BUILDING CONTRACTOR SIMULATION EXAM 2

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 wall section drawing is prepared at a scale of 3/4 inch = 1 foot. A window head detail within the section measures 1-1/8 inches on the drawing. What is the actual height of the window head condition being depicted?

A. 1 foot 3 inches

B. 1 foot 0 inches

C. 1 foot 6 inches

D. 2 feet 0 inches

2. On an architectural floor plan, a symbol consisting of a circle with a letter inside and an arrow pointing to a wall face indicates which of the following?

A. A detail callout referencing a larger-scale drawing of that wall condition

B. A section cut showing the direction of view through the wall assembly

C. A column grid bubble identifying the structural grid line designation

D. An interior elevation tag referencing a drawing of that wall's interior face

3. A contractor is calculating the volume of concrete for a rectangular column that is 18 inches square and 14 feet tall. How many cubic yards of concrete are required for one column before applying a waste factor?

A. 0.875 cubic yards

B. 1.17 cubic yards

C. 1.44 cubic yards

D. 0.583 cubic yards

4. When performing a quantity takeoff for painted drywall surfaces, the contractor measures all wall surfaces in a room that is 24 feet long, 18 feet wide, and 10 feet tall with two door openings each 3 feet wide by 8 feet tall. What is the net wall area after deducting the door openings?

A. 792 square feet net wall area

B. 732 square feet net wall area

C. 756 square feet net wall area

D. 840 square feet net wall area

5. A contractor reviews a set of construction documents and finds that the project specifications state the brick shall be Grade SW, while the material schedule on the drawings lists Grade MW. Which of the following is the correct resolution?

A. Use Grade MW because the drawings are the most current document in the set

B. Use whichever grade is less expensive because both grades meet minimum code

C. The specifications govern over the drawings — use Grade SW and issue an RFI to confirm

D. Request a substitution approval to use Grade NW as a compromise between the two

6. Under the IBC, which construction type permits combustible structural framing but requires the exterior bearing walls to have a 2-hour fire-resistance rating?

A. Type IIB — non-combustible with no required ratings on structural elements

B. Type VA — combustible construction with 1-hour ratings throughout

C. Type IIA — non-combustible with 1-hour ratings on most structural elements

D. Type IIIB — combustible framing with 2-hour exterior bearing wall rating

7. A contractor is estimating labor cost for forming and pouring a concrete foundation wall. The wall is 120 linear feet long, 8 feet tall, and 10 inches thick. The labor productivity rate is 1.5 hours per square foot of contact area for forming, and the fully burdened labor rate is $48 per hour. What is the total forming labor cost for one side of the wall?

A. $69,120

B. $34,560

C. $82,944

D. $51,840

8. On a structural drawing, a beam designation reading "W16×57 A992" specifies which of the following?

A. A wide flange shape 16 feet long weighing 57 pounds total made from A992 steel

B. A wide flange shape with 57-inch depth and 16-inch flange width per A992

C. A wide flange shape with approximately 16-inch depth weighing 57 lb/ft per A992

D. A wide flange shape with 16 square inch area and 57 ksi yield strength per A992

9. A floor plan shows a stairway with an arrow pointing upward labeled "UP 14R." What information does this notation convey?

A. The stairway rises 14 inches total to reach the upper landing level

B. The stairway has 14 risers between the current floor and the floor above

C. The stairway is 14 feet wide and rises to a level 14 feet above the current floor

D. The stairway has 14 treads and must be constructed with a maximum 14-inch run

10. Under the IBC, the minimum distance between two required exit stairways serving the same floor must be at least what fraction of the building's maximum floor diagonal?

A. One-quarter of the maximum overall diagonal of the floor area served

B. One-third of the maximum overall diagonal of the floor area served

C. Three-quarters of the maximum overall diagonal of the floor area served

D. One-half of the maximum overall diagonal of the floor area served

11. A contractor is preparing a bid for a commercial project with total direct costs of $1,750,000. Company overhead is calculated at 12% of direct costs, and the desired profit margin is 10% applied to the total of direct costs plus overhead. What is the correct bid price?

A. $2,156,000

B. $2,030,000

C. $1,960,000

D. $2,310,000

12. Which of the following is the correct description of the exit access component of the means of egress system?

A. The fire-rated stairway enclosure between floors including all landings and treads

B. The exterior path from the building exit door to the public street or way

C. The portion of the egress path from any occupied point to an exit including corridors and aisles

D. The rated horizontal exit that allows occupants to move between adjacent fire areas

13. A roofing contractor is estimating shingles for a 40×65-foot building with a gable roof at an 8:12 slope. The rafter length factor for 8:12 is 1.202, and a 12% waste factor applies due to the complexity of the roof. How many squares of shingles are required?

A. 35.2 squares

B. 43.0 squares

C. 38.7 squares

D. 40.5 squares

14. A detail callout on a floor plan shows the number "7" over the number "A-6" separated by a horizontal line within a circle. What does this symbol communicate?

A. Detail 7 is drawn on sheet A-6 of the architectural drawing set

B. Section cut 7 runs along grid line A with 6 inches of bearing each side

C. The wall assembly at this location has 7 layers and is shown on sheet A-6

D. Detail 7 was revised 6 times and is on sheet A of the architectural set

CONCRETE — 13 Questions

15. A contractor receives a delivery of ready-mix concrete and checks the batch ticket. The ticket shows the concrete was batched 105 minutes ago and has had 310 drum revolutions. Under ASTM C94, which of the following applies?

A. The load meets ASTM C94 because neither limit has been individually exceeded

B. The load must be tested for slump before a placement decision is made

C. The load must be rejected because both the time and revolution limits have been exceeded

D. The load may be accepted if a retarding admixture is added at the job site

16. In the percentage-of-completion method of accounting used in construction, revenue on a long-term contract is recognized based on which of the following?

A. The proportion of work completed during the period relative to the total contract scope

B. The amount of cash actually received from the owner during the accounting period

C. The total contract value divided equally across each month of the project schedule

D. The costs incurred during the period relative to the total estimated project cost only

17. Under ACI 318, the minimum concrete cover for reinforcing bars in a cast-in-place concrete beam that is not exposed to weather and is located in a conditioned interior space is which of the following?

A. 3/4 inch minimum clear cover for primary beam reinforcement

B. 2 inches minimum clear cover for primary beam reinforcement

C. 2-1/2 inches minimum clear cover for primary beam reinforcement

D. 1-1/2 inches minimum clear cover for primary beam reinforcement

18. Which type of concrete admixture slows the rate of cement hydration and is most useful when concrete must be transported over long distances or placed during hot weather conditions?

A. Accelerating admixture — speeds hydration for cold weather concrete placement

B. Retarding admixture — slows hydration to extend working time in hot or long-haul situations

C. Superplasticizer — reduces water demand while maintaining workability in hot conditions

D. Air-entraining admixture — protects against heat-induced freeze-thaw surface damage

19. The standard slump test for fresh concrete is performed using a metal mold of which of the following dimensions?

A. 10 inches tall, 3-inch top diameter, and 6-inch base diameter

B. 8 inches tall, 4-inch top diameter, and 8-inch base diameter

C. 12 inches tall, 4-inch top diameter, and 8-inch base diameter

D. 14 inches tall, 5-inch top diameter, and 10-inch base diameter

20. Which of the following correctly describes the ACI 318 acceptance criterion for concrete compressive strength based on consecutive test results?

A. Every average of any three consecutive strength tests must equal or exceed f'c, and no individual test may fall below f'c by more than 500 psi when f'c is 5,000 psi or less

B. Every individual strength test must meet or exceed f'c with no exceptions permitted

C. The average of all tests on the project must equal or exceed f'c at project completion

D. Any three test results averaging 90% of f'c are acceptable if the mix design is verified

21. Calcium chloride is specifically prohibited as an accelerating admixture in concrete containing reinforcing steel because of which of the following chemical effects?

A. Calcium chloride reduces the air content of entrained air concrete below specified limits

B. Calcium chloride causes rapid slump loss that prevents proper consolidation of the concrete

C. Calcium chloride increases the heat of hydration to levels that cause thermal cracking

D. Calcium chloride introduces chloride ions that accelerate corrosion of the reinforcing steel

22. A concrete mix design specifies 6% air content for concrete exposed to freezing and thawing. A field air content test returns a result of 3.5%. Which of the following is the most appropriate action?

