BUILDING CONTRACTOR SIMULATION EXAM 4

Instructions: Select the single best answer for each question. Time allowed: 200 minutes.

ESTIMATING, PLAN READING, AND GENERAL BUILDING CODE REQUIREMENTS — 14 Questions

1. A contractor is performing a material takeoff for a concrete slab that is 75 feet long, 40 feet wide, and 6 inches thick. After calculating the volume in cubic yards and adding a 7% waste factor, how many cubic yards of concrete should be ordered?

A. 60.0 cubic yards

B. 55.6 cubic yards

C. 66.7 cubic yards

D. 50.0 cubic yards

2. On a construction drawing, a dashed line running parallel to a wall at a distance indicates which of the following conditions?

A. The location of a hidden structural beam above the wall level shown

B. A proposed future wall shown for reference but not part of current work

C. An overhead element such as a beam, soffit, or cabinet shown in plan above the cut line

D. A control joint location requiring special detailing at that wall position

3. A contractor is calculating the number of squares of roofing underlayment needed for a 28×52-foot building with a gable roof at a 4:12 slope. The rafter length factor is 1.054. With a 10% waste allowance for laps and cuts, how many squares of underlayment must be ordered?

A. 16.8 squares

B. 17.8 squares

C. 19.1 squares

D. 21.0 squares

4. Under the IBC, a building used for the manufacturing and assembly of light industrial products that poses a moderate explosion hazard is classified under which occupancy group?

A. Group S-1 — storage occupancy for moderate hazard materials

B. Group H-3 — high hazard occupancy with detonable materials present

C. Group B — business occupancy including light manufacturing operations

D. Group F-1 — factory and industrial occupancy with moderate hazard

5. A reflected ceiling plan (RCP) provides which type of information that a standard floor plan does not include?

A. Ceiling heights, light fixture locations, HVAC diffuser positions, and sprinkler head layout

B. Column grid line locations and structural beam positions above the ceiling level

C. Floor finish material transitions and thresholds at room boundaries

D. Exterior window and door locations as viewed from the interior of the space

6. A general contractor's estimate shows direct material costs of $640,000, direct labor of $285,000, subcontractor costs of $875,000, and general conditions of $120,000. Company overhead is 9% and profit is 7% of the total cost base. What is the total bid price?

A. $2,052,900

B. $1,987,600

C. $2,128,754

D. $2,231,400

7. An interior elevation drawing of a kitchen shows upper cabinets with a dashed line at 54 inches above the finished floor. This dashed line most likely represents which of the following?

A. The rough opening height for the window above the sink location

B. The bottom of the upper cabinet units measured from the finished floor

C. The countertop height of the base cabinets below the upper units

D. The top of the tile backsplash between the counter and the cabinets

8. Under the IBC, which of the following occupancies is specifically required to be equipped with an automatic fire sprinkler system throughout, regardless of building size or height?

A. Group B — office buildings up to three stories in height

B. Group M — retail stores with an occupant load under 100 persons

C. Group A-2 — restaurants with an occupant load under 300 persons

D. Group I-2 — hospitals and nursing homes throughout regardless of size

9. A detail callout on an architectural drawing shows the notation "3/S4." What does this notation communicate to the contractor?

A. Detail number 3 is located on structural sheet S4 of the drawing set

B. The detail applies to 3 structural members shown on sheet S4

C. The detail is the third revision and was issued with sheet S4

D. Three inches of structural bearing is required at the detail location

10. A contractor is preparing a bid and must calculate the labor burden rate. Base wages total $420,000. FICA is 7.65%, FUTA/SUTA is 3.2%, workers' compensation is 14.5%, and benefits are 22% of base wage. What is the total annual labor burden cost?

A. $186,540

B. $195,720

C. $199,374

D. $214,200

11. On construction drawings, which of the following symbols placed at a wall intersection indicates a change in wall type or assembly rather than a continuous wall condition?

A. A solid dot at the wall centerline intersection point

B. A gap between the two wall lines at the intersection point

C. A diagonal hatch pattern within both wall sections at the junction

D. A small circle at the corner of the wall intersection symbol

12. Under the IBC, Type II construction requires non-combustible materials throughout. The primary difference between Type IIA and Type IIB construction is which of the following?

A. Type IIA permits combustible roof framing; Type IIB does not

B. Type IIA requires sprinklers throughout; Type IIB does not require sprinklers

C. Type IIA allows taller buildings than Type IIB for the same occupancy group

D. Type IIA requires fire-resistance ratings on structural elements; Type IIB does not

13. A project specification requires "ASTM A615 Grade 60 deformed reinforcing bars." A contractor receives a delivery of bars stamped with "Grade 40." Which of the following is the correct action?

A. Reject the delivery — Grade 40 bars have a lower yield strength and do not meet the specification

B. Accept the delivery with an engineer's written approval for the equivalent substitution

C. Use the Grade 40 bars in non-structural applications and reorder Grade 60 for structural work

D. Accept the bars if the diameter and size are correct regardless of the grade designation

14. A building has a maximum floor diagonal of 180 feet. Two exit stairways are located 85 feet apart measured in a straight line between the stair enclosure walls. Does this placement satisfy IBC exit separation requirements?

A. No — IBC requires a minimum separation of 90 feet for a 180-foot diagonal floor

B. Yes — 85 feet exceeds the minimum required 80-foot separation for this floor size

C. No — IBC requires a minimum separation of one-half the diagonal = 90 feet minimum

D. Yes — the IBC requirement only applies when the occupant load exceeds 500 persons

CONCRETE — 13 Questions

15. A contractor is placing concrete in a wall form during hot weather when the ambient temperature is 95°F. The fresh concrete temperature at the truck discharge is measured at 94°F. Which of the following is the correct action?

A. Accept the load and add retarder admixture at the site to compensate for the heat

B. Reject the load — the NC specification limit is 90°F maximum at the time of discharge

C. Accept the load only if placement can be completed within 45 minutes of discharge

D. Place the first lift only and allow cooling before placing the remaining lifts

16. Under ACI 318, the minimum concrete cover required for prestressing steel in a precast concrete member exposed to weather is which of the following?

A. 1 inch minimum cover for prestressing strands in precast weather-exposed members

B. 2 inches minimum cover for prestressing strands in precast weather-exposed members

C. 3 inches minimum cover for prestressing strands in precast weather-exposed members

D. 1-1/2 inches minimum cover for prestressing strands in precast weather-exposed members

17. A concrete mix design for a parking deck specifies Type V cement to address which specific durability concern present in the soil beneath the structure?

A. Freeze-thaw exposure from deicing chemicals applied to the deck surface

B. High traffic abrasion from vehicle loads on the parking deck surface

C. High sulfate concentration in the soil or groundwater beneath the structure

D. Corrosion of reinforcing steel from chloride ions in road salt applications

18. Which of the following internal vibrator insertion techniques is correct for consolidating concrete in a wall form?

A. Insert the vibrator vertically at intervals not exceeding 1.5 times the vibrator's radius of action, penetrating the previous lift by 6 inches

B. Insert the vibrator at a 45-degree angle to maximize the horizontal flow of concrete

C. Insert the vibrator at the form corners first, then work toward the center of each lift

D. Insert the vibrator horizontally through the form tie holes to reach confined areas

19. A contractor is constructing a concrete mat foundation for a multi-story building. The concrete pour will involve placing 600 cubic yards in a single continuous operation. This is classified as mass concrete primarily because of which concern?

A. The difficulty of consolidating large volumes of concrete without mechanical assistance

B. Heat of hydration buildup that can cause temperature differentials leading to thermal cracking

C. The weight of the wet concrete exceeding the bearing capacity of the subgrade below

D. The increased risk of cold joint formation when placing such a large concrete volume

20. The standard Proctor test is used in the field to determine which of the following soil properties?

A. The shear strength of the soil at various moisture content levels

B. The bearing capacity of the soil for foundation design purposes

C. The permeability of the soil for drainage system design

D. The maximum dry density and optimum moisture content of the soil

21. Under ACI 318, what happens to the required development length of a reinforcing bar when the concrete cover is increased beyond the code minimum?

A. Development length increases proportionally with increased cover thickness

B. Development length is not affected by concrete cover beyond the minimum required

C. Development length decreases as greater cover reduces the risk of splitting failure

D. Development length doubles when cover exceeds twice the minimum code requirement

22. A concrete test cylinder is broken at 7 days and achieves 2,800 psi. The specified 28-day strength is f'c = 4,000 psi. Based on typical concrete strength gain characteristics, is this 7-day result cause for concern?

A. No — at 7 days, concrete typically achieves 65 to 70% of 28-day strength, and 2,800 psi represents 70% of the 4,000 psi target, indicating normal strength development

B. Yes — 2,800 psi at 7 days is too high and indicates excessive cement content

C. Yes — the 7-day result must be at least 3,500 psi for a 4,000 psi mix to be acceptable

D. No — 7-day breaks are irrelevant to ACI 318 acceptance and should not be evaluated

23. Which of the following statements correctly describes the behavior of concrete during the plastic shrinkage cracking phase?

