# PRACTICE EXAM 3: NASCLA TRADE EXAM SIMULATION (115 QUESTIONS)

**Time Allowed:** 330 Minutes (5 Hours 30 Minutes)

**Total Questions:** 115

**Passing Score:** 70% (81 Correct)

**DOMAIN 1: GENERAL REQUIREMENTS (Questions 1–25)**

1. A contractor is constructing a 45,000 square foot singlestory retail building classified as Group M occupancy using Type IIB construction. The building is fully sprinklered and surrounded on all sides by at least 60 feet of open space. The architect wants to eliminate the floor area limitation entirely. Under IBC Section 507, does this building qualify for unlimited area?

A. No, because only Group F and Group S occupancies qualify for unlimited area under any conditions

B. Yes, because Group M occupancies are permitted unlimited area when the building is singlestory, fully sprinklered, and surrounded by 60 feet of open space

C. No, because unlimited area requires Type IA construction regardless of sprinkler status or open space

D. Yes, but only if the building is no more than one story and the occupant load does not exceed 500 persons

2. A fire protection engineer is evaluating a commercial building where the owner wants to use nonseparated occupancies to address a mixeduse condition containing Group B (office) and Group S1 (storage) uses. Under IBC Section 508.3 for nonseparated occupancies, what requirement governs the entire building?

A. Each occupancy area must have its own independent fire alarm system and egress pathway

B. The building must have fire barriers between all occupancy types regardless of the approach selected

C. The occupancy with the least restrictive requirements governs the building to reduce construction costs

D. The entire building must comply with the most restrictive requirements applicable to any occupancy present

3. Under the IBC, what is the occupant load factor for assembly areas without fixed seats used in an unconcentrated arrangement with tables and chairs?

A. 15 net square feet per person for assembly areas with tables and chairs in unconcentrated arrangement

B. 7 net square feet per person for assembly areas with chairs only in concentrated arrangement

C. 5 net square feet per person for assembly standing space without any seating provided

D. 20 net square feet per person for classroomtype educational spaces with desks and chairs

4. A contractor is reviewing the fire protection requirements for a twostory commercial building with both a Group A3 (church) occupancy on the first floor and a Group B (office) occupancy on the second floor. The building uses separated occupancies. According to IBC Table 508.4, what is the required fireresistancerated separation between the Group A3 and Group B occupancies?

A. No separation is required between Group A3 and Group B occupancies under any condition

B. A 3hour fireresistancerated separation is required with automatic sprinkler protection

C. A 1hour fireresistancerated separation is required, or a 2hour separation if not sprinklered

D. A 4hour fire wall is required to create separate buildings for height and area calculations

5. Under the IBC, which type of fireresistancerated assembly is used to restrict the movement of smoke through a building and is required in Group I2 and I3 occupancies to create smoke compartments?

A. Fire partition with a minimum ½hour fireresistance rating and selfclosing doors at all openings

B. Fire barrier with a minimum 2hour fireresistance rating and automaticclosing smoke doors

C. Fire wall with structural independence extending continuously from foundation through the roof

D. Smoke barrier with a minimum 1hour fireresistance rating designed to limit the migration of smoke

6. A contractor is building a Group A4 occupancy (indoor arena with spectator seating). The architect specifies Type IB construction. According to IBC Table 601, what is the minimum fireresistance rating required for the structural frame of a Type IB building?

A. 2hour fireresistance rating for the structural frame of Type IB construction

B. 3hour fireresistance rating for the structural frame of Type IB construction

C. 1hour fireresistance rating for the structural frame of Type IB construction

D. No fireresistance rating is required for the structural frame of Type IB construction

7. Under the IBC, the sprinkler system provides not only fire suppression but also allows specific code tradeoffs. Which of the following is a code benefit of installing an automatic sprinkler system in accordance with NFPA 13?

A. Complete elimination of all fireresistancerated construction requirements throughout the building

B. Exemption from providing any means of egress beyond a single exit from each occupied floor

C. An increase of one story in the allowable building height and a substantial increase in allowable floor area

D. Elimination of the requirement for fire alarm systems in all occupancies except Group I institutions

8. A contractor notices that a corridor serving a Group B occupancy on an upper floor has no fireresistance rating on the corridor walls. Under the IBC, is an unrated corridor permitted in this situation?