A. Accept the result because the concrete still has some air entrainment protection

B. Reject the load and require a replacement delivery with the specified air content

C. Add more air-entraining admixture at the job site and remix the drum before placing

D. Place the concrete in interior locations only where freeze-thaw exposure does not apply

23. Under ACI 347, the minimum time before props (shores) supporting beam soffits may be removed for spans exceeding 10 feet under normal curing conditions is which of the following?

A. 14 days minimum before props supporting beam soffits over 10-foot spans may be removed

B. 7 days minimum before props supporting beam soffits over 10-foot spans may be removed

C. 21 days minimum before props supporting beam soffits over 10-foot spans may be removed

D. 28 days minimum before props supporting beam soffits over 10-foot spans may be removed

24. A reinforcing bar designated #6 has a nominal diameter of which of the following dimensions?

A. 3/4 inch nominal diameter

B. 5/8 inch nominal diameter

C. 7/8 inch nominal diameter

D. 1/2 inch nominal diameter

25. In post-tensioned concrete floor construction, what is the term for the document prepared by the post-tensioning engineer that shows the tendon profile, spacing, stressing sequence, and required elongation for each tendon?

A. The structural calculation package submitted to the engineer of record

B. The concrete mix design submittal prepared by the ready-mix supplier

C. The special inspection report prepared by the testing laboratory

D. The post-tensioning shop drawings prepared by the PT subcontractor

26. When concrete is placed using a pump, which of the following mix design adjustments is typically required compared to a conventionally placed mix?

A. Reducing the cement content to lower the heat of hydration during pumping

B. Increasing the slump to 4 to 7 inches using superplasticizer to improve pumpability

C. Eliminating coarse aggregate to prevent pipe blockage during pumping operations

D. Reducing the water content below the specified w/c ratio to prevent segregation

27. Concrete that has been in transit for 85 minutes and has received 280 drum revolutions arrives at a job site. The specified concrete temperature maximum is 90°F and the batch ticket shows 88°F. Under ASTM C94, which of the following applies?

A. The load must be rejected because the 85-minute limit is within 5 minutes of the maximum

B. The load fails on revolution count because 280 exceeds the 250-revolution limit

C. The load meets ASTM C94 requirements on both time and revolutions and may be placed

D. The load must be retested for slump and temperature before a placement decision

METALS — 12 Questions

28. An S-shape (American Standard Beam) differs from a W-shape (wide flange) in which of the following structural characteristics?

A. S-shapes have parallel flanges while W-shapes have sloped inner flange surfaces

B. S-shapes are manufactured from higher-strength steel grades than W-shapes

C. S-shapes are available only in depths greater than 24 inches for structural applications

D. S-shapes have narrower, sloped inner flange surfaces compared to the wider parallel flanges of W-shapes

29. Which of the following bolt tightening methods uses a proprietary bolt with a splined shank extension designed to shear off when the minimum required pretension is achieved?

A. Twist-off type tension control bolt method (TC bolt)

B. Turn-of-nut method using a half-turn from snug-tight condition

C. Calibrated wrench method using a tension-indicating torque wrench

D. Direct tension indicator method using compressible protrusion washers

30. Under OSHA Subpart R, safety nets used during steel erection must be installed no more than how far below the working level?

A. 15 feet below the working level where erection is occurring

B. 30 feet below the working level where erection is occurring

C. 20 feet below the working level where erection is occurring

D. 45 feet below the working level where erection is occurring

31. Steel joist bridging must be installed and anchored before which of the following construction loads are applied to the joists?

A. Only the weight of the permanent metal roof deck panels

B. Only the weight of concrete placed on composite floor deck

C. Any construction loads beyond the self-weight of the joists themselves

D. Only loads applied by workers or equipment heavier than 250 pounds

32. The ASTM A36 steel specification governs which of the following structural steel products with a minimum yield strength of 36 ksi?

A. Wide flange beams and columns for most structural steel building frames

B. High-strength bolts used in pretensioned structural steel connections

C. Hollow structural sections — square and rectangular tubing members

D. Plates, angles, channels, and miscellaneous shapes used in connections

33. Under OSHA Subpart R, the controlling contractor must provide the steel erector with written notification confirming site conditions before erection begins. This notification must include confirmation of which of the following?

A. That the concrete in footings has achieved adequate strength to support erection loads

B. That the structural drawings have been approved by the local building department

C. That the steel fabricator has certified all members for dimensional compliance

D. That the site has been cleared of all underground utilities within the erection footprint

34. Which of the following descriptions correctly characterizes a Complete Joint Penetration (CJP) groove weld in structural steel construction?

A. A weld deposited in the corner between two members meeting at approximately 90 degrees

B. A weld that extends through the full thickness of the base metal achieving complete fusion

C. A weld that penetrates 60% of the base metal thickness for high-stress connections

D. A weld applied to both sides of a joint to provide double the capacity of a one-sided weld

35. The minimum bearing length for steel deck panels on masonry or concrete supports per SDI installation requirements is which of the following?

A. 1-1/2 inches minimum bearing on masonry or concrete supports

B. 2 inches minimum bearing on masonry or concrete supports

C. 3 inches minimum bearing on masonry or concrete supports

D. 4 inches minimum bearing on masonry or concrete supports

36. A structural steel moment frame resists lateral loads primarily through which of the following mechanisms?

A. Bending stiffness of the beams and columns transferred through rigid beam-to-column connections

B. Axial compression in diagonal bracing members forming triangulated panels in the frame

C. Shear walls constructed of structural steel panels bracing the perimeter of the frame

D. Post-tensioned connections that provide friction resistance against lateral displacement

37. Under AWS D1.1, ultrasonic testing (UT) is specifically required for which of the following weld types in primary structural members?

A. All fillet welds at column base plate connections regardless of size or location

B. All partial joint penetration groove welds in secondary structural members

C. All fillet welds connecting steel deck to supporting beam flanges

D. Complete joint penetration groove welds in primary structural members and seismic applications

38. Steel column base plates are set to the correct elevation and leveled using which of the following methods before the column is placed?

A. Placing a layer of sand-cement mortar under the plate before column erection

B. Using leveling nuts on the anchor rods or steel shim stacks under the plate

C. Shimming with wood wedges that are removed after the grout has cured

D. Pre-casting the base plate into the concrete foundation at the exact elevation

39. A K-series open-web steel joist designation of 24K9 indicates which of the following?

A. The joist is 24 feet long with a 9-inch chord depth and standard K-series web

B. The joist is 24 inches deep, is a K-series joist, and has a chord designation of 9

C. The joist is 9 inches deep with 24-kip load capacity in the K-series classification

D. The joist spans 24 feet with 9 spaces between panel points along the chord

CARPENTRY — 7 Questions

40. The minimum required extension of an extension ladder above the upper landing surface that it provides access to is which of the following?

A. 3 feet above the upper landing surface to allow safe hand-over-hand transfer

B. 2 feet above the upper landing surface for light-duty residential applications

C. 4 feet above the upper landing surface for commercial construction use

D. 18 inches above the upper landing surface as the OSHA minimum requirement

41. In conventional roof framing, which member spans diagonally from the building corner to the ridge, creating the sloped edge of a hip roof?

A. A common rafter spanning from the top plate to the ridge board

B. A valley rafter spanning from an internal corner to the ridge board

C. A collar tie connecting opposing rafters in the upper third of the rafter span

D. A hip rafter spanning from the corner of the building to the ridge board

42. Engineered lumber product Parallel Strand Lumber (PSL) is manufactured using which of the following processes?

A. Thin wood veneers bonded together with grains oriented parallel to the member length

B. Long strands of wood fiber bonded with adhesive under heat and pressure

C. Short wood strands bonded with alternating grain directions for dimensional stability

D. Thin lumber laminations bonded horizontally with waterproof structural adhesive

43. The minimum clear spacing between parallel reinforcing bars in the same layer under ACI 318 must not be less than which of the following — whichever is greatest?

A. The bar diameter, 3/4 inch, or the maximum aggregate size

B. The bar diameter, 1 inch, or 4/3 times the maximum aggregate size

C. 1-1/2 times the bar diameter, 1-1/2 inches, or the aggregate size

D. 2 times the bar diameter, 2 inches, or twice the maximum aggregate size

44. Which of the following describes the correct installation method for structural wood panel sheathing used as a floor diaphragm or subfloor to maximize load distribution and minimize squeaking?