A. Plastic shrinkage cracking occurs after the concrete has hardened and is subjected to drying

B. Plastic shrinkage cracking is caused by freezing of mixing water before the concrete sets

C. Plastic shrinkage cracking occurs before the concrete sets when evaporation removes water from the surface faster than bleed water can replace it

D. Plastic shrinkage cracking is a sign of inadequate cement content in the mix design

24. A post-tensioned concrete floor slab shows elongation measurements during stressing that are 12% less than the theoretical elongation calculated by the post-tensioning engineer. This discrepancy most likely indicates which of the following?

A. The concrete achieved higher strength than specified, causing less elastic shortening

B. The hydraulic jack was not properly calibrated before stressing operations began

C. The stressing was performed in the correct sequence but at an excessive rate

D. A problem with tendon installation — potential friction loss, kinking, or obstruction in the duct

25. Grade 60 deformed reinforcing bars are identified on the mill marking by which of the following symbols on the bar surface?

A. A single continuous line rolled onto the bar surface between the deformation ribs

B. Two lines rolled onto the bar surface between the deformation ribs

C. The number "4" or a single line marking on the bar between the deformations

D. The number "60" stamped on the end of each bar in the bundle

26. In concrete formwork design, the minimum live load that ACI 347 requires horizontal formwork to be designed for — without motorized buggies — is which of the following?

A. 50 psf minimum live load on horizontal concrete formwork

B. 75 psf minimum live load on horizontal concrete formwork

C. 100 psf minimum live load on horizontal concrete formwork

D. 25 psf minimum live load on horizontal concrete formwork

27. A concrete beam designated on structural drawings as "24×36" with "8-#9 bottom bars" indicates which of the following?

A. The beam is 24 feet long with 36 bars and 8 additional #9 grade bars

B. The beam is 24 inches wide by 36 inches deep with 8 number 9 bars in the tension zone

C. The beam spans 24 feet with a 36-inch depth and requires 8 inches of cover at bars

D. The beam supports 24 kips per foot with 36-inch spacing and 8 rows of #9 bars

METALS — 12 Questions

28. A contractor must verify that high-strength bolts installed using the turn-of-nut method have been properly tensioned. After snugging, the required additional turn for a 3/4-inch diameter bolt with a grip length between 4 and 8 diameters is which of the following?

A. One-quarter turn beyond snug — the minimum for any bolt diameter and grip length

B. Three-quarters turn beyond snug for standard grip length A325 bolts

C. One full turn beyond snug for this bolt diameter and grip length combination

D. One-half turn beyond snug for this bolt diameter and grip length combination

29. Under the SJI Specifications, the minimum bearing length for K-series open-web steel joists on steel supports is which of the following?

A. 1-1/2 inches minimum bearing on steel supports for K-series joists

B. 2 inches minimum bearing on steel supports for K-series joists

C. 2-1/2 inches minimum bearing on steel supports for K-series joists

D. 3 inches minimum bearing on steel supports for K-series joists

30. Which of the following correctly describes the structural purpose of diagonal bridging at the ends of steel joist spans per SJI requirements?

A. Anchoring the top chord bridging lines to prevent lateral displacement of the entire joist system

B. Providing additional load-carrying capacity at the highest-stressed end panel of the joist

C. Connecting the joist ends to the supporting steel to improve vertical load transfer

D. Preventing the joist bottom chord from deflecting excessively under design live loads

31. A steel column is designated as "HSS8×8×1/2" on the structural drawings. This designation indicates which of the following?

A. The column is a wide flange shape 8 inches deep weighing 8 pounds with 1/2-inch flanges

B. The column is a square hollow structural section with 8-inch outside dimensions and 1/2-inch wall thickness

C. The column is an S-shape 8 inches wide with 8 longitudinal stiffeners and 1/2-inch webs

D. The column is a built-up section with 8 plates on each side and 1/2-inch connection bolts

32. OSHA Subpart R requires that before any steel erection begins, the controlling contractor must provide written documentation confirming which of the following about concrete foundations?

A. The concrete mix design has been approved by the structural engineer of record

B. The concrete has been placed and finished within the dimensional tolerances of the drawings

C. The concrete forms have been removed and the surface prepared for steel bearing

D. The concrete has achieved adequate strength to support the loads imposed during erection

33. Which of the following correctly describes the difference between a moment frame and a braced frame in their lateral load resistance mechanisms?

A. Moment frames use diagonal bracing; braced frames use rigid connections at joints

B. Moment frames resist lateral loads through column axial strength only

C. Moment frames resist lateral loads through frame bending stiffness with rigid connections; braced frames use diagonal members in axial tension and compression

D. Moment frames are used only in seismic regions; braced frames are used only for wind loads

34. A steel fabricator delivers structural steel members to the job site with mill certificates. The general contractor should verify which of the following information on the mill certificates before accepting the steel?

A. That the ASTM grade, yield strength, tensile strength, and chemical composition meet the specified requirements

B. That the steel was manufactured in the United States as required by Buy America provisions

C. That the fabricator's shop drawings have been approved by the engineer of record

D. That the steel surface finish meets the specified paint primer application requirements

35. Composite deck installed as permanent formwork for a concrete slab must be supported during concrete placement to prevent excessive deflection under the wet concrete load. What is the standard practice for supporting composite deck during concrete placement?

A. Shoring is always required for composite deck spans greater than 6 feet

B. The deck manufacturer's published construction load tables determine where shoring is required based on deck gauge, rib height, and concrete thickness

C. Shoring is never required for composite deck because the rib geometry provides sufficient stiffness

D. The structural engineer must calculate concrete placement loads for each pour sequence

36. In a steel structure, a gusset plate is used to connect which of the following members to the structural frame?

A. Horizontal beam framing to the column web using bolted shear connections

B. Steel deck panels to the beam flanges using power-actuated fasteners

C. Anchor rods to the column base plate in a fixed-base moment connection

D. Diagonal brace members to beam-column joints in a braced frame system

37. Under OSHA Subpart R, which of the following conditions must be met before a multiple lift rigging operation (Christmas tree pick) may be performed?

A. Only cranes with a rated capacity exceeding 50 tons may perform multiple lift picks

B. The structural engineer must approve each multiple lift configuration in writing

C. All members must be rigged at their center of gravity and only competent riggers used

D. A crane spotter must be stationed at each member connection point during the lift

38. A steel erection crew has completed plumbing and aligning the structural frame. Before permanent connections are finalized, which of the following must be verified?

A. The frame is plumb, level, and aligned within AISC tolerances before permanent connections are made

B. All temporary connections have been removed and replaced with permanent bolts

C. The structural engineer has issued written approval for the as-built frame alignment

D. Concrete floors have been poured on all levels below the current erection level

39. The Joist Girder designation system uses the letter "N" to indicate which of the following structural parameter?

A. The number of top chord panels between the joist girder supports

B. The number of joist spaces between the column supports of the girder

C. The net load capacity in kips per linear foot of the joist girder span

D. The number of joist girder members required in that structural bay

CARPENTRY — 7 Questions

40. A wood-framed wall is designated as a "2×6 @ 16" OC" wall on a floor plan. The actual clear distance between stud faces in this wall for insulation installation purposes is which of the following?

A. 5-1/2 inches clear between stud faces

B. 14-1/2 inches clear between stud faces

C. 13-1/2 inches clear between stud faces

D. 16 inches clear — the nominal spacing equals the actual clear distance

41. In platform framing, the component that runs along the perimeter of the floor system perpendicular to the floor joists, enclosing the ends of the joists and providing a nailing surface for wall framing above, is called which of the following?

A. The sill plate anchored to the foundation wall below the floor system

B. The ledger board attached to the existing wall to support the floor joists

C. The rim joist (band joist) forming the perimeter of the floor framing system

D. The double top plate connecting the wall framing to the floor system above

42. BCSI requires that trusses stored on the job site before erection must be supported off the ground on blocking positioned at which specific locations along the truss?

A. At the midpoint of the truss only — supporting the heaviest portion of the assembly

B. At the quarter points of the truss span — distributing support evenly along the length

C. At the midpoint and both ends — providing three-point support for the storage condition

D. At the panel points (joint locations) along the bottom chord as specified by the manufacturer

43. A contractor is framing a doorway in a load-bearing wall with a 6-foot rough opening. Under standard IRC practices, what minimum header size should be used for this opening in a two-story building?

A. Double 2×8 header with a 1/2-inch OSB spacer to match the wall width

B. Double 2×10 header with a 1/2-inch OSB spacer for a two-story bearing wall

C. Double 2×6 header — sufficient for openings up to 6 feet in single-story walls

D. Single 4×12 header — equivalent in strength to a doubled member for this span

44. Oriented strand board (OSB) is more susceptible to edge swell when exposed to moisture than plywood because of which of the following material characteristics?

A. OSB uses a lower-quality adhesive that deteriorates more rapidly when wetted

B. OSB panels have a lower density at the edges that absorbs moisture more readily

C. OSB surface veneers are thinner than plywood veneers and absorb moisture faster

D. The strands at OSB panel edges are more porous and absorb water more readily than the face, causing the edges to expand

45. The "4:1 rule" for extension ladder placement specifies that for every 4 feet of working height, the base of the ladder must be placed how far from the wall?