A. No, all corridors in commercial buildings must have a minimum 1hour fireresistance rating without exception

B. Yes, corridors in Group B occupancies are permitted to be unrated when the building is equipped with an automatic sprinkler system throughout

C. No, corridors must always match the fireresistance rating of the exit stairway enclosure they serve

D. Yes, corridor ratings are optional in all occupancy groups and are provided only at the architect's discretion

9. Under the IBC, what is the minimum required height for handrails along accessible ramps, measured vertically from the ramp surface?

A. Between 30 inches and 34 inches measured vertically from the ramp surface to the top of the handrail

B. Between 42 inches and 48 inches measured vertically from the ramp surface to the top of the handrail

C. Between 36 inches and 42 inches measured vertically from the ramp surface to the top of the handrail

D. Between 34 inches and 38 inches measured vertically from the ramp surface to the top of the handrail

10. A building official inspects a commercial building and finds that several fire doors on a corridor are being held open with rubber door wedges. Under the IBC, what is the correct assessment of this condition?

A. This is a code violation because firerated doors must be selfclosing or automaticclosing and may not be held open by unauthorized means such as wedges or blocks

B. Door wedges are permitted for firerated doors as long as the building has an operational sprinkler system

C. Door wedges are acceptable on firerated corridor doors but not on doors serving exit stairway enclosures

D. Firerated doors may be held open by any means as long as the door can be closed manually within 30 seconds

11. A contractor is evaluating the maximum travel distance for a Group F2 (lowhazard factory) occupancy without sprinkler protection. According to IBC Table 1017.2, what is the maximum exit access travel distance?

A. 200 feet for Group F2 occupancies without automatic sprinkler protection

B. 250 feet for Group F2 occupancies without automatic sprinkler protection

C. 300 feet for Group F2 occupancies without automatic sprinkler protection

D. 400 feet for Group F2 occupancies without automatic sprinkler protection

12. Under the IBC, what is the minimum required landing length at the top and bottom of an accessible ramp run?

A. 36 inches minimum landing length at the top and bottom of each accessible ramp run

B. 60 inches minimum landing length at the top and bottom of each accessible ramp run

C. 48 inches minimum landing length at the top and bottom of each accessible ramp run

D. 72 inches minimum landing length at the top and bottom of each accessible ramp run

13. A contractor is reviewing IBC requirements for a building with a Group H1 (highhazard, detonation) occupancy. According to the IBC, what is the maximum travel distance to the nearest exit for a Group H1 occupancy?

A. 200 feet when the building is equipped with an approved automatic sprinkler system

B. 100 feet when the building is equipped with an approved automatic sprinkler system

C. 150 feet when the building is equipped with an approved automatic sprinkler system

D. 75 feet when the building is equipped with an approved automatic sprinkler system

14. According to IBC Chapter 11, at least what percentage of all public entrances to a commercial building must be accessible?

A. At least 60% of all public entrances must be accessible, including the main entrance

B. At least 25% of all public entrances must be accessible, but the main entrance may be excluded

C. 100% of all public entrances must be accessible without any exceptions permitted

D. At least 50% of all public entrances must be accessible, with the main entrance always included

15. Under the IBC, what is the minimum clear stair width required for an exit stairway serving an occupant load of fewer than 50 persons?

A. 44 inches minimum clear width for all exit stairways regardless of occupant load served

B. 48 inches minimum clear width for exit stairways serving fewer than 50 persons in the building

C. 36 inches minimum clear width for exit stairways serving an occupant load of fewer than 50 persons

D. 32 inches minimum clear width for exit stairways in buildings under three stories in height

16. A contractor is constructing a Type IIA commercial building. According to IBC Table 601, what fireresistance rating is required for the floor construction in Type IIA?

A. 2hour fireresistance rating for floor construction in Type IIA buildings

B. 1hour fireresistance rating for floor construction in Type IIA buildings

C. No fireresistance rating is required for floor construction in Type IIA buildings

D. 3hour fireresistance rating for floor construction in Type IIA buildings

17. Under the IBC, when two required exits from a building story are separated by at least the minimum required distance, what additional requirement ensures that occupants have access to two independent egress paths from every point in the building?

A. Both exits must lead to the same public way to ensure occupants reach the same safe assembly area

B. Both exits must be identical in size and configuration to provide equivalent egress capacity

C. Each exit must have a dedicated fire alarm pull station and emergency communication device

D. The common path of egress travel — the distance from the most remote point to where two paths become available — must not exceed the codeprescribed limit

18. A commercial building's certificate of occupancy specifies a Group B occupancy. The building owner now wants to convert part of the first floor to a Group A2 restaurant without any construction work. Under the IBC, what requirement applies to this change of occupancy?