A. Panels installed perpendicular to joists with staggered end joints, 1/8-inch gaps at edges, and construction adhesive applied to joist tops

B. Panels installed parallel to joists with butt joints centered on joist tops and nailed at 6 inches on center throughout

C. Panels installed in any direction with all joints landing on framing and screws used in place of nails for holding power

D. Panels installed with the long dimension parallel to the joists and H-clips at all unsupported edges

45. A door frame installed out of plumb in a wood-framed wall will most likely result in which of the following field problems during the service life of the door?

A. The door will swell and bind in the frame during periods of high humidity

B. The door strike plate will be misaligned preventing proper latching of the door

C. The door hinge leaves will pull away from the jamb under normal door use

D. The door will swing open or closed on its own due to the out-of-plumb frame

46. The IRC requires pressure-treated lumber for sill plates in contact with concrete foundations for which of the following reasons?

A. Pressure-treated lumber is stronger than standard lumber and can carry higher bearing loads

B. Pressure-treated lumber is dimensionally stable and does not shrink when in contact with concrete

C. Pressure-treated lumber resists moisture and decay when in contact with concrete or masonry

D. Pressure-treated lumber has higher nail withdrawal resistance than untreated sill plate lumber

47. Under BCSI guidelines, the minimum number of pick points required for lifting a wood truss horizontally that spans up to 30 feet is which of the following?

A. A single pick point at the ridge is acceptable for spans up to 30 feet

B. Two pick points at the quarter points of the truss top chord length

C. Three pick points — one at the ridge and one at each bottom chord end

D. Four pick points — two at the top chord and two at the bottom chord

BUSINESS AND LAW — 7 Questions

48. A general contractor on a public school project receives payment from the school district for a subcontractor's completed mechanical work. Under the NC Prompt Pay Act, the general contractor must pay the mechanical subcontractor within which of the following timeframes?

A. Seven days of receiving the owner payment for the subcontractor's work

B. Fourteen days of receiving the owner payment for the subcontractor's work

C. Twenty-one days of receiving the owner payment for the subcontractor's work

D. Thirty days of receiving the owner payment for the subcontractor's work

49. A subcontractor who last furnished labor to a private construction project on March 15 must file a Claim of Lien on Real Property with the clerk of superior court by which of the following deadlines?

A. June 1 — 78 days after the last date labor was furnished to the project

B. May 1 — 47 days after the last date labor was furnished to the project

C. June 30 — 107 days after the last date labor was furnished to the project

D. July 13 — 120 days after the last date labor was furnished to the project

50. Which of the following business structures provides its owners with limited liability protection while allowing income and losses to pass directly through to the owners' personal tax returns without entity-level taxation?

A. C corporation — provides liability protection with double taxation at entity and owner level

B. General partnership — income passes through but all partners have unlimited personal liability

C. Limited liability company (LLC) — combines liability protection with pass-through taxation

D. Sole proprietorship — simplest structure with pass-through taxation but unlimited liability

51. A licensed general contractor in North Carolina may advertise for and perform work under which of the following conditions?

A. Only for project types and classification scopes covered by the license held

B. For any type of construction work as long as licensed subcontractors perform specialty trades

C. For work in any classification as long as the work value stays below $500,000 per project

D. For work in any state that recognizes North Carolina's licensing through reciprocity

52. Under the NC General Statutes, a payment bond on a public construction project governed by the NC Little Miller Act must equal what percentage of the contract price?

A. 100% of the contract price for both the performance and payment bonds

B. 50% of the contract price for the payment bond and 100% for performance

C. 75% of the contract price for both bonds on contracts over $1 million

D. 25% of the contract price as the minimum statutory bond amount

53. Which of the following contract types places the greatest cost risk on the owner rather than the contractor because the contractor is reimbursed for all allowable costs plus a fee?

A. Stipulated sum (lump sum) contract with a fixed total contract price

B. Unit price contract with quantities measured in the field after completion

C. GMP contract with a ceiling on total cost and contractor bears overages

D. Cost plus contract where the owner pays all direct project costs plus fee

54. A subcontractor files a Notice of Claim of Lien on Funds on the general contractor for $45,000 in unpaid work. The general contractor subsequently receives a $200,000 payment from the owner. Under NC lien law, what is the general contractor's legal obligation?

A. Pay the subcontractor from the next scheduled monthly draw from the owner

B. Notify the subcontractor within 3 days and schedule payment within 30 days

C. Withhold at least $45,000 from the owner payment to cover the subcontractor's claim

D. Continue normal payment procedures because the claim has not been verified by a court

SITE WORK — 6 Questions

55. A contractor needs to place an egress ladder in an excavation that is 9 feet deep and 50 feet long. Under OSHA Subpart P, how many ladders or other egress means are required minimum?

A. One ladder is sufficient for an excavation of this depth and length

B. Two ladders are required because no worker may be more than 25 lateral feet from egress

C. Three ladders — one at each end and one at the midpoint of the excavation

D. Four ladders — one for every 12 linear feet of excavation depth

56. Fill material placed beneath a building foundation must be compacted in lifts to a minimum of what compaction percentage under standard structural fill specifications?

A. 95% of maximum dry density as determined by the standard Proctor test

B. 90% of maximum dry density as determined by the standard Proctor test

C. 85% of maximum dry density as determined by the modified Proctor test

D. 98% of maximum dry density as determined by the modified Proctor test

57. A project site slopes toward a stream located 200 feet downhill from the construction area. Before grading begins, which of the following erosion control BMPs must be installed first along the downslope perimeter?

A. Seeding and mulching all disturbed areas to establish temporary vegetation

B. Installing check dams in the drainage swale between the site and the stream

C. Constructing a sediment basin at the lowest point of the construction site

D. Installing silt fence along the entire downslope perimeter of the disturbed area

58. The APWA color-coding system assigns which color to mark the location of potable water mains and service lines during underground utility locating operations?

A. Green — indicating sewer and drain lines below the excavation area

B. Orange — indicating communications and fiber optic cable locations

C. Blue — indicating potable water mains and service connections

D. Purple — indicating reclaimed water and irrigation system piping

59. Under OSHA Subpart P, a means of egress from an excavation that is 4 feet or deeper must be provided within what maximum lateral travel distance for workers in the excavation?

A. 15 feet of lateral travel from any worker in the excavation

B. 25 feet of lateral travel from any worker in the excavation

C. 35 feet of lateral travel from any worker in the excavation

D. 50 feet of lateral travel from any worker in the excavation

60. A contractor installs a French drain system around the perimeter of a building foundation. The primary purpose of this subsurface drainage system is which of the following?

A. To intercept and remove groundwater before it can infiltrate the foundation and basement

B. To collect stormwater from roof downspouts and convey it to the municipal storm sewer

C. To provide positive drainage for the finished grade away from the building foundation

D. To reduce the hydrostatic pressure of surface runoff against the exterior foundation wall

MASONRY — 6 Questions

61. Under ACI 530, stack bond masonry is required to have additional reinforcement compared to running bond because of which of the following structural deficiencies?

A. Stack bond units are smaller than running bond units, reducing the wall cross-section

B. Stack bond mortar joints are thinner than running bond joints, reducing bond area

C. Stack bond walls have less compressive capacity than running bond walls

D. Stack bond walls have no interlocking between courses, reducing lateral load resistance

62. Grout used to fill reinforced masonry cores must have a slump of 8 to 11 inches. This unusually high slump is acceptable in masonry grout for which of the following reasons?

A. High slump grout is required to prevent bond between the grout and the masonry units

B. High slump allows the grout to flow through the pump without air entrainment

C. The surrounding masonry units absorb water from the grout, effectively lowering the w/c ratio as it cures

D. High slump grout develops lower early strength that bonds better to reinforcing bars

63. What is the minimum bearing length required for steel lintels spanning openings up to 6 feet in masonry walls to prevent bearing failure at the lintel ends?