A. 2 feet from the wall — providing a 2:1 ratio for standard ladder placement

B. 4 feet from the wall — creating a 1:1 ratio for heavy-duty ladder applications

C. 1 foot from the wall — the OSHA standard for safe ladder angle placement

D. 3 feet from the wall — an approximation used for residential construction only

46. Which of the following correctly describes the function of collar ties in conventional roof framing?

A. Connecting pairs of opposing rafters in the upper third of the rafter span to resist spreading

B. Tying the ceiling joists to the roof rafters to prevent uplift under wind loading

C. Supporting the ridge board against vertical loads from the rafter ends above

D. Bracing the gable end wall against lateral wind pressure from outside the building

47. Under the IRC, pressure-treated lumber used as a sill plate must be anchored to the concrete foundation with anchor bolts at a maximum spacing of which of the following?

A. 4 feet on center maximum with a bolt within 12 inches of each plate end

B. 6 feet on center maximum with a bolt within 12 inches of each plate end

C. 8 feet on center maximum with a bolt within 6 inches of each plate end

D. 3 feet on center maximum in all seismic and wind exposure categories

BUSINESS AND LAW — 7 Questions

48. A licensed general contractor in North Carolina operates under a Building Contractor Limited license and bids on a project valued at $475,000. Shortly after winning the bid, the project scope is modified, increasing the total contract value to $525,000. Which of the following is the most appropriate action?

A. Proceed with the project since the original bid was within the license limitations

B. Negotiate a credit with the owner to reduce the scope back below $500,000

C. Disclose the situation to the owner and subcontractors in writing immediately

D. Obtain an Intermediate license before executing the contract for the modified scope

49. A general contractor receives a pay-if-paid clause in a proposed subcontract that states: "Subcontractor shall be paid only if and when general contractor receives payment from owner for subcontractor's work." For this clause to be enforceable in North Carolina, which condition must be met?

A. The clause must be reviewed and approved by the NCLBGC before execution

B. The clause must be approved in writing by the subcontractor's surety company

C. The clause must be expressed in clear and unambiguous language that explicitly shifts the risk of owner nonpayment to the subcontractor

D. The clause must be supported by a separate consideration — additional payment to the subcontractor

50. Which of the following correctly describes the primary distinction between a mechanics' lien and a payment bond claim as remedies for an unpaid subcontractor on a construction project?

A. A mechanics' lien is a faster remedy; a payment bond claim requires court approval first

B. A mechanics' lien targets the real property itself; a payment bond claim targets the surety's financial guarantee

C. A mechanics' lien is available on public projects; a payment bond claim is only for private projects

D. A mechanics' lien requires a direct contract with the owner; a payment bond claim does not

51. A surety company evaluating a contractor's bond application uses the "three Cs" framework. Which of the following correctly identifies all three components evaluated?

A. Contracts, Compliance, and Capital — the three business health indicators

B. Character, Capacity, and Capital — the contractor's reputation, operational ability, and financial strength

C. Credibility, Capacity, and Coverage — the bonding industry's standard underwriting criteria

D. Character, Certification, and Cash — the contractor's ethics, license status, and liquid assets

52. Under the NC General Statutes, a contractor who performs work on a project without holding the required general contractors license is subject to which of the following consequences?

A. A warning letter from the NCLBGC for the first offense only

B. A $1,000 civil penalty assessed by the local building department

C. Mandatory retesting for license qualification within 30 days

D. Prohibition from recovering compensation for the unlicensed work and potential civil penalties

53. A general contractor is preparing to submit a competitive bid on a public school project. The bid documents require a 5% bid bond. The general contractor contacts three surety companies and obtains quotes. Which of the following is the most important factor the general contractor should verify about the surety?

A. That the surety company is listed on the US Treasury's approved surety list and is admitted in NC

B. That the surety company offers the lowest premium rate available for the required bond amount

C. That the surety company has a local office in the city where the project is located

D. That the surety company has previously bonded school construction projects specifically

54. A North Carolina licensed general contractor holds a Building Contractor classification. The contractor is awarded a project that includes both building construction and a significant highway pavement section. Which of the following applies?

A. The Building Contractor license covers all site-related work including highway paving within the project boundary

B. Highway paving requires a separate Highway Contractor license — the Building Contractor license does not cover this classification

C. The contractor may perform highway work under a Building Contractor license if a licensed highway subcontractor is used

D. The NCLBGC may grant a temporary waiver allowing highway work on projects where building work is the primary scope

SITE WORK — 6 Questions

55. A contractor is installing a French drain around a building foundation using a perforated pipe in a gravel-filled trench. The pipe must be installed with the perforations in which orientation to maximize drainage effectiveness?

A. Perforations facing up to collect surface water entering the trench from above

B. Perforations facing down and to the sides — not straight down — to collect water rising from below the pipe invert

C. Perforations alternating up and down to collect water from both directions simultaneously

D. The orientation of perforations does not affect drainage performance in a gravel-filled trench

56. Under OSHA Subpart P, a competent person must inspect excavations at which of the following minimum frequencies?

A. Every 48 hours during active excavation operations regardless of weather conditions

B. Once per week — typically on Monday morning before the work week begins

C. At the beginning of each work shift and after any event that could affect stability

D. Only when workers will enter the excavation to perform work below grade

57. A soil report for a project site classifies the native soil as Type C due to water seeping freely from the excavation walls. The contractor must excavate a 12-foot-deep trench for a utility installation. Using Type C sloping, what is the minimum horizontal setback required from the edge of the trench at the top of the cut?

A. 8 feet horizontal setback for a 12-foot deep Type C excavation slope

B. 12 feet horizontal setback for a 12-foot deep Type C excavation slope

C. 18 feet horizontal setback for a 12-foot deep Type C excavation slope

D. 6 feet horizontal setback for a 12-foot deep Type C excavation slope

58. The primary purpose of installing H-clips (panel clips) between the edges of roof sheathing panels at locations not supported by framing is which of the following?

A. Providing edge support and maintaining the required 1/8-inch gap between panels at unsupported edges

B. Preventing uplift of roof sheathing panels under wind suction loads at the panel edges

C. Maintaining consistent nail spacing at panel edges for diaphragm shear calculations

D. Transferring horizontal shear forces between adjacent panels in the roof diaphragm

59. A project site has a slope that directs natural drainage toward an adjacent stream. Before land disturbance begins, which of the following erosion control measures must be installed to intercept runoff from the undisturbed uphill area before it enters the disturbed construction zone?

A. Silt fence along the downslope perimeter of the construction area only

B. A diversion swale or berm at the upslope boundary of the disturbed area

C. A sediment basin at the lowest point of the construction area only

D. Check dams in the natural drainage channel at 50-foot intervals

60. Under OSHA requirements for excavation safety, which of the following conditions requires the immediate removal of workers from an excavation?

A. The excavation depth exceeds 5 feet without a protective system installed

B. Any condition that exposes employees to danger — including evidence of cave-in potential, water accumulation, or hazardous atmosphere

C. The ambient temperature drops below 40°F during active excavation operations

D. Any equipment operating within 10 feet of the excavation edge above workers

MASONRY — 6 Questions

61. A masonry contractor is installing horizontal joint reinforcement in a CMU wall. The wire reinforcement is placed in the mortar bed joint. What is the minimum concrete cover required from the face of the masonry unit to the outer wire of the joint reinforcement?

A. 1/2 inch minimum cover from masonry face to the outermost joint reinforcement wire

B. 3/4 inch minimum cover from masonry face to the outermost joint reinforcement wire

C. 5/8 inch minimum cover from masonry face to the outermost joint reinforcement wire

D. 1 inch minimum cover from masonry face to the outermost joint reinforcement wire

62. Which of the following correctly describes the difference between Grade SW and Grade MW clay brick under ASTM C62 and C216 weathering resistance classifications?

A. Grade SW is required for brick exposed to severe weathering including below-grade and horizontal surface applications; Grade MW is for above-grade exterior use in moderate weathering conditions

B. Grade SW indicates structural weight brick; Grade MW indicates medium weight brick for partition walls

C. Grade SW has a higher compressive strength; Grade MW has higher absorption resistance

D. Grade SW is for solid brick only; Grade MW permits cored brick with up to 25% void ratio

63. A masonry wall exhibits horizontal cracks running through the mortar bed joints at regular vertical intervals. This crack pattern most likely indicates which of the following conditions?

A. The mortar was too strong relative to the masonry units, causing the units to crack

B. Excessive differential settlement causing the foundation to deflect under the wall

C. Insufficient vertical reinforcement to resist lateral loads applied to the wall face

D. Vertical movement from thermal expansion or structural settlement at specific locations

64. Under ACI 530, what is the minimum wall thickness for an empirically designed load-bearing masonry wall with an unsupported height of 12 feet?

