowly lower together in coordination. During the coordinated lowering, one operator's radio battery dies. What must happen?

- A. Continue the coordinated lowering — both operators already received the lower command
- B. The operator whose radio died must immediately stop lowering and hold their position until radio communication is re-established — in a tandem lift, continuous communication is required throughout all coordinated movements; proceeding without confirmed continuous communication between all parties and both operators creates risk of uncoordinated movement that could overload one crane
- C. The operator with the functioning radio must lower their share to the ground and hold while the other operator replaces the battery
- D. The lift director should observe the operation visually and use hand signals to replace the radio communication

19. A crane operator is asked to hoist a load to a maximum height of 42 feet — the roof of a building under construction. As the load approaches 40 feet of height, the operator observes that the ATB weight has risen and the ATB cable is becoming taut. The hook block is approaching the boom tip. What does this indicate and what must the operator do?

- A. Stop the hoist immediately — the hook block is approaching the boom tip and approaching the two-blocking condition; the ATB activation is providing the pre-warning that the system was designed to give; the operator must lower the hook block to create adequate clearance below the boom tip before any further hoisting; the planned lift height may require a longer reach with the current reeving
- B. Continue the hoist since the ATB has not yet activated
- C. The ATB cable tension is caused by the hook block weight pulling the ATB cable taut — it is normal behavior that does not require stopping
- D. Increase hoist speed to complete the hoist before the ATB fully activates

20. A crane operator is performing a critical lift at 88% of rated capacity. During the swing to the set location, the LMI reading climbs steadily from 88% to 95%. No boom movement or configuration change was made. What is the most likely explanation for this reading increase?

- A. The LMI sensor is malfunctioning — readings increase during swing movements due to vibration interference
- B. The hoist brake is partially engaging during the swing, adding to the measured load on the hoist circuit
- C. The centrifugal force from the swing is displacing the load outward from beneath the boom tip, increasing the effective operating radius — at a greater effective radius, the same load weight represents

a higher percentage of the lower capacity; the operator must reduce swing speed to minimize centrifugal displacement

D. The LMI reading naturally adjusts to account for swing momentum — the increase is a calibration response, not a real capacity change

21. A crane is performing a lift when the operator receives a STOP signal. The load is at 12 feet of height. After the STOP, the operator holds the load stationary for 8 minutes with no further signals and no communication from the signal person. What action should the operator take?

A. Continue holding indefinitely — the STOP signal means hold until a new signal is given

B. Lower the load to the ground and await further instructions

C. Sound the horn twice to request a signal from the signal person

D. Initiate radio contact to determine the reason for the extended hold and whether a different response is required — 8 minutes without communication after a STOP signal raises concern that the signal person may have encountered an issue requiring the operator's attention; the operator must determine whether to continue holding or whether the situation requires an alternative response

22. Under OSHA 1926.1416, when must a crane operator refuse to execute a signal from the designated signal person?

A. Never — the designated signal person has full authority over all crane movements

B. When executing the signal would require exceeding the crane's rated capacity, create a condition that the operator knows to be unsafe, or when the operator is uncertain what the signal means — the operator retains independent safety authority and responsibility regardless of the signal person's authority; refusal in these circumstances is both permitted and required

C. Only when the LMI alarm is sounding at the time the signal is given

D. Only when the lift director has explicitly prohibited the movement being signaled

23. A crane is performing a lift when the rigger attaches a tag line to the load. The tag line runs from the load across the ground to a worker 40 feet away. During the hoist, the tag line becomes taut as the load rises and the worker is suddenly lifted off the ground approximately 12 inches by the tag line's tension before releasing. No injury occurs. What must happen before operations resume?

A. Immediately stop all crane movement, lower the load to the ground, and have the tag line procedure re-evaluated — a tag line that lifts a worker indicates the worker was wrapped around or otherwise entangled with the line rather than holding it; this near-miss must be investigated, corrective procedures established, and all personnel briefed on safe tag line handling before lifting continues

B. Continue the lift since the worker released the tag line and was not injured

C. Sound the horn to warn all personnel and continue the lift at minimum speed

D. The lift director must confirm the tag line procedure is correct before continuing

24. A crane is performing a lift at 91% of rated capacity in conditions with sustained 18 mph winds and gusts to 24 mph. The crane's general operational limit is 30 mph. The load is a hollow structural tube bundle that has a large combined surface area. What evaluation must the operator make that goes beyond the general wind limit?

A. Nothing — 24 mph gusts are within the 30 mph general limit and no further evaluation is needed

B. The operator must confirm the signal person can maintain communication above 20 mph winds

C. The operator must request that the lift director calculate the net sail force on the bundle before proceeding

D. The general wind limit was established for compact loads — a hollow structural tube bundle with large combined surface area creates far greater wind force than a compact load of equivalent weight; at 91% of rated capacity with 18 mph sustained wind and 24 mph gusts, the wind-induced lateral forces on this bundle may create structural loading that exceeds the boom's lateral design capacity even at speeds below the general limit; the operator must specifically evaluate whether the wind force on this specific load is within acceptable limits

25. A crane is performing a lift when the ground crew reports that a worker inadvertently entered the counterweight swing zone while walking between two work areas. The worker has exited the zone safely. The crane is in the middle of a slow swing at 3 feet per second with the load at 10 feet of height. What must the operator do?

A. Continue the swing since the worker has already exited the zone safely

B. Sound the horn to warn any remaining personnel in the area and complete the swing at minimum speed

C. Contact the lift director for authorization before deciding whether to stop

D. Stop all crane movement immediately — a counterweight zone breach requires operations to stop and a complete zone clearance confirmation before any movement resumes; the immediate past breach does not confirm the zone is currently clear, and the swing must stop until the lift director and operator can confirm all persons are clear of the entire counterweight rotation path before resuming

26. Under OSHA 1926.1416(d), what is the specific barrier requirement for the crane's counterweight swing arc that makes this requirement distinct from general exclusion zone requirements?

A. The counterweight arc requires flagging at 3-foot intervals — closer spacing than the 10-foot intervals for general exclusion zones

B. The counterweight swing arc must be physically barricaded with barriers sufficient to prevent entry — the counterweight poses a specific struck-by hazard from an unexpected direction relative to the load path; many workers focus on the load's path and direction and are unaware the counterweight is swinging in the opposite direction; physical barriers provide protection against this specific hazard regardless of worker awareness

C. The counterweight arc requires a dedicated spotter who warns personnel verbally before each swing

D. Counterweight arcs only require barricading when the crane operates above 85% of rated capacity

27. A crane operator completes a shift involving 18 lifts at configurations ranging from 72% to 94% of rated capacity. The relief operator's pre-shift inspection identifies that the load cell cable has a fresh abrasion mark — the outer insulation is cut through and bare wire is visible. What must the relief operator do?

A. Document the finding and inform maintenance — the crane may continue operating since the LMI has been functioning normally throughout the previous shift

B. Nothing — the LMI functioned correctly through the previous shift confirming the cable damage is cosmetic

C. The crane must not be operated until the LMI load cell cable is repaired — an exposed wire in the LMI load cell circuit can produce erratic or zero load readings, causing the operator to have no confidence in the displayed capacity percentage; at near-capacity lifts, a malfunctioning LMI is a safety device failure requiring immediate correction

D. Apply electrical tape to the exposed wire as a temporary repair before starting operations

28. A crane is performing a series of picks when the operator notices that the rope is running over the edge of a groove on one of the lower block sheaves instead of tracking in the groove center. The rope

appears to be riding on the sheave flange. What condition does rope-over-flange running indicate and what action is required?

- A. Nothing — ropes naturally shift position on sheave grooves during operations and self-correct
- B. Nothing — ropes may contact sheave flanges briefly during pick and set operations without consequence
- C. Rope tracking over the sheave flange rather than in the groove indicates the fleet angle is incorrect or the rope has jumped its sheave — rope running over the flange rather than in the groove creates uneven contact loading, accelerated rope and flange wear, and potential for the rope to further disengage from the sheave completely during a loaded hoist; operations must stop and the rope's engagement with all sheaves must be confirmed before any further lifting
- D. Reduce hoist speed to minimum and continue monitoring the rope tracking

29. A crane operator is approaching the end of a 10-hour shift in an outdoor environment with an ambient temperature of 97°F. The hydraulic oil temperature has been in the upper normal range for the last 3 hours. At this point in the shift, what specific action reduces hydraulic system heat accumulation before the next planned lift?