A. The spaces must comply with all requirements of the new Group A2 occupancy classification even without physical construction

B. No code compliance is required because no physical construction is being performed in the space

C. Only the fire alarm system must be upgraded because all other requirements are occupancyindependent

D. The change is prohibited without demolishing and reconstructing the affected portion to current standards

19. Under the IBC, what type of automatic fire detection is required in Group R1 (hotel) guest rooms?

A. Heat detectors only, located on the ceiling within 3 feet of each room's entry door

B. Carbon monoxide detectors only, located near the floor adjacent to each sleeping area

C. Smoke detectors within each guest room, typically located on the ceiling in the sleeping area

D. Flame detectors with ultraviolet sensing technology mounted at each window and exterior door

20. A contractor is constructing a commercial building where the architect has specified a horizontal exit as one of the two required means of egress from an upper floor. Under the IBC, what defines a horizontal exit?

A. A ramp connecting two floors at different elevations within the same fire area and building section

B. A passage through a fire wall into an adjacent building or through a fire barrier into a separate fire area on the same floor, providing refuge without vertical travel

C. An exterior door at grade level that discharges directly onto a public sidewalk or designated exit court

D. A corridor on the same floor leading to an enclosed exit stairway at the opposite end of the building

21. Under the IBC, the maximum variation permitted between the largest and smallest riser height within a single flight of stairs cannot exceed a specific tolerance. What is this maximum allowable variation?

A. ⅜ inch maximum variation between the largest and smallest riser within a single flight of stairs

B. ½ inch maximum variation between the largest and smallest riser within a single flight of stairs

C. ¼ inch maximum variation between the largest and smallest riser within a single flight of stairs

D. 1 inch maximum variation between the largest and smallest riser within a single flight of stairs

22. Under IBC Chapter 11, accessible toilet rooms must include at least one accessible toilet stall meeting specific dimensional requirements. What is the minimum width of a standard accessible toilet stall?

A. 48 inches minimum width for a standard accessible toilet stall in commercial restrooms

B. 36 inches minimum width for a standard accessible toilet stall in commercial restrooms

C. 42 inches minimum width for a standard accessible toilet stall in commercial restrooms

D. 60 inches minimum width for a standard accessible toilet stall in commercial restrooms

23. A contractor is reviewing the IBC requirements for a building with an occupant load of 1,200 persons on a single story. According to IBC Table 1006.3.4, how many exits are required from this story?

A. 2 exits are required for any story with an occupant load up to 1,500 persons

B. 3 exits are required for any story with an occupant load between 501 and 1,200 persons

C. 4 exits are required for any story with an occupant load exceeding 1,000 persons

D. 5 exits are required for any story with an occupant load exceeding 1,000 persons

24. Under the IBC, handrails on exit stairways must extend beyond the top and bottom risers of each stair flight. What is the minimum horizontal extension required beyond the top riser?

A. 6 inches minimum horizontal extension beyond the top riser of each stair flight

B. 18 inches minimum horizontal extension beyond the top riser of each stair flight

C. 12 inches minimum horizontal extension beyond the top riser of each stair flight

D. The handrail must terminate at the top riser with no horizontal extension required beyond the nosing

25. A contractor discovers that the building plans show a corridor width of 36 inches in a Group E (educational) occupancy with an occupant load of 100. Under the IBC, does this corridor width comply with the code?

A. No, the IBC requires a minimum corridor width of 44 inches when serving an occupant load of 50 or more persons

B. Yes, the IBC requires only 36 inches for all corridors in educational occupancies regardless of load

C. No, the IBC requires a minimum corridor width of 60 inches in all Group E educational occupancies

D. Yes, the 36inch width complies because educational corridors are measured differently than other occupancies

**DOMAIN 2: SITE CONSTRUCTION (Questions 26–40)**

26. A contractor is performing a preconstruction site assessment for a commercial building project. The site was previously used as a gasoline filling station. What type of environmental assessment should be performed before construction begins?

A. A simple visual inspection by the contractor is sufficient to clear the site for construction activity

B. A Phase III Environmental Assessment involving immediate soil remediation before any testing occurs

C. A Phase I Environmental Site Assessment to identify potential contamination from previous land uses, potentially followed by Phase II sampling

D. An environmental assessment is not required because the previous use was a legal commercial operation

27. Under OSHA's excavation safety standard, a ladder used for egress from a trench must extend a minimum distance above the top of the excavation. What is this minimum extension?