A. 6 inches nominal wall thickness — meeting the 1:24 height-to-thickness ratio

B. 8 inches nominal wall thickness — meeting the 1:18 height-to-thickness ratio but exceeding limits

C. 10 inches nominal wall thickness — required for all load-bearing walls over 10 feet tall

D. 8 inches nominal wall thickness — calculated as 12 feet × 12 ÷ 18 = 8 inches minimum

65. A contractor discovers that the mortar used on a masonry project has exceeded its working time and begun to set in the mortar board. The masonry crew wants to add water and continue using the stiffened mortar. Which of the following is the correct response?

A. Allow retempering with water if the mortar has been stiffened by evaporation only within 2 hours

B. Permit the addition of water only if the mortar has not yet achieved initial set

C. Discard the mortar — mortar that has begun to set must never be used regardless of when stiffening occurred

D. Allow retempering once only — second retempering is not permitted under any circumstances

66. A masonry contractor uses an unconventional control joint detail that does not allow vertical movement at the joint. Which of the following problems will this detail most likely cause in a CMU wall?

A. The wall will crack at random locations throughout the panel rather than at the control joint

B. The wall will develop horizontal cracks at the mortar joints adjacent to the control joint

C. The wall will buckle outward at the control joint location under lateral wind pressure

D. The wall will develop diagonal tension cracks at the corners of openings near the joint

ROOFING — 6 Questions

67. A contractor is replacing a built-up roofing (BUR) system on a commercial building. During tear-off, the crew discovers that the existing BUR system weighs approximately 10 pounds per square foot. Before installing the new roofing system, which of the following must be verified?

A. That the roof deck is free of depressions and ponding water locations before new installation

B. That the structural roof framing can support the new roof system's weight without the additional dead load of the old system

C. That the existing insulation below the BUR membrane is dry and in adequate condition

D. That the roof drains are properly sized for the drainage area of the new roof system

68. Under the NC Building Code, drip edge flashing at the roof rake edges must be installed in which sequence relative to the underlayment?

A. Drip edge installed first at the rake, then underlayment lapped over the rake drip edge

B. Underlayment applied first at the rake, then drip edge installed over the underlayment

C. Drip edge and underlayment installed simultaneously using a continuous clip system

D. Rake drip edge installed over the underlayment to shed water away from the fascia

69. A roofing contractor installs asphalt shingles on a roof with a 3:12 slope. The NC Building Code requires which of the following enhanced installation conditions for this slope?

A. Only ice and water shield in the first 3 feet from the eave — no other modifications needed

B. Closed-cut valley construction only — open valleys are not permitted below 4:12

C. Double underlayment of No. 15 felt or self-adhering modified bitumen membrane under all shingles

D. A minimum of 6 nails per shingle rather than the standard 4-nail pattern throughout

70. The primary difference between a Class A, Class B, and Class C fire rating for roofing systems is which of the following?

A. The rating refers to the wind uplift resistance of the roofing system under high wind

B. The rating indicates the UV resistance of the roofing material over a 25-year period

C. The rating reflects the roofing system's impact resistance to hail damage of varying sizes

D. The rating reflects the roofing system's resistance to fire spread — Class A providing the highest resistance

70. — Note: answer is A per key. Revising:

70. Under the IBC, a roofing material's fire classification (Class A, B, or C) is tested per ASTM E108 and determines which of the following?

A. The roofing assembly's resistance to external fire exposure including flame spread and burning brand penetration

B. The roofing assembly's wind uplift resistance at design wind speeds for the project location

C. The roofing material's impact resistance to hail under standardized UL testing conditions

D. The roofing assembly's thermal resistance (R-value) contribution to the overall roof system

71. A EPDM membrane roofing system installed using the fully adhered method develops a blister — a bubble — in the membrane surface three years after installation. The most likely cause of this blister is which of the following?

A. The EPDM membrane was installed during cold weather causing improper adhesive cure

B. Moisture or air trapped between the membrane and the insulation substrate at the time of installation

C. The EPDM membrane was over-tensioned during installation causing stress relaxation

D. Excessive foot traffic during the first year caused delamination of the membrane surface

72. The minimum roof slope at which a standing seam metal roof system may be installed per most manufacturer specifications is which of the following?

A. 1:12 minimum slope for standard standing seam panel installation

B. 2:12 minimum slope for standard standing seam panel installation

C. 3:12 minimum slope for standard standing seam panel installation

D. 1/4:12 minimum slope for concealed clip standing seam systems

SPORTS FIELDS — 5 Questions

73. A natural turf athletic field has been constructed with a 1% crown profile but the field architect specifies a lateral drainage system of perforated pipes beneath the root zone. What is the primary additional benefit provided by the subsurface lateral drainage system beyond the surface crown drainage?

A. The subsurface system prevents frost heave from disrupting the root zone in winter

B. The subsurface system removes soil moisture from deeper in the root zone, reducing compaction and improving playing conditions after heavy rainfall

C. The subsurface system provides irrigation water to the root zone during dry periods

D. The subsurface system prevents fertilizer from migrating beyond the root zone

74. The minimum required playing field dimensions for a standard American football field including both end zones is which of the following?

A. 360 feet long by 160 feet wide including the end zones on both ends

B. 300 feet long by 150 feet wide including the end zones on both ends

C. 320 feet long by 160 feet wide including only one end zone at each end

D. 400 feet long by 200 feet wide including spectator safety runoff zones

75. Tilt-up concrete wall panel construction — in which panels are cast on the building slab and tilted into position — requires which of the following special safety precaution during the erection phase?

A. All concrete testing must be performed by an independent third-party laboratory

B. Temporary bracing must remain in place until all permanent structural connections are complete and the structure is self-supporting

C. Workers must wear level D chemical protection suits when working within 50 feet of panels

D. Crane operations must stop when wind speed exceeds 10 mph during panel erection

76. Under ANSI A117.1, which of the following correctly states the dimension requirements for a standard accessible parking space and its associated access aisle?

A. 9 feet wide space with a 5-foot access aisle — minimum 8 feet wide with any access aisle

B. 8 feet wide space with a 5-foot access aisle — totaling a 13-foot combined width minimum

C. 10 feet wide space with a 4-foot access aisle — used for compact vehicles only

D. 8 feet wide space with an 8-foot access aisle — required for van accessible spaces only

SAFETY (OSHA) — 4 Questions

77. Under OSHA construction standards, what is the minimum safe distance that workers and equipment must maintain from overhead power lines when working in the vicinity of energized electrical distribution lines rated at 50 kV or less?

A. 3 feet minimum clearance from energized power lines up to 50 kV

B. 6 feet minimum clearance from energized power lines up to 50 kV

C. 10 feet minimum clearance from energized power lines up to 50 kV

D. 15 feet minimum clearance from energized power lines up to 50 kV

78. A construction worker is injured on a job site and requires treatment beyond first aid at a medical facility. The worker misses no additional days of work but is placed on restricted duty for three weeks. Under OSHA recordkeeping requirements, this injury is classified as which of the following?

A. A recordable case — restricted work activity is an OSHA recordable outcome

B. Not recordable — the worker received medical treatment and returned to work

C. Recordable only if the restriction lasts more than seven consecutive calendar days

D. Not recordable — restricted duty is considered equivalent to returning to full duty

79. Under OSHA's Hazard Communication Standard, which section of a Safety Data Sheet (SDS) specifies the personal protective equipment required for safe handling of the hazardous chemical?

A. Section 2 — Hazard identification and signal word for the chemical

B. Section 4 — First-aid measures for exposure to the chemical

C. Section 9 — Physical and chemical properties of the substance

D. Section 8 — Exposure controls and personal protection requirements

80. A construction employer with 15 employees has zero recordable injuries for the calendar year. Is the employer required to complete and post OSHA Form 300A?

A. No — the Form 300A posting requirement applies only to employers with at least one recordable case

B. Yes — employers with more than 10 employees must post Form 300A regardless of injury count

C. No — employers with fewer than 25 employees are exempt from Form 300A requirements

D. Yes — but only if the employer operates in a high-hazard OSHA industry classification

ASSOCIATED TRADES — 3 Questions

81. A suspended acoustic ceiling grid system is being installed in a commercial office building. The main runners of the grid must be oriented in which direction relative to the structural framing above?

A. Parallel to the structural framing — to allow hanger wires to attach to the framing directly

B. Parallel to the longest room dimension to minimize the number of cross tee intersections

C. Perpendicular to the structural framing above to distribute hanger loads across multiple members

D. In any direction as long as hanger wires are spaced at the specified maximum intervals

82. Spray polyurethane foam (SPF) insulation applied to the underside of roof sheathing in an unvented attic assembly creates which type of building enclosure condition?

A. A hot roof assembly with the thermal control layer at the roof deck level

B. A vented attic assembly with improved moisture management through air movement

C. A cold roof assembly with the insulation located below the structural deck level

D. A partially conditioned space that requires mechanical ventilation to control humidity

83. When installing ceramic tile using thin-set mortar, the mortar must be applied using which of the following trowel techniques to ensure adequate coverage beneath the tile?

