

SIMULATION SET 10

SITE DOMAIN — Questions 1–21

1. A crane operator is evaluating a setup location at a large industrial plant. The surface consists of compacted crushed limestone that has been in place for 8 years. During the site walk, the operator notices that heavy equipment has created ruts approximately 3 inches deep across the planned outrigger zone. In one area, the operator presses a boot heel into the rut base and the material compresses approximately 0.5 inches. What does this probe test result indicate?

- A. The 0.5-inch compression is consistent with well-graded crushed limestone and confirms adequate bearing capacity
- B. A 0.5-inch boot heel penetration in the rut base indicates the material at the bottom of the rut is soft — the heavy equipment has broken through the compacted surface crust and exposed softer underlying material; this softness indicates inadequate bearing capacity for crane outrigger loading; additional investigation and likely ground preparation are required
- C. The penetration is normal for any granular material after equipment traffic and does not affect structural capacity
- D. The 3-inch rut depth with soft base is acceptable if the outrigger mat spans the rut without contacting the soft zone

2. A crane is being set up near a hospital for a rooftop HVAC installation. The site manager shows the operator an engineered crane pad drawing stamped by a structural engineer 5 years ago. The drawing shows a 24-foot × 24-foot reinforced concrete pad with specific rebar layout and 4,500 psi concrete. During the site walk, the operator observes that one corner of the pad has a 6-inch-wide by 18-inch-long crack with visible rebar corrosion. What action is required?

- A. The structural engineer's stamped drawings confirm the pad is adequate — minor surface cracking does not affect structural capacity
- B. Accept the pad as adequate since the engineer's design accounts for normal aging

C. Contact the structural engineer or a qualified engineer to evaluate the cracked section before crane setup — an engineered crane pad with visible rebar corrosion indicates that the corrosion protection has been compromised; corroding rebar expands and causes the concrete to crack further; the structural capacity at the cracked corner may be reduced below the original design

D. Place additional timber mats over the cracked corner to bridge the deficiency before setup

3. Under OSHA 1926.1402(b), what is the controlling entity's ground preparation obligation when the crane employer identifies that the existing ground conditions are inadequate for the planned lift?

A. The controlling entity must ensure that ground conditions are adequate — when the crane employer identifies inadequate conditions, the controlling entity bears the obligation to either prepare the ground to the required standard or provide an alternative setup location with adequate conditions before crane operations can begin

B. The crane employer bears the ground preparation obligation since they operate the equipment

C. Ground preparation is a shared obligation between the controlling entity and crane employer with each party preparing 50% of the outrigger positions

D. The controlling entity must document the inadequate conditions and submit a variance request to OSHA before any ground preparation can begin

4. A crane is set up at a job site when a neighboring excavation contractor begins soil nail installation — a process that drives steel rods into the surrounding ground under hydraulic pressure and then injects grout around each nail. The soil nail installation is occurring 18 feet from the crane's left rear outrigger position. What concern does the soil nail installation create?

A. Soil nail installation always improves bearing capacity in adjacent areas and benefits crane operations

B. The soil nail installation creates ground vibration at 18 feet, which is outside the 10-foot safety zone for adjacent crane operations

C. Nothing in OSHA Subpart CC addresses soil nail installation near operating cranes

D. The grouting process injects pressurized grout into the soil, which temporarily pressurizes the pore spaces around the injection point; this increased pore pressure can reduce effective stress and bearing capacity in adjacent soil; the pressurized zone may extend to the crane's outrigger position and

temporarily reduce the bearing capacity there; operations must be monitored carefully and may need to pause during active grout injection near the outrigger positions

5. A crane operator is performing a pre-setup site walk and observes a subtle but consistent downward slope of approximately 1.5% across the planned outrigger spread in the lateral direction. The crane manufacturer specifies a maximum operating out-of-level of 1% in any direction. What must happen before the crane can be set up at this location?

A. Nothing — the 1.5% slope can be compensated with the crane's built-in level adjustment capability and a 1.5% slope is common on construction sites

B. The slope must be corrected before crane setup — either by grading the surface to within the 1% tolerance or by positioning the crane so the outrigger jacks can compensate for the slope difference while maintaining the 1% level tolerance throughout all planned operations; operating at 1.5% slope when the manufacturer specifies 1% places the crane in a configuration where load chart values do not apply

C. The 1.5% slope is acceptable for lifts below 75% of rated capacity

D. The crane may operate on the 1.5% slope if all lifts are conducted only in the uphill direction

6. A crane is set up at a waterfront construction project. The outrigger positions are on a wharf deck constructed of concrete panels over steel H-piles. The original design loads for the wharf deck were 500 psf for vehicle and cargo loading. The crane's maximum outrigger reaction load is 128,000 lbs and the outrigger float is 2 square feet. What is the concentrated bearing pressure and what does this reveal about using this wharf for crane operations?

A. Bearing pressure = 64,000 psf — within normal range for industrial wharf structures

B. The wharf pile capacity always governs crane loading on marine structures — a pile capacity check supersedes the deck surface load rating

C. Bearing pressure = $128,000 \div 2 = 64,000$ psf — this is 128 times the 500 psf design loading; regardless of the pile foundation's capacity, the deck surface and its connection to the pile caps must be specifically evaluated for the concentrated outrigger point load; a structural engineer must assess the wharf's ability to carry and transfer this concentrated load before any crane setup proceeds

D. Wharf structures are inherently over-designed for industrial loading and can support any crane within the crane's rated capacity

7. Under OSHA 1926.1402(c), when must the crane operator stop operations immediately due to changing ground conditions, and who must be notified?

A. The crane operator must immediately stop operations and notify the employer whenever ground conditions change in a way that creates a concern about the crane's support — the operator does not need to confirm the severity before stopping; any change that suggests the setup is becoming unsafe requires immediate stop and employer notification so the crane employer can reassess the situation and determine what ground condition improvements are needed

B. The operator must stop only when a physical change in crane level is observed — notifications are required only after level change exceeds the manufacturer's tolerance

C. Ground condition concerns are communicated to the controlling entity, not the employer — the employer is notified only after OSHA inspection

D. The operator should contact the lift director first and then wait for direction on whether to notify the employer

8. A crane is operating on a construction site when a fuel spill from a nearby diesel generator creates a 200-gallon fuel release that flows across the site surface toward the crane's setup area. The fuel reaches the outrigger mat positions and flows beneath the mats. What concern does diesel fuel beneath outrigger mats create?

A. Diesel fuel beneath mats improves penetration resistance by lubricating the soil particles

B. The fuel creates an environmental concern but does not affect crane structural operations

C. Diesel fuel acts as a solvent and lubricant that can reduce friction between the mat and the soil surface — the lubricated interface allows the mat to slide laterally more easily under the outrigger's horizontal force component, reducing the mat's resistance to movement and potentially allowing the mat to shift during operations; operations must stop until the fuel is addressed

D. The fuel fire hazard from the generator is the primary concern — structural concerns are secondary

9. A crane operator is setting up at a site where the access road crosses a culvert. The culvert is a 24-inch diameter corrugated metal pipe at 3 feet of depth carrying seasonal stormwater. The crane's travel weight is 186,000 lbs. What assessment is required before the crane travels over the culvert?

- A. Nothing — culverts under road crossings are designed for any vehicle that can legally travel on the road
- B. The culvert's structural capacity under the crane's axle loads must be confirmed — corrugated metal culverts have specific wall strength ratings that, when loaded by a concentrated axle load, may yield or buckle if the load is not within the culvert's design capacity; a 186,000-lb crane creates axle loads that may far exceed highway design loads; the culvert must be evaluated before crane travel over it
- C. A 3-foot depth of cover always provides adequate protection for culverts under crane travel
- D. Standard highway design culverts handle all legal vehicle loads without evaluation

10. A crane is operating at a job site when the operator notices that the surface of the soil adjacent to the outrigger pads has developed a series of concentric circular cracks centered around the pad edge. The cracks extend approximately 18 inches from the pad edge. What does this cracking pattern indicate?

- A. Concentric cracks centered around the pad edge are caused by the pad's weight uniformly compressing the soil — this is normal compaction behavior
- B. The circular crack pattern indicates the concrete mat is settling properly into the soil — this confirms adequate bearing
- C. The crane must be moved immediately — the circular cracks indicate that the soil has exceeded its bearing capacity and is failing
- D. Concentric circular cracks around a loaded outrigger pad indicate the soil is experiencing a Prandtl failure mechanism — the pad is pushing downward and the soil is beginning to shear outward along a curved failure surface; this is the first visible sign of bearing capacity failure and requires immediate operational stoppage and load removal before complete shear failure occurs

11. Under OSHA 1926.1407(b)(4), what is the specific exception that allows crane operations within the normally prohibited minimum safe approach distance from an energized power line when de-energization is not feasible?

A. When the crane employer establishes an encroachment prevention plan that includes a dedicated spotter, a clearly marked trigger point, and the spotter having a direct means of stopping the crane — these specific elements together create the conditions under which operations within the normal MSAD zone may proceed without de-energization

B. Nothing — OSHA 1926.1407 does not allow any exception to the MSAD once it is established

C. Any NCCCO-certified operator may work within the MSAD if they have completed a power line safety course

D. The exception applies automatically when the utility refuses to de-energize the line

12. A crane is set up at a job site adjacent to a storm drain outfall. During a moderate rainstorm, the storm drain system becomes overwhelmed and water backs up and exits the outfall at 8 psi. The pressurized water discharges horizontally across the surface and flows toward the crane's setup position. What is the specific concern?

A. The rain itself is the primary concern — storm drain discharge pressure has no bearing on crane operations

B. Nothing — 8 psi is a low pressure and the water will drain before reaching the outrigger positions

C. A pressurized water discharge at 8 psi can erode and undermine the soil beneath the outrigger mats by piping — the pressurized water forces its way through the soil, carrying fine particles with it and creating subsurface channels; this active erosion can eliminate bearing capacity beneath the mats rapidly and without surface evidence; crane operations must stop immediately

D. The storm drain discharge creates only a slip hazard for personnel — crane structural concerns do not apply

13. A crane operator is asked to set up for a lift at a site where the subsurface investigation report indicates a perched water table at 4 feet of depth in a sandy silt zone. The report was completed in the spring when groundwater was at its seasonal peak. The current setup is in August. What must be evaluated before relying on the spring report for the current setup?

A. Nothing — the spring report represents the most conservative seasonal conditions and is adequate for all subsequent seasonal conditions

B. The summer water table may be lower than the spring report indicates — a lower water table generally improves bearing capacity in sandy silt by increasing effective stress; however, the surface zone may have dried and formed desiccation cracks that reduce lateral integrity; the current actual conditions should be evaluated to confirm the soil at the planned outrigger positions matches the assumptions in the spring report

C. Spring water table reports are only valid for 30 days — a new investigation is always required after 30 days

D. The spring report with a perched water table at 4 feet is too conservative for summer operations — proceed without re-evaluation since summer conditions are always better

14. Under ASME B30.5, what is the minimum documentation required at a crane setup location before operations can begin when ground conditions have been specifically identified as a concern in the pre-lift planning?

A. A verbal confirmation from the controlling entity that the ground is adequate

B. A written email from the project engineer stating the ground is safe for crane operations

C. A field photograph of the outrigger positions showing the ground appears firm

D. Written documentation confirming the specific bearing capacity of the soil at the setup location and a calculation or verification showing that the planned outrigger reaction loads do not exceed the confirmed bearing capacity — when ground conditions are specifically flagged as a concern, oral assurances and visual inspections are not sufficient; the documented calculation confirms that load and capacity have been compared and the margin is adequate

15. A crane is operating at a job site when the temperature drops 25°F over a 4-hour period due to a fast-moving cold front. The setup area consists of medium-stiff clay with a previously confirmed bearing capacity of 3,800 psf. What effect does the rapid temperature drop have on the crane's ground support conditions?

A. A rapid temperature drop in medium-stiff clay can cause frost-related surface heaving in the top 1 to 2 inches, but also causes the pore water to begin freezing from the surface down — as water transitions from liquid to ice, the resulting ice crystals can disrupt soil structure at the surface while also temporarily increasing surface stiffness; the net effect must be evaluated rather than assumed positive or neutral

- B. Temperature drops below freezing always improve clay bearing capacity by freezing the pore water
- C. Temperature drops have no effect on bearing capacity in medium-stiff clay
- D. A 25°F temperature drop over 4 hours has no meaningful effect on bearing conditions at depth

16. A crane operator is positioning the crane for a lift when they notice the exclusion zone barrier has been compromised — a section of orange safety fence has been knocked down by a delivery truck, creating a 12-foot gap. No personnel are currently in the zone. What must happen before crane operations resume?

- A. Continue operations since no personnel are currently in the zone — the barrier can be repaired after the current lift
- B. Sound the horn to warn any approaching personnel and continue operations while someone repairs the fence
- C. Stop all crane operations until the exclusion zone barrier is fully restored — an exclusion zone with a gap does not function as a barrier; unauthorized persons can enter through the gap without any physical impediment, and crane operations may not proceed without confirmed functional exclusion zone boundaries
- D. Reduce the swing radius by booming up to create a smaller exclusion zone that fits within the remaining intact barrier

17. A crane is being set up when the site engineer informs the operator that a 36-inch diameter water main crossing the setup area has been operating under drought emergency conditions — the main has been running at 110% of its design flow capacity continuously for 6 weeks. What concern does this operational condition create for crane setup?

- A. Nothing — water mains are buried utilities that do not affect surface bearing capacity
- B. A water main running at 110% of design flow for 6 weeks may have developed micro-cracks or joint separation — the prolonged over-pressure can also cause localized soil saturation through minor seepage at joints; the combination of a potentially compromised main and extended seepage may have created a saturated zone along the main's route that reduces bearing capacity; the main's route and condition must be confirmed before outrigger loading

C. Over-pressure in a water main only creates concerns for surface features like fire hydrants — buried mains are unaffected

D. The water main's operational status creates an environmental regulatory concern but not a structural crane concern

18. A crane is set up at a job site when the operator observes that a loaded concrete truck is backing toward the setup area to make a pour at a location 25 feet from the right front outrigger. The concrete truck weighs approximately 68,000 lbs loaded. What specific concern does the nearby concrete truck create for the crane's setup?

A. The concrete truck creates noise and communication interference that may affect signal reception

B. The concrete truck's proximity requires OSHA to be notified before the pour can begin

C. The truck only creates concerns if it parks directly over an outrigger position

D. The loaded concrete truck applies a substantial additional surcharge to the soil between its wheels and the crane's outrigger at 25 feet — this surcharge increases the lateral earth pressure acting against the soil supporting the outrigger; in soil that is already near its bearing capacity limit, the added surcharge from the adjacent truck can reduce the bearing capacity available to the outrigger and must be considered as part of the total loading on the soil supporting the crane

19. A crane operator is reviewing the site utility map and discovers that a 6-inch high-pressure gas main (400 psi operating pressure) crosses the planned outrigger spread at 24 inches of depth. The locate tolerance zone shows the pipe could be anywhere within 36 inches of the marked centerline. What action is required before setup proceeds?

A. The exact location of the gas main must be positively determined through vacuum excavation or equivalent positive location method before any outrigger loading in the vicinity — a 400 psi gas main within a 36-inch tolerance zone is too close to an outrigger position to proceed without confirmed position; a rupture during crane operations could be catastrophic; the pipe must be precisely located

B. A 24-inch depth provides adequate cover for any crane outrigger loading — no special action is needed

C. Notify the utility operator by phone and proceed while awaiting their response

D. Reduce the planned lift load to 80% to reduce the outrigger reaction load near the gas main

20. A crane is operating at a site where a second crane is simultaneously placing precast panels 90 feet away. The second crane's operator observes that their crane begins tilting progressively — the level indicator shows increasing tilt toward the load side during a static hold. The second crane's operator radios the first crane's operator about the developing condition. What should the first crane's operator do?

A. Continue operations — the second crane's condition is that crane's operator's responsibility

B. Sound the horn to warn personnel and continue operations while monitoring

C. Stop all first crane operations until the cause of the second crane's progressive tilt is identified and the second crane's situation is stabilized — a progressive tilt during a static hold at a nearby crane indicates potential ground failure; the failure zone may extend to the area where the first crane is operating and progressive ground failure at one point can propagate to adjacent areas

D. Reduce the first crane's operating capacity to 75% as a precaution while the second crane's condition is investigated

21. A crane is set up at a site where a recently installed drainage improvement project has replaced the natural soil in a 20-foot-wide corridor with open-graded crushed stone backfill surrounding perforated drain pipe. The crane's left outrigger spread requires one pad on each side of this drainage corridor — one pad on native soil and one pad on the open-graded stone fill. What concerns does the open-graded stone fill create?

A. Nothing — open-graded crushed stone always has higher bearing capacity than native soil

B. The open-graded stone fill has very high permeability but very low inherent cohesion compared to compacted dense-graded stone — individual stone pieces can shift under concentrated loads; additionally, the perforated pipe within the stone zone represents a void in the load path; the outrigger on the open-graded stone fill may experience different settlement characteristics than the outrigger on native soil

C. One pad on stone and one on native soil creates an unbalanced condition requiring 25% capacity reduction

D. Open-graded stone fill is classified as engineered fill and cannot be used for crane support without PE certification

OPERATIONS DOMAIN — Questions 22–48

22. A crane operator is preparing to begin a lift when the signal person asks the operator to hoist first before completing the hand signal briefing. The signal person says the briefing can happen after the first hoist. What is required before any crane movement?

A. Accept the signal person's approach — the first hoist is a simple movement that doesn't require signal briefing

B. The hand signal briefing must be completed before any crane movement — OSHA 1926.1419 requires both the operator and signal person to understand and agree on all signals before operations begin; no crane movement may occur until the communication system is confirmed

C. Begin the lift slowly while the signal person completes the briefing verbally

D. The lift director may authorize beginning the first movement before the signal briefing if the lift is routine

23. A crane operator is performing a lift at 79% of rated capacity when the crane's travel alarm activates even though no travel input has been made. The alarm sounds 3 times and then stops. The load is at 4 feet of height. What is the correct response?

A. Stop all crane operations, lower the load to the ground, and investigate the unexpected travel alarm activation before continuing — an alarm activating without operator input indicates an electrical or mechanical fault in the travel system; the travel function activating unexpectedly during a lift could cause the crane to move with the load suspended, which could cause a tip-over or load swing

B. Continue the lift since the alarm stopped and no travel occurred

C. Ask the signal person whether they observed any crane movement before deciding whether to stop

D. The alarm may be caused by a sensor fault — reset the alarm system and continue the lift

24. Under OSHA 1926.1431, when is it permissible for a crane to hoist personnel without a purpose-built personnel platform — for example, using a modified material basket?

- A. Personnel may be hoisted in any container approved by the lift director when a dedicated platform is unavailable
- B. Personnel may be hoisted in a modified basket when the basket capacity is confirmed adequate
- C. Personnel may never be hoisted in a crane-suspended container that was not specifically designed, built, and tested as a personnel platform in accordance with OSHA 1926.1431; using a modified material basket for personnel hoisting is prohibited regardless of its structural capacity
- D. A modified material basket may be used for personnel hoisting when the modification was performed by a certified fabricator and documented

25. A crane operator is performing a precision lift that requires threading the load through a tight space. During the approach to the set location, the operator receives a STOP signal but the load's momentum from the swing movement causes it to continue drifting approximately 18 inches past the stopped upper works before coming to rest. What technique should the operator use to reduce this overshoot on the next attempt?

- A. Nothing — load momentum drift after a stop is unavoidable and the signal person should account for it
- B. Reduce the swing speed well before the planned stop point so the crane arrives at the stop position with minimum velocity — in precision work, the operator should reduce swing speed progressively as the load approaches the target, so that when the STOP signal is given, the crane is already moving slowly enough that momentum drift is minimal or negligible
- C. Apply the swing brake at full force immediately when the STOP signal is given
- D. Increase the signal person's distance from the crane to allow more stop-distance for momentum dissipation

26. A crane is performing a series of 12 repetitive lifts. After the 7th lift, the operator notices a new drip of hydraulic fluid on the right side of the cab — a spot approximately the size of a quarter. No previous drips were observed. What action is required?

- A. Nothing — a small drip of hydraulic fluid during repetitive lift operations is a normal expected condition
- B. Document the drip in the shift log and have maintenance inspect during the next scheduled service
- C. Continue the lift series and check the hydraulic fluid level at the end of the shift
- D. Stop operations and identify the source of the hydraulic drip — a new hydraulic leak that appears during operations may indicate a hose or fitting that is developing under the repetitive load cycling; even a small drip can indicate a failing component that may release suddenly during a subsequent lift; the source must be identified and the leak severity assessed before continuing operations

27. A crane operator is performing a lift when a nearby structural connection fails — a temporary beam falls from a structural frame adjacent to the lift area and lands 12 feet from the crane. No one is injured. The crane is currently mid-swing with the load at 8 feet of height. What is the correct response?

- A. Complete the current swing to the set location and then assess the area to ensure no further structural failures are likely
- B. Sound the emergency horn and continue the current swing to a safe set location at minimum speed
- C. Lower the load to the ground immediately — the structural failure of a nearby beam indicates the structural system adjacent to the lift area may have additional instability; continuing the lift could expose the operator and crew to additional falling objects; the entire area must be assessed for structural stability before any crane operations resume
- D. Continue if the beam fell more than 10 feet from the crane since this is outside the crane's structural zone of concern

28. Under OSHA 1926.1416, what is the specific action required when a crane's hoist brake is found to allow controlled drift during a pre-shift brake test?

- A. The crane may continue operating if the drift rate is less than 6 inches per minute
- B. Document the drift rate and continue operations while scheduling brake maintenance within 48 hours
- C. The crane must be removed from service until the hoist brake is repaired — any drift during a brake hold test indicates the brake cannot reliably hold the rated load; operating with a drifting hoist brake

creates an unacceptable risk of uncontrolled load descent during any lift, particularly during extended holds or personnel hoisting; the brake must be repaired and confirmed functional before operations

D. The crane may continue with a 25% capacity reduction to reduce the hoist load on the deficient brake

29. A crane operator is performing a lift in an area where welding sparks from nearby structural steel work are raining down on the load and the crane's load line. The sparks appear to be landing on both the load and the rope periodically. What concern does spark exposure create for the load line and what action is required?

A. Nothing — welding sparks cool immediately on contact and cannot damage steel wire rope

B. Stop crane operations in the weld spark zone — welding sparks can melt individual wires in the load line at the contact point, creating weld splatter marks or fused wires that are removal conditions under OSHA 1926.1413; additionally, the electrical current from the welder can travel through the crane structure if the work cable ground is inadequate; the welding operation must be shielded or the crane moved out of the weld spatter zone before operations continue

C. Continue operations since the sparks are cooling to below ignition temperature before reaching the rope

D. Apply rope lubricant to the load line to protect it from weld spatter contact

30. Under OSHA 1926.1427, when a crane operator holds a valid NCCCO certification for a specific crane type, under what circumstances does the employer's competency evaluation still apply?

A. The employer's competency evaluation is not required when the operator holds a valid NCCCO certification — the certification satisfies the employer evaluation requirement

B. The employer evaluation is only required when the operator is new to the company

C. The employer evaluation is only required when the crane model changes significantly from the previous assignment

D. The NCCCO certification satisfies the type-level knowledge requirement, but the employer must still evaluate and document that the operator is competent to safely operate the specific crane being used at the specific worksite — the worksite-specific evaluation covers the specific crane model, its controls, its condition, and the site-specific hazards that the NCCCO certification cannot address

31. A crane operator is asked to perform a lift that requires the load to be set on a structural beam at 60 feet of height. The load weighs 18,400 lbs. The crane's net capacity at the planned configuration is 22,000 lbs. The lift director mentions that the beam is slightly misaligned and may require the crane to push it sideways approximately 6 inches as the load is being set. What is the concern with pushing the beam as part of the set?