A. 2 feet above the top of the excavation to provide adequate handhold for workers exiting the trench

B. 4 feet above the top of the excavation to ensure visibility and safe transition to grade level

C. 5 feet above the top of the excavation to match the minimum depth requiring a protective system

D. 3 feet above the top of the excavation to provide a secure handhold for workers climbing out

28. A geotechnical report recommends a mat foundation for a commercial building because the individual spread footings would nearly overlap due to heavy column loads on weak soil. What is the defining characteristic of a mat foundation?

A. A large, thick reinforced concrete slab supporting the entire building footprint, distributing loads uniformly to the soil

B. A network of individual footings connected by grade beams at every column line intersection

C. A series of driven piles connected at the top by a concrete pile cap at each column location

D. A shallow trench filled with compacted gravel extending around the entire building perimeter

29. When performing a soil compaction test using a nuclear density gauge, what two properties of the compacted soil does the gauge measure?

A. Soil temperature and chemical composition of the mineral content within the fill material

B. Inplace wet density and moisture content of the compacted fill material

C. Unconfined compressive strength and permeability coefficient of the bearing soil layer

D. Particle size distribution and organic content percentage of the fill material being tested

30. A construction project requires dewatering to lower the groundwater table below the excavation level. What is the primary risk if dewatering is not performed when the water table is above the excavation bottom?

A. Dewatering is only necessary for aesthetic reasons to keep the jobsite clean and presentable

B. The groundwater will contaminate the concrete during foundation placement and reduce its strength

C. The water will saturate the bearing soil, reducing its load capacity, and will classify all excavation soil as Type C under OSHA regardless of its other properties

D. Dewatering is required by OSHA only when the excavation exceeds 20 feet in depth below the water table

31. A contractor is grading a building pad and the geotechnical engineer rejects a section of fill because it contains organic material from improperly cleared vegetation. Why is organic material prohibited in structural fill?

A. Organic material is too expensive to compact properly and increases the cost of fill operations

B. Organic material stains the concrete foundation and creates aesthetic problems visible from the exterior

C. Organic material changes the color of the soil, making it impossible to verify compaction visually

D. Organic material decomposes over time, creating voids that lead to uneven settlement and potential structural failure

32. According to the IBC, what type of foundation investigation is generally required for commercial buildings to determine subsurface soil conditions and appropriate foundation design?

A. A geotechnical investigation including soil borings, laboratory testing, and engineering analysis is required for most commercial buildings

B. A visual inspection of the surface soil by the contractor is sufficient for all commercial buildings under four stories

C. Foundation investigations are optional for all commercial buildings unless requested by the building official

D. Only buildings exceeding 10 stories require a formal geotechnical investigation with soil borings

33. A contractor is installing a helical pile foundation for a commercial building addition adjacent to an existing occupied structure. What is the primary advantage of helical piles in this application?

A. Helical piles are the least expensive deep foundation option for all commercial applications

B. Helical piles produce no vibration and minimal disturbance, making them suitable for work near existing structures

C. Helical piles can support unlimited loads regardless of soil conditions or pile configuration

D. Helical piles are the only foundation type permitted by the IBC for building additions in all soil types

34. A contractor is reviewing the SWPPP for a commercial construction project and notices that the plan requires a stabilized construction entrance with tire washing capability. Under what condition is tire washing required in addition to the standard crushed stone entrance pad?

A. Tire washing is required on every project regardless of site conditions or soil type

B. Tire washing is never required because the crushed stone pad alone is always sufficient

C. Tire washing is optional and only performed when specifically requested by the project owner

D. Tire washing is required when vehicles carry excessive mud that the stone pad alone cannot remove before they exit onto the public road

35. According to the OSHA excavation safety standard, what is the maximum allowable slope for a Type A soil excavation?

A. 1½ horizontal to 1 vertical (34° from horizontal) for all Type A soil excavations

B. 1 horizontal to 1 vertical (45° from horizontal) for all Type A soil excavations

C. ¾ horizontal to 1 vertical (53° from horizontal) for Type A soil excavations

D. Vertical sides (90°) are permitted for Type A soil excavations up to 12 feet deep

36. A contractor is installing a subsurface foundation drain system. The perforated pipe is placed at the base of the footing and surrounded by washed gravel wrapped in filter fabric. What is the purpose of the filter fabric around the gravel envelope?