- A. Nothing — the upper normal range is within the manufacturer's specified operating temperature band
- B. Extend the outrigger jacks to allow the carrier to settle and increase cooling through the outrigger beams
- C. Nothing — hydraulic temperature in the upper normal range requires no operational response until the yellow zone is reached
- D. Allow a rest period between the last lift and the next planned lift — reducing crane function activity lowers hydraulic pump output and allows the system to dissipate accumulated heat through the reservoir and cooler; operating the crane at lower load cycles near the end of a hot shift also reduces the heat input; a brief operational pause can bring temperatures back to the mid-normal range before resuming heavy lifts

30. Under OSHA 1926.1412, which type of inspection requires the crane to be removed from service until all identified deficiencies are corrected?

- A. Only annual comprehensive inspections can result in crane removal — monthly and daily inspections are informational only

B. A post-incident inspection always requires crane removal for a minimum of 24 hours regardless of findings

C. Nothing — inspections result in documentation of findings; the employer decides when to remove the crane from service based on severity

D. Any inspection — frequent, periodic, or post-incident — that identifies a condition meeting a removal-from-service criterion requires the crane to be removed from service until that specific deficiency is corrected; the type of inspection does not determine whether removal is required — the identified condition determines removal; removal-from-service criteria are the same regardless of the inspection type that identified them

TECHNICAL KNOWLEDGE DOMAIN — Questions 31–42

31. A crane's wire rope is being inspected and the inspector finds a section where several wires on the outside of the rope show a bright, shiny, flattened surface on one side — consistent with rope contact with a hard surface at an angle. The flattening runs along about 6 inches of rope length on the same side of each affected wire. What does this pattern of single-sided wire flattening indicate?

A. This is the classic indicator of wear from contact with a specific fixed point — the rope is contacting a sheave flange, a guide, or another structure at that location; the single-sided flattening indicates repeated contact at the same contact angle; the contact point must be identified and corrected, and the affected wire cross-section must be evaluated against diameter reduction removal criteria

B. Single-sided wire flattening is a normal characteristic of lang lay ropes and requires no action

C. The flattening is caused by the rope seating into the drum groove during operations — this is normal break-in

D. Wire flattening on one side indicates the rope is undersized for the sheave groove — replace with a larger rope diameter

32. Under ASME B30.9, what is the maximum number of broken wires permissible in a wire rope sling before removal from service when the sling is used in a basket hitch application?

A. The removal criteria for wire rope slings in basket hitch are the same as for choker hitch — 10 broken wires per lay length

B. Nothing — broken wire removal criteria apply to running ropes and not to slings; slings are removed based on diameter reduction only

C. Wire rope slings must be removed from service when 10 or more broken wires are found in one rope lay length, or 5 or more broken wires are found in one strand in one lay length — these criteria apply regardless of hitch configuration

D. Wire rope slings are removed when any broken wire is found — zero tolerance applies to sling broken wires

33. A crane inspector is examining a boom suspension pendant — a structural member that runs from the boom tip toward the gantry. During inspection, the inspector finds that one of the pendant's wire rope strands has a condition where three wires in the same strand have broken within a 3-inch section. What action does ASME B30.5 require?

A. Nothing — pendants are not running rope and the 6-wire-per-lay-length criterion applies

B. Monitor the pendant at monthly intervals until the total broken wire count reaches the removal threshold

C. The crane must be taken out of service — any broken wires in a boom suspension pendant are a removal condition; pendants are not running rope and do not benefit from the running rope's wire break allowances; broken wires in a pendant indicate structural fatigue in a primary load-bearing component, and failure would result in sudden, catastrophic boom lowering

D. Replace only the affected strand in the pendant using a field splice procedure

34. A crane is lifting a pre-cast concrete beam using a 4-leg wire rope bridle. The beam has lifting inserts at 4 points, and the rigger has selected a bridle with legs that are all equal length. When the beam is picked, it tilts 8 degrees toward one end, indicating the CG is not centered between the 4 attachment points. Which adjustment most directly corrects the tilt?

A. Nothing — an 8-degree tilt is within acceptable limits for pre-cast beam lifts

B. Shorten the sling leg or legs on the high side of the tilt by using a shorter sling or by choke-hitching higher — this effectively raises the attachment point on the high side, bringing the load to a level position by adjusting the geometry to match the actual CG location

C. Add a counterweight to the high end of the beam to balance the load

D. Restart the lift at minimum speed and allow the beam to self-level as tension increases in all four legs

35. Under ASME B30.10, what is the required action when a hook is found to have its latch inoperative — the latch spring is broken and the latch hangs open rather than closing across the hook throat?

- A. The hook may remain in service if the load's rigging will remain in the hook by gravity regardless of the open latch
- B. The hook with an inoperative safety latch must be taken out of service until the latch is repaired or the hook is replaced — the safety latch is required to prevent rigging from inadvertently disengaging from the hook during crane movements; an open latch creates a condition where rigging can fall off the hook during any lateral movement, swing, or load rotation
- C. The hook may remain in service for straight vertical lifts where no lateral movement is planned
- D. Nothing — hook safety latches are supplementary devices that are not required by ASME B30.10 for all operations

36. A crane operator asks about the function of the load line's reeving fleet angle and why it matters for drum winding. Which statement correctly describes fleet angle and its significance?

- A. Fleet angle refers to the angle between the load line and the vertical — a larger fleet angle means the load is further from vertical and creates more lateral force on the boom tip
- B. Fleet angle is only relevant for lattice boom cranes — telescopic boom cranes do not use fleet angles in their rope design
- C. Fleet angle is the angle between the rope as it leaves the drum and the perpendicular to the drum axis — too large a fleet angle causes the rope to wind unevenly across the drum width, creating poor layer transitions and rope damage at the crossover points; excessive fleet angle also increases rope wear by forcing the rope to bend sideways as it enters the drum groove, which is why crane design specifies maximum fleet angle limits
- D. Fleet angle is the angle the boom makes with the horizontal — it determines the load chart section to be used for the current lift

37. A crane inspector finds that one of the wire rope sling's end fittings — specifically a spelter socket — shows a small crack at the base of the socket cone, running circumferentially around approximately 20% of the socket body. What must be done?

- A. Monitor the crack at weekly intervals — removal is required only when the crack exceeds 50% of the socket circumference
- B. Apply a structural repair weld to the crack and perform a proof load before returning to service
- C. The crack may be ground smooth if it does not penetrate more than 15% of the socket body thickness

D. The sling must be removed from service immediately — any crack in a spelter socket end fitting requires removal; the spelter socket carries the full sling load through the cone-to-socket interface, and a circumferential crack at the socket base indicates progressive fatigue fracture that can advance to complete socket separation under subsequent loading

38. A crane's annual inspection finds that a structural tube section of the boom's upper chord has been dented — an indentation approximately 2 inches long and 0.5 inches deep is visible on the boom's upper chord surface. The dent appears to be from a previous impact with a structure. What is the concern with a dent in a structural tube chord?

A. Nothing — small dents on boom surfaces are cosmetic and do not affect load-carrying capacity

B. A dent in a structural tube chord introduces a geometric imperfection that significantly reduces the tube's resistance to column buckling — the chord carries compressive load during lifting operations; a buckle initiates at imperfections, and the dented section has lower buckling resistance than the nominal design; the boom must be evaluated by the manufacturer or a qualified structural engineer before returning to service

C. Apply a structural patch plate over the dented section to restore the nominal profile before returning to service

D. Monitor the dented section during the next 3 monthly inspections to confirm it is not progressing

39. A rigger is preparing to use a synthetic web sling on an outdoor lift in direct sunlight. The sling has been stored outdoors on a rack for approximately 14 months. The sling shows no visible damage — no cuts, abrasions, or chemical stains — but the color has faded noticeably from its original bright orange to a dull, washed-out orange. What does the color fading indicate about the sling?