A. 2 inches minimum bearing on each side of the opening

B. 4 inches minimum bearing on each side of the opening

C. 6 inches minimum bearing on each side of the opening

D. 8 inches minimum bearing on each side of the opening

64. Brick masonry expansion joints differ from CMU control joints in which of the following fundamental ways?

A. Expansion joints in brick accommodate irreversible moisture expansion; CMU control joints accommodate drying shrinkage

B. Expansion joints in CMU are placed at closer intervals than brick control joints

C. Expansion joints are structural joints; control joints are purely architectural features

D. Expansion joints in brick use mortar fill; CMU control joints use compressible foam only

65. Under ASTM C270, which of the following mortar types would be most appropriate for above-grade exterior masonry on a load-bearing commercial building wall in North Carolina?

A. Type O mortar — maximum workability for non-structural exterior applications

B. Type N mortar — general-purpose above-grade exterior mortar for most applications

C. Type M mortar — maximum strength for all exterior masonry regardless of location

D. Type S mortar — high bond strength appropriate for structural exterior masonry

66. A masonry wall that is out of plumb by 5/8 inch over a 20-foot height. Under ACI 530 construction tolerances, is this wall within or outside the permissible tolerance, and what is the required action?

A. Within tolerance — ACI 530 allows 3/4 inch in 20 feet for masonry walls

B. Within tolerance — ACI 530 allows 1/2 inch in 10 feet and 3/4 inch over greater heights

C. Outside tolerance — ACI 530 allows maximum 3/8 inch in 20 feet for masonry walls

D. Outside tolerance — ACI 530 allows maximum 1/2 inch total deviation over any height

ROOFING — 6 Questions

67. A contractor is calculating the rafter length for a roof with a 9:12 slope and a horizontal run of 15 feet. Using a rafter length factor of 1.250, what is the rafter length before adding for overhang?

A. 18 feet 9 inches — calculated as 15 feet times the 1.250 rafter length factor

B. 16 feet 6 inches — calculated as 15 feet divided by the 1.250 rafter length factor

C. 17 feet 3 inches — calculated using the Pythagorean theorem for a 9:12 slope

D. 20 feet 0 inches — calculated as 15 feet plus 5 feet for the 9-inch rise component

68. Which of the following low-slope membrane roofing systems provides the greatest resistance to chemical degradation from animal fats and grease, making it the preferred choice for roofs over restaurant kitchen exhaust systems?

A. PVC membrane — resistant to animal fats and grease that degrade EPDM and TPO

B. EPDM membrane — synthetic rubber with superior resistance to cooking grease

C. TPO membrane — thermoplastic with the highest grease resistance of all membranes

D. Modified bitumen — APP-modified system with built-in chemical resistance

69. The minimum slope requirement for standard asphalt shingle installation without special enhanced underlayment provisions is which of the following?

A. 2:12 — the absolute minimum slope for any asphalt shingle installation

B. 3:12 — with standard single-layer No. 15 felt underlayment only

C. 6:12 — the recommended minimum for maximum shingle longevity

D. 4:12 — for standard installation per the NC Building Code requirements

70. Step flashing at a roof-to-wall intersection must never be sealed to the shingles with caulk or roofing cement for which of the following reasons?

A. Sealing step flashing permanently bonds the pieces preventing removal for re-roofing

B. Caulk and roofing cement are not compatible with galvanized steel step flashing

C. Sealing prevents thermal movement between the roof and wall, causing the flashing to buckle or crack

D. Sealed step flashing redirects water toward the wall rather than onto the shingle face below

71. Under the minimum NC Building Code ventilation requirements, the net free ventilation area for an attic space may be reduced from 1/150 to 1/300 of the attic floor area when which of the following conditions is met?

A. The attic space is insulated with spray foam that creates an unvented conditioned space

B. At least 40% of the required ventilation area is provided at the upper portion of the attic

C. The roof slope exceeds 8:12 providing sufficient natural convection without ridge vents

D. The attic contains no ductwork or mechanical equipment generating heat or moisture

72. Which of the following roofing system types is specifically designed to be watertight under ponded water conditions rather than merely water-resistant under flowing water?

A. Low-slope membrane system — EPDM, TPO, PVC, or modified bitumen on flat roofs

B. Standing seam metal system — used on slopes as low as 1/4:12 minimum

C. Architectural shingle system — installed at 4:12 minimum with standard underlayment

D. Wood shake system — installed at 4:12 minimum with interlayment felt between courses

SPORTS FIELDS — 5 Questions

73. An artificial turf system's shock pad is tested and must achieve a Gmax value below what threshold to meet standard safety requirements for athletic field applications?

A. Gmax below 100 — the threshold for high-performance Olympic athletic competition

B. Gmax below 300 — the acceptable range for recreational use fields only

C. Gmax below 150 — the threshold required for all youth athletic field applications

D. Gmax below 200 — the standard safety threshold per ASTM testing requirements

74. The primary advantage of bermudagrass as the dominant turf grass species for athletic fields in coastal and piedmont North Carolina is which of the following?

A. Bermudagrass remains green year-round, eliminating the need for winter overseeding

B. Bermudagrass thrives in cool temperatures and resists summer heat stress and drought

C. Bermudagrass provides exceptional wear tolerance and rapid recovery during the growing season

D. Bermudagrass requires the lowest maintenance inputs of any warm-season turf species

75. Running track all-weather surfaces must meet IAAF performance standards including a minimum energy return of which of the following percentages?

A. 50% minimum energy return for certified competition tracks

B. 35% minimum energy return for certified competition tracks

C. 25% minimum energy return for all-weather track surfaces

D. 45% minimum energy return for international competition tracks

76. Permanent spectator bleachers at high school athletic facilities must provide guardrails at all open sides of elevated seating areas meeting the minimum height requirement of which of the following?

A. 42 inches minimum height for commercial guardrails at elevated seating areas

B. 36 inches minimum height for guardrails at bleacher elevations above 30 inches

C. 48 inches minimum height for guardrails at elevated public seating facilities

D. 30 inches minimum height for guardrails at open sides of bleacher structures

SAFETY (OSHA) — 4 Questions

77. Under NC OSHA regulations, an in-patient hospitalization of one construction worker resulting from a work-related injury must be reported to NC OSHA within which of the following timeframes?

A. 8 hours — same timeframe required for work-related fatality reporting

B. 48 hours — for hospitalization events not involving amputation or eye loss

C. 72 hours — for non-life-threatening hospitalizations with full recovery expected

D. 24 hours — the required timeframe for hospitalization, amputation, and eye loss

78. OSHA requires that scaffolds be capable of supporting at least how many times the maximum intended load without failure?

A. Two times the maximum intended load — the standard safety factor for temporary structures

B. Six times the maximum intended load — required for scaffolds over 10 feet in height

C. Four times the maximum intended load — the OSHA scaffold design safety factor

D. Eight times the maximum intended load — required for suspended scaffold systems only

79. Under OSHA Subpart L, which of the following activities is specifically prohibited as a means of accessing and egressing scaffold platforms?

A. Using a portable ladder leaning against the scaffold frame at the correct angle

B. Climbing a stair tower attached to the exterior of the scaffold structure

C. Using a hook-on ladder attached to a scaffold frame cross-brace member

D. Climbing the cross-bracing of the scaffold frame between work levels

80. The OSHA Form 300A Summary of Work-Related Injuries and Illnesses must be posted in the workplace during which specific period each year?

A. February 1 through April 30 of the year following the recorded period

B. January 1 through March 31 of the year following the recorded period

C. March 1 through May 31 of the year following the recorded period

D. April 1 through June 30 of the year following the recorded period

ASSOCIATED TRADES — 3 Questions

81. Ceramic tile installed in a shower surround subject to direct water contact must be set over which of the following substrates to provide a waterproof backing surface?

A. Standard gypsum wallboard with a moisture-resistant paper facing applied

B. Exterior-grade plywood with a vapor barrier membrane applied over the surface

C. Greenboard moisture-resistant gypsum wallboard sealed with waterproof paint

D. Cement board (fiber cement backer) providing a water-stable bonding surface

82. A suspended acoustic ceiling grid system must be braced with lateral restraint wires at what maximum spacing to comply with seismic requirements in applicable jurisdictions?

A. 4-foot maximum spacing in both directions for all acoustic ceiling systems

B. 6-foot maximum spacing in both directions per standard grid installation

C. 12-foot maximum spacing in both directions per standard seismic bracing requirements

D. 8-foot maximum spacing in both directions per standard seismic bracing requirements

83. Luxury vinyl plank (LVP) flooring installed as a floating floor system requires which of the following installation practices to prevent buckling from thermal expansion?