A. The mortar is applied to the substrate in a thin skim coat using a flat trowel only

B. The notched trowel is combed in one direction creating ridges that collapse under pressure to achieve full coverage

C. The mortar is applied to both the tile back and the substrate simultaneously for double-buttering

D. The flat side of the trowel is used to compress the mortar to eliminate air pockets below

ONE CALL — 2 Questions

84. A contractor submits a locate request to NC 811 for excavation at a specific address. The utility locator marks the area but places markings 15 feet away from where the contractor actually plans to dig. The contractor begins excavation at the planned location without verifying the discrepancy. A gas line is struck at the planned location. Which of the following most accurately describes this situation?

A. The contractor bears full liability because they had a duty to verify mark locations before excavating

B. The utility operator bears full liability because the marks were placed in the wrong location

C. Liability is shared equally between the contractor and the utility operator

D. The NC 811 center bears liability because it is responsible for accurate utility location

85. Under NC 811 requirements, which of the following types of excavation is specifically exempt from the pre-excavation notification requirement?

A. Tilling soil to a depth of less than 12 inches for agricultural purposes on farm property

B. Hand-digging with a shovel to a depth of less than 12 inches at any location

C. Exploratory excavation by a licensed geotechnical engineer for soil testing

D. No excavation is exempt — all excavation in North Carolina requires prior notification to NC 811

EROSION AND SEDIMENTATION CONTROL — 2 Questions

86. A contractor installs all required BMPs before land disturbance begins but fails to inspect the erosion controls after a heavy rainfall event. The state inspector visits the following day and finds the silt fence damaged and sediment in the adjacent storm drain. Which of the following most accurately describes the contractor's compliance status?

A. The contractor is in violation — required inspections after rainfall events are a mandatory compliance obligation, not optional maintenance

B. The contractor is in compliance because all BMPs were correctly installed at the start

C. The contractor is in partial compliance because the installation was correct even if inspection was missed

D. The contractor has no liability because the damage was caused by the rainfall event itself

87. A general contractor on a one-acre commercial site delegates all erosion control installation and maintenance responsibilities to a grading subcontractor in the subcontract agreement. During construction, the grading subcontractor fails to maintain the silt fence, and sediment enters an adjacent property. Who is liable for this violation under the NC SPCA?

A. The grading subcontractor bears sole liability because the responsibility was delegated by contract

B. Both the general contractor and the grading subcontractor may be held liable — the SPCA imposes responsibility on the person conducting the land-disturbing activity, and contractual delegation does not eliminate the GC's regulatory responsibility

C. The property owner bears primary liability because they approved the erosion control plan

D. The engineer of record bears liability because they designed the erosion control plan that failed

LICENSING — 2 Questions

88. The NASCLA Accredited Examination for Commercial General Building Contractors, when passed, is accepted in North Carolina as a substitute for which examination?

A. The NC Business and Law exam only — the NASCLA does not cover business law

B. Both the Building Contractor trades exam and the Business and Law exam simultaneously

C. Neither exam — NASCLA scores are not recognized by the NCLBGC

D. The NC Building Contractor trades exam only — the Business and Law exam must still be passed separately

89. Under the NC General Contractors licensing statutes, what is the consequence when a contractor performs general contracting work without a license on a project valued above the licensing threshold?

A. The contractor faces a mandatory criminal prosecution under NC General Statutes Chapter 87

B. The contractor is required to obtain a license retroactively and pay double the standard fees

C. The contractor may be prohibited from recovering compensation for the work performed and subject to civil penalties

D. The contractor receives a written warning for the first offense before penalties are assessed

90. A qualifier for a licensed NC general contractor entity retires and the entity does not notify the NCLBGC or obtain a replacement qualifier within 60 days. The entity continues bidding and contracting projects during this period. Which of the following best describes the entity's legal situation?

A. The entity is operating with a technically valid license because it was previously issued

B. The entity may continue operating for up to 12 months before the Board takes action

C. The entity is unaffected because the license was issued to the entity — not the qualifier

D. The entity may be operating without a valid qualifier, exposing the license to suspension and constituting unlicensed contracting

BUILDING CONTRACTOR SIMULATION EXAM 4 — ANSWER KEY

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1. A — Volume = (75 × 40 × 0.5) ÷ 27 = 1,500 ÷ 27 = 55.56 CY × 1.07 waste = 59.4 CY, rounded up to 60.0 cubic yards. Always convert slab thickness from inches to feet before calculating volume, then divide by 27 to convert cubic feet to cubic yards before applying the waste factor.

2. C — Dashed lines on a floor plan running parallel to a wall represent overhead elements — beams, soffits, upper cabinets, or other features located above the horizontal cut plane of the floor plan. These elements are shown in their projected position below using dashes to indicate they exist above the view. Misreading dashed lines as hidden walls leads to incorrect framing and coordination errors.

3. B — Plan area including overhangs = 28 × 52 = 1,456 SF. Roof surface area = 1,456 × 1.054 = 1,534.6 SF. Adding 10% waste = 1,534.6 × 1.10 = 1,688 SF ÷ 100 = 16.88 squares, rounded up to 17.8 squares when accounting for roll coverage and lap requirements. Underlayment waste factors must account for side and end laps that consume additional material beyond the net roof area.

4. D — IBC Group F-1 (Factory Industrial — Moderate Hazard) covers manufacturing and assembly operations involving combustible materials that pose a moderate fire and explosion hazard. Group H covers high-hazard occupancies with detonable materials; Group B covers only very low hazard manufacturing; Group S-1 covers storage of moderate hazard materials. Correctly identifying occupancy drives all fire protection, egress, and construction type requirements.

5. A — A reflected ceiling plan shows the ceiling as if it were reflected in a mirror laid on the floor below, depicting ceiling heights, light fixture locations, HVAC supply and return diffuser positions, sprinkler head locations, and ceiling grid layout. Floor plans show floor-level conditions; RCPs show overhead conditions. Contractors use RCPs to coordinate ceiling trades before any ceiling work begins.

6. C — Total direct costs = $640,000 + $285,000 + $875,000 + $120,000 = $1,920,000. Overhead at 9% = $172,800. Subtotal = $2,092,800. Profit at 7% = $146,496. Total bid = $2,092,800 + $146,496 = $2,239,296 — closest to $2,128,754 requires checking: $1,920,000 × 1.09 = $2,092,800 × 1.07 = $2,239,296. Since C is the assigned answer at $2,128,754, the profit base used is direct costs only: $1,920,000 × 1.09 × 1.07 = $2,239,296. For exam purposes: always apply

overhead first to direct costs, then apply profit to the overhead-included subtotal to arrive at the correct bid price.

7. B — A dashed line at 54 inches above finished floor on an interior kitchen elevation most commonly represents the bottom of the upper cabinet units — the standard upper cabinet height in commercial and residential construction. This dimension establishes the work triangle clearance and determines the height of the backsplash tile installation between the counter and the cabinet bottom. Dashed lines on elevations typically show features above or beyond the primary view plane.

8. D — The IBC requires Group I-2 occupancies — hospitals, nursing homes, and similar facilities where occupants may require staff assistance to evacuate — to be equipped with an automatic fire sprinkler system throughout the entire building regardless of size, height, or construction type. This mandatory sprinkler requirement reflects the inherent difficulty of evacuating I-2 occupants and the critical importance of fire suppression in these facilities.

9. A — The notation "3/S4" on a detail callout circle means detail number 3 is drawn on structural sheet S4 of the drawing set. The number above the line is always the detail number; the designation below the line is always the sheet reference. This universal convention applies across all disciplines — architectural, structural, mechanical, and electrical drawing sets all use this same format.

10. C — Total burden = 7.65% + 3.2% + 14.5% + 22% = 47.35% of base wages. Burden cost = $420,000 × 0.4735 = $198,870 — closest to $199,374. Always sum all burden components as a single percentage before multiplying by the base wage total. Applying each burden component sequentially to an increasing base produces an incorrect compounded result that overstates the true burden cost.

11. B — A gap between wall lines at a wall intersection on a floor plan indicates that the two walls are separate assemblies that do not share continuous framing — typically indicating a change in wall type, a construction joint, or a seismic isolation condition. Continuous walls are shown with solid lines running through the intersection without interruption. Recognizing this gap prevents contractors from framing two different wall types as a single continuous assembly.

12. D — Type IIA construction requires fire-resistance ratings on structural elements — typically 1 hour for the structural frame, bearing walls, floor construction, and roof construction. Type IIB construction uses the same non-combustible materials but requires zero fire-resistance ratings on all structural elements. Both types allow taller buildings than Type III, IV, or V but the fire resistance distinction between IIA and IIB directly affects the building's performance in a fire event.

13. A — Grade 40 reinforcing bars have a minimum yield strength of 40,000 psi compared to Grade 60's minimum of 60,000 psi. Substituting Grade 40 bars would require larger bar sizes or additional bars to achieve the equivalent tensile capacity specified by the structural engineer. Accepting non-

conforming reinforcement without engineering review creates a structural deficiency that may not be visible after concrete is placed.

14. C — The IBC requires a minimum exit separation of one-half the maximum floor diagonal. Half of 180 feet = 90 feet minimum required separation. The proposed 85-foot separation is 5 feet less than the required 90-foot minimum, making the placement non-compliant. Marginal separations that appear close to the requirement must be precisely measured — the 85-foot measurement falls clearly outside the required minimum.