A. The filter fabric prevents fine soil particles from migrating into the gravel and clogging the perforated pipe over time

B. The filter fabric provides structural reinforcement to the gravel envelope under the weight of the backfill

C. The filter fabric acts as a vapor barrier to prevent moisture from reaching the foundation wall above

D. The filter fabric is a root barrier that prevents landscaping roots from penetrating the drainage system

37. A contractor must install a sanitary sewer lateral from a commercial building to the municipal sewer main in the street. The specifications call for the sewer pipe to be installed at

a minimum slope to maintain selfcleaning velocity. For a 4inch diameter sanitary sewer pipe, what is the minimum required slope?

A. ¼ inch per foot minimum slope for 4inch and larger sanitary sewer pipes

B. ⅛ inch per foot minimum slope for 4inch and larger sanitary sewer pipes

C. ½ inch per foot minimum slope for 4inch and larger sanitary sewer pipes

D. 1 inch per foot minimum slope for all sanitary sewer pipes regardless of diameter

38. A contractor is constructing a detention pond as part of the stormwater management system for a new commercial development. What is the fundamental difference between a detention system and a retention system?

A. Detention systems and retention systems are identical — the terms are interchangeable in practice

B. Detention systems are located underground while retention systems are always open surface ponds

C. Detention systems permanently retain water onsite while retention systems release water slowly

D. Detention systems temporarily store water and release it at a controlled rate, while retention systems permanently keep water onsite through infiltration

39. A contractor discovers that a previously completed slab on grade has areas of ponding water against the building foundation despite the grading appearing correct at final inspection. What is the most likely cause of this condition?

A. Settlement of the backfill against the foundation has reversed the positive drainage slope, directing water toward the building instead of away from it

B. The concrete slab has expanded due to excessive heat exposure and pushed the surrounding grade uphill

C. The foundation wall is leaking from the interior and the ponding is from water escaping the building

D. The roofing system has failed and all ponding is caused by roof runoff rather than surface drainage issues

40. When placing concrete for a spread footing foundation, the contractor must verify that the bearing soil at the bottom of the excavation matches the conditions assumed in the geotechnical report. Who should inspect and approve the bearing soil before concrete is placed?

A. The building official must personally inspect every foundation bearing surface before concrete placement

B. The concrete supplier's quality control technician verifies bearing soil during the delivery process

C. The geotechnical engineer or their representative should inspect the bearing soil and verify it meets the design assumptions

D. The contractor's superintendent may approve bearing soil without geotechnical involvement on all projects

**DOMAIN 3: CONCRETE (Questions 41–46)**

41. A contractor is placing concrete for a large mat foundation and the structural engineer is concerned about thermal cracking from the heat of hydration generated during curing of the massive concrete pour. Which type of portland cement would the engineer most likely specify to reduce heat generation?

A. Type III portland cement because it generates the highest heat and accelerates strength gain rapidly

B. Type IV portland cement because it generates the lowest heat of hydration during the curing process

C. Type V portland cement because its high sulfate resistance also reduces thermal cracking potential

D. Type I portland cement because it is the generalpurpose standard for all concrete applications

42. A concrete mix design includes a waterreducing admixture. What is the primary effect of a standard waterreducing admixture on the concrete mix?

A. It reduces the water needed by 5% to 10% while maintaining the same workability, resulting in a lower watercement ratio and higher strength

B. It eliminates the need for any curing after placement by sealing moisture within the concrete matrix

C. It increases the air content of the concrete to match the requirements for freezethaw resistance

D. It accelerates the setting time by 50% to allow faster form stripping in cold weather conditions

43. ACI 318 establishes acceptance criteria for concrete compressive strength test results. What requirement must the average of any three consecutive 28day strength tests meet?

A. The average must exceed f'c by at least 500 psi to provide an adequate safety margin

B. The average must equal or exceed the specified compressive strength f'c as the minimum requirement

C. The average must equal or exceed f'c, and no individual test may fall more than 500 psi below f'c

D. Each individual test must exceed f'c with no allowance for any individual test falling below the specified value

44. A contractor is constructing a concrete column and the structural drawings show spiral reinforcement around the vertical bars. What is the primary function of spiral reinforcement in a concrete column?