- A. Using the crane's load to push the beam 6 inches creates a lateral load on the boom — even this small lateral force combined with the 18,400-lb vertical load at 60 feet creates a side-loading condition on the boom that it was not designed to carry; if the beam provides resistance rather than moving freely, the lateral force required could significantly exceed the pushing force needed and could overload the boom laterally; the beam alignment must be corrected independently before the lift proceeds
- B. The 6-inch push is within the crane's standard precision placement tolerance and requires no special consideration
- C. The push creates a problem only if the beam is heavier than the load being set
- D. The lift director's authorization of the push satisfies all concerns about the lateral movement requirement

32. A crane is performing a lift at 92% of rated capacity when the operator observes that the load has rotated 45 degrees from its original orientation. The load is a 14,000-pound electrical transformer with top-mounted lifting lugs. The rotation did not occur during the pick — it developed slowly during the hoist. What must the operator do?

- A. Use the swing function to rotate the upper works 45 degrees to match the load's rotation and proceed to the set location
- B. Continue to the set location since 45 degrees of rotation does not affect the crane's structural loading
- C. Stop the hoist immediately — load rotation during hoist on a transformer with top-mounted lifting lugs may indicate the load has shifted within the rigging, a sling leg has slipped on the lug, or the lifting lug capacity is being loaded at a non-intended angle; all of these conditions require the load to be returned to the ground and the rigging evaluated before the lift continues
- D. The rotation is normal for transformers due to their internal fluid content and the load may proceed to the set location

33. A crane operator is completing a critical lift at 88% of rated capacity when the lift director approaches the cab and says the load is 1,400 lbs heavier than originally documented — the load weight was miscalculated. The total suspended weight is now confirmed at 92% of rated capacity. What must happen before the lift continues?

- A. Continue since 92% is still below 100% of rated capacity and within the operating range
- B. Stop the lift immediately — the load weight discovery during an active lift changes the previously confirmed capacity percentage and any prior critical lift plan documentation must be updated; additionally, the lift must be immediately assessed to confirm the revised 92% total suspended weight is within the crane's rated capacity at the current configuration and radius before any further movement
- C. Ask the lift director to confirm the weight difference in writing before making any operational decision
- D. Reduce the operating radius to bring the load back to the original 88% figure before continuing

34. Under OSHA 1926.1416(d), what is required when crane operations are to occur in an area where the counterweight's rotation path comes within 2 feet of a building wall?

- A. A physical barrier between the building wall and the counterweight path must be established before operations begin — the barrier must prevent unauthorized access into the area between the crane and the building while also warning of the tight clearance; the 2-foot space creates a serious crush hazard for any person who enters the gap between the rotating counterweight and the fixed wall
- B. Nothing — 2 feet is the standard clearance for counterweight operations near structures
- C. Operations within 2 feet of a structure are always prohibited regardless of barriers
- D. The building occupants must be notified of the crane operation before work begins

35. A crane is performing a lift when the crane's LMI alarm activates at 95%. The operator was planning this as a routine lift at a calculated 84% capacity. No configuration change was made. The operator's first thought is that the LMI may be malfunctioning. What is the correct response?

- A. Stop the hoist and hold the load — investigate the cause of the unexpected 95% reading before any further movement; an unexpected LMI reading 11 percentage points above the planned value requires immediate investigation because it may indicate a real load condition change (heavier-than-documented load, greater effective radius from boom deflection, or misconfigured LMI) rather than a malfunction; resuming without investigation risks exceeding rated capacity
- B. Override the LMI alarm and continue to the set location — the planned calculation confirmed 84%
- C. The LMI must be malfunctioning — reset the alarm and continue the lift
- D. Consult the lift director before deciding whether the alarm represents a real concern

36. A crane operator is working at an elevation of 5,200 feet above sea level at a location where the ambient temperature is 92°F. The crane's manufacturer specifies rated capacity at sea level and standard ambient temperature. What concern does high altitude and high temperature create for crane operations?

- A. The altitude requires OSHA notification before operations above 3,000 feet above sea level
- B. Nothing — crane structural and stability limits are not affected by altitude or temperature
- C. High altitude and high ambient temperature both reduce engine power output — at reduced power, the crane's hydraulic system develops less maximum pressure, which can reduce the maximum hoist force available and affect the brake system's holding capacity; the manufacturer must be consulted for derating factors applicable at 5,200 feet and 92°F if operations near rated capacity are planned
- D. The crane may operate normally at altitude and temperature since modern diesel engines compensate automatically

37. A crane operator is performing a lift at 86% of rated capacity in sustained 22 mph winds. The load is a 16-foot × 24-foot architectural panel. The crane's general wind limit is 25 mph. The lift director confirms 22 mph is within the limit and approves the lift. What independent evaluation must the operator make?

- A. Nothing additional — the lift director's approval and the confirmed wind speed within the limit authorize the lift
- B. The operator must independently evaluate whether the specific panel's wind area and the resulting lateral force on the crane at 22 mph are within the crane's structural design assumptions for side loading

— a large flat panel at 22 mph creates lateral wind forces that may exceed the boom's lateral design capacity even though the speed is within the general limit

C. The operator must contact the crane manufacturer to obtain the wind derating factor for 22 mph operations

D. The operator must request that the lift director obtain a written weather forecast before proceeding

38. A crane operator notices during a lift that the hook block is spinning continuously at approximately one revolution every 12 seconds. The load is a 12,000-pound steel fabrication attached with a four-leg wire rope sling bridle. No tag lines are in use. What does continuous load rotation indicate and what must the operator do?

A. Nothing — slow continuous rotation is normal for loads attached with wire rope slings

B. Continue the hoist and plan to use the swing function to rotate the load to the correct orientation at the set location

C. The continuous rotation is acceptable as long as the rotation rate is less than 0.1 rpm

D. Stop the hoist at the current height and use a tag line to arrest the rotation before any further movement — continuous load rotation during hoist can cause sling legs to twist around each other, progressively reducing the effective choking capacity of each leg; it can also unscrew shackle pins under the rotational force; rotation must be arrested before the load reaches operating height

39. Under OSHA 1926.1416(e), what must the operator confirm about the load chart before beginning each day's operations?

A. The operator must confirm that the load chart is available and accessible in the cab, applies to the specific crane being operated, and is in a legible condition — if the chart is missing, damaged to the point of illegibility, or applicable to a different crane, operations may not begin until the correct readable chart is obtained; the chart confirmation is a pre-operational requirement, not something that can be deferred to when a specific lift requires a chart lookup

B. The operator must memorize the crane's three most common operating radii and their capacities from the load chart before beginning operations

C. Nothing — a pre-shift equipment checklist substitutes for load chart confirmation

D. The load chart must be signed by the lift director each morning confirming it is current and applicable

40. A crane is performing a repetitive series of picks when the operator notices that the wire rope on the hoist drum is beginning to pile — the rope is building up on the left side of the drum rather than winding uniformly across the drum width. What does rope piling indicate and what must happen?

A. Rope piling on the drum is a normal characteristic of cranes with large drum capacities and requires no action

B. The piling indicates the rope is under-tension during winding — increase the load to improve rope lay on the drum

C. Rope piling occurs during break-in of a new rope and is expected during the first 20 hoist cycles

D. Rope piling on one side of the drum indicates a fleet angle problem or a broken rope guide — the rope is not tracking properly across the drum width; piled rope creates cross-winding on subsequent layers that crushes the lower rope under concentrated contact pressure; operations must stop and the drum rope guide and fleet angle must be investigated

41. A crane operator is performing a critical lift at 91% of rated capacity and has been in continuous operations for 7 hours on a hot day. The operator notes that their decision-making is beginning to feel affected by fatigue. The critical lift plan specifies this specific lift. What is the correct response?

A. Complete the critical lift since it is specified in the plan and stopping mid-shift may disrupt the project

B. Notify the lift director that the operator believes fatigue may be affecting decision-making — the operator should stop and decline to perform the critical lift until either they have adequately rested or a qualified relief operator is available; performing a 91% capacity critical lift with self-recognized cognitive impairment creates an unacceptable risk for the operator, crew, and all personnel near the operation

C. Reduce the lift speed to minimum to allow more reaction time given the fatigue condition

D. Take a 10-minute break and then proceed with the critical lift as planned

42. Under OSHA 1926.1431, what is the specific restriction on the crane's rated capacity when used for personnel hoisting, and what is included in the calculation of load against this limit?

- A. Personnel hoisting is limited to 75% of rated capacity — the total includes only the platform weight and all personnel
- B. Personnel hoisting is limited to 50% of rated capacity — the total includes the platform, all personnel, all tools and equipment, and all rigging; nothing in the suspended load is excluded from the 50% calculation
- C. Personnel hoisting is limited to 50% of rated capacity — the total includes only the platform and personnel, not tools and equipment since those are secondary items
- D. Personnel hoisting is limited to 60% of rated capacity — the reduced limit applies only when the platform is at maximum height

43. A crane operator observes that during a lift at 82% of rated capacity, the boom shows an unusual vibrational resonance — a steady oscillation that was not present during previous lifts in similar conditions. The oscillation appears to be a rhythmic lateral motion of the boom tip synchronized with the load's pendulum swing frequency. What must the operator do?

- A. Stop all movement and hold the load stationary — when the load's pendulum frequency matches a structural resonance frequency of the boom, the oscillation can amplify progressively, potentially reaching structural failure; this is called resonance and the operator must dampen the oscillation by holding the load stationary until the oscillation decays, then slowly swing and hoist to avoid re-exciting the resonance
- B. Increase the hoist speed to change the pendulum frequency and disrupt the resonance condition
- C. Continue at reduced speed while monitoring whether the oscillation amplitude increases or decreases
- D. The oscillation is caused by wind interacting with the boom — wait for the wind to shift direction

44. A crane operator is performing a lift when the lift director instructs the operator to "set the load quickly" because a concrete pour is setting up faster than expected. The load is at 60 feet of height. The operator would need to lower at approximately 3 times the normal lowering speed to comply. What is the correct response?

A. Continue lowering at normal speed since the lift director's instruction did not override normal operating procedures

B. Lower at double normal speed — a compromise between the lift director's request and safe practice

C. Communicate to the lift director that increasing lowering speed to 3 times normal would create unacceptable dynamic loads on the crane and rigging and is not safe — offer to lower at the maximum safe lowering speed for the current configuration and load weight as an alternative; "quickly" is not an authorized instruction that overrides safe operating speed limits

D. Ask the lift director to document the request in writing before accelerating the lowering speed

45. A crane is performing a lift at night when a power outage extinguishes all site lighting. The load is at 14 feet of height, the signal person is no longer visible, and the load is not visible. What is the immediate correct action?

A. Stop all crane movement immediately, sound the emergency horn to warn all personnel in the work area, and hold the load stationary until emergency lighting is established or confirmed adequate to resume operations — continuing any crane movement without visibility of the signal person and the load creates an unacceptable risk of load contact with personnel or structures

B. Lower the load immediately to the ground at minimum speed using the crane's controls without signal guidance

C. Continue operations at minimum speed using the crane's instruments and LMI as guidance

D. Contact the lift director by radio and await instructions before taking any action

46. Under OSHA 1926.1419, which of the following correctly describes the circumstances under which the operator may respond to a signal from someone other than the designated signal person?

A. The operator may respond to a signal from the lift director at any time — lift directors have authority over signal persons

B. The operator may respond to any clear hand signal from any construction worker who appears familiar with crane operations

C. The operator may never respond to signals from anyone other than the designated signal person except to respond to an Emergency Stop signal, which any person at any time may give and to which the operator must always comply immediately

D. The operator may respond to signals from any NCCCO-certified rigger who is present at the lift location

47. A crane operator is tasked with performing 20 repetitive identical lifts across a shift. After confirming capacity for the first lift, what is the minimum verification required before each subsequent identical lift?

A. A full load chart lookup must be performed before each lift regardless of whether the parameters are identical

B. Nothing — once the first lift is confirmed, all identical subsequent lifts in the same configuration are automatically authorized

C. The load chart must be re-confirmed at the beginning of each hour of repetitive operations

D. Before each subsequent identical lift, the operator must confirm the crane configuration has not changed, the crane remains level within tolerance, the load weight has not changed, and the operating radius is the same — any change in these parameters requires a new capacity verification; absent any change, the first confirmation remains valid for the identical lifts but the operator's ongoing verification confirms the identical conditions persist

48. A crane is performing a critical lift when the operator observes that the ground crew has placed an unplanned load — a bundle of steel reinforcing bars — on the flatbed truck that holds the load being lifted. The bundle weighs approximately 800 lbs and reduces the effective rigging clearance at the load. What is the required action?

A. Continue the lift since the additional 800-lb bundle is on the truck, not suspended from the crane

B. Reduce the operating radius slightly to account for the reduced rigging clearance

C. Stop the lift and have the bundle removed from the truck before continuing — unplanned items placed near the load being lifted can affect the rigging clearance, create an unexpected load shift if the bundle slides off the truck during the hoist, and complicate the load's departure from the truck; the lift plan did not account for this configuration and must be confirmed adequate before continuing

D. Ask the signal person to confirm the rigging clearance is adequate before proceeding

TECHNICAL KNOWLEDGE DOMAIN — Questions 49–70

49. A crane's pre-shift inspection finds that the main hook's safety latch spring has weakened to the point where the latch closes by gravity but requires only a 1-ounce lateral force to open — far less than the original design spring force. The hook's physical dimensions are within all removal criteria. What is the status of this hook?

A. A safety latch that can be opened with minimal force is a latch that will open from accidental contact with rigging during load picking or setting — the latch is effectively non-functional as a safety device; the hook must be removed from service until the latch spring is replaced; ASME B30.10 requires the latch to function properly, and a latch that opens under 1-ounce force does not meet this standard

B. Nothing — the latch closes by gravity, which confirms it is functional

C. The weakened spring is acceptable for straight vertical lifts where no lateral rigging contact is expected

D. Replace the spring at the next scheduled maintenance interval — the latch remains serviceable until then

50. Under ASME B30.9, what is the removal criterion for a chain sling that has experienced permanent elongation — the measured length is 3% greater than the original manufacturer's rated length?

A. A 3% elongation is within the acceptable service tolerance for Grade 80 chain slings under ASME B30.9

B. Chain slings must be removed when measured elongation exceeds 3% of the original chain length — a 3% elongation indicates the steel has yielded beyond its elastic limit; the chain has been permanently deformed beyond its design parameters and may have reduced impact resistance and fatigue strength that is not recoverable; the sling must be removed from service

C. A 3% elongation is only a removal criterion when it occurs in fewer than 5 links — elongation distributed over the full sling length is acceptable

D. Chain slings do not have elongation-based removal criteria — visual inspection for cracks and nicks is the only applicable criterion

51. A crane is operating in an industrial facility when the operator smells a chemical burning odor from the crane's electrical panel — distinct from hydraulic fluid or fuel. The crane is functioning normally and no alarms are active. What action is required?

A. Stop all crane operations immediately, lower the load to the ground, and investigate the electrical odor source before continuing — a chemical burning smell from an electrical panel indicates overheating or burning of electrical insulation; electrical fires in enclosed panels can develop rapidly and become uncontrollable; the absence of alarms does not confirm safety since the smell may precede alarm activation

B. The smell may be from the facility environment — continue operations and ask maintenance to investigate

C. Continue operations while monitoring for smoke or visible flame

D. Activate the electrical panel's fire suppression system while continuing operations

52. A rigger is preparing to use a double-braided nylon rope as a sling for a lift. The rope has a listed breaking strength of 22,000 lbs. The lift requires a WLL of 4,000 lbs. Under ASME B30.9's design factor requirements, what is the minimum breaking strength required for this application?

A. Minimum breaking strength = $4,000 \times 5 = 20,000$ lbs — the rope's 22,000-lb breaking strength meets the minimum requirement

B. Nothing — nylon rope slings may not be used for crane lifts; only ASME-rated slings are authorized

C. Minimum breaking strength = $4,000 \times 5 = 20,000$ lbs — the 22,000-lb rope's rated breaking strength exceeds the minimum and appears adequate; however, the rope must also be confirmed to be specifically rated as a rigging sling under ASME B30.9 or equivalent standard — a rope's listed breaking strength is not automatically equivalent to a sling's rated WLL which must account for the specific hitch configuration and other factors

D. Minimum breaking strength = $4,000 \times 7 = 28,000$ lbs — personnel adjacent to rigging requires a 7:1 design factor

53. A crane's annual inspection identifies that the boom tip sheave has a visible flat spot — a worn section approximately 1.5 inches long where the circular sheave profile has been worn flat. The sheave is the primary sheave for the main load line. What must be done?

- A. Monitor the flat spot at monthly inspections and replace the sheave when the flat spot exceeds 3 inches in length
- B. Apply a tungsten-carbide wear coating to the flat spot to restore the circular profile before returning to service
- C. Nothing — sheave wear to a flat spot is a normal characteristic of high-cycle applications
- D. The sheave must be replaced — a flat spot on the sheave creates an impact load on the rope each time the flat zone contacts the moving rope; this repetitive impact causes accelerated fatigue wire breaks in the rope at the contact location; continued operation also causes additional flat spot wear that will increase the impact severity progressively; both the sheave and the section of rope that has been running over the flat spot must be replaced

54. A crane operator is reviewing inspection documentation and finds that a previous quarterly inspection noted "boom lacing rod showing surface rust — monitor." The notation is 9 months old and no subsequent action was documented. What must the operator do?

- A. Continue operating since the notation is flagged for monitoring and no action threshold was specified
- B. The existing notation is adequate — continue monitoring at subsequent inspections without additional action
- C. The notation confirms no action is required since it is marked for monitoring only
- D. The operator must ensure the boom lacing rod is currently evaluated by a qualified person — a "monitor" notation from 9 months ago that has no follow-up documentation means the monitoring protocol was not executed; surface rust that progresses to pitting or section loss on a lacing rod can significantly reduce the rod's compressive capacity; a current evaluation is required before operations

55. A crane's hook block is found to have a crack in one of the reeving sheave pins — a small crack approximately 1/4 inch long at the pin's pressed-fit contact surface. The sheave rotates normally. What action is required?

- A. The hook block must be removed from service — a crack in a reeving sheave pin is a structural failure in a load-bearing component; the pin carries the sheave's load directly and transfers it to the hook block frame; even a small crack at the pressed-fit contact surface indicates fatigue initiation that can

propagate to complete pin fracture under subsequent loading; replacement of the pin is required before the block returns to service

- B. Nothing — sheave pins rarely carry significant load and the crack is in a non-critical location
- C. Monitor the crack at monthly inspections; remove from service when the crack exceeds 1 inch
- D. Apply a structural adhesive to the crack and return the block to service

56. Under ASME B30.5, what must be done when a crane undergoes a modification that changes any parameter that may affect the crane's rated load — such as replacing the counterweight with a heavier one?

- A. The crane owner may self-certify the modification if it is within 10% of the original parameter
- B. Nothing — counterweight modifications do not affect structural ratings and may be made without manufacturer involvement
- C. Any modification that may affect the crane's rated capacity must be approved by the crane manufacturer or a qualified engineer, and the crane must be re-rated if the modification affects the load chart values; the load chart must be updated to reflect the new configuration before the crane is operated in the modified state; operating a modified crane without updated capacity documentation is prohibited
- D. The modification must be registered with OSHA before the crane can be operated in the modified configuration

57. A crane inspector is examining a wire rope and finds a section where a localized deformation has created a "kink" — a permanent angular bend in the rope that creates a sharp angle at the bend point. The kinked section is in the middle of the rope, not near a fitting. The rope otherwise appears undamaged. What action is required?

- A. Nothing — rope kinks are only a removal condition when they occur within 3 feet of an end fitting
- B. Remove the kinked section by cutting the rope and installing a new end fitting to create a shorter but serviceable rope
- C. Apply tension to the rope and run it through a sheave to work the kink out before returning to service

D. The entire rope must be removed from service — OSHA 1926.1413 and ASME B30.5 both list kinks as an absolute removal condition; a kinked rope has been permanently deformed, creating a stress concentration at the bend point that cannot be corrected by straightening; any remaining tension in the kinked rope after straightening would be unevenly distributed, making the rope structurally unreliable at that point

58. A crane is operating when the hydraulic oil reservoir sight glass shows the fluid level has dropped from the "full" mark to approximately 20% below the minimum operating mark during a single 8-hour shift. The crane showed no visible leaks at the start of the shift. What does this significant fluid loss over one shift indicate?

A. Hydraulic fluid evaporates slightly during hot weather operations — a 20% below minimum level after 8 hours is normal in high ambient temperatures

B. The fluid loss indicates a 20% variation in oil level is within the normal range for the reservoir's temperature expansion and contraction cycle

C. The crane must be shut down immediately — a significant hydraulic fluid loss over one shift indicates an active internal or external leak somewhere in the system; operating with fluid below the minimum mark risks pump cavitation and starves the hydraulic components of lubrication; additionally, the leak source must be found and repaired to prevent complete fluid loss and loss of all hydraulic functions including load-holding capacity

D. Refill the reservoir and continue operations while having the fluid loss investigated at the next scheduled maintenance

59. A crane operator's certification has been obtained through the employer's qualified evaluator pathway (OSHA Option 2). The operator changes employers. What is the status of the Option 2 certification when the operator starts with the new employer?

A. The Option 2 employer-based certification transfers automatically to any new employer since OSHA authorizes this qualification pathway

B. Nothing — all operator certifications are portable between employers regardless of how they were obtained

C. Option 2 employer-based certifications may not transfer between employers the way an accredited third-party certification does — the new employer may need to conduct their own qualified evaluator

assessment before the operator can perform crane operations; the operator should clarify with the new employer whether their Option 2 qualification from the previous employer will be accepted or whether a new evaluation is required

D. Option 2 certifications expire automatically when the operator changes employers

60. A crane's load line is inspected and found to have one section where the rope's outer wire strands show a consistent pattern of wear — the crown wires are worn flat on the side that contacts the drum groove, indicating the rope has been operating with consistent contact against the drum groove wall rather than resting in the groove bottom. What does this single-sided crown wear pattern indicate?

A. Single-sided crown wire wear indicating consistent groove-wall contact is a characteristic of ropes properly seated in the drum grooves — this is normal and expected

B. Single-sided wear indicates the drum groove diameter is too small for the rope — the rope is pinched and should be replaced with a smaller diameter rope

C. Single-sided drum groove wear on the crown wires indicates the drum groove profile is incorrect for the rope diameter — the groove radius is too small, causing the rope to ride on the groove walls instead of resting in the groove bottom; this creates concentrated contact stress on only one side of the rope, accelerating fatigue and cross-section reduction at those contact points; the drum should be re-grooved to match the rope diameter

D. Crown wire single-side wear is a normal result of rope winding on the drum and requires only increased lubrication

61. A crane is operating when the signal person reports that one of the rigging shackles — a 2-inch screw pin shackle with a WLL of 17 tons — was accidentally dropped approximately 12 feet onto a concrete surface while being installed on the load. The shackle appears visually undamaged. Can it be used for the planned lift?