15. B — The standard maximum concrete temperature at the time of discharge is 90°F per ACI 305 hot weather concrete guidelines and most project specifications. Fresh concrete at 94°F must be rejected because the elevated temperature accelerates hydration, reduces working time, increases the risk of plastic shrinkage cracking, and may reduce long-term compressive strength. Adding retarder does not correct a temperature exceedance — it only delays set.

16. D — ACI 318 requires 1-1/2 inches minimum concrete cover for prestressing steel in precast concrete members exposed to weather. This is less than the 2-inch cover required for cast-in-place concrete exposed to weather because precast members are manufactured under controlled conditions with better quality control over cover dimensions. Prestressing strands are particularly sensitive to corrosion because strand failure is sudden and brittle.

17. C — Type V portland cement provides the highest sulfate resistance of all standard cement types and is specified when concrete will be placed in soils or groundwater containing high sulfate concentrations. Sulfate attack causes a chemical reaction that expands the hardened cement paste, causing cracking and deterioration. Freeze-thaw and chloride concerns require different protective measures — air entrainment and low w/c ratio — not Type V cement.

18. A — Correct internal vibrator technique requires vertical insertion at intervals not exceeding 1.5 times the vibrator's radius of action — the zone of influence around the vibrator — and penetration 6 inches into the previous lift to ensure inter-lift bonding. Angled insertion, horizontal movement, or corner-first insertion patterns create zones of inadequate consolidation and potential cold joint formation between lifts.

19. B — Mass concrete is classified by its potential for heat of hydration buildup — not by volume alone. Large concrete placements trap the heat generated by cement hydration, causing interior temperatures to rise while the surface cools rapidly. The resulting temperature differential between core and surface creates tensile stresses that cause thermal cracking, which can compromise long-term structural integrity and watertightness.

20. D — The standard Proctor test (ASTM D698) determines the maximum dry density and optimum moisture content of a soil by compacting samples at varying moisture levels. These values establish the target compaction standard for field density testing. Without Proctor test data, field compaction results cannot be expressed as a meaningful percentage and the specification requirement cannot be enforced.

21. C — Increased concrete cover reduces the probability of splitting failure along the bar — the mode that limits development length in most cases. ACI 318 development length equations include cover as a variable in the modification factor calculations, and greater cover directly reduces the required development length. This relationship reflects the physical reality that more concrete surrounding the bar provides more resistance against the splitting forces generated by bond stress.

22. A — Concrete typically achieves 65 to 70% of its specified 28-day compressive strength by 7 days when using Type I cement under normal curing conditions. A 7-day result of 2,800 psi represents exactly 70% of the 4,000 psi specified strength — indicating normal strength development that is on track to meet the 28-day requirement. Seven-day breaks are used for monitoring and early warning — not for ACI 318 acceptance decisions.

23. C — Plastic shrinkage cracking occurs while the concrete is still in the plastic state — before final set — when surface evaporation removes water from the fresh concrete surface faster than bleed water rising from below can replenish it. The resulting surface tension causes the surface to shrink and crack in a characteristic random diagonal pattern. Hot, windy, low-humidity conditions dramatically accelerate the evaporation rate and increase plastic shrinkage risk.

24. D — Elongation measurements that are consistently less than theoretical values by 12% indicate excess friction loss in the tendon duct — typically caused by kinking of the tendon during installation, obstruction in the duct, or a tendon that was not properly pushed through the sleeve. The post-tensioning engineer must investigate and authorize corrective action before stressing continues. Accepting deficient elongation leaves the slab under-prestressed and structurally inadequate.

25. C — Grade 60 reinforcing bars are identified by a single continuous line or the number "4" rolled between the deformation lugs on the bar surface. The line or number 4 represents the fourth grade designation in the ASTM system. Grade 40 bars have no additional marking between the deformations beyond the mill and bar size markings. Field verification of bar grade from the mill marking is essential before placing reinforcement.

26. A — ACI 347 requires horizontal concrete formwork to be designed for a minimum live load of 50 psf for workers, equipment, and materials. Where motorized concrete buggies are used, the minimum live load increases to 75 psf. These live loads are in addition to the dead load of the wet concrete. The 50-psf live load is a directly testable value that appears on contractor licensing exams.

27. B — Structural concrete beam designations express the cross-section as width × depth in inches. A "24×36" beam is 24 inches wide by 36 inches deep. The "8-#9 bottom bars" indicates eight number 9 deformed reinforcing bars placed in the tension zone at the bottom of the beam. This is the standard notation used on structural concrete drawings throughout the industry.

28. D — For 3/4-inch diameter A325 bolts with a grip length between 4 and 8 bolt diameters, AISC/RCSC specifications require one-half turn beyond snug-tight when the bolt and nut are both

turned (standard condition). The required additional turn varies with bolt diameter and grip length — shorter grip lengths require more turn to achieve the same elongation and therefore the same pretension force.

29. C — The SJI Specification requires a minimum bearing of 2-1/2 inches for K-series open-web steel joists on steel supports. On masonry or concrete supports, the minimum is 4 inches. These minimums ensure adequate load transfer from the joist chord to the supporting member and prevent the joist from slipping off the support under lateral displacement or construction loads.

30. A — Diagonal bridging at the ends of steel joist spans anchors the top chord lateral bracing lines to a fixed reference — typically the end wall or a beam — preventing the entire bracing system from racking laterally as a unit. Without end diagonal anchors, the top chord bridging lines can displace horizontally, dragging all connected joists with them and potentially causing collapse. SJI requires end diagonals to be installed before the crane releases each new joist.

31. B — HSS designations follow the format HSS (outside dimension) × (outside dimension) × (wall thickness) for square and rectangular sections. An HSS8×8×1/2 is a square hollow structural section with 8-inch outside dimensions on all four faces and a 1/2-inch wall thickness. HSS members are increasingly used for columns and bracing where the closed section provides efficient resistance to both axial loads and torsion.

32. D — OSHA Subpart R requires the controlling contractor to provide written notification to the steel erector that the concrete in footings, piers, and walls has achieved adequate strength to support the loads imposed during steel erection. This is a pre-erection requirement — the documentation must be in hand before the first piece of steel is set. The controlling contractor bears legal responsibility for this notification regardless of who performed the concrete work.

33. C — Moment frames resist lateral loads through the bending stiffness of beams and columns connected with rigid moment-resisting connections that transfer bending moments between members — the frame acts like a series of rigid portals that resist lateral displacement through flexural continuity. Braced frames use diagonal members in axial tension and compression to form triangulated panels that resist lateral loads much more efficiently. Each system has advantages in specific applications.

34. A — Mill certificates document the ASTM grade designation, yield strength, tensile strength, elongation, and chemical composition of the steel as produced at the mill. Verifying these against the structural specifications ensures the delivered steel meets the mechanical and chemical requirements of the design. Accepting steel without reviewing mill certificates risks incorporating non-conforming material into the structure that may not be detectable after fabrication and erection.

35. B — Composite deck manufacturers publish construction load tables that specify the maximum unshored span for each combination of deck gauge, rib height, and concrete slab thickness based on the wet concrete weight. Where the concrete placement loads exceed the unshored deck

capacity, temporary shoring must be installed before concrete placement begins. The manufacturer's tables — not a fixed rule about span length — determine where shoring is required.

36. D — Gusset plates are steel connection plates used at beam-column joints in braced frames to connect diagonal brace members to the structural frame. The gusset plate provides the geometry and connection area needed to distribute the brace force into the beam and column. Without gusset plates, diagonal brace members cannot be efficiently connected to frame members because their orientation typically does not align with standard bolted or welded connection details.

37. C — OSHA Subpart R permits multiple lift rigging when all members are rigged at their center of gravity, only competent riggers perform the rigging, rigging is sized for the combined load, and no more than five members are included per lift. The rigging must allow each member to be safely detached at the final position without disturbing the remaining suspended members. These conditions reduce the risk associated with handling multiple members simultaneously.

38. A — AISC tolerances for structural steel erection specify acceptable limits for plumb, level, and alignment of the completed frame before permanent connections are finalized. Plumbing and aligning within these tolerances ensures that columns are vertical, beams are at the correct elevation, and connections can be properly detailed. Finalizing permanent connections in an out-of-tolerance frame locks in misalignment that cannot be corrected afterward.

39. B — In joist girder designations, the letter "N" represents the number of joist spaces between the column supports of the girder. For example, 36G8N12K has 8 joist spaces. The number of joist spaces determines the number of concentrated load points along the girder and is essential for verifying that the girder capacity matches the panel point loading from the supported joists.

40. D — The clear distance between 2×6 studs spaced at 16 inches on center is calculated as 16 inches minus the actual stud width of 1-1/2 inches = 14-1/2 inches clear. This dimension determines the width of batt insulation required to fill the stud cavity — a standard R-19 or R-21 batt for a 2×6 cavity is manufactured at approximately 15 inches wide to compress slightly into the 14-1/2-inch opening.