A. Color fading on synthetic web slings is a printing variation and has no relationship to structural capacity

B. Color fading is a cosmetic manufacturing variation — no concern applies

C. Nothing — synthetic web slings are rated for outdoor use and color variation is expected

D. Visible color fading — bleaching of the original color to a dull or washed-out shade — is a direct indicator of UV radiation degradation of the synthetic fiber polymer chains; this degradation reduces the sling's tensile capacity without creating visible physical damage; a sling showing significant UV fading may have lost a substantial portion of its rated capacity and must be removed from service or tested before use

40. A crane's wire rope is found during annual inspection to have a section where the rope's strands have flared outward — the rope cross-section at that point shows the strands spreading apart, creating a diameter larger than nominal with loose strands visible. This condition is commonly called "bird-caging." What causes bird-caging and what action is required?

- A. Bird-caging is caused by normal rope stretching under heavy loads — the rope is fully serviceable after bird-caging occurs
- B. Bird-caging is caused by the rope core expanding during normal service — no removal criterion applies
- C. Bird-caging occurs when the rope's outer strands are forced outward by a sudden shock load or compression that collapses the core — the strands lose their internal contact geometry and the rope cannot efficiently distribute load among strands; the rope must be immediately removed from service
- D. Bird-caging can be corrected by applying a turnback fitting and twisting the rope back to its normal geometry

41. Under OSHA 1926 Subpart CC, what is the specific requirement for the crane's load line to be used during personnel hoisting regarding its design factor?

- A. Personnel hoisting requires a 5:1 design factor — the same as for general material hoisting
- B. Personnel hoisting requires a 7:1 design factor — the rope's certified minimum breaking strength must be at least 7 times the maximum load that will be applied during any personnel hoisting operation
- C. Personnel hoisting requires a 10:1 design factor to provide additional safety margin for human life
- D. The design factor requirement for personnel hoisting is determined by the crane manufacturer and varies by crane model

42. A crane operator is reviewing a wire rope inspection report that describes a section of rope near a sheave as having "valleys broken" — the term used for wires that break at the contact point between strands (in the valley between two strands) rather than on the exposed crown of the wires. Why are valley breaks particularly significant?

- A. Valley breaks are less significant than crown breaks because the valley wire carries less tension than the crown wire
- B. Valley breaks are not a removal criterion in ASME B30.5 — only crown wire breaks count toward the removal threshold

- C. Valley breaks are easier to detect than crown breaks since they occur at the visible surface of the rope
- D. Valley breaks are particularly significant because they occur at the contact point between strands — indicating fatigue from contact stresses rather than simple tension fatigue; any valley break in a crane wire rope is a removal criterion under ASME B30.5 regardless of the total break count in the section, because contact fatigue failure progresses much more rapidly than tension fatigue

MANUFACTURER LOAD CHARTS DOMAIN — Questions 43–65

43. A crane's load chart shows the following values for the 80-foot boom at full outrigger extension: 30 ft = 32,400 lbs; 35 ft = 25,600 lbs; 40 ft = 20,200 lbs. The total rigging weight is 3,100 lbs and the payload weighs 19,000 lbs. The planned operating radius is 34 feet. Using the conservative approach, what capacity governs and is the lift within capacity?

- A. Conservative capacity at 35 ft = 25,600 lbs; total suspended weight = 3,100 + 19,000 = 22,100 lbs; 22,100 lbs is within the 25,600-lb conservative capacity — the lift proceeds with 3,500 lbs of margin
- B. Nothing — the conservative approach uses the next smaller tabulated radius (30 ft = 32,400 lbs)
- C. Conservative capacity at 40 ft = 20,200 lbs; total suspended weight = 22,100 lbs; 22,100 exceeds 20,200 — the lift cannot proceed
- D. Interpolated capacity at 34 ft = 26,960 lbs; 22,100 lbs is within capacity — lift proceeds

44. A crane load chart note reads: "Capacities in this section apply only when the crane carrier is level within 0.5% of grade in all four outrigger positions simultaneously." The operator has confirmed 0.4% out-of-level in the fore-aft axis and 0.35% in the lateral axis. What is the combined resultant and does the crane satisfy the note?

- A. Nothing — each individual axis reading satisfies the 0.5% limit independently
- B. Nothing — the 0.5% limit applies to the average of both axis readings: $(0.4 + 0.35) / 2 = 0.375\%$ — well within 0.5%
- C. Nothing — the note says "simultaneously" meaning each axis must simultaneously be within 0.5%; both axes individually satisfy 0.5% and the note's condition is met
- D. Combined resultant = $\sqrt{(0.4^2 + 0.35^2)} = \sqrt{(0.16 + 0.1225)} = \sqrt{0.2825} = 0.531\%$; the resultant exceeds the 0.5% note requirement in the diagonal direction; the crane must be re-leveled to bring the combined resultant within the note's 0.5% specification

45. A crane load chart section shows all capacity values for radii between 15 and 25 feet are shaded gray (structural-limited). At 30 feet and beyond, all cells are white (stability-limited). A lift is planned at 22 feet of radius at 94% of the structural-limited capacity. The load is a precision machine that cannot tolerate abrupt movements. Which operational constraint does the structural-limited designation impose that is especially important for this load?

- A. Structural-limited lifts require a manufacturer's representative on site for all lifts above 90%
- B. Nothing beyond standard lift procedures applies to structural-limited lifts
- C. Smooth, controlled crane movements are mandatory for structural-limited lifts near capacity — sudden starts, stops, or direction changes add dynamic structural loads to the already near-design-limit static stress; for a precision machine that also cannot tolerate abrupt movement, this requirement serves double duty — protecting the crane's structural integrity and the load's precision components simultaneously
- D. The structural limit requires using a longer boom to reduce the structural loading to a stability-limited configuration

46. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — OVER REAR SECTOR (30° EACH SIDE OF REAR CENTER)": 30 ft = 28,600 lbs. The same section's "360° ALL DIRECTIONS" shows 22,400 lbs at 30 ft. The planned lift requires the boom to start over-rear, travel 120 degrees, and set over-side. A total suspended weight of 26,000 lbs is planned. Which capacity governs for lift planning?

- A. Nothing — use the over-rear capacity of 28,600 lbs since that is where the load is picked
- B. The over-rear capacity of 28,600 lbs governs since it is the section where the greatest load moment occurs
- C. Nothing — average the two capacity values for a lift that spans both sectors
- D. The 360-degree all-directions capacity of 22,400 lbs governs for the entire lift — the load must travel through the 360-degree sector during the swing and the total suspended weight of 26,000 lbs exceeds the 22,400-lb all-directions capacity; the lift cannot proceed as planned since the load must pass through the all-directions sector where the lower capacity governs

47. A crane's load chart for the telescoping boom section shows capacities organized by boom extension position: 50%, 75%, and 100% extension. All positions require all boom sections to be pinned at the rated extension percentage. The crane's boom is currently at 80% extension with the 75% and 100% extension positions both pinned but the intermediate 80% position is not a rated pinned configuration. What must the operator do?

- A. Use the 75% extension section conservatively since it shows lower capacity than the 100% section
- B. Nothing — an 80% extension between two pinned positions is covered by the 75% to 100% telescoping range
- C. Interpolate between the 75% and 100% sections to estimate capacity at 80% extension
- D. The boom must be extended or retracted to either the rated 75% or 100% extension position before any lifting — a boom at 80% extension with the 80% position not specifically rated as a pinned configuration is in an unrated condition; the load chart only covers the rated pinned configurations and the operator must place the boom in one of those positions

48. A crane load chart section note reads: "The following capacities assume no boom extension during the lift. The crane must be in its final boom configuration before picking the load, and the boom configuration must not change while the load is suspended." An operator needs to reposition the load at a higher hook height after picking. To achieve this, the operator plans to extend the boom 5 feet after picking to raise the hook point. Does the note permit this?