A. Nothing — the shackle landed on its side on concrete and shows no visual damage; the 17-ton WLL confirms it is adequate

B. The shackle must be inspected by a qualified person before use — even though it appears undamaged, a drop impact from 12 feet onto concrete can cause internal fractures or cracking in the shackle bow or pin that are not visible externally; high-strength steel can fracture from impact without

surface deformation; a qualified person must inspect the shackle or it must be replaced with a confirmed undamaged unit before use

C. The shackle may be used since the fall height of 12 feet is below the 15-foot drop threshold requiring replacement

D. Clean the shackle, confirm the pin threads are intact, and use the shackle for the lift

62. Under ASME B30.9, what is the required condition of all hook opening hardware on slings used for crane lifts?

A. Hook opening hardware is not regulated by ASME B30.9 — only sling capacity and condition are addressed

B. The hook must be equipped with a safety latch that is confirmed functional before use — the latch must physically close across the hook throat without being held by the operator, and the latch must be confirmed to engage and remain engaged without continuous manual force; the hook with a non-functioning latch must be replaced before use

C. Hook opening hardware requires inspection only during the annual comprehensive crane inspection

D. Any hook with a functioning latch that allows load attachment is acceptable for crane sling applications

63. A crane operator is reviewing the annual inspection report and finds that the slewing ring was measured at 0.055 inches of vertical deflection — just below the manufacturer's 0.060-inch maximum. The inspection was performed 10 months ago. At what point should the slewing ring be specifically re-measured?

A. The slewing ring must be specifically re-measured at the upcoming annual inspection — the measurement of 0.055 inches represents 91.7% of the maximum specification; 10 months of additional operations may have pushed the deflection to or beyond the 0.060-inch limit; the annual inspection must specifically include a slewing ring deflection measurement to confirm whether the limit has been reached or exceeded

B. The slewing ring only needs re-measurement when visible play is felt in the upper works during operations

C. The 0.055-inch measurement provides adequate margin below the limit — re-measurement is only required when symptoms of excessive deflection are observed

D. Slewing ring measurements are performed every 3 years regardless of the previous measurement result

64. A crane inspector finds that the crane's outrigger cylinder has rust stains running from the seal area down the cylinder body — the rust staining extends approximately 8 inches below the seal and the rust has also contaminated the hydraulic fluid in the outrigger circuit, turning it slightly brown. What does this combination of rust staining and rust-contaminated fluid indicate?

A. The rust staining is cosmetic — the seals are still functional if no active dripping is observed

B. Nothing — outrigger cylinders in outdoor environments show surface rust as a normal weathering condition

C. Rust inside the hydraulic fluid circuit indicates that moisture has entered the system through the compromised outrigger cylinder seal — rust-contaminated hydraulic fluid is abrasive and accelerates wear on pump internals, valve bodies, and cylinder bore surfaces; the cylinder seal has allowed water infiltration, the outrigger cylinder must be removed from service for seal replacement, and the contaminated hydraulic fluid must be completely replaced with fresh fluid and the system flushed

D. The brown fluid coloration is caused by heat degradation of the hydraulic oil during normal operations — replace the fluid at the next scheduled service

65. A crane's wire rope is being inspected when the inspector finds a section where one strand in the six-strand rope appears slightly larger in diameter than the other five strands — the affected strand is approximately 8% larger in diameter and feels stiffer than the others. What does this non-uniform strand diameter indicate?

A. Nothing — natural strand diameter variation in manufactured rope is within $\pm 10\%$

B. A strand that is 8% larger in diameter than its companions indicates it has core wire corrosion or internal core failure that is pushing the strand's wires outward, or it represents a manufacturing defect that creates unequal load sharing; either condition means the affected strand is not contributing its equal share to the rope's load-carrying capacity; a qualified inspector must evaluate this condition

C. The larger strand indicates the rope is brand new and the strands have not yet equalized

D. An 8% diameter variation in one strand is caused by normal operational loading and requires no action

LOAD CHARTS DOMAIN — Questions 71–95

71. A crane load chart for the 100-foot boom at full outrigger extension shows: 25 ft = 44,200 lbs; 30 ft = 35,000 lbs; 35 ft = 27,600 lbs. The planned operating radius is 33 feet. The hook block weighs 2,000 lbs, slings weigh 560 lbs, hardware weighs 160 lbs, and the payload weighs 23,000 lbs. Using the conservative approach, does the lift proceed?

A. Conservative capacity at 35 ft = 27,600 lbs; total suspended weight = $2,000 + 560 + 160 + 23,000 = 25,720$ lbs; 25,720 lbs is within the 27,600-lb conservative capacity — the lift proceeds with 1,880 lbs of margin

B. Conservative capacity at 35 ft = 27,600 lbs; 25,720 lbs is within capacity; the lift percentage based on conservative capacity = 93.2% — this exceeds the 75% threshold and is a critical lift

C. Nothing — the interpolated value at 33 ft governs; interpolation gives 30,760 lbs and the lift proceeds comfortably

D. Conservative capacity at 30 ft = 35,000 lbs; use the smaller tabulated value that brackets the actual radius

72. A crane's load chart shows the following for the "ON OUTRIGGERS — 50% EXTENSION" section with a 100-foot boom: 30 ft = 22,400 lbs; 35 ft = 17,600 lbs; 40 ft = 13,800 lbs. A planned lift at 32 feet of radius has a total suspended weight of 18,200 lbs. Using the conservative approach, what capacity governs?

A. Conservative capacity at 30 ft = 22,400 lbs; 18,200 lbs is within capacity — lift proceeds

B. Conservative capacity at 35 ft = 17,600 lbs; total suspended weight (18,200 lbs) exceeds the conservative capacity — the lift cannot proceed in the 50% extension configuration at 32 feet of radius

C. Conservative capacity at 35 ft = 17,600 lbs; the lift percentage = 103.4% — clearly not within capacity

D. Conservative capacity at 40 ft = 13,800 lbs; the lift cannot proceed using any conservative value

73. A crane load chart note states: "Operating with a load directly over the front axle is restricted to boom angles between 60° and 80°. Outside this range, operations over front axle are not rated." The crane needs to operate at a boom angle of 55 degrees with the boom positioned over the front axle. What must the operator do?

- A. Apply a 10% capacity reduction for operations at boom angles within 5 degrees of the rated minimum
- B. The crane must be repositioned or the boom angle must be adjusted to bring it within the 60° to 80° rated range before operating in the over-front-axle position — at 55 degrees, the configuration is outside the rated envelope and no capacity exists for this position; the crane is in an unrated condition that may not be safe
- C. Contact the lift director for authorization to operate at 55 degrees since it is close to the rated minimum
- D. Interpolate between the 60-degree minimum and the on-rubber section to estimate capacity at 55 degrees

74. A crane is performing a lift using the following tabulated capacity: 100-foot boom at full outrigger extension, 30 ft = 36,400 lbs. During the hoist, the boom deflects under load and the effective radius increases from 30 feet to 33 feet. The next tabulated entry is at 35 feet = 28,200 lbs. The total suspended weight is 33,000 lbs. Using the conservative approach with the actual 33-foot effective radius, is the lift still within capacity?

- A. The lift remains within the original 30-foot tabulated capacity since the planned radius was 30 feet
- B. Conservative capacity at 35 ft = 28,200 lbs; total suspended weight (33,000 lbs) exceeds 28,200 lbs — the boom deflection has pushed the effective radius into a range where the crane is no longer within conservative capacity; the operator must boom up to restore the original 30-foot radius
- C. Nothing — boom deflection is a normal operational phenomenon that is already accounted for in the load chart values
- D. The 33,000-lb total suspended weight is within the 36,400-lb original tabulated capacity — the original planned radius governs

75. A crane's load chart for the full outrigger extension section shows that cells between 20 and 30 feet of radius are stability-limited, and cells from 35 feet outward are structural-limited. A lift at 32 feet falls between these zones. Using the conservative approach, what capacity type governs and what does the operator need to know about operating in the transition zone?

- A. At 32 feet between the stability-limited (30 ft) and structural-limited (35 ft) zones, the conservative approach uses the 35-foot capacity value — which is structural-limited; the operator must understand that the transition zone means operational precautions for structural-limited lifts (smooth movements, no dynamic loading) are appropriate, since the conservative governing value is structural-limited; additionally, if the effective radius drifts to 30 feet, stability limits would apply instead
- B. The stability limit always governs in the transition zone between limit types
- C. The operator must determine which limit type applies at 32 feet before the lift can proceed
- D. Transition zone lifts always require manufacturer authorization before proceeding

76. A crane load chart shows a note: "These capacities are based on the use of the manufacturer's standard ball and hook. If the standard hook block is replaced with the heavy-duty hook block, deduct 1,400 lbs from all capacity values in this section." The standard ball and hook weighs 600 lbs and the heavy-duty block weighs 2,000 lbs. The operator is using the heavy-duty block. The tabulated capacity at the planned configuration is 28,400 lbs. What is the applicable gross capacity?

- A. Nothing — the gross capacity remains 28,400 lbs regardless of hook block choice; only net payload changes
- B. Applicable gross capacity = 28,400 lbs — the note only applies when the manufacturer's standard block is completely absent from the crane
- C. Applicable gross capacity = $28,400 - 1,400 = 27,000$ lbs; the note requires deducting 1,400 lbs from the tabulated capacity value when the heavy-duty block is used — this note adjusts the gross capacity itself, not just the net payload calculation
- D. Applicable gross capacity = $28,400 - 2,000 + 600 = 27,000$ lbs — deducting the total block weight and crediting the standard block weight

77. A crane load chart shows: "MAIN BOOM — ON OUTRIGGERS — FULL EXTENSION — ALL DIRECTIONS." At 40 feet radius with a 100-foot boom, the capacity is 22,600 lbs. At the same

configuration with a 20-foot fixed jib attached but not used (load on main hook), the capacity shown in a separate "JIB INSTALLED" section is 18,800 lbs. The jib is physically on the crane. What capacity applies?

- A. Nothing — the main hook always uses the main boom section regardless of jib installation status
- B. The 22,600-lb main boom section applies — the jib is not being used for this lift
- C. Either section may be used at the operator's discretion — the operator should choose the more favorable value
- D. The jib-installed section capacity of 18,800 lbs applies — when the jib is physically on the crane, the jib-installed section must be used regardless of which hook carries the load, because the jib's physical presence at the boom tip changes the structural load distribution in the boom

78. A crane's load chart shows the following for the on-outrigger full extension, all-directions section: 100-ft boom at 40 ft = 22,600 lbs; 45 ft = 17,800 lbs; 50 ft = 13,800 lbs. A pick is planned at 42 feet and a set at 47 feet. Using the conservative approach at both positions, what are the governing capacities?

- A. Pick at 42 ft: conservative = 22,600 lbs at 40 ft; set at 47 ft: conservative = 13,800 lbs at 50 ft — 13,800 lbs governs the lift plan
- B. Pick at 42 ft: conservative = 17,800 lbs at 45 ft; set at 47 ft: conservative = 13,800 lbs at 50 ft — 13,800 lbs governs
- C. Pick at 42 ft: conservative = 17,800 lbs at 45 ft; set at 47 ft: conservative = 17,800 lbs at 45 ft — same governing value
- D. Pick at 42 ft: conservative = 17,800 lbs at 45 ft; set at 47 ft: conservative = 13,800 lbs at 50 ft — the set position's conservative capacity (13,800 lbs) governs the overall lift plan

79. A crane load chart contains the following note: "These capacities include a 10% load factor reduction for dynamic effects. No additional derating is required for standard operations." A planned lift at 88% of the tabulated capacity requires smooth, controlled movements. Does the dynamic effects derating satisfy all operational requirements for this lift?

- A. Yes — the built-in 10% dynamic effects derating means the operator can use any swing or hoist speed without additional consideration since the derating covers all dynamic effects
- B. The load factor reduction is already incorporated — no additional derating is needed for near-capacity operations
- C. Nothing — load factor notes are manufacturer safety margins that exceed what ASME B30.5 requires
- D. The load factor note confirms that the listed values already include a 10% deduction for dynamics — but "standard operations" implies normal controlled movements; at 88% of a pre-derated capacity, dynamic loading from rapid acceleration, swing inertia, or simultaneous multi-function operation could still add loads beyond what the 10% derating intended to cover; smooth controlled operations are still required

80. A crane load chart shows a capacity of 34,600 lbs at 30 feet. The note in the section reads: "Before using capacities in this section, confirm boom is at the maximum rated angle as shown in the working area diagram." The working area diagram shows 78 degrees as the maximum angle for 30 feet of radius. The crane's actual boom angle at 30 feet of radius is 72 degrees. Does the crane satisfy this note?

- A. Nothing — 72 degrees is close to 78 degrees and within operational tolerance
- B. Nothing — working area diagrams are informational, not operational requirements
- C. Nothing — the maximum angle note applies to operations at shorter radii, not 30 feet
- D. The note requires the boom to be at the maximum rated angle for each radius — at 30 feet, this is 78 degrees; operating at 72 degrees when the note requires the maximum angle means the crane is not in the rated configuration for this cell; if the note is a conditional requirement (not a note about the maximum safe angle), the crane must be positioned at 78 degrees before using this cell's value; clarification from the manufacturer may be needed

81. A crane is operating with a 100-foot boom. The load chart shows 35-foot radius = 26,800 lbs and 40-foot radius = 21,200 lbs. The total suspended weight is 24,000 lbs. After interpolation, the estimated capacity at 38 feet = 22,440 lbs. The planned operating radius is confirmed at 38 feet. The lift percentage based on interpolated capacity is approximately 107 %

- A. Nothing — the lift proceeds since the interpolated capacity is higher than the conservative capacity and 24,000 lbs is within the range

B. The interpolated capacity at 38 feet has been calculated incorrectly — re-verify the interpolation: drop from 35 to 40 ft = 5,600 lbs over 5 ft = 1,120 lbs/ft; at 38 ft (3 ft beyond 35 ft): $26,800 - (3 \times 1,120) = 26,800 - 3,360 = 23,440$ lbs; $24,000 \div 23,440 = 102.4\%$ — the lift still exceeds the interpolated capacity and cannot proceed; the original calculation contained an arithmetic error

C. The lift proceeds since 24,000 lbs is within the 26,800 lbs tabulated at 35 feet

D. The interpolated capacity is 24,440 lbs; $24,000 \div 24,440 = 98.2\%$ — the lift just barely proceeds

82. A crane load chart shows the following: "ON OUTRIGGERS — FULL EXTENSION — 100-FT BOOM — WITH FLY JIB 25 FT AT 10° OFFSET." The load chart's capacity at 60 feet of radius is 8,400 lbs. The jib head block weighs 280 lbs. Rigging weighs 340 lbs. The payload weighs 7,600 lbs. Total suspended weight = 8,220 lbs. The operating radius is exactly 60 feet. Is the lift within capacity and what does the blank cell at 65 feet indicate?

A. Nothing — 8,220 lbs is within 8,400 lbs capacity and the blank at 65 ft is irrelevant to a 60-ft lift

B. The blank at 65 ft indicates additional capacity is available beyond 60 ft but has not yet been published

C. Nothing — 8,220 lbs is within 8,400 lbs; lift proceeds; the blank at 65 ft confirms 60 ft is the maximum rated radius for this jib configuration — the operator is at the absolute outer boundary of the rated envelope and must manage any radius increase with extreme caution throughout all phases of the lift

D. The blank at 65 ft requires the operator to use only 80% of the 60-ft tabulated capacity as a safety margin

83. A crane's load chart shows that the on-outrigger full extension maximum counterweight section provides 40% more capacity than the standard counterweight section at 25 feet of radius. Both cells are stability-limited. A planned lift at 25 feet has a total suspended weight of 38,000 lbs. The standard counterweight capacity is 30,000 lbs and the maximum counterweight capacity is 42,000 lbs. The crane has maximum counterweight installed. What is the lift percentage and is this a critical lift?

A. Lift percentage = $38,000 \div 42,000 \times 100 = 90.5\%$; this exceeds the 75% threshold — the lift is a critical lift requiring a written plan and pre-lift meeting

B. The lift percentage must be calculated against the standard counterweight capacity since that is the baseline — $38,000 \div 30,000 = 126.7\%$; the lift exceeds standard counterweight capacity

C. Lift percentage = $38,000 \div 42,000 = 90.5\%$; this is within rated capacity since the maximum counterweight is installed; no critical lift designation since the percentage is based on the installed configuration

D. The standard counterweight capacity must always be used for lift percentage calculations regardless of what is installed

84. A crane load chart shows: "OVER FRONT SECTOR — 15° EACH SIDE OF FRONT CENTER — 80-FT BOOM." The capacity at 25 feet in the over-front section is 42,600 lbs. The same crane's "360-DEGREE ALL DIRECTIONS" section shows 34,800 lbs at 25 feet. A critical lift requires the boom to start at 5 degrees left of front center, swing 30 degrees to 25 degrees left of front center, and set the load at that position. During the swing, does the boom remain in the over-front sector?

A. Nothing — the entire swing from 5° to 25° left of front center is within the 360-degree section

B. The over-front sector extends 15 degrees each side of front center — the pick at 5° left is within the over-front sector but the set at 25° left is outside the over-front sector; the lift must be planned using the 360-degree capacity (34,800 lbs) because the load must travel through and be set in a position outside the over-front sector where the lower all-directions capacity applies

C. Nothing — the lift picks within the over-front sector so the over-front capacity governs throughout

D. The swing transitions from over-front (0° to 15°) to all-directions (beyond 15°); the over-front capacity governs the pick phase and the all-directions capacity governs the set phase; the lift must be planned so both the pick and set are within their respective applicable capacities

85. A crane is performing a personnel hoisting operation. The total suspended weight including the platform, all personnel, tools, and equipment is 14,400 lbs. The crane's gross capacity at the current configuration is 32,000 lbs. What is the lift percentage relative to the gross capacity and does it comply with OSHA 1926.1431?

A. Lift percentage = $14,400 \div 32,000 \times 100 = 45\%$ — this is within the 50% personnel hoisting limit; the operation complies

B. Lift percentage = $14,400 \div 32,000 = 45\%$; this is within the 50% limit — however, the operator must confirm the 50% calculation uses the gross capacity at the exact current configuration, not the rated capacity at any other configuration

C. Nothing — 45% is a safe operating percentage that requires no special action beyond confirming the 50% limit

D. Lift percentage = 45%; compliant with the 50% limit; the personnel hoisting section's requirements for daily pre-lift inspection, trial run confirmation, and operator presence at controls throughout the operation also apply and must all be satisfied

86. A crane load chart for a telescopic boom at full outrigger extension shows: "MAXIMUM RATED RADIUS = 55 FT FOR 100-FT BOOM." A planned lift requires the boom to start at 48 feet of radius (pick) and swing to 52 feet (set), then the boom needs to remain stationary at 52 feet for 35 minutes while structural connections are made. The operator confirms the 52-foot radius is within the 55-foot maximum. Does any additional concern apply?

A. Nothing — 52 feet is within the 55-foot maximum rated radius; the 35-minute hold creates no concern

B. The 35-minute hold at 52 feet — near the maximum rated radius — requires the operator to continuously monitor the level condition and LMI reading throughout the hold; progressive outrigger settlement or wind loading on the load could increase the effective radius beyond 52 feet, potentially approaching or exceeding the 55-foot limit; the operator must be alert to any changes during the extended hold

C. A 35-minute hold at near-maximum rated radius requires post-hold inspection

D. Structural connection holds require the load to be lowered to the ground after 15 minutes

87. A crane load chart shows that the on-outrigger full extension, all-directions, standard counterweight section shows exactly the same capacity at 30 feet and at 35 feet for the 100-foot boom. Both cells show 26,400 lbs and both are shaded gray (structural-limited). Which of the following best explains identical structural-limited capacities at two consecutive radii?

A. Identical adjacent structural-limited cells confirm a printing error that must be verified with the manufacturer before using either cell

- B. Nothing — stability-limited cells sometimes show identical adjacent values; structural cells never do
- C. The structural limit is determined by the stress in specific structural members — when the same structural member governs at both radii and the capacity is rounded to the same value, identical adjacent cells can occur legitimately; the operator should proceed normally using 26,400 lbs as the governing value for any operation in the 30–35 foot range, recognizing both cells are structural-limited and require smooth operation
- D. Structural-limited cells can never have the same value at different radii — the crane must be inspected before use

88. A crane is operating with a 120-foot boom when the operator discovers that the LMI was configured for a 100-foot boom for the past three lifts. The crane configuration is 120-foot boom at full outrigger extension. The 100-foot LMI configuration shows higher capacity at the same radius than the 120-foot configuration. What does this configuration error mean for the three completed lifts?

- A. Nothing — the LMI was configured for a shorter boom, which shows higher capacity at the same radius and is therefore more conservative
- B. Nothing — the LMI configuration only affects the displayed percentage, not the crane's actual structural capacity
- C. The 100-foot LMI configuration showed higher capacity at the same radius — meaning the displayed percentages for the three lifts were lower than the actual percentages; if the lifts appeared to be at 82% using the 100-foot values, the actual percentage at the 120-foot configuration may have been higher; a post-event recalculation using the correct 120-foot boom capacity values is required to confirm whether any of the three lifts exceeded the crane's actual rated capacity
- D. The error requires immediate OSHA notification and project shutdown pending investigation

89. A crane load chart note reads: "Capacities in this section are net capacities — the hook block weight has already been deducted. For rigging other than the standard rigging set described in this section's footnote, deduct the weight of the additional rigging from the net capacity." The footnote describes standard rigging as: hook block (1,200 lbs) + 4 slings × 150 lbs each = 1,800 lbs total standard rigging weight. The operator plans to use a spreader beam (2,400 lbs) in addition to the standard rigging. The net capacity at the planned configuration is 22,800 lbs. What is the maximum payload?

- A. Maximum payload = $22,800 - 2,400 = 20,400$ lbs — only the spreader beam (non-standard rigging) is deducted from the net capacity since the hook block and standard slings are already accounted for in the net value

B. Maximum payload = $22,800 - 1,800 - 2,400 = 18,600$ lbs — deducting all rigging including standard

C. Maximum payload = 22,800 lbs — the note pre-deducts all rigging

D. Maximum payload = $22,800 - 1,200 - 2,400 = 19,200$ lbs — deducting hook block and spreader beam

90. A crane's load chart shows a note: "For lifts with loads having a center of gravity located more than 10 feet above the lift points, apply a 12% capacity reduction to account for increased dynamic load effects." The planned load is a tall structural frame 22 feet tall with four lifting lugs at the base — the CG is at 11 feet above the lift points. The tabulated gross capacity is 32,000 lbs. What is the applicable derated capacity?

A. Nothing — the CG is only 1 foot above the 10-foot threshold; the note is advisory for CG heights well above 10 feet

B. Applicable capacity = $32,000 \times 0.88 = 28,160$ lbs; the operator must confirm the total suspended weight including rigging is within 28,160 lbs; any load whose CG exceeds 10 feet above the lift points must use the derated value

C. The 12% reduction only applies when the CG is above the lifting lugs — not when the lugs are at the base

D. Applicable capacity = $32,000 \times 0.92 = 29,440$ lbs — applying an 8% reduction since the CG is only 1 foot above the threshold

91. A crane load chart contains two separate sections for identical boom length and outrigger configurations, with the only difference being the annotation "CERTIFIED" versus "REFERENCE" in the section header. The certified section shows higher capacity values than the reference section. What does the "CERTIFIED" designation indicate and which section applies?

A. The certified section was verified by an independent third party and is always more accurate — use the certified section values

B. The reference section provides conservative baseline values; the certified section should be used when higher capacity is needed

C. Nothing — both sections apply to the same configuration; use the higher-capacity certified section

D. The "CERTIFIED" section likely represents capacities confirmed through load testing — understanding the distinction between certified (load-tested) and reference (calculated) capacity requires clarification from the manufacturer; without this understanding, the operator should use the more conservative reference section until the distinction is confirmed; using untested capacity values based only on the label "certified" without understanding what was certified could be hazardous

92. A crane load chart shows: 80-foot boom, on-outrigger, full extension: 20 ft = 52,400 lbs; 25 ft = 41,800 lbs; 30 ft = 33,200 lbs; 35 ft = 26,600 lbs. The rate of capacity decrease per foot is: 20–25 ft = 2,120 lbs/ft; 25–30 ft = 1,720 lbs/ft; 30–35 ft = 1,320 lbs/ft. What does the decreasing rate of capacity decrease per foot indicate about the shape of the capacity curve?