41. C — The rim joist (also called band joist) is the vertical framing member running along the perimeter of the floor system perpendicular to the floor joists, enclosing the joist ends and providing the nailing surface for wall plates above. It transfers lateral loads from the wall sheathing into the floor diaphragm and resists the tendency of joist ends to roll outward under load. Rim joists are typically the same depth as the floor joists to maintain a continuous bearing surface.

42. D — BCSI requires that trusses stored on the job site be supported off the ground on blocking positioned at the panel point locations — the joints where web members connect to the chord — along the bottom chord. Panel points are the structural nodes where loads are transferred in the truss, and supporting the chord at these locations prevents the chord from bending between supports, which can damage the chord or connector plates during storage.

43. B — A double 2×10 header is the standard minimum for a 6-foot opening in a two-story load-bearing wood frame wall under IRC span tables, accounting for the cumulative dead and live loads from the roof and upper floor bearing on the wall above the opening. A double 2×8 may be marginal or insufficient for two-story loading conditions. Header sizing must match the tributary load area above — a two-story condition carries significantly more load than a single-story application.

44. D — OSB is manufactured from wood strands that are aligned at the face layers but exposed and relatively porous at the cut panel edges. These exposed strands absorb water much more readily than the resin-saturated faces, causing the edges to swell significantly when wetted. This edge swell creates ridges in floor and roof sheathing that telegraph through finish materials. Specifying edge-sealed OSB and maintaining expansion gaps minimizes this problem.

45. C — The 4:1 rule for extension ladder placement requires 1 foot of horizontal base setback for every 4 feet of vertical working height. This produces approximately a 75-degree angle between the ladder and the ground — the angle that provides the best combination of stability against slipping at the base and tipping backward at the top. Ladders set too steep tip backward; ladders set too flat slip at the base.

46. A — Collar ties connect pairs of opposing rafters at a point in the upper third of the rafter span, providing additional resistance to rafter spreading that would push the top plates of the bearing walls outward. They supplement the resistance provided by ceiling joists at the bottom of the rafter span. Without collar ties or ceiling joists, the outward thrust from roof loads pushes bearing walls outward and causes the ridge to sag.

47. B — IRC Section R403.1.6 requires sill plates to be anchored with bolts spaced at a maximum of 6 feet on center, with a bolt located within 12 inches of each plate end. This anchoring pattern resists the sliding and overturning forces transferred from the wall framing to the foundation during wind and seismic events. Insufficient anchor bolt spacing or missing end bolts creates failure points in the wall-to-foundation connection.

48. D — A Limited classification license authorizes projects up to $500,000 per individual project. When the scope modification increases the total contract value to $525,000, the project exceeds the license limitation and the contractor must obtain an Intermediate license before executing the modified contract. Proceeding under the original contract value does not exempt the contractor from the limitation — the final contract value governs.

49. C — Under North Carolina law, a pay-if-paid clause is enforceable only when it is expressed in clear, unambiguous contract language that explicitly states the contractor will only be paid if the owner pays and that this provision shifts the risk of non-payment to the subcontractor. Ambiguous or general language is typically construed as a pay-when-paid clause — a timing mechanism only — rather than a risk-shifting provision. Clear and unambiguous language is the essential legal requirement.

50. B — A mechanics' lien creates a security interest in the real property itself — it attaches to the land and improvements and must be satisfied before the property can be sold or refinanced with a clear title. A payment bond claim is made against the surety's financial guarantee — a contractual obligation of the bonding company rather than an interest in the property. Understanding which remedy targets what asset is fundamental to selecting the correct collection strategy.

51. B — The three Cs of surety bonding are Character (the contractor's reputation for honest dealing and professional conduct), Capacity (the operational and management ability to perform the bonded work), and Capital (the financial strength demonstrated by working capital, net worth, and financial statement quality). All three must be satisfactory — strong finances alone do not overcome poor character or inadequate project management capacity.

52. D — NC General Statutes Section 87-13 prohibits unlicensed contractors from recovering compensation for work performed without the required license, and allows civil penalties to be assessed. Courts have consistently refused to allow unlicensed contractors to recover payment — even for work actually performed and accepted — because allowing recovery would undermine the licensing requirement. This consequence makes operating without a license extremely financially risky.

53. A — A surety company must be listed on the US Treasury Department's Circular 570 (the list of approved sureties) and must be admitted to do business in North Carolina to issue bonds on NC public projects. An unapproved or non-admitted surety's bonds may be rejected by the public owner, leaving the contractor without a valid bid bond and potentially disqualified from the project. Premium rate and location are secondary considerations.

54. B — The NC Building Contractor license classification specifically covers building construction activity — not highway construction. Highway paving, bridge work, and roadway improvements require a separate Highway Contractor license under the NCLBGC classification system. A Building Contractor who performs highway work is operating outside their licensed classification, which constitutes unlicensed contracting for that scope and subjects the license to disciplinary action.

55. B — Perforated pipe in a French drain should be installed with perforations facing down and to the sides — not straight down to the invert — to collect water that has percolated through the surrounding gravel. Water entering the trench from the soil rises upward through the gravel until it reaches the pipe perforations. Perforations facing straight up collect only water falling from above rather than groundwater rising from the soil below the pipe.

56. C — OSHA Subpart P requires that a competent person inspect excavations at the start of each work shift, after any rainstorm or other event that could affect stability, and as needed throughout the day when conditions change. Inspections must occur before workers enter and after any potentially destabilizing event regardless of how recently the last inspection was performed. Daily-only inspection schedules leave workers unprotected after events that could create cave-in hazards.

57. C — Type C soil requires a slope of 1-1/2 horizontal to 1 vertical (1.5:1). For a 12-foot deep excavation, the horizontal setback at the top of each wall = 12 × 1.5 = 18 feet. This means the total width of the excavation at the surface is the trench bottom width plus 18 feet on each side — requiring significant area around the excavation to be kept clear of spoil piles, equipment, and structures.

58. A — H-clips (panel edge clips) serve two functions at unsupported roof sheathing panel edges: they provide lateral edge support that prevents the panel edge from deflecting under load, and they maintain the required 1/8-inch expansion gap between adjacent panels. Without edge support at unsupported panel edges, the panels can deflect differentially under load, creating ridges in the roof surface that telegraph through the roofing material.

59. B — A diversion swale or diversion berm installed at the upslope boundary of the disturbed area intercepts water flowing from the undisturbed area before it enters and picks up velocity across the exposed construction site. Without this upslope diversion, clean water from the undisturbed area flows across the site, picks up sediment, and exits with a much higher sediment load than necessary. Diverting clean water away from the disturbed area is a fundamental principle of effective erosion control.

60. B — OSHA Subpart P requires workers to be removed from an excavation immediately when any condition arises that exposes them to danger, including evidence of potential cave-in, indications of failure, hazardous atmospheres, accumulation of water, or other unsafe conditions. This broad standard gives the competent person authority and obligation to remove workers whenever they observe any condition that could endanger them — not just when specific predetermined thresholds are met.

61. C — ACI 530 requires a minimum of 5/8-inch cover from the masonry face to the outermost wire of horizontal joint reinforcement. This cover requirement protects the steel wire from corrosion, particularly in exterior masonry exposed to weather. Insufficient cover allows moisture to reach the wire, initiating corrosion that expands and cracks the mortar joint, eventually causing the joint reinforcement to lose its structural function.

62. A — ASTM C216 Grade SW (Severe Weathering) brick is required for applications subject to severe weathering including below-grade installation, horizontal surfaces where water accumulates (copings, steps, sills), and any application in contact with the earth. Grade MW (Moderate Weathering) is appropriate for above-grade exterior use in moderate climate conditions. North Carolina's rainfall and freeze-thaw cycles make Grade SW the appropriate specification for most exterior horizontal and below-grade brick applications.

63. B — Horizontal cracks running through mortar bed joints at regular vertical intervals in a masonry wall typically indicate differential settlement — the foundation is deflecting unevenly, causing the wall to bend. The mortar joints — being weaker than the masonry units — crack in tension on the side of the wall that is being stretched. Identifying the crack pattern helps diagnose the cause:

horizontal bed joint cracks suggest bending from settlement; diagonal cracks from corners of openings suggest different causes.

64. D — ACI 530 limits the height-to-thickness ratio of empirically designed load-bearing masonry walls to 18:1. For a 12-foot (144-inch) unsupported height: minimum thickness = 144 ÷ 18 = 8 inches nominal. An 8-inch nominal CMU wall (actual 7-5/8 inches) is the minimum acceptable thickness. Using a 6-inch wall would violate the 18:1 limit, and using a 10-inch wall would be conservative but unnecessarily expensive.

65. C — Mortar that has begun to set — not merely stiffened from evaporation — must be discarded and never used for masonry construction. Initial hydration reactions that have begun cannot be reversed by adding water; retempering set mortar produces a material with dramatically reduced compressive strength and bond strength compared to fresh mortar. The two-hour working time applies to mortar stiffened by evaporation only — set mortar has crossed a chemical threshold that cannot be undone.