- A. Nothing prevents boom extension after picking as long as the LMI confirms the new configuration is within capacity
- B. The note says "no boom extension during the lift" — the operator may boom up without extending since the note refers to extension, not boom angle
- C. The note's condition that "the boom configuration must not change while the load is suspended" explicitly prohibits any boom extension after picking the load; the higher hook height must be achieved by re-planning the lift from a different configuration before picking, or by booming up (changing angle without extending) if the note allows angle changes
- D. The operator may extend 5 feet as long as the extension is done slowly at minimum speed

49. A crane load chart shows a note: "At operating radii beyond 40 feet with this configuration, the maximum permissible load rotation speed is 1 rpm." The operator is performing a lift at 45 feet of radius at a swing speed equivalent to 2.5 rpm. The LMI reads 78% capacity. What is the compliance issue?

- A. Nothing — the LMI reading confirms the crane is operating within capacity at 78%
- B. The rpm limit is advisory for operations below 85% of rated capacity
- C. The note is advisory and the lift director may authorize exceeding it for schedule requirements
- D. The 1 rpm maximum is a binding load chart condition at radii beyond 40 feet — the operator is violating this condition at 2.5 rpm regardless of the LMI reading; the capacity values in this section were

developed assuming no more than 1 rpm of swing-induced dynamic loading at these radii; exceeding this limit means using capacity values derived under conditions that do not match the actual operation

50. A crane load chart shows: 120-foot boom, full outrigger, all directions: 50 ft = 13,200 lbs; 55 ft = 10,000 lbs; 60 ft = blank. A planned lift requires a pick at 51 feet and a set at 54 feet. Total rigging weighs 1,400 lbs and payload weighs 8,200 lbs. Total suspended weight = 9,600 lbs. Using the conservative approach at both positions, what is the status of the lift?

- A. Nothing — 9,600 lbs is well within the conservative capacity of 10,000 lbs at both positions
- B. Conservative capacity at pick (51 ft) = 10,000 lbs at 55 ft; conservative capacity at set (54 ft) = 10,000 lbs at 55 ft; total suspended weight (9,600 lbs) is within 10,000 lbs at both positions — the lift proceeds with 400 lbs of margin at the conservative governing capacity
- C. Conservative capacity at 55 ft = 10,000 lbs governs both positions; 9,600 lbs is within capacity — but the operator should note the 400-lb margin is very small and careful radius management is required
- D. Conservative capacity at set (54 ft) = blank; the maximum rated radius is 55 ft; 54 feet is within the rated envelope but the blank at 60 ft confirms 55 ft as the outer boundary; conservative capacity at 55 ft (10,000 lbs) is the governing value; 9,600 lbs is within capacity

51. A crane load chart shows a gross capacity of 34,200 lbs at 30 feet for the 80-foot boom at full outrigger extension. A note states: "Gross capacity values in this section include a pre-deducted standard hook block of 1,400 lbs." The operator is using the standard block. Total rigging (not including the standard block) weighs 1,800 lbs and the payload weighs 30,000 lbs. Is the lift within gross capacity?

- A. Yes — the 1,400-lb standard block has already been deducted from 34,200 lbs; the remaining capacity is available for other rigging (1,800 lbs) and payload (30,000 lbs); total = 31,800 lbs; since 31,800 lbs is below 34,200 lbs, the lift appears within gross capacity as displayed — but wait, the pre-deducted block means 34,200 lbs is already net of the block; total non-block rigging plus payload = $1,800 + 30,000 = 31,800$ lbs; 31,800 lbs within 34,200 lbs — the lift proceeds
- B. No — the 1,400-lb block must still be deducted: $34,200 - 1,400 - 1,800 - 30,000 = 1,000$ lbs margin
- C. Nothing — gross capacity always includes the hook block regardless of notes
- D. Yes — 30,000 lbs payload is within the 34,200 lbs gross capacity — no rigging deduction is needed since the note covers all deductions

52. A crane is operating with maximum counterweight. The load chart shows a stability-limited capacity of 38,400 lbs at 30 ft. The same crane with standard counterweight shows 31,200 lbs at the same

configuration and radius — also stability-limited. Why does maximum counterweight provide 7,200 lbs more stability-limited capacity at 30 feet?

- A. Maximum counterweight reduces the structural loading at the boom foot, allowing higher capacity at all radii
- B. Nothing — both sections show stability-limited cells which always have identical values regardless of counterweight
- C. Maximum counterweight increases the restoring moment available to resist the tipping force from the suspended load — at 30 feet where stability limits govern, the greater counterweight mass located farther behind the tipping fulcrum creates a larger restoring moment; this allows a heavier load to be carried before the net moment favors tipping, directly producing the higher stability-limited capacity
- D. Maximum counterweight increases the crane's hydraulic pressure, allowing greater hoist force at all radii

53. A crane load chart shows: "LUFFING JIB — 50 FT JIB — 120 FT MAIN BOOM — MAXIMUM COUNTERWEIGHT." At 20° jib angle = 11,400 lbs; 30° = 14,800 lbs; 40° = 17,200 lbs. For this jib configuration, capacity increases as jib angle increases. The planned jib angle is 35 degrees. Using the conservative approach for a luffing jib where capacity increases with angle, what is the governing capacity?

- A. Conservative capacity = 14,800 lbs at 30 degrees — the lower adjacent tabulated value is conservative when capacity increases with angle
- B. Nothing — the conservative approach always uses the next larger tabulated value regardless of the capacity trend direction
- C. Conservative capacity = 11,400 lbs at 20 degrees — the lowest tabulated value is always the most conservative
- D. Conservative capacity = 17,200 lbs at 40 degrees — the next larger tabulated angle provides the bounding capacity when capacity increases with angle

54. A crane is configured with a 100-foot boom. The load chart shows for on-outrigger full extension: 35 ft = 26,800 lbs; 40 ft = 21,400 lbs; 45 ft = 17,000 lbs. A critical lift has a total suspended weight of 19,800 lbs. The operator determines that a 37-foot operating radius would support the lift interpolated capacity, but the conservative approach at 40 feet (21,400 lbs) does not provide adequate margin for the operator's comfort. Using the conservative approach, what is the maximum operating radius at which this lift can proceed?

- A. Maximum operating radius = 37 feet using interpolated capacity — the conservative approach is optional
- B. Maximum operating radius = 40 feet — conservative capacity at 40 ft (21,400 lbs) exceeds the 19,800-lb total suspended weight; the lift may proceed at any radius up to and including 40 feet using the conservative approach
- C. Maximum operating radius = 35 feet — the conservative approach at 35 ft (26,800 lbs) must be used
- D. Maximum operating radius = 42 feet — between 40 and 45 feet the conservative capacity is 17,000 lbs at 45 ft which does not support 19,800 lbs; the maximum radius where conservative capacity exceeds 19,800 lbs is somewhere between 35 and 40 feet, but only tabulated radii may be used as maximums under the conservative approach; the maximum is 40 feet

55. A crane load chart shows a note: "All capacity values in this section require confirmation that the crane's slewing ring backlash does not exceed the manufacturer's maximum specification of 0.012 inches." During the most recent annual inspection, the slewing ring backlash was measured at 0.010 inches. That inspection was 11 months ago. What must the operator confirm before using this section?

- A. The 11-month-old inspection result of 0.010 inches is within the 0.012-inch specification and the note's condition is satisfied
- B. The operator must contact the manufacturer to obtain a current backlash certification before using this section
- C. Nothing — the note's condition requires only that the specification not be exceeded; the 11-month-old measurement confirms compliance
- D. The note requires confirmation of current backlash compliance — the 11-month-old measurement may not reflect the current condition; slewing ring wear progresses continuously during operations; before using this section, the slewing ring backlash must be measured again and confirmed within 0.012 inches; an 11-month-old measurement cannot confirm today's actual backlash

56. A crane load chart section for a 100-foot boom shows gross capacity values in the over-front sector that are 22% higher than the 360-degree all-directions section at the same radius. A planned lift requires a 180-degree swing from over-front to over-rear. The total suspended weight is 88% of the over-front capacity and 107% of the all-directions capacity. What must the operator conclude?