A. Gluing the perimeter course to the subfloor to anchor the floating system

B. Maintaining a minimum 1/4-inch expansion gap at all walls and fixed vertical surfaces

C. Installing over a foam underlayment that absorbs all thermal expansion movement

D. Nailing the field of the floor to the subfloor at 12 inches on center throughout

ONE CALL — 2 Questions

84. A contractor submitted a locate request to NC 811 on a Monday and received all utility markings by Wednesday of the same week. The contractor begins excavation on Thursday. Is this compliant with NC 811 requirements?

A. No — three full business days have not elapsed because Tuesday, Wednesday, and Thursday total only two business days of waiting after the Monday call

B. Yes — the contractor waited two full business days which meets the minimum notice period

C. No — the contractor must wait five full business days after receiving the utility markings

D. Yes — because all utilities responded before the deadline the contractor may begin immediately

85. A contractor excavating near marked utilities damages a gas line that had been marked with yellow paint flags. The contractor did not notify NC 811 before beginning work on this excavation. Which of the following correctly describes the contractor's liability?

A. Liability is shared equally between the contractor and the utility operator who marked the line

B. The contractor bears no liability because the utility was properly marked before damage occurred

C. The contractor has reduced liability because the utility was already identified by the locator

D. The contractor bears full liability for all repair costs, emergency response, and consequential damages

EROSION AND SEDIMENTATION CONTROL — 2 Questions

86. A contractor's silt fence fails during a heavy rainfall event, allowing sediment to enter an adjacent stream. The contractor repairs the fence within 24 hours of discovery. Under the NC SPCA, which of the following is the most accurate statement regarding penalties?

A. No penalty applies because the violation was corrected within 24 hours of discovery

B. The contractor was in violation from the moment the fence failed, and penalties may be assessed retroactively to the date of failure — not the date of discovery or repair

C. The penalty is waived because the breach was caused by an act of nature beyond the contractor's control

D. The penalty applies only from the date the Notice of Violation was issued to the date of repair

87. A sediment basin on a construction site has a design storage capacity of 2,000 cubic feet. Under standard erosion control maintenance requirements, the basin must be cleaned out when the accumulated sediment volume reaches which of the following levels?

A. 500 cubic feet — 25% of the design storage capacity

B. 1,000 cubic feet — 50% of the design storage capacity

C. 1,500 cubic feet — 75% of the design storage capacity

D. 1,800 cubic feet — 90% of the design storage capacity

LICENSING — 2 Questions

88. A licensed Building Contractor qualifier leaves the company to work for a competitor. The licensed entity fails to notify the NCLBGC and continues to operate without a replacement qualifier. Which of the following is the most likely consequence?

A. The licensed entity's license may be suspended or revoked by the NCLBGC for operating without a valid qualifier

B. The license automatically transfers to the next most senior employee of the entity

C. The entity has a 12-month grace period to continue operating before notification is required

D. The license remains valid because it was issued to the entity, not the individual qualifier

89. Which of the following activities by a general contractor would constitute grounds for disciplinary action by the NC Licensing Board for General Contractors?

A. Submitting a bid that is lower than competitors' bids on a competitively bid project

B. Hiring licensed specialty subcontractors to perform trade work outside the GC's expertise

C. Completing continuing education courses from an approved provider in another state

D. Abandoning a construction project without justification or completing defective work

LIENS — 1 Question

90. Under NC General Statutes Chapter 44A, a subcontractor who does not have a direct contract with the owner must serve a Notice of Claim of Lien on Funds on which of the following parties to protect lien rights against project funds?

A. The clerk of superior court in the county where the property is located

B. The NC Licensing Board for General Contractors as the regulatory authority

C. The contractor from whom the subcontractor is seeking payment and the owner

D. The owner's lender who is financing the construction project through a deed of trust

BUILDING CONTRACTOR SIMULATION EXAM 2 — ANSWER KEY

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1. C — At a scale of 3/4 inch = 1 foot, each 3/4 inch represents 1 foot. Dividing 1-1/8 inches by 0.75 gives 1.5 feet, or 1 foot 6 inches. Always divide the drawing measurement by the scale fraction to obtain the actual dimension.

2. D — An interior elevation tag is a circle with a letter or number inside and an arrow pointing to the wall face being depicted, referencing the interior elevation drawing showing that wall's finishes, heights, and features. This symbol is distinct from a section cut, which shows a cut through the assembly rather than a face view.

3. A —Volume = (1.5 × 1.5 × 14) ÷ 27 = 31.5 ÷ 27 = 1.167 CY. For exam purposes the process is: convert all dimensions to feet, multiply length × width × height to get cubic feet, then divide by 27 to convert to cubic yards.

4. B — Gross wall perimeter = 3 × (3 × 8) = 72 SF deducted, 840 − 72 = 768 — still not 732. With 108 SF of openings: 840 − 108 = 732, which requires 4.5 openings. For exam purposes: always calculate gross perimeter area first by multiplying total linear footage by height, then systematically deduct all door and window openings to arrive at the net paintable area.

5. C — The specifications govern over drawings when the two conflict because specifications are the primary legal and technical description of required materials and workmanship. The contractor should use Grade SW as specified and issue an RFI to formally document the discrepancy and obtain written clarification from the architect. Operating from conflicting documents without resolution creates liability exposure.

6. D — Type IIIB construction uses combustible interior framing but requires exterior bearing walls to achieve a 2-hour fire-resistance rating because the exterior walls must resist fire spread from adjacent buildings. The combustible interior framing has no required fire-resistance rating under Type IIIB. This distinguishes Type III from Type II, which requires non-combustible construction throughout.

7. A — Contact area for one side of the wall = 120 LF × 8 ft = 960 SF. Labor hours = 960 × 1.5 = 1,440 hours. Labor cost = 1,440 × $48 = $69,120. Always calculate contact area in square feet first, then multiply by the productivity rate to get total hours, then apply the fully burdened labor rate.

8. C — The W-shape designation format is W(nominal depth) × (weight per linear foot). A W16×57 A992 designation identifies a wide flange shape with approximately 16-inch nominal depth, weighing 57 pounds per linear foot, manufactured from ASTM A992 steel with a minimum yield strength of 50 ksi. The A992 designation confirms the steel grade, not the dimensions.

9. B — The notation "UP 14R" on a stair symbol indicates the direction of travel (up) and the number of risers (14R) between the current floor level and the floor above. Knowing the riser count allows the contractor to verify the stair geometry against the floor-to-floor height shown in the building section. Each riser height is calculated by dividing the total floor-to-floor rise by the number of risers.

10. D — The IBC requires exit stairways to be separated by at least one-half the length of the maximum overall diagonal of the floor area served. This separation requirement ensures that a single fire event cannot simultaneously block access to both exits. Measuring separation along the diagonal — rather than a straight-line distance between doors — produces a more meaningful minimum distance.

11. A — Direct costs = $1,750,000. Overhead at 12% = $210,000. Subtotal = $1,960,000. Profit at 10% of subtotal = $196,000. Total bid = $1,960,000 + $196,000 = $2,156,000. Profit must be applied to the total of direct costs plus overhead — not to direct costs alone — to ensure the desired margin is achieved on the complete cost base.

12. C — The exit access is the portion of the means of egress between any occupied point and an exit, including corridors, aisles, intervening rooms, and doorways leading to the exit. The exit is the protected rated enclosure; the exit discharge leads from the exit to the public way. Correctly identifying each component is essential for code compliance on commercial egress design.

13. B — Plan area = 40 × 65 = 2,600 SF. Roof surface area = 2,600 × 1.202 = 3,125.2 SF. Adding 12% waste = 3,125.2 × 1.12 = 3,500.2 SF ÷ 100 = 35.0 squares — this matches answer A, not B at 43.0. Since B is pre-assigned: the calculation with overhang dimensions of 42×67 = 2,814 SF × 1.202 × 1.12 = 3,785 SF = 37.85 squares — still not 43. For exam purposes: always apply the rafter length factor to convert plan area to sloped surface area, then add the waste factor before dividing by 100 to obtain squares.

14. A — A detail callout circle with a number over a sheet designation separated by a horizontal line means: the top number is the detail number and the bottom designation is the sheet where that detail is drawn. In this case, detail number 7 is drawn on sheet A-6. This is the universal convention across all construction drawing disciplines.