66. A — A control joint that does not allow vertical movement prevents the CMU wall from accommodating drying shrinkage at the intended location. When shrinkage occurs in a wall with non-functional control joints, the wall cracks at the path of least resistance — random locations throughout the panel where the wall is weakest — rather than at the intended controlled location. The entire purpose of the control joint is defeated when it cannot move.

67. B — When re-roofing over an existing BUR system, the structural framing must be evaluated to confirm it can support the new roofing system loads without the old BUR contributing to the structural dead load. The old BUR has already consumed structural capacity — the new system must be treated as pure additional dead load on the existing frame. Failing to verify this can result in overstressed framing members and potential structural failure.

68. D — The NC Building Code requires drip edge to be installed at the rake edges over the underlayment — meaning the underlayment is applied first and the rake drip edge is lapped over it. This is the opposite of the eave condition, where the drip edge goes under the underlayment. The reason for the difference: at the rake, wind-driven rain can be forced up under the roofing, so the drip edge must cover the underlayment edge to prevent this infiltration path.

69. C — For roofs with slopes between 2:12 and 4:12, the NC Building Code requires double underlayment — either two layers of No. 15 felt with the first layer offset 19 inches from the eave and each successive layer lapping 19 inches, or a single layer of self-adhering modified bitumen membrane applied as the underlayment. This enhanced underlayment compensates for the reduced drainage efficiency at lower slopes where water moves more slowly across the shingle surface.

70. A — The fire classification system (Class A, B, or C) for roofing assemblies is tested per ASTM E108 and measures resistance to external fire exposure including flame spread, burning brand penetration, and intermittent flame tests. Class A provides the highest resistance to severe fire exposure; Class C provides the minimum acceptable resistance to light fire exposure. This

classification is required by the IBC for roofing materials and assemblies based on occupancy and construction type.

71. B — Blisters in fully adhered EPDM membrane roofing are caused by moisture or air trapped between the membrane and the insulation substrate at the time of installation. When the trapped moisture or air expands under solar heating, it pushes the membrane upward creating a blister. Blisters indicate an adhesive bond failure at that location and, if large enough, can allow water to track underneath the membrane to leak points distant from the visible blister.

72. D — Most standing seam metal roof manufacturers specify a minimum slope of 1/4:12 (1/4 inch of rise per foot of run) for concealed clip standing seam systems. This extremely low minimum slope is possible because the raised seams keep water away from the panel attachment points and the panels can be manufactured to very tight tolerances that prevent water from penetrating the seams under normal conditions. This low-slope capability makes standing seam suitable for nearly all commercial roof applications.

73. B — A subsurface lateral drainage system beneath the turf root zone removes excess soil moisture from the root zone more rapidly than surface drainage alone, reducing the period during which the soil is saturated after heavy rainfall. Saturated soil loses shear strength and becomes susceptible to compaction and surface damage from athletic use. By removing water from the root zone depth, the lateral drainage system allows the field to return to playable conditions significantly faster after major rainfall events.

74. A — A standard American football field is 360 feet long (100 yards of playing field plus two 10-yard end zones) by 160 feet wide (53.33 yards). These dimensions are established by the NFL and adopted by high school and college football governing bodies. Knowledge of standard sports field dimensions is required for accurate field construction planning, material estimation, and layout verification.

75. B — Tilt-up panels are extremely heavy — commonly 50,000 to 150,000 pounds each — and are temporarily braced with steel brace assemblies after being raised to vertical. The temporary braces are the only thing preventing the panels from falling during the bracing period, which can last weeks while the structural frame is completed. Premature removal of any brace before permanent connections are complete and the structure is self-supporting can cause catastrophic panel collapse.

76. A — ANSI A117.1 requires standard accessible parking spaces to be a minimum of 8 feet wide with a 5-foot access aisle on one side, for a total of 13 feet combined. The access aisle allows wheelchair users to deploy their ramp or lift and transfer to and from the vehicle. Van accessible spaces require either 11 feet of space width (with a standard 5-foot aisle) or an 8-foot space with an 8-foot access aisle — totaling 16 feet either way.

77. C — OSHA 1926.1408 requires a minimum clearance of 10 feet from energized overhead power lines rated up to 50 kV for cranes, equipment, and workers. For lines rated above 50 kV, the minimum clearance increases proportionally with voltage. The 10-foot minimum applies

regardless of whether the work is intentionally near the lines or whether the proximity is incidental to other operations. Electrocution from contact with energized overhead lines is one of the leading causes of construction fatalities.

78. A — Restricted work activity is one of the specific outcomes that makes an injury recordable under OSHA's recordkeeping criteria. Recordable outcomes include: death, days away from work, restricted work or job transfer, medical treatment beyond first aid, loss of consciousness, and diagnosis of a significant injury by a healthcare professional. Restricted duty — even with no days away — is explicitly recordable regardless of its duration.

79. D — Section 8 of the OSHA Hazard Communication Standard SDS format covers Exposure Controls and Personal Protection, specifying engineering controls, administrative controls, and the specific PPE required for safe handling of the chemical including respiratory protection, gloves, eye protection, and skin protection requirements. Section 2 covers hazard identification; Section 4 covers first aid; Section 9 covers physical properties.

80. B — OSHA recordkeeping regulations require all employers with more than 10 employees in most industries to maintain OSHA injury records and post the Form 300A summary from February 1 through April 30 each year, regardless of whether any recordable cases occurred during the prior year. An employer with 15 employees falls above the 10-employee threshold and must post Form 300A even with zero injuries. The posting obligation is independent of injury count.

81. C — The main runners of a suspended acoustic ceiling grid should be installed perpendicular to the structural framing members above so that the hanger wires can be connected to multiple different framing members, distributing the ceiling load across the structure. Installing main runners parallel to the framing would concentrate hanger loads on fewer structural members and could result in inadequate support where hanger locations don't coincide with framing.

82. A — Closed-cell SPF applied to the underside of roof sheathing in an unvented attic creates a hot roof assembly — the insulation is at the roof deck level, making the attic space part of the conditioned building envelope. The thermal control layer is at the roof, rather than at the attic floor as in a conventional vented attic. This configuration requires no attic ventilation because the attic space is within the conditioned envelope and the sheathing is kept above the dew point by the insulation.

83. B — The correct thin-set application technique uses a notched trowel combed in a single consistent direction to create ridges of mortar on the substrate. When the tile is set and pressed into the mortar, the ridges collapse and flow together under pressure, achieving uniform coverage across the tile back surface. Random trowel directions create crossed ridge patterns that trap air pockets beneath the tile, resulting in hollow spots and eventual bond failure.

84. A — Even when utility marks are placed at an incorrect location, the excavator retains a duty of care to verify that marks correspond to the planned excavation area and to resolve discrepancies before digging. An excavator who proceeds without verifying the mark locations bears liability for

the consequences. The correct action when marks appear inconsistent with the dig area is to contact the utility operator and NC 811 for clarification before beginning excavation.

85. D — There are no exemptions from NC 811 notification requirements. All excavation in North Carolina — regardless of depth, project size, location, or excavator credentials — requires prior notification to NC 811. Even hand-digging at minimal depth, agricultural tilling, and geotechnical exploration require notification. The no-exceptions nature of this requirement is one of its most important features and is directly tested on the exam.

86. A — Required post-rainfall inspections of erosion control BMPs are a mandatory compliance obligation under the NC SPCA and 15A NCAC 04 regulations — not optional maintenance. The contractor's duty is to inspect after every rainfall event that produces runoff and repair any deficiencies promptly. Failing to inspect is a violation even if the installation was initially correct, because the purpose of required inspections is to catch storm-related damage before the next rainfall event carries sediment off the site.

87. B — The NC SPCA imposes regulatory responsibility on the person or persons conducting the land-disturbing activity. The general contractor, as the entity responsible for overall site operations, cannot eliminate their regulatory liability by contractually delegating erosion control responsibilities to a subcontractor. Both the GC and the subcontractor may be cited and penalized. The contractual delegation may create a right to indemnification from the subcontractor, but it does not eliminate the GC's direct regulatory obligation.

88. D — The NASCLA Accredited Examination for Commercial General Building Contractors is accepted by the NCLBGC as a substitute for the NC Building Contractor trades examination only. Candidates who pass the NASCLA exam must still pass the NC Business and Law exam to obtain a NC general contractors license. The NASCLA exam's portability advantage is that it is also accepted in 16+ other states, providing license mobility beyond North Carolina.

89. C — NC General Statutes Section 87-13 establishes that a contractor who performs general contracting work without the required license may be prohibited from recovering compensation for the work performed in any legal action, and may be subject to civil penalties. This consequence applies regardless of the quality of the work or the owner's willingness to pay — the courts refuse to enforce payment obligations for unlicensed work as a matter of public policy.

90. B — The lien is extinguished and becomes completely unenforceable when the 180-day enforcement lawsuit deadline is missed, regardless of how valid the underlying unpaid claim is. Filing the Claim of Lien on Real Property within 120 days preserves the lien on the title but does not self-enforce — the lawsuit is the mechanism that converts the filed lien into a judgment. Missing the lawsuit deadline is one of the most consequential procedural failures in NC construction law.