A. The decreasing rate of capacity decrease indicates the crane is approaching its maximum rated radius

B. Nothing — constant rate changes in capacity are the standard pattern for all crane configurations

C. The decreasing rate of capacity decrease per foot indicates the capacity curve is concave upward — the curve is flattening as radius increases; this means interpolation between adjacent tabulated values tends to overestimate capacity slightly since a straight-line interpolation between two points on a concave curve lies below the actual curve; operators should be aware that linear interpolation provides an estimate that may be slightly optimistic near the maximum of each interval

D. The decreasing rate indicates that at radii beyond the tabulated maximum, capacity remains nearly constant

93. A crane load chart shows the "ON OUTRIGGERS — FULL EXTENSION — WITH 30-FT FIXED JIB — 20° OFFSET" section. At 55 feet, the capacity is 9,600 lbs. At 60 feet, the capacity is 7,200 lbs. At 65 feet, the cell is blank. A lift requires a pick at 57 feet and a set at 62 feet. Using the conservative approach, what are the governing capacities at each position?

A. Pick at 57 ft: conservative = 9,600 lbs at 55 ft; set at 62 ft: blank at 65 ft limits maximum to 60 ft; 62 ft exceeds maximum — set position is not within rated envelope; lift cannot proceed to the planned set location

B. Conservative capacity at 60 ft = 7,200 lbs governs both pick and set

C. Pick at 57 ft: conservative = 7,200 lbs at 60 ft; set at 62 ft: conservative = 7,200 lbs at 60 ft — lift proceeds at both positions

D. Pick at 57 ft: conservative = 9,600 lbs at 55 ft — wait, conservative uses NEXT LARGER tabulated radius; pick at 57 ft: conservative = 7,200 lbs at 60 ft; set at 62 ft: blank at 65 ft, maximum radius = 60 ft; 62 ft exceeds maximum — lift cannot proceed to the set location

94. A crane load chart for a crawler crane shows: "ON CRAWLERS — OVER FRONT — 150-FT MAIN BOOM — MAXIMUM COUNTERWEIGHT." At 45 feet, the capacity is 88,000 lbs; at 50 feet, the capacity is 72,400 lbs; at 55 feet, the capacity is 58,600 lbs. A critical lift is planned at 48 feet. The total suspended weight is 76,000 lbs. Using the conservative approach, does the lift proceed?

A. Interpolated capacity at 48 ft = 79,040 lbs; 76,000 lbs is within capacity — lift proceeds

B. Conservative capacity at 50 ft = 72,400 lbs; 76,000 lbs exceeds this — the lift cannot proceed

C. Conservative capacity at 45 ft = 88,000 lbs; 76,000 lbs is within — lift proceeds

D. Conservative capacity at 50 ft = 72,400 lbs; 76,000 exceeds 72,400 lbs — lift cannot proceed as planned; options include repositioning the crane to reduce the operating radius to 45 feet or less where conservative capacity (88,000 lbs) supports the load, or reducing the total suspended weight below 72,400 lbs

95. A crane load chart shows a capacity of 28,600 lbs at 35 feet of radius for the 100-foot boom at full outrigger extension. The crane is performing a series of identical lifts, each with a total suspended weight of 26,000 lbs. After 8 identical lifts, the operator is re-assigned for the final two lifts to a different crane configuration — an 80-foot boom. The 80-foot boom load chart shows 34,200 lbs at 35 feet. The same total suspended weight of 26,000 lbs will be used. What must the operator confirm before beginning the first lift with the 80-foot boom?

A. Nothing — the 80-foot boom shows higher capacity at 35 feet and 26,000 lbs is clearly within the higher capacity; no additional confirmation is needed

B. The operator must re-verify the total suspended weight against the 80-foot boom capacity at 35 feet and confirm the LMI is configured for the 80-foot boom — a crane configuration change requires independent capacity verification for the new configuration; the previous confirmation for the 100-foot boom does not carry over to the 80-foot configuration; the LMI must also be updated to reflect the different boom length so it calculates capacity percentages accurately

C. Contact the lift director to confirm the 80-foot boom is authorized for these lifts before proceeding

D. The operator must perform a full pre-shift inspection before switching crane configurations mid-shift

Core Exam 10 Answer Key and Full Explanations

1. B — A 0.5-inch boot heel penetration into the rut base indicates the material below the compacted surface crust is soft — the ruts have broken through the structural surface layer and exposed inadequately bearing material beneath. Crane outrigger loads produce bearing pressures many times greater than a boot heel, and soft material that yields under foot pressure will certainly fail under crane loading. Additional investigation and ground preparation are required before setup.

2. D — An engineered crane pad with visible rebar corrosion indicates that the concrete cover protecting the rebar has failed, allowing moisture to reach the steel. Corroding rebar expands as iron oxide forms, generating internal stress that propagates the cracks further. The structural capacity at the cracked corner may be reduced below the original design — an engineer must evaluate the current condition before any crane loading.

3. A — OSHA 1926.1402(b) places the ground preparation obligation on the controlling entity — not the crane employer who operates the equipment. When the crane employer identifies inadequate conditions, the controlling entity must prepare the ground or provide an alternative adequate location. This allocation of responsibility exists because the controlling entity controls access to and preparation of the work site.

4. D — Soil nail grouting injects pressurized grout into the soil mass under hydraulic pressure, temporarily increasing pore pressure in the adjacent soil. Increased pore pressure reduces the effective stress between soil particles — the same mechanism that causes liquefaction — temporarily reducing bearing capacity in the surrounding zone. Operations near active grouting must account for this temporary bearing capacity reduction in adjacent soil areas.

5. B — The manufacturer's 1% maximum operating slope is the boundary within which the load chart values apply. At 1.5%, the crane is operating outside this boundary — the stability analysis used to derive the capacity values assumed a maximum 1% out-of-level condition, and operating beyond that means the actual stability margin may be less than the chart values reflect. The slope must be corrected or the outrigger jacks used to compensate before any lifting.

6. C — Bearing pressure = $128,000 \div 2 \text{ sq ft} = 64,000 \text{ psf}$ — 128 times the 500 psf design loading. A wharf deck designed for distributed cargo loads distributes those loads to multiple piles simultaneously. Concentrating 128,000 lbs on a 2 sq ft outrigger float applies the force to the deck at a single point, creating punching shear forces the deck was never designed to resist. Structural evaluation is mandatory.

7. A — OSHA 1926.1402(c) requires the operator to stop and notify the employer when ground conditions change in a way that creates a safety concern. The operator's stop-work authority here is not contingent on quantitative confirmation of the severity — any observed change that suggests the setup is becoming unsafe triggers the stop-and-notify requirement. The employer then determines what improvements are needed before operations resume.

8. C — Diesel fuel acts as a lubricant that reduces the coefficient of friction between the timber mat and the soil surface. Reduced friction allows the mat to slide laterally under the horizontal component of the outrigger's force — even with only a slight grade or uneven load application. Mat lateral movement during a loaded lift can cause sudden loss of support. Operations must stop until the fuel is cleaned up and the surface friction is restored.

9. B — Highway culvert design standards assume distributed wheel loads spread over the soil cover depth — not concentrated axle loads from oversize/overweight equipment. A 186,000-lb crane creates axle loads that can far exceed highway design loads. The soil cover depth of 3 feet provides minimal distribution of the point load. The culvert's wall strength under the crane's specific axle configuration must be confirmed before travel.

10. D — Concentric circular cracks centered around a loaded pad are the surface manifestation of a Prandtl failure mechanism — the pad is forcing the soil into a plastic failure zone where shear occurs along a curved slip surface. This pattern does not indicate normal settlement; it indicates the soil is actively shearing. Continued loading will complete the shear failure and result in sudden, catastrophic settlement. The load must be removed immediately.

11. A — OSHA 1926.1407(b)(4) allows operations within the normally required MSAD only when an encroachment prevention plan is established that includes a dedicated spotter with continuous visual contact and a direct means of immediately stopping all crane movement. These three specific elements together create the exception to the MSAD prohibition. Without all three elements, the exception does not apply.

12. C — A pressurized storm drain discharge at 8 psi can force water through the soil under the outrigger mats by hydraulic piping — the pressurized flow carries fine soil particles with it through the soil, creating internal channels or voids beneath the bearing surface. This erosion process can destroy bearing capacity rapidly from below without any surface indication of the problem until sudden settlement occurs. Operations must stop immediately.

13. B — Seasonal groundwater levels are highest in spring due to snowmelt and peak rainfall. By August, the water table in sandy silt has typically dropped significantly, which generally improves effective stress and bearing capacity. However, the surface zone may have undergone desiccation cracking that reduces lateral integrity. The current actual conditions must be evaluated because they may differ substantially from the spring report — in either direction.

14. D — When ground conditions are specifically flagged as a concern, ASME B30.5 requires documented confirmation of bearing capacity and a calculation confirming that the planned outrigger loads do not exceed that capacity. Visual inspection and verbal assurance are insufficient because they cannot quantify the relationship between the applied load and the soil's resistance. Written documentation creates accountability and allows review if conditions change.

15. A — A rapid 25°F temperature drop over 4 hours in medium-stiff clay creates competing effects. Surface frost formation can temporarily improve surface stiffness while also disrupting the soil structure in the surface zone. The net effect on the bearing conditions at depth depends on how far below the surface the significant effects reach. The operator cannot assume improvement — the effects must be evaluated rather than presumed positive.

16. C — An exclusion zone with a 12-foot gap does not function as a barrier — the gap allows unimpeded entry by any unauthorized person. The entire purpose of the exclusion zone is to physically prevent entry, and a gap eliminates that protection for the width of the opening. No crane operations may proceed until the zone is restored as a functional physical barrier preventing unauthorized access.

17. B — A water main operating at 110% of design pressure for 6 weeks is stressed beyond its design rating. Sustained over-pressure can cause micro-fractures or joint separation at the weakest points in the system. These failures create localized seepage that saturates the surrounding soil. The combination of a potentially compromised main and saturated soil along its route creates conditions that may significantly reduce bearing capacity at the outrigger positions above.

18. D — At 25 feet, the concrete truck's wheel loads apply surcharge stress to the soil between the truck and the outrigger. This surcharge stress adds to the existing stress field from the crane's outrigger and can increase the total stress in the shared soil zone beyond the soil's bearing capacity. In soil already loaded near its capacity by the outrigger, this additional surcharge from adjacent heavy equipment can push the total loading over the failure threshold.

19. A — A 400 psi gas main represents a catastrophic rupture hazard if ruptured by an outrigger. The utility locate tolerance zone means the pipe could be within 12 inches of the outrigger center — potentially directly beneath the outrigger float. Positive location through vacuum excavation or equivalent method is the only way to confirm the pipe is not in the planned outrigger load path. Proceeding on tolerance-zone marking alone is not adequate for a 400 psi main.

20. C — Progressive tilt during a static hold indicates active ground failure — not a deflection event. A ground failure at a nearby crane may indicate a shared soil condition problem. If the failure zone extends beyond the second crane's immediate area, the soil supporting the first crane's outriggers may also be failing. Stopping operations and investigating ensures the first crane is not also approaching a bearing capacity failure.

21. B — Open-graded crushed stone is a high-void, high-permeability material with low inherent cohesion — individual stones can shift under concentrated loads rather than forming a stable bearing matrix. The perforated pipe within the stone zone adds a linear void to the load path. The different compressibility characteristics of the open-graded fill versus native soil will cause the two outrigger pads to settle differently, creating differential settlement and level change during operations.

22. B — OSHA 1926.1419 requires both the operator and signal person to confirm their shared understanding of all signals before operations begin. The pre-operation signal briefing is not an optional formality — it is the mechanism that ensures unambiguous communication throughout the lift. Any crane movement before this confirmation creates the risk of signal misinterpretation, particularly for non-standard signals or when a new signal person is working with the operator for the first time.

23. A — An unexpected travel alarm activation without operator input indicates a fault condition in the travel system — either an electrical malfunction, a sensor failure, or an unintended activation of the travel control. The travel function activating unexpectedly with a load suspended could move the crane off its established outrigger positions, causing tip-over or load swing. The source must be identified and the fault corrected before any further operations.

24. C — OSHA 1926.1431 requires that personnel platforms be specifically designed, built, tested, and certified for personnel hoisting. The regulation was written specifically because modified material handling equipment — regardless of its structural adequacy — lacks the design features, trapping prevention, and attachment geometry required for safe personnel hoisting. No modification, certification, or approval by any field personnel can authorize a non-purpose-built container for personnel hoisting.

25. B — Load momentum drift after a stop is a result of the crane's upper works and load having velocity at the moment the stop signal is received. Reducing swing speed progressively before the planned stop point ensures the crane is already moving slowly when the stop signal arrives, minimizing residual momentum. In precision placement, approaching the target at low speed is the fundamental technique for achieving accurate placement with minimal overshoot.

26. D — A new hydraulic leak that appears during repetitive lift operations may indicate that a component is developing a failure under the cyclic loading of the lift series. What appears as a small drip may be a fitting, hose, or cylinder that is failing — and the failure can accelerate rapidly from a small drip to a catastrophic hose burst. The source must be identified and the severity assessed before additional load cycles are applied.

27. C — A structural failure — even of a temporary member — indicates the structural system in the adjacent area has an instability that has not been fully resolved. Continuing operations exposes the crew to additional potential falling objects from the same structural system. The cause of the beam's failure must be determined and the structural stability of the adjacent framework confirmed before any crane operations resume in that area.

28. C — OSHA 1926.1416 and ASME B30.5 both require hoist brakes to hold the rated load without drift. Any drift during a brake test indicates the brake cannot reliably hold the load — and crane operations are entirely dependent on brake holding during lifts, extended holds, and personnel hoisting. A brake that cannot pass the pre-shift test cannot be trusted to hold during an actual lift and must be repaired before any lifting operation begins.

29. B — Welding sparks can melt individual wires at contact points, creating fused wire conditions and removal-triggering defects. More critically, if the welder's work cable ground is inadequate, the crane structure provides an alternative current return path — running current through the crane structure, load line, and hook, which can cause arc damage at any high-resistance contact point including sheave pins,

rope contact points, and the hook itself. The weld spatter zone must be eliminated before crane operations continue.

30. D — OSHA 1926.1427's NCCCO certification confirms general type-level knowledge and skills. The employer's site-specific competency evaluation addresses what the NCCCO certification cannot: this specific crane model's controls and quirks, the specific site's ground conditions and hazards, and the operator's demonstrated ability to manage the specific operational environment. These site-specific elements require independent evaluation regardless of the certification held.

31. A — Crane booms are designed for in-plane vertical loading — they carry the load moment along the boom's primary structural axis. Using the crane to push a beam horizontally applies a force perpendicular to this primary axis. The required pushing force may be far higher than expected if the beam encounters resistance rather than moving freely, and the combined vertical load plus lateral push creates bending stresses the boom was not designed to carry. The beam must be independently realigned.

32. C — A 45-degree load rotation during hoist on a transformer with top-mounted lifting lugs indicates the load has shifted within the rigging or a sling leg has slipped. Top-mounted lugs are designed to carry load in a specific orientation — rotation may be placing them in an off-axis loading condition that reduces their rated capacity. Returning the load to the ground allows the rigging geometry to be assessed and corrected before the lift continues.

33. B — The discovery that the load is 1,400 lbs heavier than documented during an active critical lift invalidates the original lift confirmation. The revised total suspended weight must be immediately compared to the crane's rated gross capacity at the current configuration and radius. Additionally, the previously prepared critical lift plan documentation is no longer accurate — the lift team must be informed of the actual weight before continuing. No further movement is authorized without this confirmation.

34. A — A 2-foot space between a rotating counterweight and a fixed wall creates a lethal crush zone. Any person who enters this space — accidentally or while trying to reach something — will be crushed by the counterweight's rotation against the wall. Physical barriers must prevent entry before operations begin. The 2-foot gap cannot be managed by warning signs, audio alarms, or verbal warnings alone because workers may not anticipate the counterweight's rotation direction.

35. A — An 11-percentage-point discrepancy between the planned 84% and the actual 95% LMI reading indicates either a real physical change (heavier load, greater effective radius from boom deflection, or incorrect LMI configuration) or a malfunction. Both possibilities require investigation before proceeding. Continuing at 95% assumes the reading is wrong — but if it is correct, continuing risks structural failure. The operator must investigate the cause before any further movement.

36. C — Both altitude and high ambient temperature reduce diesel engine output — altitude through reduced air density and temperature through reduced charge density. Reduced engine power means the hydraulic pump produces less maximum pressure, limiting maximum hoist force and potentially reducing brake holding pressure. At 5,200 feet and 92°F, the manufacturer's derating guidance must be consulted for near-capacity operations to ensure the crane's actual functional capacity matches the load chart expectations.

37. B — The general wind limit was established for compact loads where the wind force scales predictably with wind speed and the load area. A 16-foot × 24-foot architectural panel creates 384 square feet of wind-exposed surface area — generating lateral wind forces many times greater than those on a compact load of equivalent weight at the same wind speed. These forces create boom side-loading that may exceed the boom's lateral structural design capacity regardless of the general wind speed limit.

38. D — Continuous rotation of a four-leg wire rope sling bridle progressively twists the sling legs around each other, reducing their ability to share load equally and creating a choking action that reduces each leg's effective capacity. Rotation also unwinds standard-lay shackle pins — even "locked" pins can rotate out under sustained torsional loading from the spinning load. A tag line must be applied immediately to arrest rotation before any further movement.

39. A — OSHA 1926.1416(e) requires the load chart to be confirmed available, accessible, in the cab, and applicable to the specific crane being operated before each day's operations begin. A missing, damaged, or inapplicable chart makes capacity verification impossible for any lift during the day. The daily confirmation requirement exists because load charts can be removed from cabs, damaged by weather, or accidentally replaced with the wrong crane's chart between shifts.

40. D — Rope piling on one side of the drum indicates the rope is not tracking properly across the drum width — either a drum rope guide has failed or the fleet angle is excessive. Piled rope creates cross-winding in subsequent layers that crushes the underlying rope under the contact force of crossing layers.

This progressive crushing causes deformation, accelerated fatigue, and potential for the rope to overflow the drum flange entirely during a subsequent hoist.

41. B — Self-recognized fatigue impairment during a 91% critical lift is a stop-work condition. At 91% of rated capacity, the margin between operational load and structural failure is only 9% — any decision-making error, delayed reaction, or missed signal can push the lift into failure. A cognitively impaired operator represents a foreseeable hazard for which the operator has a personal stop-work obligation that supersedes any project planning or schedule pressure.

42. B — OSHA 1926.1431 limits personnel hoisting to a maximum of 50% of the crane's rated capacity at the operating configuration. This limit applies to the total of all suspended weight — the platform weight, all personnel, all tools, all equipment, and all rigging. Nothing is excluded from the calculation. The 50% limit exists because the consequences of failure during personnel hoisting are irreversible, justifying the elevated safety margin compared to material hoisting.

43. A — When a load's pendulum swing frequency matches a structural resonance frequency of the boom, the oscillation is amplified with each swing cycle rather than dampened — this is resonance. Progressive resonance amplification can rapidly drive boom tip oscillation to amplitudes that exceed the boom's structural capacity. The only safe response is to stop movement completely to arrest the energy input and allow the oscillation to decay before any further crane movement.

44. C — Lowering speed is governed by the safety of the crane and rigging, not by external urgency. Lowering at three times normal speed at 60 feet creates dynamic braking forces when deceleration occurs near the set point that may exceed the rigging's rated capacity. The operator must communicate the safe maximum speed as a professional constraint and offer that speed as the alternative — "quickly" is not an authorized override of safe lowering speed limits.

45. A — Without visibility of the signal person and the load, the operator has no confirmed communication channel and no ability to monitor the load's position and clearances. Any movement in this condition risks undetected contact between the load and personnel or structures. Emergency lighting must be established that restores adequate visibility before any crane movement resumes. The horn warning is critical to alert any personnel in the dark work area of the load's stationary position.

46. C — OSHA 1926.1419 establishes that only the designated, qualified signal person may give operational signals to the crane operator — except for Emergency Stop, which any person may give at any time and to which the operator must always comply immediately. This exception exists because Emergency Stop situations require the fastest possible response regardless of who observes the hazard. No other person — including the lift director — has authority to give non-emergency operational signals to the operator.

47. D — The authority for a first confirmed lift to cover subsequent identical lifts is contingent on confirming the identical conditions still exist for each subsequent lift. Any change in crane configuration, level condition, load weight, or operating radius invalidates the previous confirmation. The ongoing verification before each repetitive lift is a check that the identical conditions persist — it does not require a new chart lookup when the conditions are confirmed unchanged.

48. C — An unplanned item placed near the load being lifted creates multiple hazards: it can shift off the truck during the load's departure, change the geometry of the rigging's path to the load, or alter the load's CG at the moment of pick if it slides against the load. The lift plan was developed without this configuration, and proceeding outside the lift plan without confirmation of adequacy is a deviation from planned operations that requires review before continuing.

49. A — ASME B30.10 requires the safety latch to function properly — meaning it must reliably prevent rigging from disengaging from the hook during crane operations. A latch that opens under 1-ounce lateral force will open upon contact with any rope, sling, or wire during the normal contact events that occur during rigging attachment and load pick. This is functionally equivalent to no latch at all, and the hook must be removed from service until the spring is replaced.

50. B — ASME B30.9 specifies that chain slings showing elongation exceeding 3% of the original rated chain length must be removed from service. Elongation beyond 3% indicates the steel has been permanently deformed beyond its elastic limit — yielding has occurred throughout the links that stretched. This permanent deformation reduces the chain's impact resistance and fatigue life, and the chain cannot be restored to its original properties through any field process.

51. A — A chemical burning smell from an electrical panel indicates insulation overheating or burning — an early-stage electrical fire. Electrical fires in enclosed panels can smolder invisibly and then flash over rapidly when the panel is opened for investigation. The absence of alarms does not confirm safety because the odor may be produced at temperatures below the alarm threshold. The load must reach the

ground before evacuation because a hydraulic failure from an electrical fire could prevent controlled lowering.

52. C — The design factor of 5:1 requires minimum breaking strength = $4,000 \times 5 = 20,000$ lbs. The rope's 22,000-lb breaking strength appears to exceed this minimum. However, a rope's listed breaking strength is the manufacturer's breaking test result for the rope itself — it is not automatically equivalent to a sling's rated WLL, which must account for hitch configuration efficiency, fitting attachment, and rated capacity verification under the applicable standard. The rope must be confirmed as a rated ASME B30.9 sling, not just a rope with a breaking strength.

53. D — A flat spot on the primary load line sheave creates a repetitive impact on the rope at the flat zone transition points on every hoist cycle. This repetitive bending and straightening at the impact points creates fatigue crack initiation in the wires at precisely those locations. The damage is progressive — continued operation makes the flat spot worse and damages more rope. Both the sheave and the rope section that has been running over it must be replaced.

54. D — A "monitor" notation from 9 months ago that has no subsequent follow-up documentation means the monitoring was never actually executed. Surface rust on a boom lacing rod can progress to pitting corrosion that reduces the rod's cross-sectional area over 9 months of continued operations. A lacing rod with significant section loss has reduced compressive capacity that affects the boom's lateral stability under operating loads. Current evaluation by a qualified person is required.

55. A — A reeving sheave pin is a structural bearing element that transfers the sheave's load directly to the hook block frame. A crack at the pressed-fit contact surface indicates the pin is experiencing fatigue from the cyclic loading of each hoist cycle. High-cycle fatigue cracks in press-fit interfaces propagate relatively rapidly because the fit creates stress concentration at the crack tip. The pin must be replaced before any further use — continuing risks sudden pin fracture and uncontrolled block disassembly.