A. Spiral reinforcement provides fire protection for the vertical bars by increasing the concrete cover

B. Spiral reinforcement acts as formwork support to hold the vertical bars in position during the concrete pour

C. Spiral reinforcement serves as a temperature and shrinkage control mechanism for the column concrete

D. Spiral reinforcement provides lateral confinement that prevents the vertical bars from buckling outward under compressive load

45. A concrete contractor is scheduling a large commercial slab pour during the month of December in northern Alabama. Overnight temperatures are forecast to drop below 40°F. According to ACI 306R (Guide to Cold Weather Concreting), what precaution must the contractor take?

A. No precautions are needed because concrete generates sufficient heat during hydration to protect itself

B. The contractor should use cold water in the mix to slow hydration and prevent thermal cracking

C. The concrete placement should be postponed until temperatures consistently exceed 70°F in spring

D. The contractor must protect the concrete from freezing during early curing by providing insulating blankets, heated enclosures, or other approved cold weather protection measures

46. During a concrete slab pour, the contractor's finisher uses a bull float immediately after screeding. What is the purpose of bull floating?

A. To embed aggregate particles below the surface, smooth the slab, and close any voids left by the screeding operation

B. To intentionally expose the coarse aggregate on the surface for a decorative exposedaggregate finish

C. To apply a curing compound to the concrete surface while it is still workable and receptive

D. To cut contraction joints into the slab at the specified spacing before the concrete begins to set

**DOMAIN 4: MASONRY (Questions 47–50)**

47. A masonry contractor is building a reinforced CMU wall and needs to install vertical rebar in the wall cores. At what typical maximum spacing are vertical reinforcing bars placed in a standard reinforced masonry wall?

A. Vertical rebar is typically placed at 24, 32, or 48 inches on center depending on structural requirements

B. Vertical rebar is placed in every core of every CMU block without exception in all reinforced walls

C. Vertical rebar is placed at 8 inches on center in all reinforced masonry walls regardless of loading

D. Vertical rebar is placed only at the corners of the wall and nowhere else along the wall length

48. In masonry wall construction, horizontal joint reinforcement (ladder wire or truss wire) is placed in the mortar bed joints at regular intervals. What is the typical spacing for horizontal joint reinforcement?

A. Every 48 inches (every sixth course of standard 8inch CMU block) for all wall applications

B. Every 8 inches (every course of standard 8inch CMU block) for maximum crack control

C. Every 32 inches (every fourth course of standard 8inch CMU block) for structural applications

D. Every 16 inches (every other course of standard 8inch CMU block) as the typical standard spacing

49. A masonry wall requires cleanout openings at the base of grouted cells. Under what condition are cleanout openings required?

A. Cleanout openings are required at every grouted cell regardless of the pour height or wall configuration

B. Cleanout openings are required when the grout pour height exceeds 5 feet to allow inspection and debris removal

C. Cleanout openings are required only on walls exceeding 20 feet in total height regardless of pour method

D. Cleanout openings are never required because grout is selfconsolidating and fills all voids automatically

50. A contractor is constructing a multiwythe masonry cavity wall with an air space between the exterior brick veneer and the interior CMU backup wall. What is the primary function of the air space (cavity) in this wall assembly?

A. The cavity is a structural element that adds loadbearing capacity to the composite wall assembly

B. The cavity provides a sound transmission barrier that significantly improves the wall's acoustic rating

C. The cavity serves as a drainage channel for any water that penetrates the exterior brick veneer, directing it downward to weep holes for discharge

D. The cavity is filled with grout to bond the two wythes together and create a solid composite wall section

**DOMAIN 5: METALS (Questions 51–56)**

51. A contractor is reviewing structural drawings for a commercial building and sees a notation specifying "CJP" groove welds for the beamtocolumn moment connections. What does a complete joint penetration (CJP) groove weld achieve?

A. A weld that penetrates only the outer 25% of the joint thickness for lightduty shear connections

B. A decorative surface weld that improves the appearance of exposed structural steel connections

C. A partialstrength connection designed to allow controlled rotation at the beamcolumn interface

D. A fullstrength connection where the weld metal fuses through the entire thickness of the connected members, producing a weld at least as strong as the base metal

52. AISC specifies tolerances for the plumb of erected steel columns. What is the typical plumb tolerance for structural steel columns?