- A. The lift may proceed since it begins in the over-front sector where the capacity is adequate
- B. The lift may proceed at 88% of over-front capacity since that is where the pick occurs

C. Nothing — the average capacity between the two sectors is 97.5% and is within the rated limits

D. The total suspended weight exceeds the all-directions capacity — the lift cannot proceed in this configuration because the load must swing through the all-directions sector; the lift would exceed rated capacity during the swing; either the load must be reduced to below the all-directions capacity, or the crane must be repositioned so the swing does not pass through the over-front or all-directions boundary

57. A crane's manufacturer load chart contains a section note: "These capacities are based on the crane's load line being reeved with the manufacturer's original load line rope of 3/4-inch diameter, 6×36 IWRC, right regular lay. Substitution of any other rope construction requires manufacturer's written approval." The crane's load line has been replaced with 3/4-inch, 6×19 Seale, IWRC, right regular lay — the same diameter and grade but different construction. Does the note affect this section's use?

A. Nothing — same diameter and grade ensures identical capacity and the note is satisfied

B. Nothing — the operator can confirm that 6×19 Seale has equivalent or higher capacity per foot than 6×36

C. The note is advisory — different rope constructions of the same grade and diameter are always interchangeable without manufacturer approval

D. The note specifies the rope construction required to use these capacity values — a different construction (6×19 Seale vs. 6×36) has different flexibility, bending fatigue characteristics, and fleet angle behavior; without the manufacturer's written approval for the substituted construction, this section's capacity values cannot be used with the installed rope

58. A crane load chart shows: "ON CRAWLERS — MAXIMUM COUNTERWEIGHT — OVER SIDE — 140 FT BOOM": 50 ft = 82,000 lbs; 55 ft = 66,400 lbs; 60 ft = blank. A critical lift at 53 feet has a total suspended weight of 58,000 lbs. The conservative capacity at 55 feet is 66,400 lbs. The lift percentage based on conservative capacity is approximately 87.3%. What does this lift percentage require?

A. Nothing additional — 87.3% is below the 90% threshold that triggers additional requirements

B. The lift requires a written critical lift plan and pre-lift meeting since 87.3% exceeds the 75% critical lift threshold; all planned lift parameters must be reviewed with the crew, communication protocols established, and emergency procedures identified before the lift begins

C. The lift at 87.3% requires manufacturer's on-site support during the critical lift operation

D. The critical lift at 87.3% requires a post-lift inspection regardless of the lift's outcome

59. A crane load chart shows a capacity of 28,400 lbs at 35 feet of radius. A note reads: "Before using any capacity values in this section, confirm the boom and jib are free of accumulated ice, snow, or debris, and deduct the total weight of any material that cannot be removed." During operations, 3 inches of wet snow has accumulated on the boom. The operator estimates the snow weighs approximately 400 lbs. How does this note affect the applicable capacity?

A. The note requires deducting the 400-lb snow weight from the gross capacity — the applicable capacity becomes $28,400 - 400 = 28,000$ lbs; all subsequent lifts must be within this reduced capacity until the snow is removed

B. The note only applies to ice accumulation — wet snow is lighter than ice and is excluded from the note's requirements

C. The note requires removing the snow before any further lifts — not deducting it; the capacity values cannot be used until the snow is confirmed removed

D. The 400-lb snow weight is below the 1% threshold and does not require deduction from capacity

60. A crane is configured with a 100-foot main boom and a 30-foot fixed jib at 20-degree offset. The jib section of the load chart shows 12,600 lbs at 45 feet. The main boom section (without jib) shows 26,800 lbs at 45 feet. The operator plans to use the main hook only — the jib hook is not used. The jib is physically attached to the boom tip. Which capacity value applies?

A. Nothing — the main hook operates from the main boom regardless of what is attached at the boom tip

B. Nothing — only the hook being used determines which section applies

C. The jib section capacity of 12,600 lbs governs — the jib being physically attached to the boom tip adds tip weight that changes the boom's structural loading; the load chart section for jib-installed configuration must be used regardless of which hook carries the payload

D. The operator may choose either section based on which provides more favorable capacity for the planned lift

61. A crane is set up and the operator has confirmed the configuration matches the load chart section being used. Before beginning a critical lift at 89% of rated capacity, the lift director asks whether the crane can "push to 95% if needed." Under what circumstances could this be authorized?

- A. The lift director may authorize up to 95% for critical lifts when no other crane is available
- B. The crane's rated capacity is a fixed engineering limit that cannot be increased by operational authorization — neither the lift director, the employer, nor any other party can authorize exceeding the manufacturer's rated capacity; if the load requirement demands 95%, a different crane or configuration must be found
- C. Operating at 95% is acceptable if the crane has passed its most recent annual inspection without deficiencies
- D. The operator may self-authorize 95% when the crane is confirmed level and all setup conditions are verified

62. A crane's load chart shows a section titled: "ON OUTRIGGERS — FULL EXTENSION — HEAVY JIB (120 LBS)." The crane is using the manufacturer's standard light jib that weighs 85 lbs — 35 lbs lighter than the heavy jib. The light jib uses the same structural dimensions and attachment points as the heavy jib. May the operator use the heavy jib section for the lighter jib configuration?

- A. Nothing prevents using the heavy jib section for the lighter jib — less weight at the tip is always more conservative
- B. The operator must use the section specifically labeled for the actual installed jib — even if the lighter jib seems more conservative, the section title defines the exact configuration its values apply to; the structural loading differences between the light and heavy jib may extend beyond weight differences to include different reeving, pendant geometry, or tip fitting configurations; the operator must use the section matching the actual installed equipment
- C. The lighter jib may use the heavy jib section since weight is the only parameter that differs
- D. An informal manufacturer confirmation by phone is sufficient to authorize using the heavy jib section for the lighter jib

63. A crane load chart shows: 100-foot boom, on-outrigger, full extension: 25 ft = 44,600 lbs; 30 ft = 35,400 lbs; 35 ft = 27,800 lbs. The rate of capacity decrease per foot is: 25–30 ft = 1,840 lbs/ft; 30–35 ft = 1,520 lbs/ft. A lift at 28 feet is planned. Using linear interpolation between 25 and 30 feet, what is the estimated capacity at 28 feet?

- A. Interpolated capacity at 28 ft = $44,600 - (3 \times 1,840) = 44,600 - 5,520 = 39,080$ lbs
- B. Nothing — the conservative approach always uses tabulated values, not interpolation

C. Interpolated capacity at 28 ft: drop per foot 25–30 ft = $(44,600 - 35,400) \div 5 = 9,200 \div 5 = 1,840$ lbs/ft; at 28 ft (3 ft beyond 25 ft): $44,600 - (3 \times 1,840) = 44,600 - 5,520 = 39,080$ lbs

D. Interpolated capacity at 28 ft = $35,400 + (2 \times 1,840) = 35,400 + 3,680 = 39,080$ lbs — interpolating from 30 ft backward

64. A crane load chart section header reads: "ON OUTRIGGERS — FULL EXTENSION — 360° ALL DIRECTIONS — WITH SUPERLIFT AT 25 FT POSITION — MAXIMUM SUPERLIFT COUNTERWEIGHT." During operations, a site constraint requires moving the superlift counterweight cart from 25 to 20 feet from the crane centerline — a reduction of 5 feet. The 20-foot cart position is not a rated configuration in any section. What must the operator do?

A. Use the 25-foot superlift section conservatively since it represents a larger counterweight distance

B. Nothing — the change in superlift cart position only affects the crane's travel configuration

C. Interpolate between available superlift cart position sections to estimate capacity at 20 feet

D. The superlift cart must remain at the 25-foot position for this section's values to apply — changing the cart position to 20 feet places the crane in an unrated configuration; the operator must either return the cart to the 25-foot rated position or contact the manufacturer to obtain rated capacity values for the 20-foot cart position before proceeding with any lifting

65. A crane's load chart for the on-outrigger full extension section shows that the same capacity value (26,400 lbs) appears in both the 35-foot and the 40-foot radius cells for the 100-foot boom at standard counterweight. All surrounding cells show the expected decrease with radius. What does an identical capacity value at two consecutive radii most likely indicate?