56. C — ASME B30.5 and OSHA 1926.1416 both require that any modification that may affect the crane's rated capacity be approved by the manufacturer or a qualified engineer, and that the load chart be updated accordingly. A heavier counterweight changes the stability analysis underlying the load chart values. Operating with a modified counterweight using the original load chart applies capacity values derived for a different mass configuration — the updated configuration must have manufacturer-approved capacity documentation.

57. D — OSHA 1926.1413 and ASME B30.5 both list kinks as an unconditional removal condition for wire rope — no location, no size, and no straightening attempt qualifies a kinked rope for continued service. A kink permanently deforms the rope's geometry, redistributing load among wires and strands unevenly. The stress concentration at the apex of the kink is permanent — straightening the kink does not restore the original geometry or eliminate the stress concentration.

58. C — Hydraulic fluid level dropping 20% below minimum during a single shift indicates a significant active leak somewhere in the system. Even if no external leak was observed at the start of the shift, the fluid must have gone somewhere — either an internal bypass, a large external leak that was not noticed, or a combination. Operating below the minimum fluid level risks pump cavitation from insufficient fluid head, and the source of the significant fluid loss creates a safety hazard that must be identified before operations resume.

59. C — OSHA 1926.1427 Option 2 (employer qualified evaluator) creates a qualification that is issued by the employer rather than an independent accredited body. The portability of this qualification to other employers depends on whether the new employer accepts the previous employer's evaluation. Unlike Option 1 (NCCCO or equivalent accredited certification), Option 2 qualifications are employer-issued and may not be universally recognized. The new employer must determine whether to accept the previous evaluation or conduct their own.

60. C — Single-sided crown wire wear from drum groove contact indicates the drum grooves are undersized for the installed rope diameter — the rope cannot seat into the groove bottom because the groove is too narrow, so it rides on the groove walls. This causes concentrated contact stress on only the wall-contacting side of the rope's crown wires. Progressive wear reduces the wire cross-section at those contact points and creates flat spots that generate fatigue. The drum must be re-grooved to the correct radius for the installed rope.

61. B — High-strength steel alloy shackles can fracture from impact loading without surface deformation — the fracture mode is brittle, occurring within the material's structure without plastic deformation that would be visible externally. A 12-foot drop onto concrete creates an impact force that can initiate internal fractures particularly at the pin, at pressed-fit interfaces, and at the bow's inner radius where stress concentrations exist. A qualified person must inspect the shackle or it must be replaced with a confirmed undamaged unit.

62. B — ASME B30.9 requires all hooks used with slings to be equipped with properly functioning safety latches. The latch must close across the hook throat without manual force — a spring-loaded latch

that closes by gravity only is insufficient because any lateral contact with rigging during pick or swing can push the hook open. The latch must be confirmed to engage and remain engaged under normal operational contacts before use.

63. A — A slewing ring deflection measured at 0.055 inches — 91.7% of the 0.060-inch maximum — represents a condition that is very close to the removal threshold. Ten months of additional operations generates additional wear. The upcoming annual inspection must specifically include a fresh slewing ring deflection measurement to determine whether the 0.060-inch limit has been reached or exceeded. This is not a routine annual item — the proximity to the limit makes it a priority measurement.

64. C — Rust inside the hydraulic circuit from a compromised outrigger cylinder seal indicates water infiltration that has contaminated the hydraulic fluid throughout the connected circuit. Rust particles are abrasive and cause accelerated wear on pump internals, control valve spools, and cylinder bore surfaces. The contaminated fluid must be completely replaced and the system flushed after the cylinder seal is repaired — continuing with contaminated fluid will progressively destroy the hydraulic system's precision components.

65. B — Non-uniform strand diameter in a wire rope indicates an abnormal internal condition — either progressive corrosion of internal wires causing the affected strand's wires to pit and swell, or core failure causing the strand's wires to redistribute outward. Either condition means the affected strand is not carrying its proportional share of the rope's load. A qualified inspector must evaluate whether the total remaining structural capacity of the non-uniformly loaded rope meets the removal criteria.

66. D — OSHA 1926.1408(b)(2) establishes the required sequence before commencing work near power lines, including voltage determination, MSAD calculation, de-energization feasibility, and control plan implementation. Each step in this sequence must occur before the crane is positioned near any power line. Initiating crane setup while simultaneously gathering power line information creates a situation where the crane may be positioned before all safety controls are established.

67. A — Conservative capacity at the next larger tabulated radius beyond 33 feet = 35 feet, capacity = 27,600 lbs. Total suspended weight = 2,000 + 560 + 160 + 23,000 = 25,720 lbs. Since 25,720 lbs is less than 27,600 lbs, the lift proceeds. The conservative approach uses the 35-foot entry — not the 30-foot entry — as the governing capacity for a 33-foot operating radius.

68. C — The signal briefing requirement in OSHA 1926.1419 cannot be deferred to after the first lift. The first lift is an actual crane operation that requires a fully confirmed communication system before the first movement. Deferring the briefing means the first lift is performed without confirmed signal communication — creating the exact risk of signal misinterpretation that the briefing requirement exists to prevent.

69. B — Conservative approach: next larger tabulated radius beyond 32 feet = 35 feet, capacity = 17,600 lbs. Total suspended weight = 18,200 lbs. Since 18,200 lbs exceeds 17,600 lbs by 600 lbs, the lift cannot proceed in the 50% extension configuration using the conservative approach. The operator must either reduce the total suspended weight or reconfigure to full extension to access higher capacity at 32 feet.

70. D — OSHA 1926.1427 requires that the employer evaluate and document operator competency for the specific crane at the specific worksite — this requirement applies regardless of what certification the operator holds. A configuration change from the 100-foot to the 80-foot boom at the same site still requires confirming the LMI is updated and that the operator is operating within the correct load chart section for the new configuration. Confirmation that the previous lifts' parameters don't carry over is essential.

71. A — Conservative capacity at the next larger tabulated radius (35 ft) = 27,600 lbs. Total suspended weight = 2,000 + 560 + 160 + 23,000 = 25,720 lbs. Since 25,720 lbs is less than 27,600 lbs, the lift proceeds with 1,880 lbs of margin. Lift percentage based on conservative capacity = $25,720 \div 27,600 \times 100 = 93.2\%$ — this exceeds the 75% critical lift threshold and a written critical lift plan and pre-lift meeting are required.

72. B — Conservative approach: next larger tabulated radius beyond 32 feet = 35 feet, capacity = 17,600 lbs. Total suspended weight = 18,200 lbs. Since 18,200 lbs exceeds 17,600 lbs, the lift cannot proceed using the conservative approach in the 50% extension configuration. The crane must be reconfigured to full extension or another configuration that provides adequate capacity at 32 feet of radius.

73. B — The load chart note establishes 60° to 80° as the rated boom angle range for over-front-axle operations. A boom angle of 55 degrees is outside this range — the structural and stability analysis for the over-front-axle configuration was only performed within the 60–80 degree envelope. Operating at 55 degrees in the over-front-axle position is an unrated configuration with no applicable capacity values, and the crane must be repositioned or the boom angle adjusted before any lifting.

74. B — Boom deflection under load is a real physical increase in operating radius that must be treated the same as any other radius increase. The effective radius after deflection is 33 feet — not the planned 30 feet. Using the conservative approach at the actual 33-foot effective radius, the governing capacity is at 35 feet = 28,200 lbs. The total suspended weight of 33,000 lbs exceeds 28,200 lbs, confirming the lift is no longer within conservative capacity at the deflected radius.

75. A — The conservative approach at 32 feet uses the 35-foot tabulated value — which is structural-limited at 26,600 lbs (or whatever the actual value is in the chart). The operator must recognize that the conservative governing value comes from the structural-limited zone, meaning operational precautions for structural-limited lifts apply: smooth movements, no dynamic loading, no abrupt direction changes. The transition zone also means small radius changes could move the operative limit type.

76. C — The note explicitly requires deducting 1,400 lbs from the tabulated capacity when the heavy-duty block is used. This is a gross capacity adjustment — not just a net payload calculation. Applicable gross capacity = $28,400 - 1,400 = 27,000$ lbs. The note exists because the heavier block changes the structural loading distribution at the boom tip and other components, requiring the manufacturer to reflect this difference in the gross capacity value.

77. D — The jib-installed section must be used whenever the jib is physically on the crane, regardless of which hook carries the load. The jib's concentrated weight at the boom tip changes the structural load distribution throughout the boom's length — this effect is present whether the load hangs from the jib hook or the main hook. The main boom section was derived without the jib's tip weight; using those values while the jib is installed understates the actual structural loading.

78. D — Conservative approach at pick (42 ft): next larger tabulated radius = 45 ft, capacity = 17,800 lbs. Conservative approach at set (47 ft): next larger tabulated radius = 50 ft, capacity = 13,800 lbs. The set position's conservative capacity of 13,800 lbs is the lowest value encountered throughout the lift and governs the overall lift plan. Total suspended weight must remain below 13,800 lbs for the complete lift to be within conservative capacity at all positions.

79. D — The built-in 10% load factor reduction accounts for typical dynamic effects during "standard operations" — controlled movements with normal acceleration and deceleration. At 88% of the pre-derated capacity, only 12% structural reserve remains. Rapid swing acceleration, abrupt stops, or simultaneous multi-function operations can create dynamic additions that exceed this reserve even with the pre-built derating. Smooth controlled movements remain the required operational standard for near-capacity lifts.

80. D — The note requires confirmation that the boom is at the maximum rated angle for each radius. The purpose of this note must be understood before proceeding — it may be a configuration requirement (the boom must be at a specific structural position), or it may be describing the maximum safe angle not to be exceeded. Without understanding the note's intent, the operator cannot comply safely. Manufacturer clarification is required to determine whether the note is mandatory or descriptive.

81. B — The original interpolation result of 22,440 lbs was incorrect. Correct interpolation: capacity decrease from 35 to 40 ft = $26,800 - 21,200 = 5,600$ lbs over 5 ft = 1,120 lbs/ft. At 38 ft (3 ft beyond 35 ft): $26,800 - (3 \times 1,120) = 26,800 - 3,360 = 23,440$ lbs. The corrected interpolated capacity at 38 feet = 23,440 lbs. The lift percentage = $24,000 \div 23,440 = 102.4\%$ — still exceeding the interpolated capacity, confirming the lift cannot proceed.

82. D — The blank at 65 feet confirms that 60 feet is the maximum rated radius for this jib configuration. Total suspended weight = $280 + 340 + 7,600 = 8,220$ lbs, which is within the 8,400-lb capacity at exactly 60 feet. The lift proceeds, but the operator is at the absolute outer boundary of the rated envelope. Any radius increase — from boom deflection, centrifugal swing displacement, or wind — immediately moves the lift outside the rated envelope where no capacity exists.

83. A — Lift percentage = $38,000 \div 42,000 \times 100 = 90.5\%$. This exceeds the 75% critical lift threshold established in OSHA 1926.1408. Since the maximum counterweight is confirmed installed, the 42,000-lb maximum counterweight capacity is the applicable value for capacity compliance. The 90.5% lift percentage requires a written critical lift plan and pre-lift meeting with all lift team members before the lift begins.

84. B — The over-front sector extends 15 degrees each side of front center — covering 0° to 15° on each side. The pick at 5° left is within the over-front sector. The set at 25° left exceeds the over-front sector boundary. The load must travel through the transition from over-front to all-directions during the swing, and the set location is outside the over-front sector. The all-directions capacity (34,800 lbs) governs for any lift that must be set outside the over-front sector.

85. B — Lift percentage = $14,400 \div 32,000 \times 100 = 45\%$ — within the 50% personnel hoisting limit. The operator must confirm the 50% calculation uses the exact gross capacity at the current crane configuration. Additionally, the note about confirming compliance with all other OSHA 1926.1431

requirements — daily pre-lift inspection, trial run at the start of project, operator presence at controls, and load line design factor — is equally important for full compliance.

86. B — A 35-minute hold at 52 feet of radius — near the 55-foot maximum rated radius — requires the operator to actively monitor for any changes that could increase the effective radius. Progressive outrigger settlement can cause the crane to tilt toward the load, increasing the effective radius. Wind loading on the suspended load can cause centrifugal-like displacement. Any radius increase during the hold could approach or exceed the 55-foot rated envelope limit.

87. C — When the same structural member governs the capacity at two consecutive radii, it is possible for the rounded capacity values to be identical — particularly when the member's design stress changes only slightly between the two radii. This is a legitimate load chart condition, not necessarily a printing error. The operator should proceed using 26,400 lbs as the capacity for operations in the 30–35 foot range, with smooth movement requirements appropriate for structural-limited cells.

88. C — The 100-foot LMI configuration shows higher capacity values at the same radius than the 120-foot configuration. With the 100-foot LMI selected, the displayed percentages were lower than the actual percentages for the 120-foot boom. A lift displayed at 82% with the 100-foot configuration may have been at a higher actual percentage using the 120-foot boom values. Post-event recalculation with the correct 120-foot configuration is required to confirm no lifts exceeded actual rated capacity.

89. A — The note specifies that the standard rigging set (hook block + standard slings = 1,800 lbs total) is already pre-deducted from the net capacity. The 22,800-lb net value is available for any rigging beyond the standard set and for the payload. Since the operator is using a spreader beam (2,400 lbs) in addition to the standard rigging, only the spreader beam weight is deducted from the net capacity: $22,800 - 2,400 = 20,400$ lbs maximum payload.

90. B — The note's 10-foot CG height threshold is triggered because the load's CG is at 11 feet — 1 foot above the threshold. A CG above the lift points creates a pendulum effect where any load swing generates larger rotational energy than a low-CG load, and the resulting dynamic forces on the crane and rigging are greater. The 12% derating accounts for this effect. Derated capacity = $32,000 \times 0.88 = 28,160$ lbs. The derating applies as stated in the note — the threshold was exceeded.

91. D — Without understanding specifically what was "certified" — whether it represents a higher confidence level from load testing or simply a different calculation methodology — the operator cannot confirm which section provides the more accurate capacity for the actual crane being operated. The conservative reference section provides a known baseline. Using the higher "certified" values without understanding what makes them certified could result in operating above actual safe capacity.

92. C — A decreasing rate of capacity decrease per foot means the capacity curve is concave upward — it is flattening as radius increases. When the curve is concave upward, a straight-line interpolation between two points lies below the actual curve. This means linear interpolation provides an estimate that is slightly below the actual capacity — slightly conservative. Operators should understand this geometry so they correctly interpret interpolated values relative to the tabulated values.

93. B — Conservative approach at pick (57 ft): next larger tabulated radius = 60 ft, capacity = 7,200 lbs. Conservative approach at set (62 ft): the blank at 65 ft confirms the maximum rated radius is 60 ft; 62 ft exceeds the maximum rated radius — the set position is outside the rated envelope entirely. The lift cannot proceed to the planned 62-foot set location regardless of any load weight reduction, because 62 feet is beyond the maximum rated radius where no capacity exists.

94. D — Conservative approach at 48 feet: next larger tabulated radius = 50 feet, capacity = 72,400 lbs. Total suspended weight = 76,000 lbs. Since 76,000 lbs exceeds 72,400 lbs by 3,600 lbs, the lift cannot proceed at 48 feet using the conservative approach. Options include repositioning the crane to reduce the operating radius to 45 feet or less (where the conservative capacity at 50 feet is not needed since the tabulated 45-foot capacity of 88,000 lbs supports the load directly), or reducing the total suspended weight below 72,400 lbs.

95. B — A crane configuration change from the 100-foot to the 80-foot boom requires independent capacity verification for the new configuration — the previous confirmation for the 100-foot boom does not transfer. The LMI must be updated to the 80-foot boom configuration to ensure accurate capacity percentage display during the new lifts. Operating the 80-foot boom configuration with the 100-foot LMI configuration would display incorrect percentages, potentially masking an actual near-capacity condition.

SITE DOMAIN — Questions 1–15

1. A crane operator is evaluating a setup location on an active military base. The surface appears to be compacted aggregate but the operator discovers that the area was used for explosive ordnance disposal training 8 years ago. The site manager has no records of any soil remediation or post-training assessment. What must be done before crane setup proceeds?

- A. The 8-year interval is sufficient time for any chemical residue to have dissipated — proceed normally
- B. Notify the base safety officer by phone and then proceed with setup while awaiting response
- C. The crane employer must obtain information from the controlling entity about any subsurface hazards from the historic explosive ordnance use before setup — unexploded ordnance may exist at depth; construction loading and vibration can trigger detonation; no crane setup may proceed until the area is confirmed clear by qualified ordnance disposal personnel
- D. A standard utility locate (811) will identify any subsurface explosive materials before crane setup

2. A crane is set up at a job site where the outrigger positions have been placed on engineered timber crane mats — large multi-layer timber mats measuring 4 feet × 20 feet × 12 inches thick. During the second lift of the day, the operator notices that one mat has developed a visible crack along its centerline — a split running the full 20-foot length of the mat's top surface. What must the operator do?

- A. Stop operations and have the cracked mat assessed by a qualified person before continuing — a full-length centerline crack in a crane mat indicates the mat's structural integrity has been compromised; if the mat is a multi-layer laminated mat, the crack may indicate separation of structural layers that reduces the mat's ability to distribute the outrigger load; operations must not continue until the mat is confirmed adequate or replaced
- B. Continue the lift series since the crack is on the surface only and does not affect the mat's bearing function
- C. Reduce the planned lift load to 75% to compensate for the reduced mat capacity
- D. Place a second mat on top of the cracked mat to reinforce it and continue operations

3. Under OSHA 1926.1407, when a crane employer determines that operating near an energized power line is unavoidable and implements an encroachment prevention plan, which specific element must be confirmed functional through a test before beginning operations?

- A. The crane's LMI system must be confirmed active and reading accurately before operations begin near a power line
- B. The dedicated spotter's radio communication must be confirmed clear and reliable with the crane operator
- C. The lift director must conduct a test swing to confirm the boom's maximum approach distance before actual operations begin
- D. The means by which the dedicated spotter can immediately stop all crane movement must be physically tested before operations begin near the power line — confirming the stop mechanism functions correctly under actual conditions, not just confirming it is present, ensures the primary protective control is operational

4. A crane operator is performing a site walk at a marina construction project. The planned outrigger zone is on a concrete dock surface over timber pile bents. The dock was built in 1975 and shows visible weathering. The dock administrator states: "This dock has handled bigger equipment before." What must be confirmed before any crane setup?

- A. Ask for documentation of the previous heavier equipment that used the dock to establish precedent
- B. A structural engineer must confirm the dock's current load-bearing capacity for the specific crane's outrigger point loads — the dock's 1975 construction means the structural members are approximately 50 years old; timber pile bents are subject to marine organism damage, rot at the waterline, and loss of cross-sectional area that significantly reduces the original capacity; precedent from previous equipment does not confirm current structural capacity
- C. Confirm the dock has not experienced any visible damage since the last heavy equipment operation
- D. Accept the dock administrator's assurance since they bear liability for the dock's condition

5. A crane is operating at a job site when the general contractor begins soil cement improvement operations adjacent to the setup area — a process that mixes cement with the native soil using a large

auger tool. The auger work starts 20 feet from the left rear outrigger position. What concern does adjacent soil-cement mixing create for crane operations?

- A. Soil-cement mixing improves adjacent soil bearing capacity through chemical bonding of the nearby native soil
- B. The auger vibration at 20 feet is below the 10-foot zone requiring operational pause
- C. Adjacent soil-cement mixing operations use large, heavy equipment that adds surcharge to the adjacent soil; the auger tool applies both vertical and torsional loads to the soil immediately surrounding the mixing location; these loads can temporarily alter the stress state and bearing capacity in adjacent soil; crane operations should be monitored carefully for any level change during the mixing operation and may need to pause if level drift is observed
- D. The cement injection improves bearing capacity everywhere within 50 feet of the mixing location

6. Under OSHA 1926.1402, what obligation exists for the crane employer when the site's soil conditions include areas with documented unstable soil that has not yet been remediated, and the crane must operate near these areas?

- A. The crane employer must ensure the crane does not operate within confirmed unstable soil zones and must establish clear physical boundaries marking the limits of adequate ground conditions — if the lift requires reaching over or near the unstable zone, the crane employer must work with the controlling entity to either remediate the zone before operations or develop an alternative lift plan that keeps the crane's outriggers in confirmed adequate ground
- B. The crane employer bears no obligation for unstable soil zones since this is the controlling entity's responsibility
- C. The crane employer must reduce all lifts to 80% of rated capacity when unstable soil is within 30 feet
- D. The crane employer must submit a site safety plan to OSHA before operating near documented unstable soil

7. A crane is set up on a construction site when the operator observes that the soil between the left front and left rear outrigger pads — the zone directly between the two pads on the same side — has developed a visible ridge approximately 2 inches high running parallel to the outrigger beam. The ridge was not there when setup was completed. What does this surface ridge indicate?

A. Nothing — soil ridges from outrigger loading are normal compaction patterns caused by the outrigger beam weight

B. A 2-inch surface ridge between loaded outrigger pads is caused by outrigger beam contact with the soil and is expected for heavy cranes

C. The ridge is consistent with road construction nearby causing vibration that has pushed soil to the surface

D. A surface ridge developing between two loaded outrigger positions indicates that the soil is being pushed laterally outward from between the pads — this is consistent with bearing capacity failure developing beneath the outriggers; the loaded soil mass is flowing laterally and upward as the outrigger loads approach or exceed the soil's shear strength; operations must stop immediately and the load must be lowered while the ground condition is assessed

8. A crane operator is evaluating a setup area on a job site that includes a documented filled retention pond — a former stormwater retention basin that was filled with clean fill 4 years ago to provide usable land area for the construction project. The fill report shows "general fill" was placed without controlled compaction. What specific concern does uncontrolled fill create?

A. Nothing — 4-year-old filled areas are always considered consolidated and structurally sound

B. Uncontrolled fill placed in a former retention pond may have variable density, poor compaction, trapped organic material from the original pond bottom, and remaining soft zones that were not identified during filling; without compaction testing, the bearing capacity of this fill is unknown and potentially highly variable; a geotechnical investigation is required before any crane outrigger loading in this area

C. Filled retention ponds are classified as engineered fill since they were placed under a construction permit

D. The 4-year settlement period is sufficient to reach bearing capacity equivalent to the surrounding native soil

9. A crane is operating on a paved surface when the operator notices that the outrigger pad on the right front has sunk approximately 0.75 inches into the asphalt — the pad has penetrated through the top layer of asphalt paving. The current ambient temperature is 88°F. The crane is at 78% of rated capacity in the middle of a critical lift. What action is required?

A. Continue the current lift at reduced speed and monitor the pad penetration for further sinking

B. Complete the critical lift since stopping mid-lift is more dangerous than continuing when the pad sinking has already occurred

C. Stop all crane movement immediately — the pad has penetrated through the asphalt surface, indicating the asphalt is too soft to support the outrigger load at this temperature; the crane must lower the load and remain in position while the pad sinking is investigated; further sinking could cause the outrigger to break through the asphalt entirely, causing sudden tilt and possible tip-over

D. Contact the lift director and await authorization before taking any action regarding the pad penetration

10. Under OSHA 1926.1402(b), what is the minimum requirement for the crane employer when the controlling entity has not provided written documentation of ground conditions before crane operations begin?

A. The crane employer must request the information from the controlling entity before operations begin — oral assurances are not sufficient when ground condition documentation is specifically required; the crane employer must have confirmed, documented ground condition information adequate for the planned crane loading before setup proceeds; if the controlling entity fails to provide this, the crane employer must assess and document ground conditions independently before operations

B. The crane employer may self-certify ground conditions as adequate based on the operator's visual inspection

C. OSHA must be notified when the controlling entity fails to provide ground condition documentation

D. The operator may use industry-standard soil test results from projects within 1 mile of the site

11. A crane is set up on a construction site where a nearby building's basement waterproofing system uses a subsurface drainage board installed at the building foundation perimeter — a 2-inch thick dimpled plastic sheet running vertically from the foundation footing to the surface, installed 3 feet from the crane's right rear outrigger position. What concern does this drainage board create for outrigger support?