A. 1/500 of the column length, and no individual column may deviate more than 1 inch from plumb at any elevation

B. 1/100 of the column length, and no individual column may deviate more than 3 inches from plumb

C. 1/250 of the column length, and no individual column may deviate more than 2 inches from plumb

D. There is no published tolerance for column plumb — each column is evaluated on a casebycase basis

53. A contractor is installing metal roof decking on a commercial steelframe building. Headed shear studs are specified on the structural drawings for the floor decking but not for the roof decking. What is the purpose of the shear studs on the floor decking?

A. The shear studs attach the ceiling grid system to the underside of the floor deck assembly

B. The shear studs provide fire resistance by creating air gaps between the deck and the concrete slab

C. The shear studs transfer horizontal shear forces between the concrete slab and the supporting steel beam, creating composite action

D. The shear studs anchor the sprinkler piping to the floor deck to prevent movement during seismic events

54. A structural steel erection plan requires that certain bracing members be installed before the crane releases each section of the frame. What is the primary purpose of installing bracing early in the erection sequence?

A. Early bracing installation allows the crane to be removed from the site sooner to reduce rental costs

B. Early bracing provides lateral stability to the partially erected frame, preventing it from collapsing under wind or construction loads

C. Early bracing serves as a safety net system that catches workers who fall from the steel during erection

D. Early bracing is purely aesthetic and is installed early only to satisfy the architect's visual inspection requirements

55. When a structural steel member is exposed as an architectural feature and must be fireproofed without concealing the steel profile, which fireproofing method is most appropriate?

A. Sprayapplied fireresistive material (SFRM) because it conforms to any steel profile shape

B. Gypsum board enclosure built around the member with a minimum ⅝inch Type X board

C. Concrete encasement providing maximum fire resistance with a minimum 2inch cover on all sides

D. Intumescent coating that appears as ordinary paint but swells to form an insulating char layer when exposed to heat

56. A contractor is erecting steel and the ironworkers are using A325 highstrength bolts for the structural connections. The contract specifies slipcritical connections for all lateral forceresisting system connections. What distinguishes a slipcritical connection from a bearingtype connection?

A. Slipcritical connections use only fillet welds while bearingtype connections use only bolts

B. Slipcritical connections require all bolts to be installed fingertight while bearingtype connections require full tension

C. Slipcritical connections are designed for shear only while bearingtype connections resist both shear and tension

D. Slipcritical connections transfer forces through friction between the clamped surfaces, while bearingtype connections transfer forces through the bolt shanks bearing against the hole walls

**DOMAIN 6: WOOD (Questions 57–61)**

57. A contractor orders No. 2 grade dimension lumber for floor joists. The lumber will be enclosed within the building envelope after construction. What moisture content designation should the contractor specify to minimize shrinkagerelated problems after installation?

A. SGRN (surfaced green) with moisture content exceeding 19% for maximum dimensional flexibility

B. SDRY or KD (kilndried) with moisture content of 19% or less to minimize postinstallation shrinkage

C. Airdried only with no specific moisture content limitation because interior lumber does not need to be dried

D. MC30 with moisture content of 30% or less, which is the standard for all structural lumber applications

58. In platform framing, what structural purpose does the rim joist (band joist) serve at the perimeter of the floor frame?

A. The rim joist provides additional insulation value at the building perimeter for energy code compliance

B. The rim joist is a decorative trim element that is not structurally connected to the floor framing system

C. The rim joist encloses the ends of the floor joists, provides a nailing surface for sheathing, and transfers lateral loads from the floor diaphragm to the walls below

D. The rim joist serves as a ledger board for attaching exterior decking and porch structures to the building

59. A contractor is reviewing the structural drawings for a roof system and sees a note specifying "24F1.8E" for a large glulam roof beam. What do the numbers in this designation represent?

A. The beam is 24 feet long with a weight of 1.8 pounds per linear foot for transport calculations

B. The beam has 24 laminations with each lamination measuring 1.8 inches in thickness

C. The designation is a paint color code for the architectural finish applied to the exposed glulam surface

D. The beam has an allowable bending stress of 2,400 psi and a modulus of elasticity of 1,800,000 psi

60. A field superintendent observes a carpenter cutting the bottom chord of a prefabricated wood roof truss to make room for a ductwork run. What is the correct response to this situation?