A. Nothing — some crane configurations have flat capacity curves over limited radius ranges

B. Nothing — adjacent cells with equal values indicate the crane has reached its maximum rated capacity plateau

C. Nothing — equal adjacent cell values are consistent with a structural-limited condition where capacity does not change with radius in that zone

D. Identical adjacent cell values in a load chart are highly likely to be a printing error — capacity consistently decreases as radius increases; two consecutive cells showing identical values are suspicious and warrant confirmation from the manufacturer or the specific load chart source document; operating on potentially incorrect tabulated values near capacity without verifying the correct value could create an unsafe condition; the manufacturer should be contacted to confirm the correct capacity at both radii before use

Specialty Exam 9 Answer Key and Full Explanations

1. D — Bearing pressure = $96,000 \div 2.25 \text{ sq ft} = 42,667 \text{ psf}$ — approximately 53 times the 800 psf distributed turbine loading. Equipment pad designs are developed for the specific equipment they were engineered for; a turbine's distributed load bears no relationship to a crane's concentrated outrigger point load. A structural engineer must evaluate whether the reinforced concrete can redistribute this point load to its supporting structure before any crane setup proceeds.
2. B — Temporary shoring systems are designed specifically for lateral earth retention loads — resisting the horizontal pressure of the retained soil. A crane outrigger positioned above a shoring pile transmits concentrated vertical and lateral loads directly into the shoring system that its design analysis did not account for. The shoring designer must evaluate the additional loading before any outrigger is placed above the system.
3. A — Remediated soil is not the same as undisturbed native soil — remediation involves excavation, chemical treatment, or replacement that changes the soil's structure, moisture content, and load-bearing characteristics. The crane employer must understand what was done and whether the treated area has been confirmed adequate for the specific crane loading. Pre-remediation soil assessments and post-remediation conditions are fundamentally different and cannot be used interchangeably.
4. C — A membrane ballasted roof has four layers with very different structural contributions. The ballast and insulation board provide essentially no structural capacity — all load must be carried by the structural roof deck. The deck spans between beams and columns, and outrigger point loads must land on or near structural support points. A structural engineer must confirm the deck's capacity for the specific point loads before any rooftop crane setup proceeds.
5. D — A level change during a static hold or during operations indicates progressive ground movement — not a static deflection event. Progressive tilt means the soil beneath one or more outriggers is consolidating or shifting in response to the applied load. Even if the 0.2% shift remains within the 0.5% tolerance, a trend of continuing movement requires investigation because the tipping point of ground failure may occur before the tolerance limit is reached.
6. B — Power line conditions can change between work days — utility maintenance, storm damage, conductor sag from temperature, or repositioning can change the line's location or voltage. The daily pre-operation verification confirms that all controls established in the original assessment remain valid and active. This is not a formality — changed conditions discovered during daily verification allow adjustments before operations begin rather than during them.

7. A — When the water table drops, the soil above the previous water table level no longer benefits from buoyancy forces offsetting gravity. The soil's effective weight increases, increasing the effective confining stress between particles and improving shear strength and bearing capacity. The dewatering system must continue operating during crane operations to maintain this improved condition — if the system fails, the water table will recover and bearing capacity will return to pre-dewatering levels.

8. C — Parking structures are designed for distributed vehicle loads with specific span assumptions — not for concentrated point loads from crane outriggers. The structural drawings identify the beam and column locations that can carry concentrated loads and the maximum allowable forces at specific locations. Without this information, the operator cannot confirm the deck will carry the outrigger loads safely. A structural engineer may need to interpret the drawings to confirm crane compatibility.

9. D — Flash flood events from upstream sources arrive with little warning — water can rise several feet per minute in low-lying areas near creeks and rivers. By the time the flood wave is visible, there may be no time to lower loads and relocate the crane safely. The warning is the time to act, not the arrival of water. Waiting for an official evacuation order in a rapidly evolving flood event can result in the crane being swept away or the operator being unable to evacuate safely.

10. B — "Firm" means the soil's bearing capacity is confirmed adequate for the specific crane loads — not just visually compacted. "Drained" means the soil's moisture content and water table do not reduce the bearing capacity, not just that no standing water is visible. The drainage condition is most often inadequately evaluated because surface inspection confirms absent standing water while subsurface moisture migration continues to reduce effective bearing capacity without visible evidence.

11. B — Progressive darkening of dry soil under a loaded outrigger mat indicates that pore water from below is being squeezed upward through the soil matrix by the applied pressure — a phenomenon called consolidation-induced pore pressure. This upward water movement indicates the soil is under pressure approaching its capacity for the applied load rate. The condition can progress to shear failure without further visible surface warning.

12. C — The bank soil's bearing capacity of 3,600 psf was assessed at the previous river water level. As the river rises 2 feet, hydrostatic pressure on the river-side of the bank increases. This increase in pore water pressure reduces the effective stress between soil particles and lowers shear strength throughout the bank. Dense silty clay, while less permeable than granular soil, still responds to increased boundary water pressure through progressive pore pressure equilibration.

13. A — OSHA 1926.1402's obligations for controlling entities and crane owners are separate regulatory requirements that exist independently of business structure. Being the same company does not merge or eliminate either obligation — the company must fulfill the controlling entity's ground preparation and information obligations separately from the crane owner's equipment obligations. Regulatory compliance obligations run with the role, not the corporate entity.

14. B — Verbal assurance from a superintendent is not a ground condition confirmation for crane operations. Compaction quality requires documented testing — the compaction percentage achieved, the soil classification, the target density, and confirmation that the tested density corresponds to adequate bearing capacity for the specific crane loads. Newly compacted subgrade that has not been tested may appear firm but may not meet the bearing capacity required for concentrated outrigger loading.

15. D — Bearing pressure = $88,000 \div 2.25 = 39,111$ psf — over 130 times the 300 psf distributed landscape loading the roof was designed for. A reinforced concrete roof deck designed for distributed loads fails in a completely different mode under concentrated point loads — punching shear failure rather than flexural failure. No crane may operate over this roof structure without a structural engineer specifically confirming the roof's resistance to the crane's concentrated outrigger point loads.

16. C — Sudden unexplained loss of hydraulic swing speed without operator input indicates a developing hydraulic or mechanical problem in the swing circuit. Continuing at the reduced speed does not resolve the problem — it masks it while potentially worsening the underlying condition. Completing the swing at degraded performance accepts an unknown risk. The load must be set at the nearest safe position and the cause investigated before any further operations.

17. D — OSHA 1926.1431 requires personnel hoisting to be conducted with maximum stability and control. Load line twist during personnel hoisting indicates torsional stress accumulation that can unscrew shackle pin connections, rotate the platform into obstacles, and release stored rotational energy suddenly. The consequences of hardware disengagement or platform contact while personnel are aboard are irreversible — lowering to the ground is the only safe response.

18. B — In a tandem lift, coordinated movement requires continuous confirmed communication between all parties. A radio battery failure during an active coordinated movement removes the confirmation channel for that operator. The operator without communication cannot confirm they are receiving the same direction cues as the other operator, and any deviation from synchronized movement creates uncontrolled load redistribution between the two cranes. All movement must stop until communication is restored.

19. A — The ATB system is designed to provide pre-warning before the hook block reaches the boom tip sheave — the weight hanging on the ATB cable rises and is contacted by the rising hook block before the actual two-blocking contact occurs. The tautening cable and rising weight indicate the hook block is approaching the boom tip's clearance limit. Stopping the hoist immediately and lowering the block to create clearance is the required response — continuing would result in two-blocking.

20. C — Centrifugal force during swing displaces the suspended load outward from the boom tip's rotation axis, increasing the effective operating radius beyond the static planned value. At a greater effective radius, the crane's rated capacity is lower — the same load weight consumes a higher percentage of the reduced capacity. The LMI's reading climb reflects this real physical change in effective load moment, not a sensor error.

21. D — An 8-minute hold with no communication after a STOP signal is unusual and warrants operator-initiated contact. The STOP signal could have been given for many reasons — some may require a different response than continued indefinite hold. The signal person may have encountered an emergency, the hold conditions may have changed, or the next action may require coordination that hasn't been communicated. The operator must determine the current situation.

22. B — OSHA 1926.1416 grants the crane operator independent safety authority and responsibility. The operator must refuse any signal that would require exceeding rated capacity or creating an unsafe condition. This authority is not negated by the signal person's designation or the lift director's authority — it is a parallel safety layer that protects against the consequences of a signal person error, capacity miscalculation, or changed condition that the operator observes and the signal person does not.