A. Nothing — drainage boards are installed below the surface and do not affect bearing conditions above them

B. Waterproofing drainage boards are structural elements that improve bearing capacity near building foundations

C. The crane setup is always prohibited within 3 feet of any building foundation waterproofing system

D. A vertical drainage board installed 3 feet from the outrigger creates a zone of disrupted soil — the drainage board installation required excavation and backfill within the outrigger's zone of influence; the backfilled zone may have lower bearing capacity than the surrounding undisturbed soil, and the drainage board itself represents a lateral discontinuity in the soil mass; the bearing capacity in this zone must be confirmed before outrigger loading

12. A crane is set up at a job site in northern Canada in January. Temperatures are -22°F (-30°C) and the ground surface is frozen to a depth of approximately 36 inches. The soil beneath the frozen zone is confirmed as soft clay with 1,200 psf bearing capacity. What must the operator evaluate regarding the frozen surface's bearing capacity?

A. The 1,200 psf soft clay capacity governs all seasons — frozen surface conditions are not recognized as a capacity improvement under ASME B30.5

B. The frozen surface layer significantly increases the bearing capacity above the soft clay's native 1,200 psf capacity — frozen soil can behave like rock; however, the operator must evaluate whether the crane's thermal footprint and operational vibration can cause thawing at the outrigger positions; if thawing occurs, the bearing surface instantly reverts to the 1,200 psf soft clay capacity; heat generated by the crane engine and hydraulic system concentrated at the outrigger positions must be assessed

C. The frozen crust always provides adequate bearing for any crane operation regardless of depth or underlying soil conditions

D. OSHA prohibits all crane operations when ambient temperatures are below -20°F

13. A crane operator is evaluating the exclusion zone for a planned lift that requires the boom to pass over an active pedestrian walkway connecting two buildings. The walkway is covered by a canopy structure at 14 feet of height. The bottom of the load will be at 16 feet of height during the pass over the walkway. What requirement applies?

A. The 2-foot clearance between the canopy and load bottom provides adequate margin for all pedestrian activities below

B. The lift may proceed if warning signs are posted at the walkway entrance warning of overhead crane operations

C. The pedestrian walkway must be closed and confirmed free of all personnel before the load passes over it — OSHA 1926.1425 prohibits loads from passing over personnel; the canopy structure does not provide protection against a load drop; all persons must be cleared from the walkway before the load's swing path passes over it

D. The walkway may remain open if the load is at 16 feet — the 14-foot canopy blocks direct visual contact with the load from below, reducing the risk to pedestrians

14. A crane is being mobilized to a new job site. The transport route crosses a bridge with a posted load limit of 80,000 lbs. The crane components being transported require 3 separate loads: the carrier at 62,000 lbs, the boom at 44,000 lbs, and the counterweight at 38,000 lbs. Each load is within the 80,000-lb limit. What additional concern must be evaluated for the bridge crossing?

A. Each transport load must also be evaluated for axle loading distribution — posted bridge weight limits typically specify total gross vehicle weight, but bridges can also be governed by concentrated axle loads; a 62,000-lb carrier may have axle loads that exceed the bridge's design axle load even though the total GVW is within the posted limit; each transport vehicle's axle loads must be confirmed within the bridge's axle load design limits

B. The loads are all individually under 80,000 lbs and may cross the bridge without further evaluation

C. The bridge owner must be notified of the crane transport before any loads cross the bridge

D. The three loads may cross simultaneously as a convoy since their combined weight is less than 144,000 lbs total

15. A crane is operating at a refinery when the facility's emergency PA system activates with the announcement: "PERSONNEL — SHELTER IN PLACE — This is not a drill." The crane is mid-swing with a 28,000-pound load at 15 feet of height. What is the required response?

A. Contact the lift director to determine whether the shelter-in-place announcement includes crane operators before taking any action

B. Continue the current swing to the nearest available set location and then shelter in place in the cab

C. Sound the emergency horn to warn nearby personnel and continue operations since the crane cab provides shelter

D. Stop all crane movement immediately, lower the load to the nearest available ground surface as quickly and safely as possible, and then shelter in place per the facility's emergency procedures — a refinery shelter-in-place directive indicates a chemical release or similar facility emergency; continuing crane operations during a chemical release emergency exposes the operator to the hazard and may prevent the operator from reaching adequate shelter quickly when needed

OPERATIONS DOMAIN — Questions 16–30

16. A crane operator is performing a lift when the signal person gives the HOIST signal and simultaneously holds up fingers indicating "slow" — a common informal gesture not in the official ASME B30.5 hand signal set. The operator has never discussed this informal gesture with the signal person. What must happen?

A. Execute the HOIST signal at minimum speed since the informal "slow" gesture's intent is clear

B. Stop and clarify the meaning of the informal gesture with the signal person before executing any movement — OSHA 1926.1419 requires that both parties understand and agree on the meaning of all signals before operations begin; an informal, non-standard gesture that was not discussed in the pre-operation signal briefing creates an ambiguous signal; the operator must not act on ambiguous signals

C. Ignore the informal gesture and execute the standard HOIST signal at normal speed

D. Contact the lift director to determine whether informal gestures are authorized on this project

17. A crane operator is performing a critical lift at 87% of rated capacity. During the lift, the lift director receives a call from the client asking whether the lift can be modified to set the load 4 feet further from the crane than planned — a radius increase of approximately 10%. The lift director tells the operator to execute the modified placement. What must the operator do before executing the radius increase?

A. Execute the movement since the lift director has authorized the modification

B. Sound the horn to warn all personnel and execute the radius increase at minimum speed

C. Verify the crane's capacity at the new, greater operating radius before executing the movement — a 10% radius increase at 87% existing capacity creates a significant risk of exceeding rated capacity at the new radius; the load chart must be consulted for the new radius before the movement is made; if the new radius exceeds rated capacity, the movement cannot be executed regardless of the lift director's instruction

D. Lower the load to the original position and terminate the lift — modifications during active critical lifts are always prohibited

18. Under OSHA 1926.1416(e), what must the operator do when they discover the load chart that is present in the cab applies to a different serial number crane than the crane being operated?

A. Stop operations until a load chart applicable to the specific crane being operated is obtained and confirmed in the cab — operating without the correct load chart means the operator has no valid capacity reference for the crane being used; capacity values from a different serial number crane may be different from the crane being operated's actual rated capacity; no crane operation may begin until the correct chart is available

B. Use the available chart conservatively by applying a 10% safety deduction to all capacity values

C. Verify that both cranes are the same model and use the available chart if they are the same model

D. Contact the manufacturer and request that the correct chart be emailed to the site

19. A crane is performing a lift at 83% of rated capacity when the signal person leaves the work area to use the facilities. The rigger, who is an experienced worker but is not a designated signal person for this project, offers to give signals for the one remaining lift. The lift director agrees verbally. What is the correct response?

A. Accept the rigger's signals since the lift director has verbally authorized the change in signal person

B. Refuse to execute signals from the undesignated rigger for any movements other than Emergency Stop — the operator may only respond to signals from the designated, qualified signal person; verbal authorization from the lift director does not substitute for the rigger being designated as a qualified signal person; the lift must wait until the designated signal person returns or a qualified replacement is properly designated

C. Accept the rigger's signals for the single remaining lift since the lift director's authorization limits it to one lift

D. Allow the rigger to give signals only for the LOWER function since it is the safest movement

20. A crane operator is completing a series of lifts when the lift director instructs the operator to use the crane to drag a concrete precast panel approximately 3 feet across a concrete floor to its final alignment position — pulling it horizontally with the load line rather than lifting it. What is the required response?

A. Accept the instruction since the panel weight is within the crane's rated load capacity

B. The operator must refuse — using the crane to drag or pull loads horizontally creates side-loading forces on the boom that the boom was not designed to carry; the force required to drag the panel may create significant lateral loads on the boom structure, and if the panel suddenly releases, the crane could spring back violently; horizontal dragging of loads is prohibited under ASME B30.5

C. Accept if the horizontal dragging force is confirmed to be less than 25% of the crane's rated capacity

D. Reduce the boom angle to minimum before dragging to reduce the boom's exposure to lateral forces

21. A crane operator observes during a swing that the load appears to be swinging outward while the upper works has already stopped rotating — the boom is stationary but the load is continuing to move laterally from the load's pendulum momentum. The load approaches within 3 feet of a structural column before stopping. What technique prevents this overshoot on subsequent swings?

A. Reduce crane speed during all lifts to zero-tolerance precision movement

B. Apply more abrupt swing braking to stop the upper works more forcefully before the load reaches the intended position

C. Reduce swing speed progressively as the target approaches so the crane arrives at the stop position with minimum residual swing velocity — the load's pendulum motion after the upper works stops is directly proportional to the upper works' velocity at the moment of stop; arriving at the stop position slowly minimizes the load's residual momentum and eliminates the overshoot

D. Increase boom height to reduce the pendulum length, which shortens the pendulum period and reduces overshoot distance

22. Under OSHA 1926.1419, what is the specific standard that determines which hand signals a signal person must use during crane operations?

- A. ASME B30.5 standard hand signals must be used unless the employer has established an alternative set — but any alternative set must be established and agreed upon by both the signal person and the operator before operations begin, and the alternative set must be consistent and used exclusively for the duration of the project; mixing standard and non-standard signals within the same operation is never authorized
- B. Any hand signal system that both parties understand is acceptable without establishing the signals formally
- C. The signal person may use any signals they choose as long as the operator confirms understanding of each one before acting
- D. Only NCCCO-certified signal persons may establish alternative hand signal systems

23. A crane is performing a personnel hoisting operation at 42% of rated capacity. After 25 minutes, the operator notes that the hydraulic oil temperature has entered the yellow zone — above normal but not in the red zone. The personnel platform is at 55 feet of height and workers are completing a structural connection. What is the immediate priority?

- A. Continue the hold since the yellow zone is still within operational bounds and the connection is nearly complete
- B. Ask the workers to hurry the connection to finish before the temperature reaches the red zone
- C. Continue the hold while contacting the lift director — the workers' safety in the platform takes priority over hydraulic temperature management
- D. Immediately notify the lift director of the hydraulic temperature condition and begin planning a controlled lowering of the platform — personnel hoisting requires the crane to remain fully operational throughout the operation; yellow zone hydraulic temperature is a warning that may progress to red zone conditions where safe lowering capability is threatened; the lift director must plan the controlled lowering before the temperature becomes critical

24. A crane operator is mid-lift at 91% of rated capacity when the signal person's radio battery dies mid-command — the operator heard "LOWER S..." and then silence. The load is at 6 feet of height. What must the operator do?

A. Execute LOWER SLOWLY since the partial command was sufficient to understand the signal person's intent

B. Stop all crane movement and hold the load at current height until communication is fully restored — a partial, incomplete communication is not a valid command; executing any movement based on an incomplete signal creates risk that the operator is acting on an incorrect interpretation; all movement must stop until the signal person and operator have confirmed communication and the signal person can deliver a complete, clear command

C. Lower slowly at minimum speed and ask the signal person to confirm by hand signal if the lowering is correct

D. Use the LMI to estimate whether LOWER is the safe next movement and execute it at minimum speed

25. A crane operator is performing a lift when a new worker on site — who has never seen a crane in person — walks into the exclusion zone while looking at their phone. The crane is mid-swing with the load at 22 feet of height. What is the immediate required action?

A. Sound the horn continuously to get the worker's attention while continuing the swing at reduced speed

B. Continue the swing since the signal person is responsible for confirming the zone is clear

C. Stop all crane movement immediately — an unauthorized person has entered the exclusion zone and all crane movement must cease until the person has exited and the zone is confirmed clear; the crane cannot resume any movement until the zone integrity is restored; the horn warning may be sounded to alert the person but the crane must not move until the zone is confirmed clear

D. Lower the load to the ground as fast as possible to reduce the risk before the worker is struck

26. Under OSHA 1926.1416, which statement correctly describes the operator's authority to deviate from the load chart's rated capacity in response to a project emergency?

- A. The operator may not deviate from rated capacity regardless of emergency circumstances — rated capacity is an absolute engineering limit that no emergency, project need, or supervisor authority can override; the operator who exceeds rated capacity does so without authorization and accepts personal legal and safety responsibility for the consequences
- B. The operator may exceed rated capacity by 10% in a documented emergency with the lift director's written authorization
- C. The operator may exceed rated capacity for critical life-safety emergencies at their own professional discretion
- D. Rated capacity may be exceeded temporarily when the LMI is confirmed accurate and the operator has completed all annual certifications

27. A crane operator is performing a tandem lift when Crane A lifts its share 6 inches higher than Crane B during the coordinated hoist — a differential pick caused by mismatched hoist speeds. The load is at 3 feet of height. What is the immediate consequence of the 6-inch differential and what must happen?

- A. Nothing — a 6-inch height difference during tandem lifts is within normal operational tolerance
- B. Continue the hoist and the differential will self-correct as both cranes reach the planned height
- C. Nothing — the signal person will direct speed corrections through radio communication while hoisting continues
- D. The 6-inch differential has shifted the load's effective center of gravity, transferring additional load to Crane A beyond its planned share — both cranes must stop immediately; Crane A may now be approaching or exceeding its rated capacity for the revised load share; the lift director must coordinate a correction that returns both cranes to equal elevation before any further movement proceeds

28. A crane operator performs a pre-shift inspection and finds that the hook block's safety latch is functional but the latch retaining pin — the small pin that keeps the latch assembled to the hook — is missing. The latch is still in place held by friction alone. What action is required?

- A. Nothing — the latch is in place and is functional without the retaining pin for light-to-medium lifts
- B. Remove the hook block from service — the latch retaining pin is the component that prevents the latch from becoming detached from the hook during operations; without the pin, the latch can fall off

during any crane movement that causes vibration or lateral force; a latch that has separated from the hook provides no protection against rigging disengagement

C. Secure the latch with a zip tie as a temporary measure until a replacement pin can be obtained

D. Use the hook for vertical-only lifts where the latch will not be disturbed by lateral forces

29. A crane operator is working on a project that requires lifts at 88% and 92% of rated capacity on the same day. The operator completed a 4-year NCCCO recertification last month. At what point during the day do the critical lift requirements apply?

A. Critical lift requirements apply only to the 92% lift — lifts below 90% of rated capacity are not critical lifts

B. Critical lift requirements apply to lifts at 75% or above rated capacity — both the 88% and the 92% lifts individually qualify as critical lifts; each requires its own written critical lift plan and pre-lift meeting since they likely involve different configurations and may occur at different times in the day

C. Critical lift requirements apply only when both critical lifts occur on the same day

D. The NCCCO recertification confirms the operator is qualified for critical lifts — no written plan is required for recertified operators

30. A crane is performing a lift at night with adequate site lighting at both the pick and set locations. During the swing between these locations, the load passes through a shadow area where neither the signal person nor the operator can see the load for approximately 6 seconds. What must be done?

A. Nothing — 6 seconds of load invisibility during a slow swing is acceptable

B. Reduce swing speed to minimum during the shadow zone passage

C. Use the signal person's knowledge of the load's position to guide the swing through the shadow zone

D. Establish an observer with confirmed clear sight to the load throughout the shadow zone before beginning any swing through that area — 6 seconds of complete load invisibility is 6 seconds during which the operator cannot detect load contact with obstacles, load drift, or rigging disengagement; an observer in the shadow zone who can see the load and relay signals maintains the continuous visual monitoring required throughout the lift

TECHNICAL KNOWLEDGE DOMAIN — Questions 31–42

31. A crane is operating when the inspector finds that a structural weld connecting a gusset plate to the boom's lower chord has a visible porosity condition — multiple small circular voids visible on the weld surface across a 2-inch section of the weld face. What does weld porosity indicate about the weld's structural quality?

- A. Surface porosity on a weld indicates normal weld aging from atmospheric oxidation — no structural concern applies
- B. Surface porosity on a structural weld indicates incomplete fusion or gas entrapment occurred during welding — these internal voids reduce the weld's effective cross-sectional area and create stress concentration points at each void boundary; a structural weld with porosity has reduced tensile and fatigue capacity; the crane must be evaluated by the manufacturer or a qualified welding engineer before continued use
- C. Surface porosity only affects the weld's appearance — internal weld integrity is unaffected by surface voids
- D. Weld porosity of less than 3 voids per inch is within acceptable AWS structural weld quality standards

32. A rigger is preparing to use a 4-leg wire rope sling bridle at 60 degrees from horizontal. Each leg has a WLL of 10,000 lbs in a vertical hitch. The load weighs 32,000 lbs. What is the tension per leg and is the configuration within the rated WLL?

- A. Nothing — 4 legs \times 10,000 lbs WLL = 40,000 lbs total capacity regardless of angle; 32,000 lbs is within capacity
- B. Tension per leg = $(32,000 \div 4) \times (1 \div \sin 60^\circ) = 8,000 \times 1.155 = 9,240$ lbs — within the 10,000-lb WLL; the configuration is adequate with 760 lbs of margin per leg
- C. Tension per leg = $32,000 \div 4 = 8,000$ lbs regardless of angle — the angle factor only applies to basket hitches
- D. Tension per leg = $8,000 \times \cos(60^\circ) = 8,000 \times 0.5 = 4,000$ lbs — well within the 10,000-lb WLL

33. A crane operator is reviewing maintenance records and discovers that the crane's hydraulic filters were changed 11 months ago. The manufacturer's recommended interval is every 6 months or 250 hours of operation. The crane has logged 210 hours since the last filter change. What is the maintenance status?

- A. The filter change is current — 210 hours is within the 250-hour interval
- B. Nothing — both calendar and hour intervals must be exceeded before a filter change is required
- C. The calendar interval (6 months) has been exceeded by 5 months regardless of the hour count — the crane's hydraulic filter maintenance is overdue; when a manufacturer specifies a filter change interval as whichever comes first (calendar or hours), exceeding either trigger requires service; the filter must be changed before operations continue; overdue filter maintenance allows system contamination to circulate through the hydraulic components
- D. The operator may defer the filter change until the 250-hour mark since the crane is currently within the hour-based interval

34. A crane inspector finds during the annual inspection that the hook's throat opening has increased from the nominal 3.5 inches to 4.05 inches — an increase of 0.55 inches. What is the percentage increase and does it meet the removal criterion?

- A. Percentage increase = $0.55 \div 3.5 \times 100 = 15.7\%$ — this exceeds the ASME B30.10 removal criterion of 15% throat opening increase; the hook must be removed from service and replaced before any further crane operations
- B. The 0.55-inch increase is within the 1-inch absolute tolerance for standard crane hooks
- C. The percentage increase is 15.7% — approaching but not yet meeting the 20% removal criterion under ASME B30.10
- D. The hook throat may continue in service since no cracks are present at the stretched section

35. A crane's annual inspection identifies that one of the sheaves on the main hook block has a groove wear pattern where the groove radius has worn from the original 0.390 inches to 0.480 inches — a wear increase of 0.090 inches. The rope diameter is 3/4 inch. What is the required groove radius for a 3/4-inch rope and does this groove require replacement?

A. A groove worn beyond the manufacturer's maximum specification for sheave groove wear requires replacement — the proper groove radius for a 3/4-inch rope is approximately $3/4 \times 0.530 = 0.398$ inches (rope diameter \times specific factor); the worn groove at 0.480 inches is larger than the nominal radius and indicates the groove has been worn to a degree that the rope no longer contacts the groove sides correctly; the sheave must be replaced

B. The larger groove provides more clearance for the rope and is acceptable for continued service

C. Nothing — sheave groove wear specifications are informational and do not trigger mandatory replacement

D. The groove can be re-machined to the correct profile and the sheave returned to service

36. Under ASME B30.9, what action is required when a wire rope sling is found to have a section where the lay length has increased 8% beyond the nominal — indicating the strands have opened from the normal tight configuration?

A. Monitor the lay length increase at weekly intervals — remove from service only when the increase exceeds 15%

B. Remove the sling from service immediately — an 8% increase in lay length indicates the rope's strands have been spread beyond their normal geometry, suggesting a shock load or core failure has disrupted the rope's internal structure; a sling with increased lay length has reduced effective tensile capacity and unpredictable load distribution among strands; it must be removed from service

C. Apply rope lubricant to the affected section to re-condition the lay before returning to service

D. The 8% increase is within normal service variation tolerance for wire rope slings

37. A crane operator is reviewing the pre-shift inspection documentation and the inspector noted: "Hydraulic hose on boom hoist circuit showing chafing at contact point with boom structure — outer cover worn through approximately 30% of circumference." What is the correct action based on this finding?

A. Nothing — 30% outer cover wear on a hydraulic hose is within acceptable limits

B. Monitor the chafing at daily inspections until the cover is worn completely through before replacing the hose

C. Stop crane operations until the chafed hose is replaced or the contact point is protected — a hose with 30% cover wear at a contact point has lost the majority of its abrasion protection at that location; the high-pressure reinforcement braid beneath the outer cover is now exposed to continued abrasion; the hose can fail suddenly when the wire braid is abraded through, releasing pressurized hydraulic fluid at high velocity and creating a fire and injury hazard

D. Apply duct tape to the chafed area as a temporary protective measure before the next scheduled maintenance

38. A crane's load line is being inspected after a lift that was inadvertently performed at approximately 115% of rated capacity when the load weight was discovered to be significantly heavier than documented. The rope shows no visible broken wires, deformation, or changes in diameter. What must happen before the rope is used for any subsequent lift?

A. A qualified person must inspect the entire load line for deformation, wire breaks, core damage, diameter changes, and geometry alterations resulting from the overload event — visual confirmation of no visible damage is not adequate because overloads can cause internal damage, strand rearrangement, and core failure that are not detectable through external visual inspection; the rope must be confirmed undamaged by a qualified person before any further use

B. Nothing — the absence of visible damage confirms the rope is undamaged and serviceable

C. The rope must be proof-tested at 125% of its rated breaking strength before returning to service

D. Replace the rope automatically after any confirmed overload event without inspection

39. A crane inspector is examining a below-the-hook spreader beam and finds that one of the lift points — a swivel eye bolt — has the eye oriented perpendicular to the sling attachment direction rather than in the plane of the sling. What specific hazard does this misorientation create?

A. Nothing — swivel eye bolts are designed to accommodate all loading directions including perpendicular loads

B. The perpendicular orientation creates a slight reduction in WLL that requires a 5% capacity derating

C. The swivel allows the eye to rotate to the correct orientation under load — no pre-alignment is needed

D. An eye bolt loaded perpendicular to the plane of its eye — loaded across the narrower dimension of the eye rather than through the eye — experiences bending across the narrow dimension of the eye that can dramatically reduce its capacity below the rated WLL; under load, the eye may bend open rather than the expected in-plane loading; the eye bolt must be repositioned in the plane of loading before the lift proceeds

40. A rigger is preparing a multi-leg sling bridle and discovers that one leg of a 4-leg wire rope sling has a visible kink — a permanent angular bend approximately 30 degrees — approximately 18 inches from the master ring. What must be done?

A. Nothing — a kink 18 inches from the master ring is outside the critical fitting zone and is acceptable

B. Remove the entire 4-leg sling set from service — the kinked leg contains a permanent deformation that is an unconditional removal condition under ASME B30.9; the kink creates a stress concentration at the bend point that can fail at loads well below the leg's rated WLL; using a 4-leg sling set with one kinked leg is prohibited because the kinked leg's failure during a lift would transfer its load share to the remaining three legs, potentially overloading them

C. Cut the kinked section out and re-splice the leg shorter before use

D. Use the sling with the kinked leg but reduce the total lift to 75% of the sling set's WLL

41. A crane is performing a lift at 88% of rated capacity when the boom hoist rope — the rope that controls the boom elevation angle — develops an audible squeal that occurs during any boom movement. The main hoist rope and all other crane functions are operating silently. What does a squeal specifically from the boom hoist rope circuit most likely indicate?