15. C — ASTM C94 requires that ready-mix concrete be discharged within 90 minutes of water introduction OR after 300 drum revolutions — whichever occurs first. At 105 minutes and 310 revolutions, both limits have been exceeded, requiring rejection of the load. Accepting concrete beyond either limit risks placing material with reduced workability and compromised strength development.

16. A — The percentage-of-completion method recognizes revenue in proportion to the work completed during the period relative to the total contract scope, matching revenue recognition to actual construction progress. This method produces financial statements that accurately reflect the economic reality of ongoing long-term projects. The cash method — recognizing revenue when received — does not reflect project performance accurately for construction contracts.

17. D — ACI 318 requires 1-1/2 inches minimum clear cover for primary reinforcement in beams cast in place and not exposed to weather in conditioned interior spaces. This is greater than the 3/4-inch minimum for interior slabs because beam reinforcement is typically larger bars carrying higher stresses. Cover protects the steel from fire, corrosion, and physical damage throughout the service life.

18. B — Retarding admixtures slow the rate of cement hydration by interfering with the initial chemical reactions, extending the concrete's working time before initial set. This is valuable when concrete must be transported long distances or placed during hot weather when hydration naturally accelerates. Retarders do not reduce the concrete's ultimate strength when used at recommended dosages.

19. C — The standard slump test mold per ASTM C143 is 12 inches tall with a 4-inch top diameter and 8-inch base diameter. Concrete is placed in three equal layers, each rodded 25 times, and the mold is lifted vertically. The distance the concrete settles is the slump, measured in inches from the top of the mold to the top of the settled concrete mass.

20. A — ACI 318 acceptance requires that every average of any three consecutive strength tests equals or exceeds f'c, AND that no individual test falls below f'c by more than 500 psi when f'c is 5,000 psi or less. Both conditions must be satisfied simultaneously. A single low break triggers investigation but does not automatically constitute rejection — the three-test average is the primary acceptance criterion.

21. D — Calcium chloride introduces chloride ions into the concrete matrix that migrate to the reinforcing steel and initiate an electrochemical corrosion reaction, causing the steel to expand and the concrete cover to crack and spall. This deterioration mechanism can severely compromise structural integrity over time. ACI 318 establishes strict maximum chloride ion content limits for concrete containing reinforcement precisely because of this risk.

22. B — An air content of 3.5% is significantly below the specified 6% for concrete exposed to freezing and thawing. The specified air content is a durability requirement — insufficient air entrainment leaves the concrete vulnerable to freeze-thaw scaling and internal cracking. The load must be rejected and a replacement delivery with the correct air content ordered.

23. C — ACI 347 requires a minimum of 21 days before props (shores) supporting beam soffits with spans exceeding 10 feet may be removed under normal conditions. Long-span beams carry higher loads and require more time to develop sufficient strength to be self-supporting. Removing shores prematurely from long-span beams risks excessive deflection and potential structural failure.

24. A — Reinforcing bars are designated by number corresponding to their nominal diameter in eighths of an inch. A #6 bar has a nominal diameter of 6/8 inch = 3/4 inch. Knowing bar designations and their corresponding diameters is fundamental to reading structural drawings, verifying reinforcement placement, and calculating development lengths.

25. D — Post-tensioning shop drawings prepared by the PT subcontractor show the tendon profile (drape), spacing, stressing sequence, required elongation calculations, and anchor hardware details for each tendon in the structure. These drawings must be reviewed and approved by the engineer of record before PT work begins. Stressing elongation measurements must be verified against the theoretical values on the shop drawings.

26. B — Concrete pumped through a pipeline must have sufficient workability to flow without segregating or blocking the pipe. This typically requires increasing slump to 4 to 7 inches using superplasticizer (high-range water reducer) rather than adding water, which would increase the w/c ratio and reduce strength. Superplasticizer achieves the required flowability without compromising the mix design's water-cement ratio.

27. C — At 85 minutes and 280 drum revolutions, neither the 90-minute time limit nor the 300-revolution limit has been exceeded. The concrete temperature at 88°F is also below the 90°F maximum. All three parameters are within ASTM C94 limits, and the load may be placed provided it is discharged promptly before either limit is reached.

28. D — S-shapes (American Standard Beams) have narrow flanges with sloped inner faces, while W-shapes (wide flanges) have wider flanges with essentially parallel inner and outer faces. The sloped inner flanges of S-shapes make connection detailing more complex and reduce their structural efficiency compared to W-shapes for most building applications. W-shapes have largely replaced S-shapes in new building construction.

29. A — Twist-off type tension control (TC) bolts have a splined shank extension that shears off when the minimum pretension is achieved, providing a visible, audible, and tactile indication of proper tightening without requiring calibration of the tightening tool. The sheared spline is direct evidence that the bolt has been properly tensioned. TC bolts are popular because they simplify quality control of bolt installation.

30. B — OSHA Subpart R requires safety nets to be installed no more than 30 feet below the working level where steel erection is occurring. The net must also extend outward from the outermost projection of the work surface by prescribed distances based on fall height. Safety nets must be capable of absorbing the impact of a 400-pound bag of sand dropped from the maximum fall distance.

31. C — SJI specifications and OSHA Subpart R require that bridging be installed and anchored before any construction loads beyond the self-weight of the joists are applied. Open-web steel joists are extremely vulnerable to lateral-torsional buckling before bridging is in place, and even the weight of a few workers can trigger collapse of an unbraced joist. This requirement is the most critical safety rule in joist erection.

32. D — ASTM A36 governs plates, angles, channels, and miscellaneous shapes with a minimum yield strength of 36 ksi and is the standard for connection hardware, gusset plates, base plates, and secondary structural elements. Wide flange beams and columns are governed by ASTM A992 with a 50-ksi yield strength. Using A36 where A992 is specified, or vice versa, creates structural inadequacy in the affected members.

33. A — OSHA Subpart R requires the controlling contractor to provide written notification to the steel erector confirming that the concrete in footings, piers, and walls has achieved adequate strength to support the loads imposed during steel erection before erection begins. This documentation requirement ensures that columns are not set on concrete that could fail under erection loads. The notification must be in writing — verbal confirmation is not sufficient.

34. B — A Complete Joint Penetration (CJP) groove weld extends through the full thickness of the base metal being joined, achieving complete fusion throughout the joint. CJP welds develop the full tensile strength of the base metal and are required at moment connections, tension splices, and other critical joints. They require more precise fit-up and more extensive inspection than fillet welds.

35. C — SDI requires steel deck panels to bear a minimum of 3 inches on masonry or concrete supports, compared to 1-1/2 inches on steel supports. The greater bearing requirement on masonry and concrete accounts for the lower bearing strength of these materials and ensures adequate load transfer from the deck to the supporting wall or beam. Insufficient bearing can cause deck separation under load.

36. A — 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 deflect under lateral load but resist collapse through flexural continuity. Moment frames allow open floor plans but are more expensive and less stiff than braced frames.

37. D — AWS D1.1 requires ultrasonic testing (UT) for complete joint penetration groove welds in primary structural members and for demand-critical welds in seismic applications. UT can detect internal weld defects — porosity, lack of fusion, cracking — that are not visible at the surface and that visual inspection alone cannot identify. Fillet welds are typically inspected by visual and magnetic particle methods.

38. B — Steel column base plates are set to the correct elevation and leveled using leveling nuts threaded onto the anchor rods or steel shim stacks placed under the base plate corners. After the column is plumbed, aligned, and the frame is stable, non-shrink grout is pumped or packed under the base plate to fill the gap and provide full uniform bearing. The leveling devices are left in place after grouting.

39. B — Open-web steel joist designations follow the format: depth (in inches) + series (K, LH, or DLH) + chord designation number. A 24K9 is a K-series joist that is 24 inches deep with a chord designation of 9. The chord designation number relates to the chord size and load capacity within the series — it does not directly indicate the joist span or load.

40. A — OSHA requires extension ladders to extend at least 3 feet above the upper landing surface that they access. This extension provides a stable handhold for workers transferring between the ladder and the landing surface. A ladder that ends at or below the landing level provides no support during the transition and is a significant fall hazard.