23. A — A tag line that lifts a worker indicates the worker was entangled with the line rather than holding it — this is a near-miss that reveals a fundamental failure in tag line handling procedure. The crew must be retrained on proper tag line management before operations resume. This specific near-miss is also a reportable event that must be investigated to prevent a future incident where the entangled worker cannot release in time.

24. D — Wind force on a load is proportional to the load's projected surface area and the square of wind speed. A hollow structural tube bundle can have a very large combined surface area, creating wind forces far exceeding those on a compact load of equivalent weight. At 91% of rated capacity with gusty conditions and a high-area load, the lateral wind forces on the bundle can create boom side-loading and load swing that exceeds the crane's structural design assumptions regardless of whether the general wind limit has been exceeded.

25. D — A counterweight zone breach is a safety boundary failure that requires full zone clearance confirmation before resuming movement. The fact that the worker has already exited confirms one person's exit — it does not confirm no other personnel have entered the zone since the initial breach, or that the zone path is fully clear ahead of the next swing movement. Full zone clearance must be independently confirmed before any swing resumes.

26. B — Workers in construction environments focus on the load — they track the load's path and move away from it. Few workers naturally anticipate the counterweight swinging in the opposite direction behind the crane. Physical barriers provide protection independent of worker awareness, attention, or experience. The requirement for physical barricades reflects this reality — audible warnings and verbal notices rely on continuous worker attention that cannot be guaranteed in a busy construction environment.

27. C — An LMI load cell cable with cut insulation and exposed bare wire can cause intermittent signal loss, short circuits, or complete loss of LMI function. Any of these outcomes would cause the LMI to display incorrect capacity percentages during loaded operations. A malfunctioning LMI during near-capacity lifts removes the operator's real-time capacity monitoring — a safety device failure that requires correction before any lifting operations resume.

28. C — When rope tracks over a sheave flange instead of in the designed groove, the rope contacts a non-designed bearing surface that provides inadequate support and creates lateral bending in the rope. The rope can progressively disengage from the sheave further during the next loaded hoist, creating a risk of complete rope departure from the sheave under load. Once rope-over-flange tracking is identified, operations must stop and the sheave engagement must be confirmed before proceeding.

29. D — Hydraulic systems generate heat proportional to work performed — pump output, function cycling, and internal leakage all add heat to the fluid. Reducing activity allows the cooling system (fan, cooler, reservoir radiation) to dissipate accumulated heat faster than new heat is added. An operational pause before the next heavy lift allows the temperature to return to the mid-normal range, preserving adequate fluid viscosity and seal integrity for the subsequent lift.

30. D — OSHA 1926.1412 and ASME B30.5 both establish removal-from-service criteria that trigger mandatory removal whenever an identified condition meets or exceeds those criteria — regardless of which inspection type identified the condition. Frequent, periodic, post-incident, and post-repair inspections all carry the same requirement: if a removal criterion is found, the crane comes out of service. The inspection type is irrelevant to the removal obligation.

31. A — Single-sided wire flattening — bright, polished, and localized to one side of the affected wires — is diagnostic of contact with a specific fixed point during rope travel. The rope contacts the point repeatedly at the same angle, polishing and flattening the crown wires on the contact side. This wear pattern is progressive and will eventually reduce wire cross-section below minimum diameter standards. Identifying and correcting the contact point is essential to prevent accelerated rope replacement cycles.

32. C — ASME B30.9 removal criteria for wire rope slings specify removal when 10 or more broken wires are found in one lay length, or 5 or more broken wires are found in one strand in one lay length. These criteria apply regardless of hitch configuration — the sling's capacity is compromised equally whether the rope is in a vertical, choker, or basket hitch when the wire break threshold is met. Hitch configuration affects capacity calculation but not removal criteria.

33. D — Boom suspension pendants are structural tension members that carry the boom's entire suspended load through the crane's back-stay system. Unlike running rope, pendants are not designed with the wire break allowances that account for normal fatigue cycling. Any broken wire in a pendant indicates fatigue initiation in a primary structural member. The consequences of pendant failure — sudden uncontrolled boom collapse — are catastrophic and justify zero-tolerance removal criteria.

34. B — Correcting load tilt in a bridle requires changing the effective height of the attachment point on the high side — raising the pick point on the side that needs to come down. Shortening the sling leg on the high side effectively moves that attachment point upward, reducing the height difference between sides and bringing the load to level. This is the standard rigging adjustment for loads whose actual CG is not centered at the planned attachment geometry.

35. B — The safety latch prevents rigging from disengaging from the hook during any crane movement that creates momentary slack or lateral displacement of the rigging. Crane movements — particularly swing direction changes, boom movements, and load oscillation — can cause rigging to shift within the hook throat. An inoperative latch leaves the rigging free to disengage at exactly the moments of greatest dynamic loading. ASME B30.10 requires a functional latch for all crane hook operations.

36. C — Fleet angle describes the angle the rope makes with the perpendicular to the drum axis as it pays on and off the drum. A large fleet angle forces the rope to approach the drum groove at an angle, causing it to push toward one side of the groove and cross-wind onto the adjacent layer prematurely. Crane designs specify maximum fleet angles (typically 1.5° to 4°) because exceeding them causes uneven drum winding, premature rope wear, and potential rope jump.

37. D — The spelter socket's cone-and-socket interface carries the entire sling load through the mechanical interlock between the rope's formed wire cone and the socket's tapered bore. A

circumferential crack at the socket base indicates progressive fatigue fracture of the socket body — the repeated loading cycles have initiated a crack that will advance through the remaining material under subsequent loading. Any crack in this primary load-carrying component requires immediate removal.

38. B — Boom chord tubes are structural compression members whose resistance to buckling depends on their cross-sectional geometry — specifically, the moment of inertia of the tube cross-section. A dent introduces a local geometric imperfection that reduces the tube's moment of inertia at the dent location and creates a point of weakness where buckling will preferentially initiate under compressive load. The manufacturer or a qualified structural engineer must evaluate the buckling reserve before the crane returns to service.

39. D — UV radiation photodegrades synthetic polymer fiber chains — it breaks chemical bonds in the polyester or nylon molecular structure, reducing tensile strength progressively and invisibly. Color fading occurs because the same UV energy that breaks fiber bonds also breaks the chromophore bonds in the fabric dye. Visible fading indicates that UV degradation has accumulated — the same radiation that removed the color has also removed some portion of the fiber's structural capacity. The sling must be removed or tested before use.

40. C — Bird-caging occurs when a sudden shock load or compression forces the rope's outer strands outward — the shock load creates a moment where the strands are pushed beyond their normal geometry. Once bird-caged, the strands cannot carry load uniformly — some strands are slack while others are overloaded. The rope's structure has been permanently disrupted and the rope must be removed from service immediately. There is no field repair for bird-caging.

41. B — OSHA 1926.1431 requires a 7:1 design factor for the load line used in personnel hoisting — the rope's certified minimum breaking strength must be at least 7 times the maximum load applied. This is a 40% higher design factor than the 5:1 required for general material hoisting. The elevated factor reflects the irreversible consequence of load line failure during personnel hoisting and the higher value of human life relative to equipment or materials.

42. D — Valley breaks indicate that wire failure is driven by contact fatigue — the wires at the contact point between strands are experiencing compressive and shear loading in addition to the tension carried by the rope. This combined stress state accelerates crack propagation compared to pure tension fatigue. ASME B30.5 treats valley breaks as absolute removal conditions because contact fatigue failure progresses unpredictably and can reach complete strand separation much faster than tension fatigue with visible accumulated crown wire breaks.

43. A — Conservative approach: next larger tabulated radius beyond 34 feet = 35 feet, capacity = 25,600 lbs. Total suspended weight = 3,100 + 19,000 = 22,100 lbs. Since 22,100 lbs is less than 25,600 lbs, the lift is within the conservative capacity with 3,500 lbs of margin. The lift proceeds using the 35-foot tabulated value as the governing capacity.

44. D — When the crane is simultaneously out-of-level in two perpendicular axes, the combined resultant is calculated as: $\sqrt{(0.4^2 + 0.35^2)} = \sqrt{(0.16 + 0.1225)} = \sqrt{0.2825} = 0.531\%$. This resultant represents the maximum out-of-level condition in the diagonal direction — exceeding the note's 0.5% requirement. Individual axis compliance does not ensure resultant compliance when both axes have significant readings simultaneously.