A. Nothing — boom hoist rope squeal is normal for cranes with high boom angles

B. The squeal is caused by wind-induced rope vibration at the current boom configuration

C. The squeal likely indicates dry friction at a sheave or drum — the boom hoist sheave may be seized, or a drum groove may have lost lubrication; dry friction between rope and a seized sheave can cause rapid wire breaks at the friction contact point; a lubrication or bearing failure in the boom hoist circuit requires investigation before any boom movement continues

D. The squeal is caused by resonance between the boom hoist rope's tension and its natural frequency — it is a normal phenomenon at certain boom angles

42. A crane operator is reviewing the crane's documentation and finds that the most recent annual inspection report contains the following finding: "Main boom — Section 3 lower chord shows surface rust with minor pitting — estimated 5–8% section loss — recommend monitoring." No corrective action or engineering evaluation is documented. The current date is 14 months after the inspection. What is the status of this crane?

- A. The inspection confirmed the crane was operable at the time of inspection and the 5–8% section loss is within acceptable tolerance for continued monitoring
- B. Nothing — monitoring recommendations do not require follow-up until the next scheduled annual inspection
- C. Nothing — 5–8% section loss is below the 10% removal threshold for boom chord members
- D. The crane has been operating for 14 months with a documented structural deficiency — a 5–8% section loss in a main boom lower chord was identified 14 months ago without engineering evaluation or corrective action; the rust and pitting have continued for 14 additional months; the crane must be removed from service until a qualified engineer evaluates whether the current section loss (which has increased over 14 months) is still within acceptable structural limits

MANUFACTURER LOAD CHARTS DOMAIN — Questions 43–65

43. A crane load chart shows the following for the 100-foot boom at full outrigger extension: 30 ft = 36,200 lbs; 35 ft = 28,400 lbs; 40 ft = 22,200 lbs. The planned operating radius is 37 feet. The total suspended weight is 24,800 lbs. Using the conservative approach, is the lift within capacity?

- A. Conservative capacity at 35 ft = 28,400 lbs; 24,800 lbs is within capacity
- B. Conservative capacity at 40 ft = 22,200 lbs; 24,800 lbs exceeds this — the lift cannot proceed
- C. Nothing — the interpolated capacity at 37 ft (25,240 lbs) confirms the lift just barely proceeds
- D. Conservative capacity at 40 ft = 22,200 lbs; total suspended weight (24,800 lbs) exceeds 22,200 lbs — the lift cannot proceed in this configuration using the conservative approach at 37 feet of operating radius

44. A crane load chart section note reads: "Before beginning any lift in this section, the crane's slewing ring backlash must be measured and confirmed within the manufacturer's specification." The last slewing ring measurement documented is from the annual inspection 10.5 months ago. What must be done before using this section's capacity values?

- A. Nothing — the 10.5-month-old measurement confirms prior compliance; the note's condition is satisfied
- B. The slewing ring backlash must be currently measured and confirmed within specification before using these capacity values — a note requiring measurement confirmation before each lift means current measurement, not historical compliance; 10.5 months of additional operations may have increased the backlash beyond the specification limit; the note requires verification at the time of use
- C. The measurement requirement applies only to the first use of this section after installation
- D. A qualified person's written estimate of the current backlash satisfies the note's measurement requirement

45. A crane load chart shows two sections for the same boom length and outrigger configuration: "STANDARD BOOM" and "STRENGTHENED BOOM (OPTIONAL PACKAGE)." The strengthened boom section shows 18% higher capacity at the same radius. The operator does not know which boom is installed. Which section must be used?

- A. Use the strengthened boom section since it shows the crane's maximum potential capacity
- B. Average the two sections' values to estimate the capacity regardless of which boom is installed
- C. The operator must determine which boom is actually installed before using either section — using the strengthened boom section values when the standard boom is installed would result in operating above the standard boom's actual rated capacity; the operator must physically confirm the boom configuration and then use only the section matching the installed equipment
- D. Use the standard boom section conservatively until the boom type can be confirmed — even if the strengthened boom is installed

46. A crane is operating with a 100-foot boom at full outrigger extension. The load chart shows: 25 ft = 44,800 lbs; 30 ft = 35,600 lbs; 35 ft = 28,200 lbs. All cells are white (stability-limited). A planned

critical lift at 27 feet of radius has a total suspended weight of 41,000 lbs. Using the conservative approach, what capacity governs?

- A. Conservative capacity at 30 ft = 35,600 lbs; 41,000 lbs exceeds this — the lift cannot proceed using the conservative approach; the operator must either reduce the total suspended weight or reposition the crane to bring the operating radius to 25 feet or less where the tabulated capacity directly supports the load
- B. Conservative capacity at 25 ft = 44,800 lbs; 41,000 lbs is within capacity — lift proceeds
- C. Interpolated capacity at 27 ft = 40,520 lbs; 41,000 lbs exceeds the interpolated capacity — lift cannot proceed
- D. Conservative capacity at 35 ft = 28,200 lbs; this is the most conservative value and governs the lift plan

47. A crane load chart section note reads: "Capacities in this section are reduced by 15% from the theoretical tipping calculation to provide the stability safety margin. Do not apply any additional derating for stability concerns." This note confirms which safety margin approach was used?

- A. The crane manufacturer used a 15% stability margin — meaning capacities are set at 85% of the theoretical tipping load; this is slightly less conservative than the ASME B30.5 typical 25% stability margin; operators must understand that this crane's stability-limited capacities have a smaller margin from tipping than the ASME standard approach; additional care during near-capacity operations is warranted
- B. Nothing — the note confirms the manufacturer's approach exceeds ASME requirements
- C. The 15% margin is the standard approach used by all manufacturers and confirms these values are equivalent to any other crane's stability-limited values
- D. The note means all capacity values in this section may be increased by 15% for short-term emergency use

48. A crane load chart shows: 80-foot boom, on-outrigger full extension, all directions: 20 ft = 54,200 lbs; 25 ft = 43,600 lbs; 30 ft = 34,800 lbs. The rate of capacity decrease per foot: 20–25 ft = 2,120 lbs/ft; 25–30 ft = 1,760 lbs/ft. A lift at 23 feet is planned. Using linear interpolation between 20 and 25 feet, what is the estimated capacity at 23 feet?

A. Interpolated capacity = $54,200 - (3 \times 2,120) = 54,200 - 6,360 = 47,840$ lbs

B. Interpolated capacity at 23 ft = $54,200 - (3 \times 2,120) = 47,840$ lbs; drop per foot = $(54,200 - 43,600) \div 5 = 10,600 \div 5 = 2,120$ lbs/ft; at 23 ft (3 ft beyond 20 ft): $54,200 - 6,360 = 47,840$ lbs

C. Interpolated capacity = $43,600 + (2 \times 2,120) = 47,840$ lbs — interpolating from the 25-ft entry backward

D. Interpolated capacity = $(54,200 + 43,600) \div 2 = 48,900$ lbs — using the midpoint method

49. A crane load chart section note reads: "These capacities are based on the use of standard outrigger pads included with the crane. Larger outrigger pads may be used provided they are confirmed as structurally adequate for the maximum outrigger reaction loads shown in Appendix B." The crane is using custom timber crane mats instead of the manufacturer's standard outrigger pads. The mats are 4 feet \times 4 feet vs. the manufacturer's standard 24 \times 24 inch pads. What does the note require?

A. Nothing — larger outrigger pads are always acceptable substitutions since they distribute the load better

B. The lift may proceed since the timber mats are confirmed in common use at construction sites

C. The custom timber mats must be confirmed structurally adequate for the maximum outrigger reaction loads listed in Appendix B before these capacity values can be used — the note explicitly conditions the use of non-standard outrigger pads on confirmation of structural adequacy; the mats must be confirmed to carry the reaction loads without structural failure

D. The manufacturer must be contacted for written approval before any non-standard outrigger pad can be used

50. A crane load chart shows: "ON OUTRIGGERS — FULL EXTENSION — OVER FRONT": at 25 ft = 48,400 lbs; at 30 ft = 38,600 lbs. "ON OUTRIGGERS — FULL EXTENSION — 360° ALL DIRECTIONS": at 25 ft = 36,200 lbs; at 30 ft = 28,800 lbs. A planned lift requires picking over the front at 28 feet and setting at 32 feet over the side. The total suspended weight is 32,000 lbs. What is the compliance status?

A. The over-front section at 25 ft (48,400 lbs) clearly supports the 32,000-lb pick — the lift proceeds

- B. Nothing — the conservative approach at both positions confirms the lift is within capacity using the over-front section throughout
- C. Nothing — the conservative approach at the set (32 ft) uses 28,800 lbs from the all-directions section; 32,000 lbs exceeds 28,800 lbs; the lift cannot proceed to the planned set location as configured
- D. The pick at 28 ft in the over-front sector uses the all-directions capacity — 36,200 lbs — since the all-directions section governs the entire lift; 32,000 lbs is within the all-directions capacity; lift proceeds

51. A crane load chart contains the following note: "These capacities do not apply when the crane is equipped with any attachment, fixture, or device not described in this load chart unless written authorization from the manufacturer has been obtained." The crane operator discovers that a previous crew has attached a work platform — a 200-pound steel platform with railings — to the counterweight for use as a maintenance access point. The platform is still attached. What must happen before lifting begins?

- A. Nothing — the counterweight-mounted platform is on the counterweight, not the boom, and does not affect the boom's structural capacity values
- B. The platform creates no issue since the counterweight's capacity exceeds its weight plus the 200-pound platform
- C. Nothing — 200 pounds is below the threshold where non-standard attachments require authorization
- D. The counterweight-mounted platform must be removed or written manufacturer authorization for its use must be obtained before these capacity values can be used — the note applies to any attachment "not described in this load chart"; the platform changes the counterweight's mass distribution and may affect stability characteristics used in the load chart analysis; the note's condition is not satisfied with the platform attached

52. A crane is configured with a 100-foot boom. The load chart shows that the maximum counterweight section at 30 feet provides 42,000 lbs capacity and the standard counterweight section provides 33,400 lbs at the same configuration. A lift at 30 feet requires a total suspended weight of 38,000 lbs. Maximum counterweight is confirmed installed. What is the lift percentage and does it require a critical lift plan?

- A. Nothing — $38,000 \div 42,000 = 90.5\%$; critical lift threshold requires only a general safety briefing at this percentage

B. Lift percentage = $38,000 \div 42,000 \times 100 = 90.5\%$; since 90.5% exceeds the 75% critical lift threshold, a written critical lift plan and pre-lift meeting are required before the lift begins

C. Lift percentage based on standard counterweight = $38,000 \div 33,400 = 113.8\%$; the lift cannot proceed without maximum counterweight

D. Lift percentage = 90.5%; the lift proceeds without a critical lift plan since the operator has current NCCCO certification

53. A crane load chart for a telescopic boom crane shows the following: "BOOM 100 FT — 4-PART LINE — ON OUTRIGGERS — FULL EXTENSION": 35 ft = 27,200 lbs. The crane is configured with 2-part line. The section specifically states "4-PART LINE." What is the compliance issue?

A. Nothing — the 4-part line section provides the structural and stability limits; the reeving configuration only affects the single-line pull, not the rated hook load

B. The operator must use the 2-part line section if one exists, or contact the manufacturer for 2-part line capacities — using the 4-part line section's capacity values with 2-part line installed may produce operating conditions different from what the capacity analysis assumed; if no 2-part line section exists, the manufacturer must confirm whether the 4-part section applies to 2-part reeving

C. Nothing — the reeving configuration is a convenience choice and the 4-part section applies to all reeving configurations

D. The crane may use the 4-part section values with 2-part line as long as the load does not exceed the single-line pull rating multiplied by 2

54. A crane's load chart shows that the on-outrigger full extension section's over-front sector provides 30% higher capacity than the 360-degree all-directions section. A planned lift starts at 10 degrees right of front center (within the over-front sector), swings to 90 degrees right (over the side), and returns to 10 degrees right of front center for the final set. The total suspended weight is 85% of the over-front capacity and 110% of the all-directions capacity. What must the operator conclude?

A. The lift proceeds since it both starts and ends within the over-front sector

B. The over-front capacity governs since the lift begins and ends in the over-front sector

C. The lift proceeds at 85% of over-front capacity throughout — both the swing and return are within the over-front sector's 30-degree boundaries

D. The lift cannot proceed as planned — the load must pass through the 90-degree over-side position during the swing, which is in the all-directions sector; the total suspended weight at 110% of the all-directions capacity exceeds the applicable capacity during this portion of the swing; the load must be reduced below the all-directions capacity or the lift must be redesigned to avoid the all-directions sector

55. A crane load chart shows: "FOR LIFTS IN THIS SECTION, THE MINIMUM BOOM ANGLE IS 45°." The planned lift at 40 feet of radius with the 80-foot boom requires a boom angle of 42 degrees to achieve the necessary height clearance. What is the compliance issue?

A. Nothing — the 42-degree angle is within 5 degrees of the 45-degree minimum and is within operational tolerance

B. The crane must either reduce the operating radius until 45 degrees is achievable at the required height, or use a longer boom configuration that achieves the required height at a boom angle above 45 degrees — at 42 degrees, the configuration is outside the rated operating range and no capacity exists for this position

C. Use a jib extension to achieve the required height at the rated 45-degree minimum boom angle

D. Apply a 10% capacity reduction for boom angles within 5 degrees of the rated minimum

56. A crane load chart section shows: "CAPACITY VALUES IN THIS SECTION INCLUDE THE WEIGHT OF THE STANDARD HOOK BLOCK (1,600 LBS) AS A PRE-DEDUCTED ITEM." The operator plans to use the standard hook block. Rigging (slings + hardware) weighs 2,200 lbs. The payload weighs 24,000 lbs. The tabulated capacity at the planned configuration is 30,400 lbs. What is the maximum payload?

A. Maximum payload: 24,000 lbs — confirm rigging within $30,400 - 1,600 = 28,800$ lbs remaining

B. Maximum payload = $30,400 - 2,200 = 28,200$ lbs — deducting only the additional rigging since the standard hook block is pre-deducted; the 24,000-lb payload is within this available capacity

C. Maximum payload = $30,400 - 1,600 - 2,200 = 26,600$ lbs — the standard block must still be deducted

D. Maximum payload = 30,400 lbs — all deductions have been pre-made

57. A crane is configured with a 120-foot boom. The load chart shows that the maximum rated radius for the 120-foot boom at full outrigger extension is 65 feet. The load chart shows 12,400 lbs at 65 feet. A lift plan was confirmed for a pick at 60 feet and a set at 63 feet. During the swing, the load is laterally displaced 3 feet by a wind gust, creating an effective radius of 66 feet at the maximum displacement. What is the compliance status?

A. Nothing — the 66-foot effective radius is only 1 foot beyond the maximum and is within operational tolerance

B. Nothing — wind-induced displacement is a temporary condition that does not change the applicable load chart radius

C. The 66-foot effective radius exceeds the 65-foot maximum rated radius — the crane is momentarily outside its rated operating envelope; the operator must immediately slow the swing and wait for the load to settle back within the rated envelope before proceeding; this event confirms that adequate wind load management is required for this lift to prevent further radius exceedances

D. The crane is within capacity since the 66-foot instantaneous radius is not a sustained operating radius and the rated capacity applies to steady-state conditions only

58. A crane load chart for a crawler crane shows: "ON CRAWLERS — OVER FRONT — MAXIMUM COUNTERWEIGHT": at 45 ft = 88,000 lbs; at 50 ft = 72,400 lbs; at 55 ft = 58,800 lbs. A critical lift at 48 feet has a total suspended weight of 78,000 lbs. Using the conservative approach, the governing capacity is 72,400 lbs at 50 feet. The lift percentage = $78,000 \div 72,400 \times 100 = 107.7\%$. What must the operator conclude?

A. The lift proceeds since the interpolated capacity at 48 feet (80,640 lbs) exceeds 78,000 lbs

B. Nothing — a single lift in excess of conservative capacity is acceptable when the load is within the interpolated capacity

C. The total suspended weight (78,000 lbs) exceeds the conservative capacity (72,400 lbs) — the lift cannot proceed at 48 feet using the conservative approach; the operator must either reduce the total suspended weight to below 72,400 lbs, or reposition the crane to bring the operating radius to 45 feet or less where the tabulated conservative capacity (88,000 lbs at 45 ft) supports the load

D. The lift exceeds the conservative capacity — contact the manufacturer for authorization to use interpolated values for critical lifts

59. A crane load chart for the on-outrigger full extension section shows a note: "Operating with boom in the rear sector (aft of the rear outrigger line) reduces capacity to 70% of the values shown in this section." The planned lift starts over the front and swings to 185 degrees — 5 degrees past the over-rear position. At what point does the 70% derating apply?

A. The 70% derating applies only when the boom is more than 15 degrees past the rear center — 185 degrees is too close to 180 degrees to trigger the reduction

B. The 70% derating applies starting from 90 degrees (over-side) since the rear sector begins at 90 degrees from front

C. Nothing — the note applies only to lifts that both begin and end in the rear sector

D. The 70% derating applies when the boom enters the rear sector as defined by the note — "aft of the rear outrigger line" defines the rear sector boundary; at 185 degrees (5 degrees past over-rear), the boom has entered the rear sector; during this portion of the swing, the capacity is 70% of the section's tabulated values; the total suspended weight must be within this derated capacity before the boom enters the rear sector

60. A crane load chart shows a section for "ON OUTRIGGERS — 75% EXTENSION." The rated outrigger spread at 75% extension is 18 feet. Due to a site constraint, the operator deployed the outriggers to 80% extension — a spread of 19.2 feet. Neither the 75% nor the 100% sections exactly match. What must the operator do?

A. The 100% extension section applies since 80% is closer to 100% than to 75% — use the higher capacity section

B. Interpolate between the 75% and 100% sections based on the proportional spread to estimate capacity at 80% extension

C. The 75% extension section must be used as the most conservative rated section that is bounded below the actual 80% extension — the 75% section is the rated configuration closest to the actual setup that does not overstate the available capacity; using the 100% section for an 80% configuration would apply values from a more favorable configuration than what exists

D. Contact the manufacturer to obtain rated capacity values for the 80% extension position before any lifting begins

61. A crane load chart shows that the 80-foot boom, full outrigger extension, all-directions section's capacity values are all stability-limited from 15 to 25 feet, and all structural-limited from 30 feet and beyond. A lift at exactly 27 feet falls in the transition zone. Using the conservative approach, the governing value comes from the 30-foot structural-limited cell. The total suspended weight is 91% of this conservative value. What specific operational requirement does the structural-limited conservative capacity impose?

A. A written manufacturer's certification is required for all structural-limited lifts above 85% of the tabulated value

B. Nothing additional beyond standard lift procedures — the conservative value provides the required safety margin

C. At 91% of structural-limited conservative capacity, all crane movements must be exceptionally smooth — no rapid acceleration or deceleration, no simultaneous multi-function operation, and no boom side-loading from dynamic swing forces; the structural-limited designation means the crane's structural members are at near-design-limit stress and dynamic loads from abrupt movements can exceed the structural design capacity

D. The lift at the transition zone requires a stability engineer's assessment before proceeding

62. A crane's load chart shows the capacity at 30 feet of radius is 36,400 lbs for the 100-foot boom. After the lift, the operator calculates that the actual total suspended weight was 34,100 lbs — a lift percentage of 93.7%. The LMI showed 87.3% throughout the lift. What explains the discrepancy between the actual 93.7% and the LMI-displayed 87.3%?

A. The 6.4% discrepancy between actual and displayed percentages indicates the LMI was configured for the wrong boom length — a shorter boom would show higher capacity values at the same radius, producing a lower displayed percentage for the same actual load weight; the LMI configuration must be investigated and corrected before any further operations

B. LMI accuracy tolerance of $\pm 10\%$ explains all discrepancies below 10 percentage points

C. The LMI was rounding to the nearest 5% — the actual reading was 90% which rounds to either 87% or 93%

D. The discrepancy is caused by temperature-induced drift in the load cell — recalibrate the LMI and continue

63. A crane load chart shows: "Luffing jib — 40 ft jib — 120 ft main boom — maximum counterweight": at 25° jib angle = 13,200 lbs; at 35° = 17,400 lbs; at 45° = 20,800 lbs. Capacity increases with jib angle. The planned jib angle is 30 degrees. A note in the section reads: "Jib angle increments of 10° only. Operations at intermediate angles are not rated." The operator needs exactly 30 degrees. What action is required?

A. Interpolate between 25° and 35° to estimate the capacity at exactly 30 degrees

B. Nothing — the note means increments of 10° are the minimum change between settings; 30 degrees is an even increment of 10° from 20° and is valid

C. Nothing — 30 degrees is within the rated 25–45 degree range and may be used

D. The jib must be set at either 25 degrees or 35 degrees — the note specifies that only 10-degree increment positions are rated; 30 degrees falls between two rated positions; since the note explicitly states "intermediate angles are not rated," 30 degrees is an unrated position regardless of how it relates to the range; the lift must be re-planned using one of the rated jib angles

64. A crane load chart note reads: "Maximum total suspended weight for all lifts in this section = 48,000 lbs regardless of the tabulated capacity shown." The tabulated capacity at the planned configuration is 52,600 lbs. The total suspended weight is 46,000 lbs — within both the tabulated and the note's maximum. What does the note establish as the governing capacity?

A. The tabulated capacity of 52,600 lbs governs since it is the primary load chart entry

B. The note's 48,000-lb maximum is the governing capacity for all lifts in this section regardless of tabulated values — the note represents a maximum limit that applies across the entire section regardless of what individual cells show; the operator must use 48,000 lbs as the absolute upper limit for total suspended weight in this section; at 46,000 lbs, the planned lift is within the note's maximum

C. The average of the note and tabulated values = 50,300 lbs governs

D. The tabulated value governs only for the specific radius where it is lower than the note maximum

65. A crane is performing a final lift in a shift at 89% of rated capacity based on the conservative approach. The conservative governing capacity is from the next larger tabulated radius. After setting the load, the operator discovers that the actual operating radius was 2 feet greater than planned — the crane was not positioned correctly. If the 2-foot greater radius is taken into account with the conservative approach, the next governing tabulated radius value would produce a lift percentage of 97.2%. What does this post-lift discovery require?

A. Nothing — the lift was completed without incident and the post-lift radius measurement is informational

B. Nothing — the 97.2% post-lift calculation is within the crane's rated capacity and no follow-up is required

C. The crane must be inspected and the incident documented — the lift was performed at 97.2% of rated capacity based on the conservative approach; this was above the 75% critical lift threshold and required a written critical lift plan; additionally, the lift percentage was significantly higher than believed during the lift; a post-incident inspection by a qualified person is required to confirm no structural damage occurred, and the incident must be documented and investigated to prevent future radius measurement errors

D. Reduce the next shift's operations to 80% of rated capacity as a precautionary measure following the radius error.

Specialty Exam 10 Answer Key and Full Explanations

1. C — Historic explosive ordnance disposal training sites can contain unexploded ordnance at depth that standard utility locates cannot detect. Construction loading, crane vibration, and ground penetration can trigger detonation of buried ordnance. No crane setup may proceed until qualified ordnance disposal personnel have confirmed the area is clear — this is a life-safety hazard with no acceptable operational workaround.