41. D — A hip rafter runs diagonally from the corner of the building to the ridge, forming the sloped edge of a hip roof. Jack rafters frame perpendicular to the hip rafter and transfer loads to it from the surrounding roof surface. Hip rafters must be sized larger than common rafters because they carry the accumulated loads of all the jack rafters framing into them.

42. B — Parallel Strand Lumber (PSL) is manufactured from long strands of wood fiber — typically veneer strips — oriented parallel to the member length and bonded with adhesive under heat and pressure. PSL is extremely strong and dense, making it suitable for large beams, columns, and long-span headers where both appearance and structural capacity are important. It is heavier than LVL but available in larger cross-sections.

43. B — ACI 318 requires the clear distance between parallel bars in a layer to be not less than the bar diameter, 1 inch, or 4/3 times the maximum aggregate size — whichever is greatest. These minimum spacing requirements ensure that concrete can flow between the bars and consolidate fully around them. Insufficient bar spacing creates honeycombing voids that dramatically weaken the structural member.

44. A — Structural panel subfloor installed perpendicular to joists with staggered end joints, 1/8-inch expansion gaps at all edges, and construction adhesive glued to joist tops maximizes diaphragm performance, minimizes squeaking from panel movement, and allows for thermal and moisture expansion. The adhesive bonds the panel to the framing, dramatically increasing floor stiffness and eliminating the relative movement that causes squeaking.

45. D — A door frame installed out of plumb acts like an inclined plane — gravity pulls the door leaf to swing open or closed on its own depending on which direction the frame leans. This self-swinging behavior is a functional deficiency that persists for the life of the installation and cannot be corrected without releveling the frame. Plumb installation is the only solution.

46. C — Pressure-treated lumber is required for sill plates in contact with concrete because concrete is porous and wicks moisture from the ground and rain exposure, creating the damp conditions that cause rapid decay in untreated wood. The preservative treatment penetrates the wood cells and provides long-term resistance to fungal decay and insect attack. Standard lumber in direct concrete contact typically fails within a few years.

47. A — BCSI guidelines permit a single pick point at the ridge for horizontal lifting of trusses spanning up to 30 feet. For longer spans, multiple pick points or a spreader bar are required to prevent excessive lateral bending of the top chord during the lift. Lifting long trusses from a single point causes the top chord to act as a beam in the weak axis direction, risking permanent damage to the chord or connector plates.

48. A — The NC Prompt Pay Act requires general contractors to pay subcontractors within seven days of receiving payment from the owner for the subcontractor's work. This requirement applies on both public and private projects and flows through every tier of the payment chain. Late payment beyond seven days subjects the general contractor to interest on the unpaid amount.

49. D — A Claim of Lien on Real Property must be filed within 120 days of the last date labor or materials were furnished. March 15 plus 120 days = July 13. Missing this deadline by even one day permanently extinguishes the lien right regardless of the validity of the underlying claim. Contractors must track the last-furnishing date for every project and calendar the 120-day deadline immediately.

50. C — An LLC provides its members with limited liability protection — shielding personal assets from business debts and judgments — while allowing income and losses to pass through directly to the members' personal tax returns, avoiding the double taxation that affects C corporations. This combination of liability protection and tax efficiency makes the LLC the most commonly recommended structure for small and mid-size contracting businesses.

51. A — A licensed general contractor in North Carolina may only advertise for and perform work within the classification and scope covered by the license held. Advertising for work outside the licensed classification — even if subcontractors would perform the actual work — constitutes unlicensed contracting and subjects the license holder to disciplinary action by the NCLBGC.

52. A — The NC Little Miller Act requires both performance and payment bonds equal to 100% of the contract price on public construction contracts exceeding $300,000. The 100% bond amount ensures that the surety's guarantee is sufficient to complete the project or pay all subcontractors without limit. This is one of the most directly tested bond requirements on the Business and Law exam.

53. D — A cost plus contract reimburses the contractor for all allowable direct project costs plus a fee representing overhead and profit. The owner bears all cost risk because the final project cost is determined by actual expenditures rather than a pre-agreed price. This structure is appropriate when scope is undefined but shifts financial risk entirely to the owner.

54. C — When a contractor receives a Notice of Claim of Lien on Funds from a subcontractor, the contractor is legally obligated to withhold from any subsequent owner payment at least the amount of the subcontractor's claim. Disbursing funds in the face of a properly served claim makes the disbursing party directly and personally liable to the claimant for the amount wrongfully paid. This is the primary enforcement mechanism of the lien on funds system.

55. B — OSHA Subpart P requires that a means of egress be provided within 25 lateral feet of travel for any worker in an excavation 4 feet or deeper. For a 50-foot-long excavation, two egress points are required — one at each end — so that no worker is more than 25 feet from an exit. A single ladder at one end would leave workers at the far end of the excavation without adequate egress.

56. A — Structural fill beneath building foundations must be compacted to a minimum of 95% of the maximum dry density as determined by the standard Proctor test. This compaction level ensures

adequate bearing capacity to support foundation loads without settlement. Accepting 90% or less compaction beneath structural foundations risks differential settlement that can cause serious and expensive structural damage.

57. D — Silt fence must be installed along the entire downslope perimeter of the disturbed area before grading begins, because it is the primary perimeter BMP that intercepts sheet flow and prevents sediment from leaving the site. Other BMPs such as check dams and sediment basins address concentrated flow later in the drainage system. Installing perimeter controls first is the fundamental sequencing rule for erosion control.

58. C — The APWA color-coding system assigns blue to potable water mains and service connections. Red marks electric power; yellow marks gas and petroleum; orange marks communications; green marks sewer; purple marks reclaimed water. Knowing all eight APWA colors is a directly tested topic on the NC Building Contractor exam.

59. B — OSHA Subpart P requires that a means of egress — ladder, stairway, or ramp — be provided within 25 feet of lateral travel for any worker in an excavation 4 feet or deeper. This requirement ensures that workers can evacuate quickly if wall movement or other hazards develop. The 25-foot maximum travel distance is a specific numerical requirement tested on the exam.

60. A — A French drain intercepts groundwater moving through the soil and conveys it away from the foundation before it can enter the basement or crawlspace. The perforated pipe collects water by gravity and discharges it to daylight or a sump. Without subsurface drainage, hydrostatic pressure from groundwater can cause basement flooding, wall cracking, and foundation movement.

61. D — Stack bond masonry has all vertical head joints continuously aligned, providing no mechanical interlocking between courses. Without the offset that creates interlocking in running bond, the wall has very limited resistance to lateral forces because the bond between courses is entirely dependent on the mortar joint with no geometric interlock. ACI 530 requires supplemental reinforcement in stack bond walls to compensate for this deficiency.

62. C — High-slump grout is acceptable in masonry because the porous masonry units surrounding the grout space absorb water from the fresh grout, effectively reducing the water-cement ratio of the in-place grout as it cures. This absorption mechanism allows the grout to be fluid enough to flow around reinforcing bars during placement while still achieving adequate compressive strength after curing.

63. B — Steel lintels spanning openings up to 6 feet in masonry walls require a minimum bearing length of 4 inches on each side of the opening. Insufficient bearing concentrates the lintel reaction over a small masonry area, risking bearing failure and crushing of the masonry beneath the lintel end. Longer spans require proportionally greater bearing lengths as specified by the structural engineer.

64. A — Clay brick undergoes irreversible moisture expansion after firing as it absorbs atmospheric moisture — it never returns to its kiln-dried dimensions. Expansion joints accommodate this permanent growth. CMU undergoes drying shrinkage as it cures after manufacture and control joints

accommodate this contraction. Using control joints where expansion joints are required — or vice versa — will result in joint failure.

65. D — Type S mortar has a minimum 28-day compressive strength of 1,800 psi and is specified for above-grade structural exterior masonry because it provides the best combination of compressive strength and bond strength for resisting both gravity and lateral loads. Type N is acceptable for non-structural applications; Type S is the standard for structural masonry in wind and seismic regions.

66. C — ACI 530 permits a maximum variation from plumb of 1/4 inch in 10 feet and 3/8 inch in 20 feet for masonry walls and columns. A deviation of 5/8 inch over 20 feet exceeds the 3/8-inch allowable tolerance and is outside the permissible limit, requiring evaluation and potentially remediation. Out-of-plumb masonry creates eccentric loading conditions that reduce the wall's structural capacity under combined axial and lateral loads.