45. C — Structural-limited cells at near-capacity require smooth, controlled movements because structural members have little reserve for dynamic loading. At 94%, only 6% structural reserve exists for any additional stress from acceleration, deceleration, or simultaneous multi-function operation. For a precision machine that independently cannot tolerate abrupt movement, the smooth operation requirement serves both the crane's structural protection and the load's protection from mechanical shock simultaneously.

46. D — The load must pass through the 360-degree all-directions sector during the 120-degree swing. The all-directions capacity of 22,400 lbs is the capacity that applies throughout the entire portion of the swing outside the over-rear sector. The planned 26,000-lb total suspended weight exceeds this 22,400-lb capacity — the lift would be in an overloaded condition during the swing through the all-directions sector regardless of the adequate capacity at the pick point.

47. D — Telescoping boom load charts rated by pinned extension percentage are designed for the specific structural conditions at each rated pinned position. At 80% extension, neither the 75% nor 100% pinned configuration accurately represents the structural loading — the boom is in an intermediate position that has not been analyzed in the load chart. The operator must move the boom to one of the rated pinned positions to have a valid capacity reference.

48. C — The note's explicit prohibition is "the boom configuration must not change while the load is suspended" — this covers extension as well as angle. Extending the boom 5 feet after picking changes the boom configuration in the most fundamental way — it changes the boom length, which changes both the operating radius and the applicable load chart section. This change while the load is suspended directly violates the note's stated condition.

49. D — Load chart notes specifying maximum rotation speeds are binding conditions because the capacity values were derived under specific assumptions about dynamic loading from swing inertia and centrifugal forces. At 2.5 rpm versus the maximum 1 rpm at 45 feet, the dynamic forces acting on the crane and load are substantially higher than what the capacity analysis assumed. The LMI's 78% reading reflects the static configuration — it does not account for the dynamic loading from the excessive swing speed.

50. B — Conservative approach at 51 feet: next larger tabulated radius = 55 feet, capacity = 10,000 lbs. Conservative approach at 54 feet: next larger tabulated radius = 55 feet, capacity = 10,000 lbs. Total suspended weight = 9,600 lbs. Both positions use the 55-foot conservative value of 10,000 lbs, and 9,600 lbs is within this capacity at both points. The lift proceeds with a 400-lb margin, requiring careful radius management since the blank at 60 feet confirms 55 feet as the maximum rated radius.

51. A — The note states the 34,200-lb gross capacity already has the standard 1,400-lb block pre-deducted. Since the operator is using the standard block, no additional block deduction is required. The remaining capacity after the pre-deduction is available for other rigging and payload: 1,800 (rigging) + 30,000 (payload) = 31,800 lbs. Since 31,800 lbs is within the 34,200-lb pre-deducted gross capacity, the lift proceeds.

52. C — Stability-limited capacity is determined by the balance between the overturning moment from the suspended load and the restoring moment from the crane's counterweight. Maximum counterweight places more mass further behind the tipping fulcrum, creating a larger restoring moment. This allows a heavier load to be balanced at 30 feet before the net moment favors tipping — directly producing the 7,200-lb higher capacity compared to standard counterweight at the same radius.

53. A — For a luffing jib where capacity increases with jib angle, the conservative bounding value for an intermediate angle is the lower adjacent tabulated value — the one at the smaller angle. At 35 degrees (between 30° and 40° entries), the 30-degree capacity of 14,800 lbs is the conservative governing value because it is lower than the 40-degree value, and conservatism requires using the lower bound when the actual angle might be slightly below the planned value.

54. B — Conservative approach: capacity at 40 feet = 21,400 lbs; total suspended weight = 19,800 lbs. Since 19,800 lbs is less than 21,400 lbs, the lift proceeds conservatively at any radius up to and including 40 feet. At the next tabulated radius (45 feet), the conservative capacity = 17,000 lbs, which does not support 19,800 lbs. The maximum operating radius using the conservative approach is therefore 40 feet.

55. D — Slewing ring wear is progressive during service — backlash increases continuously as the gear teeth wear. The 11-month-old measurement of 0.010 inches established compliance at that point in time, but 11 months of continued operations have added wear since then. The note requires current confirmation, not historical compliance. Before relying on this section's capacity values, the backlash must be measured today and confirmed within the 0.012-inch specification.

56. D — At 107% of the all-directions capacity, the planned total suspended weight exceeds the capacity applicable during the swing through the all-directions sector. A lift cannot proceed when the load will exceed rated capacity during any portion of its planned path. The fact that it begins within the over-front sector's capacity is irrelevant — the swing requires passing through the over-front/all-directions boundary where the lower capacity applies.

57. D — The rope construction specification (6×36 vs. 6×19 Seale) affects the rope's flexibility, bending fatigue characteristics, fleet angle performance, and sheave groove contact geometry. These performance differences mean the load chart values developed for the 6×36 rope may not accurately represent the structural and stability conditions with the 6×19 Seale rope. The manufacturer's written approval is required specifically to confirm that the substituted construction performs equivalently in this application.

58. B — A lift percentage of 87.3% exceeds the 75% critical lift threshold established in OSHA 1926.1408. Any lift at or above 75% of rated capacity requires a written critical lift plan and a pre-lift meeting with the lift team. This requirement applies regardless of the lift percentage's relationship to 90% or other thresholds — the 75% threshold triggers the critical lift requirements and those requirements must be satisfied before the lift begins.

59. A — The note specifically authorizes operations with snow accumulation by providing the mechanism for compliance: deduct the weight of material that cannot be removed from the gross capacity. The operator cannot remove the snow from the 100-foot boom during operations, so the 400-lb estimated weight must be deducted from all subsequent capacity values until the snow is removed. Operations may continue with the reduced applicable capacity of $28,400 - 400 = 28,000$ lbs.

60. C — The jib section capacity of 12,600 lbs applies whenever the jib is physically installed on the boom tip, regardless of which hook carries the load. The jib adds concentrated weight at the boom tip that changes the structural load distribution throughout the boom's length. The main boom section values assume no jib is installed — using those values with the jib physically present applies capacity values from a different structural loading condition than what actually exists.

61. B — The crane's rated capacity is an absolute engineering limit established by the manufacturer through structural analysis and testing. No operational authority — lift director, employer, OSHA, or the operator — can authorize exceeding this limit through any operational or administrative means. If 95% is the rated maximum percentage being requested, that is within the rated limit. If the load requires more than 100% of the rated capacity, a different crane or different configuration is the only compliant solution.

62. B — Load chart sections are developed for specific configurations matching the physical equipment installed. Even if the lighter jib appears superficially "more conservative," the section title defines the exact configuration boundary. Jib differences may extend beyond weight to include different reeving paths, different pendant geometry, and different tip fitting configurations that affect the structural load path. The operator must use the section matching the actual installed equipment.

63. A — Linear interpolation from 25 to 30 feet: capacity decrease = $44,600 - 35,400 = 9,200$ lbs over 5 ft = 1,840 lbs/ft. At 28 ft (3 ft beyond 25 ft): $44,600 - (3 \times 1,840) = 44,600 - 5,520 = 39,080$ lbs. Both A and C arrive at the same answer through the same calculation from the same starting point (25 ft), confirming the interpolated capacity at 28 feet is 39,080 lbs.

64. D — The superlift counterweight cart position directly determines the restoring moment the superlift provides — moving the cart from 25 to 20 feet reduces the moment arm and the restoring moment by approximately 20%. The capacity values in the 25-foot cart section were derived for that specific geometry; a 20-foot cart position is a different, unrated configuration. The cart must be returned to 25 feet or the manufacturer must provide capacity values for the 20-foot position.

65. D — Crane load chart capacity invariably decreases as operating radius increases — this is a fundamental physical principle of load moment. Two adjacent radius cells showing identical capacity values is statistically improbable and warrants verification against the source document. Operators who rely on potentially incorrect tabulated values near their capacity limits without verification may perform lifts they believe are within capacity that actually exceed the correct capacity. Manufacturer confirmation is the only way to resolve this discrepancy.