2. A — A full-length centerline crack in a multi-layer crane mat indicates the mat's laminated structural layers may be separating, reducing its ability to distribute the concentrated outrigger load uniformly. A mat that cannot distribute the load will allow the outrigger to concentrate its force on the unseparated portions, creating localized bearing pressure far exceeding the soil's capacity. The mat must be assessed by a qualified person before operations continue.

3. D — An encroachment prevention plan's primary active protection is the dedicated spotter's ability to immediately stop all crane movement when the MSAD is approached. Testing this stop mechanism before operations begin — not just confirming it is present — verifies that the primary protective control actually functions under real conditions. A stop mechanism that exists but doesn't work provides no protection during actual encroachment.

4. B — A marina dock built in 1975 has approximately 50 years of service, during which timber pile bents are continuously exposed to marine organisms, wave action, and waterline rot — all of which progressively reduce cross-sectional area and load capacity. The dock administrator's anecdotal statement about previous equipment provides no information about current structural condition. A structural engineer must assess the dock's current capacity for the specific crane outrigger point loads.

5. C — Soil-cement mixing equipment is large and heavy, applying surcharge loads to adjacent soil as it operates. The auger applies torsional and vertical loads that temporarily alter the stress state in surrounding soil. Combined with the crane's existing outrigger loads, this additional surcharge may push the total stress in the shared soil zone beyond the bearing capacity limit. Careful monitoring for level change during adjacent mixing operations is essential.

6. A — OSHA 1926.1402 requires the crane to operate only in areas with confirmed adequate ground conditions. When documented unstable zones exist, the crane employer must establish clear boundaries of adequate ground and ensure the crane's footprint remains within those boundaries. If the lift requires reaching over unstable zones without adequate ground support at the outrigger positions, working with the controlling entity to remediate or redesign the lift is required.

7. D — A surface ridge developing between loaded outrigger pads indicates the soil mass is being laterally displaced outward — pushed between the two loaded positions. This is the classic Prandtl failure mechanism signature: the loaded soil begins to shear along curved failure surfaces, and material is extruded laterally and upward at the edges of the failure zone. This is active bearing capacity failure in progress, requiring immediate load removal and ground assessment.

8. B — A former retention pond filled without controlled compaction contains unknown density distribution, potentially trapped organic material from the original pond bottom, and no established bearing capacity. Organic material in old pond bottoms decomposes progressively, creating voids and soft zones that don't appear on the surface. Without compaction testing confirming the fill meets required bearing capacity, no crane outrigger loading is authorized in this area.

9. C — Outrigger pad penetration through the asphalt surface indicates the asphalt is in a semi-plastic state at the current temperature — unable to resist the concentrated bearing pressure. Progressive sinking will continue as the asphalt softens further under sustained loading. Sudden breakthrough of the pad through the full asphalt thickness could cause rapid outrigger drop and tip-over. Operations must stop and the pad penetration must be investigated before continuing.

10. A — OSHA 1926.1402(b) requires the crane employer to have documented ground condition information confirming adequacy for the planned crane loading. If the controlling entity fails to provide this documentation, the crane employer must obtain it independently through their own investigation before operations begin. Visual inspection by the operator alone is not sufficient — the documented information must confirm the specific bearing capacity relative to the planned outrigger loads.

11. D — Drainage board installation requires excavation and backfill adjacent to the foundation, creating a disturbed soil zone within the outrigger's load influence area. The backfilled zone may have lower bearing capacity than undisturbed soil, and the drainage board itself creates a lateral discontinuity in the soil mass at that depth. These conditions require bearing capacity confirmation before outrigger loading in the 3-foot proximity zone.

12. B — Frozen soil can have dramatically higher bearing capacity than the unfrozen native material — sometimes equivalent to rock. However, this improvement is entirely dependent on the soil remaining frozen. The crane's heat sources — engine compartment, hydraulic lines, and outrigger contact — concentrated at the outrigger positions can thaw the frozen layer, causing instantaneous reversion to the soft clay's 1,200 psf capacity while the crane is under load. This thermal failure mode is the critical risk to evaluate.

13. C — OSHA 1926.1425 prohibits loads from passing over personnel without exception. The canopy structure does not protect people below from a load drop — it would be penetrated by the falling load. All persons must be physically cleared from the walkway before the load's swing arc passes over it. Warning signs and awareness do not satisfy the prohibition — physical clearance is required.

14. A — Posted bridge load limits specify total gross vehicle weight, but bridge structural design is also governed by concentrated axle loads — the force applied at each axle contact point. A 62,000-lb crane can have front or rear axle loads that individually exceed the bridge's design axle load even though total GVW is within the posted limit. Each transport vehicle's axle loads must be confirmed within the bridge's design axle load limits before crossing.

15. D — A refinery shelter-in-place directive indicates a chemical release, fire, or explosion hazard that requires all personnel to move to designated shelter areas. Continuing crane operations during a chemical release keeps the operator exposed and prevents them from reaching shelter quickly when needed. The load must be lowered as quickly as safely possible before the operator shelters — a sustained load in position with no operator monitoring also creates a secondary hazard.

16. B — OSHA 1926.1419 requires both the operator and signal person to understand and agree on all signals before operations begin. An informal, non-standard gesture that was not discussed in the pre-operation briefing creates ambiguity — the operator and signal person may interpret it differently. Any signal whose meaning is not mutually confirmed must be clarified before any crane movement is executed in response to it.

17. C — A 10% radius increase from 87% existing capacity creates a significant risk of exceeding rated capacity at the new radius, because capacity typically decreases substantially with increasing radius at mid-range configurations. The operator cannot assume the lift is within capacity at the new radius without consulting the load chart. Executing the movement without chart verification means potentially performing an overloaded lift without any confirmation — which is the operator's personal responsibility regardless of the lift director's instruction.

18. A — OSHA 1926.1416(e) requires a load chart specific to the crane being operated to be in the cab before operations begin. A chart from a different serial number may have different capacity values — even for the same crane model — because of variations in installed options, counterweights, or manufacturer revisions. There is no authorized adjustment factor that converts a different crane's chart to the crane being operated. Operations stop until the correct chart is present.

19. B — OSHA 1926.1419 establishes that only the designated, qualified signal person may give operational signals — with the sole exception of Emergency Stop, which any person may give at any time. The lift director's verbal authorization does not transform the undesignated rigger into a designated qualified signal person for operational signals. The lift must wait until the designated signal person returns or a qualified replacement is properly designated and confirmed.

20. B — ASME B30.5 prohibits using the crane's load line to drag, push, or side-pull loads. Horizontal dragging applies lateral forces to the boom that the boom structure was not designed to carry — the boom is engineered for in-plane vertical loading only. If the panel provides resistance rather than sliding freely, the horizontal force could be many times what was anticipated, creating sudden boom side-loading that can cause structural failure.

21. C — The load's pendulum overshoot after the boom stops is proportional to the upper works' velocity at the moment of stop. Progressive deceleration well before the target point allows the crane to arrive at the stop position already moving slowly, so that when the STOP is applied, the residual momentum — and therefore the overshoot — is minimal. Abrupt braking from high speed transfers all the residual momentum to load pendulum without absorbing it.

22. A — OSHA 1926.1419 and ASME B30.5 both authorize the use of standard hand signals as defined in B30.5, or an alternative set that has been established and agreed upon by both parties before operations begin. The critical requirement is mutual understanding before operations start — not the specific signal system used. However, alternative sets must be consistently applied and mutually confirmed, and mixing standard and non-standard signals within the same operation creates ambiguity.

23. D — Yellow zone hydraulic temperature is a warning that conditions are approaching the red zone where safe operation may be compromised. Personnel in a suspended platform have no ability to self-rescue — their safety depends entirely on the crane's continued function. Immediate notification of the lift director allows planning a controlled lowering before the temperature becomes critical, rather than waiting until red zone conditions force an emergency response while personnel are suspended.

24. B — A partial radio message ending mid-command cannot be completed by the operator through inference or best-guess interpretation. At 91% of rated capacity, an incorrect interpretation of the incomplete signal could result in an unsafe movement. All movement must stop until confirmed, complete communication is restored and the signal person can transmit the full, unambiguous command. No movement may be based on a partial signal at any capacity level.

25. C — An unauthorized person in the exclusion zone requires all crane movement to cease immediately — OSHA 1926.1424 requires the zone to be maintained to prevent unauthorized entry, and when a breach occurs, the protective boundary has failed. The horn may be used to alert the intruder, but crane movement cannot resume until the zone is confirmed physically clear of all unauthorized persons. Continuing crane movement with an unauthorized person in the zone is prohibited regardless of how slowly the crane moves.

26. A — The crane's rated capacity is an absolute engineering limit that no operational authority — at any level, for any reason — can authorize exceeding. OSHA 1926.1416 makes this explicit. A crane that exceeds its rated capacity does so without authorization, and the operator who executes the excess bears responsibility for the resulting condition. No emergency, project necessity, or supervisor directive creates an exception to this absolute limit.

27. D — In a tandem lift, the load sharing between cranes is determined by the rigging geometry and relative elevation of each crane's attachment point. When Crane A is 6 inches higher than Crane B, the load has tilted and Crane A is carrying a greater share than its planned portion — it may be carrying significantly more than 50% of the total load. If Crane A was planned at 85% capacity for its share, the additional load from the differential may push it above 100%. Both cranes must stop until the differential is corrected.

28. B — The latch retaining pin is the mechanical fastener that holds the safety latch assembly to the hook body. Without the pin, the latch is held only by friction and can fall off during any vibration, lateral rigging contact, or dynamic crane movement. A latch that has separated from the hook provides no protection against rigging disengagement — the hook is then functionally operating without a latch, which is a removal condition under ASME B30.10.

29. B — OSHA 1926.1408 defines critical lifts as those at or above 75% of the crane's rated capacity. Both the 88% and 92% lifts individually exceed this threshold. Each lift that qualifies as a critical lift requires its own written critical lift plan and pre-lift meeting — the fact that both occur on the same day does not combine them into a single requirement or eliminate the need for separate planning documentation for each distinct lift.

30. D — Continuous visual monitoring of the load throughout a lift is a fundamental safety requirement that cannot be suspended for any period. During the 6-second shadow zone, undetected load contact with an obstacle, rigging disengagement, or load drift can occur without the operator or signal person being able to observe it. An observer positioned with confirmed clear sight to the load in the shadow zone maintains continuous monitoring and relay capability throughout the entire swing.

31. B — Weld porosity occurs when gas is trapped within the molten weld pool during solidification, creating internal voids. These voids reduce the weld's effective cross-sectional area and create stress concentration points at each void boundary. Under cyclic crane loading, cracks can initiate at void boundaries and propagate through the remaining weld metal — this is weld fatigue failure that requires engineering evaluation before the crane can continue service.

32. B — With four legs at 60 degrees from horizontal: tension per leg = (total load ÷ legs) × (1 ÷ sin angle) = (32,000 ÷ 4) × (1 ÷ sin 60°) = 8,000 × (1 ÷ 0.866) = 8,000 × 1.155 = 9,240 lbs per leg. Since 9,240 lbs is below the 10,000-lb WLL, the configuration is within capacity with 760 lbs of margin per leg. The sin function of the angle from horizontal is the correct factor for bridle leg tension calculation.

33. C — Manufacturer-specified service intervals are triggers for maintenance — "6 months or 250 hours, whichever comes first" means that exceeding either threshold requires service. At 11 months, the 6-month calendar interval has been exceeded by 5 months, making the filter change overdue regardless of the 210 hours being within the 250-hour threshold. Overdue return line filter maintenance allows contamination to circulate throughout the hydraulic system.

34. A — Percentage increase = $0.55 \div 3.5 \times 100 = 15.7\%$. ASME B30.10 specifies removal from service when the hook throat opening has increased more than 15% beyond the nominal dimension. At 15.7%, this threshold is exceeded — the hook must be removed from service. The 15% limit exists because throat opening increase indicates permanent plastic deformation, meaning the hook has been loaded beyond its elastic limit and its remaining structural capacity is reduced.

35. A — The correct sheave groove radius for a rope is approximately the rope radius plus a small clearance — for a 3/4-inch rope, the nominal groove radius should be approximately 3/8-inch (0.375 inches) with allowable tolerances. A groove worn to 0.480 inches is substantially larger than the nominal, meaning the rope contacts only the groove bottom rather than the intended contact arc along the groove sides. This loss of contact arc concentrates bending stress and accelerates rope fatigue. The sheave must be replaced.

36. B — An 8% increase in lay length indicates the strand geometry has been permanently altered beyond normal service variation — suggesting a shock load, core failure, or severe overloading event has disrupted the rope's internal structure. When the lay length increases, strands have opened from their designed tight configuration, causing unequal load sharing among strands. ASME B30.9 requires removal when structural geometry has been compromised in ways that reduce effective tensile capacity.

37. C — A hydraulic hose with 30% outer cover wear at a contact abrasion point has lost most of its abrasion protection at the most vulnerable location. The high-pressure wire braid reinforcement beneath the outer cover is now exposed to continued contact abrasion — once the wire braid is abraded through, the inner tube fails and pressurized fluid is released at high velocity. Pressurized hydraulic fluid at 2,000–5,000 psi creates a hydraulic injection injury hazard and a fire hazard near hot exhaust surfaces.

38. A — An overload of approximately 115% of rated capacity subjects the load line to forces that may have caused internal wire damage, strand rearrangement, core compression, and geometric deformation that are not visible externally. High-strength steel wire can sustain internal fractures from overload without surface cracking or diameter reduction that would be detectable visually. Only a qualified

person's thorough inspection — looking for all ASME B30.5 and OSHA 1926.1413 removal criteria — can confirm whether the rope is serviceable.

39. D — Eye bolts are designed to carry loads in the plane of the eye — the load passes through the eye's bore along the intended axis. When an eye bolt is loaded perpendicular to the plane of the eye, the load is applied across the narrower cross-section of the eye material, creating bending rather than the intended tension. This bending can cause the eye to open at a fraction of the rated WLL. The eye bolt must be realigned in the plane of loading before the lift proceeds.

40. B — A kinked sling leg is a removal condition under ASME B30.9 — this is unconditional and applies to any location in the sling. Using the 4-leg sling set with one kinked leg is prohibited because the kinked leg's capacity is compromised; if the kinked leg fails during the lift, its load share transfers instantly to the three remaining legs, potentially overloading them simultaneously. The entire sling set must be removed from service.

41. C — A squeal specifically from the boom hoist rope circuit indicates dry friction at a contact point — either a seized boom hoist sheave or a drum with insufficient lubrication. A seized sheave causes the rope to slide over the stationary sheave surface rather than rolling, creating contact friction that generates the squeal and rapidly abrades the rope wires at the contact point. This condition requires immediate investigation before any boom movement continues.

42. D — A documented 5–8% estimated section loss in a main boom lower chord from 14 months ago — with no engineering evaluation or corrective action documented — means the crane has been operating with a known structural deficiency for over a year during which the rust and pitting have continued to progress. The current section loss is almost certainly greater than the 5–8% documented 14 months ago. The crane must be removed from service until a qualified engineer evaluates the current condition.

43. D — Conservative approach: next larger tabulated radius beyond 37 feet = 40 feet, capacity = 22,200 lbs. Total suspended weight = 24,800 lbs. Since 24,800 lbs exceeds 22,200 lbs by 2,600 lbs, the lift cannot proceed at 37 feet using the conservative approach. The operator must either reduce the total suspended weight or reposition the crane to bring the operating radius to 35 feet or less where the 28,400-lb conservative capacity supports the load.

44. B — A load chart note requiring measurement confirmation "before beginning any lift in this section" means current measurement is required — not historical compliance from 10.5 months prior. Slewing ring wear progresses continuously during operations, and the specification limit may have been reached or exceeded since the last measurement. Only a current measurement can confirm the note's condition is satisfied at the time of use.

45. C — Using the strengthened boom section when the standard boom is installed would allow the crane to be loaded beyond the standard boom's actual structural capacity. The operator must physically confirm which boom configuration is installed before selecting the applicable section. The fact that the strengthened boom shows higher capacity makes this identification critical — an error in the wrong direction creates an overloaded condition.

46. A — Conservative approach: next larger tabulated radius beyond 27 feet = 30 feet, capacity = 35,600 lbs. Total suspended weight = 41,000 lbs. Since 41,000 lbs exceeds 35,600 lbs, the lift cannot proceed at 27 feet using the conservative approach. The operator must either reduce the total suspended weight to below 35,600 lbs, or reposition the crane to bring the operating radius to 25 feet or less where the 44,800-lb tabulated capacity directly supports the load.

47. A — The note reveals that this crane's capacity values are set at 85% of the theoretical tipping load — a 15% stability margin. ASME B30.5 typically establishes stability-limited values at 75% of the tipping load — a 25% margin. This crane's stability-limited values therefore have a smaller margin from actual tipping than is typical under ASME B30.5. Operators must understand this difference means less protection against unusual conditions such as out-of-level, wind, or centrifugal load displacement.

48. B — Linear interpolation from 20 to 25 feet: capacity decrease = $54,200 - 43,600 = 10,600$ lbs over 5 ft = 2,120 lbs/ft. At 23 ft (3 ft beyond 20 ft): $54,200 - (3 \times 2,120) = 54,200 - 6,360 = 47,840$ lbs. Both A and B arrive at the same correct answer of 47,840 lbs through equivalent calculations — one starts from 20 ft forward, confirming the result.

49. C — The note's condition for using non-standard outrigger pads is explicit: they must be confirmed structurally adequate for the maximum outrigger reaction loads in Appendix B. Larger contact area reduces soil bearing pressure, but the mats themselves must be structurally capable of spanning their contact area under the concentrated outrigger float load without deflecting, splitting, or crushing. This confirmation must be made before these capacity values can be used.

50. C — The set location at 32 feet is over the side — in the all-directions sector. The conservative capacity at the set position = next larger tabulated radius in the all-directions section beyond 32 feet = 35 feet (if tabulated) or using the 30-foot all-directions value of 28,800 lbs. Since 32,000 lbs exceeds 28,800 lbs, the lift cannot proceed to the planned set location. The load must be reduced or the crane repositioned so the set location falls within the all-directions section's capacity.

51. D — The note applies to any attachment "not described in this load chart." A work platform on the counterweight was not installed during the crane's design and rating process. The platform changes the counterweight's mass distribution, which directly affects the stability analysis used to derive the capacity values. Either the platform is removed or written manufacturer authorization must be obtained before these values can be relied upon.

52. B — Lift percentage = $38,000 \div 42,000 \times 100 = 90.5\%$. Since 90.5% exceeds the 75% critical lift threshold established in OSHA 1926.1408, this lift is a critical lift requiring a written critical lift plan and a pre-lift meeting with all lift team members. The maximum counterweight configuration confirms the correct section is being used, but the critical lift requirements apply based on the percentage of the applicable rated capacity being used.

53. B — The section header specifies "4-PART LINE" as a configuration condition. The capacity values may have been developed with the mechanical advantage of 4-part reeving in mind, and different reeving configurations can affect structural load distribution and available hook force. A 2-part line section must be located and used, or the manufacturer must confirm whether the 4-part section's values apply to 2-part reeving. Using the 4-part section without this confirmation is operating outside the section's stated configuration.

54. D — The load must pass through the 90-degree over-side position during the swing, which is in the all-directions sector. The total suspended weight at 110% of the all-directions capacity exceeds the capacity applicable during this portion of the swing. The fact that the lift starts and ends within the over-front sector does not authorize exceeding capacity in the sectors the load must traverse during the swing. The lift must be redesigned to keep the total suspended weight within all-directions capacity throughout the entire swing arc.

55. B — The note establishes 45 degrees as the rated minimum boom angle for this section. At 42 degrees, the crane is outside the rated operating envelope — no capacity value exists for the 42-degree position in this section. The operator must either reduce the operating radius until 45 degrees achieves

the required height clearance, or switch to a longer boom configuration that achieves the clearance at angles above 45 degrees. No capacity reduction or interpolation creates a valid capacity for 42 degrees.

56. B — The note states the standard hook block (1,600 lbs) is pre-deducted from the tabulated gross capacity. The 30,400-lb value therefore represents the capacity available for rigging beyond the standard block and for payload. Deducting only the additional rigging: $30,400 - 2,200 = 28,200$ lbs available for payload. The 24,000-lb payload is within 28,200 lbs. The standard hook block requires no additional deduction since it was already removed from the gross capacity in the tabulated value.

57. C — The maximum rated radius of 65 feet is the absolute boundary of the crane's rated operating envelope. When wind displaces the load to an effective radius of 66 feet, the crane has momentarily exceeded this boundary — no rated capacity exists at 66 feet. This is not a sustained condition, but the event confirms that wind management is essential for this lift. The operator must slow the swing and allow the load to settle back within the rated envelope before continuing.

58. C — Using the conservative approach: governing capacity at the next larger tabulated radius (50 ft) = 72,400 lbs. Total suspended weight = 78,000 lbs. Since 78,000 lbs exceeds 72,400 lbs by 5,600 lbs (107.7%), the lift cannot proceed at 48 feet using the conservative approach. The two compliant options are to reduce the total suspended weight to below 72,400 lbs, or to reposition the crane to bring the operating radius to 45 feet or less where the 88,000-lb tabulated capacity directly supports the load.

59. D — The note defines the rear sector as "aft of the rear outrigger line." When the boom swings to 185 degrees — 5 degrees past over-rear — it has entered the zone aft of the rear outrigger line. The 70% derating must be applied to all capacity values during the time the boom is in this sector. The total suspended weight must be within the derated capacity before the boom enters this zone, not after it arrives — the operator must know the derating will apply before the boom crosses the sector boundary.

60. C — At 80% outrigger extension, the actual spread falls between the two rated positions of 75% and 100%. The 75% extension section is the rated configuration that does not overstate the available capacity for the actual setup. Using the 100% extension section for an 80% configuration would apply capacity values derived for a more favorable (wider) outrigger spread than what exists. The conservative bounding section — 75% extension — must be used until the crane can achieve a rated position.

61. C — Structural-limited cells reflect the crane's structural members being at their design stress limits. At 91% of structural-limited conservative capacity, only 9% structural reserve remains under static loading. Dynamic loading from rapid acceleration, abrupt stops, simultaneous multi-function operation, or boom side-loading from swing inertia can add structural stress that consumes this reserve and exceeds the design capacity. Smooth, controlled movements are the essential operational requirement for near-capacity structural-limited lifts.

62. A — A 6.4-percentage-point discrepancy between actual and LMI-displayed percentages is consistent with the LMI being configured for a shorter boom that shows higher capacity at the same radius. If the LMI is configured for a 90-foot boom when the actual boom is 100 feet, the LMI computes against the higher 90-foot capacity values, displaying a lower percentage than the actual loading condition warrants. This configuration error must be identified and corrected before any further operations.

63. D — The note explicitly states "operations at intermediate angles are not rated." This is an absolute restriction — 30 degrees is an intermediate angle between the 25-degree and 35-degree rated positions, regardless of how it relates mathematically to the range. The jib must physically be set at either 25 degrees or 35 degrees before any lifting, and the applicable capacity values for that rated position must then be used.

64. B — The note's 48,000-lb maximum establishes an absolute upper limit that applies to all lifts in this section regardless of what individual tabulated cells show. The note overrides any higher tabulated value — the load chart section cannot be used for total suspended weights above 48,000 lbs even if a specific cell shows a higher number. At 46,000 lbs, the planned lift is within the note's maximum and the lift proceeds.

65. C — The post-lift discovery that the actual operating radius was 2 feet greater than planned — producing an actual lift percentage of 97.2% rather than the believed 89% — reveals that the lift was performed at a significantly higher percentage than confirmed. At 97.2%, the lift was well above the 75% critical lift threshold and required a written critical lift plan. The near-rated-capacity operation without a critical lift plan is a regulatory violation. A post-incident inspection confirms no structural damage occurred, and investigation of the radius measurement error prevents recurrence.