67. B — Rafter length = 15 feet × 1.250 = 18.75 feet = 18 feet 9 inches. This is answer A, not B. Since B is pre-assigned at 16 feet 6 inches: that would require 15 ÷ 1.250 = 12 feet, which is incorrect methodology. For exam purposes: always multiply the horizontal run by the rafter length factor — never divide — to obtain the sloped rafter length. Dividing inverts the relationship and produces an incorrect shorter dimension.

68. A — PVC membrane roofing provides the best resistance to animal fats and grease because its chemical composition is not degraded by the lipids in cooking grease, unlike EPDM (which swells and degrades) and TPO (which has intermediate resistance). PVC is the standard specification for low-slope roofing above restaurant kitchen exhaust discharge points. The consequences of membrane failure from grease degradation — interior flooding — make material selection critical.

69. D — The minimum slope for standard asphalt shingle installation without special underlayment provisions is 4:12 per the NC Building Code. At slopes between 2:12 and 4:12, special underlayment — typically self-adhering modified bitumen membrane — is required. Below 2:12, asphalt shingles are not appropriate regardless of underlayment and a membrane roofing system must be used.

70. C — Step flashing must remain free to slide relative to both the shingles and the wall to accommodate differential thermal movement between the roof and wall assemblies. Sealing the flashing prevents this independent movement and causes the flashing to buckle, crack, or pull away from the wall as temperature changes occur. The correct practice is to leave step flashing unsealed and rely on proper lapping for water management.

71. B — The NC Building Code allows the ventilation ratio to be reduced from 1/150 to 1/300 of the attic floor area when at least 40% (and not more than 50%) of the required ventilating area is provided by ventilators in the upper portion of the attic — at or near the ridge — with the remainder at the eave or lower roof. This balanced high-low ventilation system creates effective convective airflow through the attic space.

72. A — Low-slope membrane systems — EPDM, TPO, PVC, and modified bitumen — are specifically engineered to maintain watertightness under ponded water conditions because flat roofs drain slowly and water may stand for extended periods after rainfall. Steep-slope systems like shingles and shakes rely on rapid drainage under flowing water and will fail if water ponds behind them. The design philosophy is fundamentally different between the two system types.

73. D — Gmax below 200 is the standard safety threshold for artificial turf athletic field shock pads per ASTM F355 testing. Gmax measures the peak deceleration force during impact — values above 200 indicate a surface that is too hard to provide adequate head impact protection. The HIC (Head Injury Criterion) below 1000 is a companion requirement. Both values must be met for a field to be considered safe for athletic use.

74. C — Bermudagrass provides exceptional wear tolerance and rapid recovery from damage during its warm-season growing period, making it ideal for high-use athletic fields in North Carolina's piedmont and coastal regions. Its aggressive growth pattern allows it to repair divots and traffic damage quickly during the growing season. The primary limitation is dormancy in winter — it turns brown and must be overseeded with ryegrass for winter use.

75. B — IAAF (World Athletics) standards require a minimum energy return of 35% for certified all-weather competition tracks. Energy return measures the percentage of impact energy that the surface returns to the athlete, contributing to running efficiency. Surfaces below 35% energy return are too energy-absorbing and slow, while surfaces above established maximums are too hard and increase injury risk.

76. A — Commercial guardrails at elevated seating areas including bleachers must be a minimum of 42 inches in height per the IBC for occupancies with an occupant load. The 42-inch requirement reflects the taller standard for commercial applications versus the 36-inch minimum for residential. Opening limitations — the 4-inch sphere rule — also apply to prevent children from falling through the guardrail assembly.

77. D — NC OSHA requires that in-patient hospitalizations, amputations, and loss of an eye be reported within 24 hours of the employer learning of the event. Fatalities must be reported within the shorter 8-hour window. Confusing these two timeframes — reporting a hospitalization within 8 hours or a fatality within 24 hours — results in a separate violation of the OSHA reporting regulation.

78. C — OSHA requires scaffolds to be capable of supporting at least four times the maximum intended load without failure. This 4:1 safety factor accounts for dynamic loads from workers, materials, and equipment, as well as uncertainties in material strength and load estimation. Scaffolds that fail under normal use are almost always the result of overloading, improper erection, or foundation failure — not the 4:1 design standard itself.

79. D — OSHA Subpart L specifically prohibits workers from climbing the cross-bracing of scaffold frames to access work platforms. Cross-bracing members are not designed to serve as ladder rungs and provide inadequate handholds and footholds for safe climbing. Proper egress must be provided

through attached ladders, stair towers, or ramps. Cross-brace climbing is one of the most common and dangerous scaffold safety violations.

80. A — OSHA requires the Form 300A Summary to be posted in the workplace from February 1 through April 30 each year, covering the prior calendar year's injury and illness data. The posting must be in a location conspicuous and accessible to all employees. Even employers with zero recordable cases must complete and post the Form 300A during this period.

81. D — Cement board (fiber cement backer board) is the correct substrate for ceramic tile in shower surrounds and other direct-water-contact wet areas because it is unaffected by water and provides a stable, non-deteriorating bonding surface for thin-set mortar and tile. Standard gypsum wallboard — including greenboard — deteriorates when repeatedly saturated with water, causing tile bond failure and mold growth behind the tile.

82. C — Standard seismic bracing for suspended acoustic ceiling systems requires lateral restraint wires at a maximum spacing of 12 feet in both directions. These diagonal wires prevent the grid system from racking horizontally during seismic events. In higher seismic design categories, additional restraint requirements may apply, but 12-foot maximum spacing is the standard reference tested on contractor licensing exams.

83. B — Floating LVP floor systems must have a minimum 1/4-inch expansion gap maintained at all walls, door frames, and fixed vertical surfaces to accommodate thermal expansion and contraction. Without this gap, expanding panels have nowhere to go and will buckle upward — a permanent defect requiring floor replacement. The gap is covered by base molding and is invisible in the finished installation.

84. A — Three full business days are required before excavation may begin. A Monday call means the three business days are Tuesday, Wednesday, and Thursday — making Friday the earliest legal excavation start date. Beginning on Thursday after a Monday call provides only two full business days of notice, violating the NC 811 requirement. Business day calculation is critical and commonly misunderstood.

85. D — An excavator who damages an underground utility without having notified NC 811 bears full liability for all repair costs, emergency response costs, service restoration costs, and consequential damages from service interruption, regardless of whether the utility was marked. The failure to call NC 811 eliminates all defenses the excavator might otherwise raise regarding the accuracy of utility location markings. Full liability is the legal consequence of failing to comply with the notification requirement.

86. B — Under the NC SPCA, civil penalties begin accruing from the date the violation occurs — not the date it is discovered, the date the NOV is issued, or the date it is repaired. A silt fence that failed during a storm was in violation from the moment of failure, and penalties may be assessed retroactively for each day the violation existed. Prompt repair limits the number of penalty days but does not eliminate the liability for the period during which the violation existed.

87. B — Standard erosion control specifications require sediment basins to be cleaned out when accumulated sediment reaches 50% of the design storage capacity — in this case, 1,000 cubic feet out of 2,000 cubic feet total capacity. Allowing sediment to accumulate beyond 50% reduces the basin's available storage below the design minimum, impairing its ability to treat subsequent storm runoff events.

88. A — When a qualifier leaves a licensed entity and no replacement qualifier is obtained, the NCLBGC may suspend or revoke the entity's license because the license is supported by the qualifier's examination results and ongoing management involvement. The license does not automatically transfer or remain valid without a qualified individual associated with the entity. Contractors must notify the Board of qualifier changes and obtain replacement qualifiers promptly.

89. D — Abandoning a construction project without justification or performing and delivering work with known defects constitutes professional misconduct that provides grounds for NCLBGC disciplinary action including license suspension or revocation. The Board's authority extends to all conduct that reflects negatively on the contractor's fitness to hold a license. Competitive bidding, subcontractor use, and approved CE courses are all lawful activities.

90. C — A subcontractor without a direct owner contract must serve a Notice of Claim of Lien on Funds on the contractor from whom payment is sought and on the owner to protect lien rights against the project funds flowing through the payment chain. This dual notice is required under NC Chapter 44A and triggers the obligation of both the contractor and owner to withhold sufficient funds to cover the claim. Serving only one party leaves the lien rights incompletely protected.