A. The cut is acceptable if the carpenter reinforces the chord with a metal plate bolted on each side

B. Minor modifications to truss web members are acceptable but chord cuts require the carpenter to use a finer saw blade

C. Truss modifications are permitted as long as the cut does not remove more than 25% of the chord crosssection

D. All work must stop immediately — cutting any truss member without written approval from the truss designer or a registered engineer is prohibited and may cause structural failure

61. The IBC requires preservativetreated lumber or naturally durable wood for specific applications. Which of the following applications does NOT require preservativetreated lumber?

A. Sill plates resting on a concrete foundation wall that is 12 inches above exposed exterior ground

B. Wood columns embedded in the ground and supporting a permanent commercial structure

C. Interior wall studs in a climatecontrolled commercial office building enclosed within the building envelope

D. Wood floor joists closer than 18 inches to exposed ground in a crawl space beneath the building

**DOMAIN 7: THERMAL AND MOISTURE PROTECTION (Questions 62–66)**

62. A contractor is installing fiberglass batt insulation in the stud cavities of an exterior wall. The batts are being compressed to fit around electrical wiring and junction boxes. What effect does compression have on fiberglass batt insulation performance?

A. Compression has no effect on Rvalue because fiberglass performance depends only on the material density

B. Compression significantly reduces the effective Rvalue because the trapped air pockets that provide insulating value are eliminated

C. Compression increases the Rvalue by packing more insulating material into the same cavity depth

D. Compression voids the manufacturer's warranty but does not change the thermal performance rating

63. A building envelope consultant recommends installing a continuous air barrier on a commercial building. Which of the following materials can serve as both insulation and an air barrier in a single application?

A. Closedcell spray polyurethane foam, which expands to fill every gap and crack while providing approximately R6.5 per inch

B. Fiberglass batt insulation, which provides R3.7 per inch and stops air movement through its dense fiber matrix

C. Building paper (15pound asphaltsaturated felt), which provides both thermal resistance and air sealing

D. Polyethylene sheeting (6mil vapor barrier), which provides R1.0 per inch and blocks air infiltration

64. A contractor is installing a builtup roofing (BUR) system on a commercial building. How many plies of reinforcing felt are typically used in a standard commercial BUR assembly?

A. 1 to 2 plies of reinforcing felt in a standard commercial builtup roof assembly

B. 6 to 8 plies of reinforcing felt in a standard commercial builtup roof assembly

C. 10 or more plies of reinforcing felt in a standard commercial builtup roof assembly

D. 3 to 4 plies of reinforcing felt in a standard commercial builtup roof assembly

65. A contractor is selecting a singleply membrane roofing system for a commercial restaurant with kitchen exhaust that may expose the roof membrane to grease and animal fats. Which singleply membrane type is best suited for this application due to its superior chemical resistance?

A. EPDM (ethylene propylene diene monomer) membrane for its excellent weathering and UV resistance

B. TPO (thermoplastic polyolefin) membrane for its energyefficient white reflective surface

C. PVC (polyvinyl chloride) membrane for its superior resistance to chemicals, grease, and fats

D. Modified bitumen membrane for its traditional asphaltbased construction and torchapplied installation

66. A contractor is installing exterior rigid insulation on a commercial building wall and must attach it through the insulation to the structural sheathing below. What potential thermal performance problem does the contractor need to be aware of with the fastener penetrations?

A. The fastener penetrations create thermal bridges through the continuous insulation layer, though the effect is typically minor with properly selected fasteners

B. Fastener penetrations completely negate the benefit of continuous insulation and should never be used

C. Fastener penetrations are prohibited by the IECC and all continuous insulation must be adhesively attached

D. Fastener penetrations improve thermal performance by creating ventilation channels within the insulation layer

**DOMAIN 8: DOORS, WINDOWS, AND GLAZING (Questions 67–70)**

67. A commercial window specification lists a Visible Transmittance (VT) of 0.55. What does this value indicate about the window's performance?

A. The window blocks 55% of all ultraviolet radiation from penetrating the glazing assembly

B. The window allows 55% of visible light to pass through the glazing from exterior to interior

C. The window has a thermal resistance value that is 55% higher than standard singlepane glass

D. The window reflects 55% of infrared heat radiation back toward the building exterior in summer

68. A contractor is installing hollow metal door frames in a new commercial building. The specification calls for 16gauge frames for heavyduty exterior applications. What does the gauge designation indicate about the steel used for the frame?

A. The weight of the frame in pounds per linear foot for shipping and handling calculations

B. The yield strength of the steel in thousands of pounds per square inch for structural analysis

C. The fireresistance rating of the frame in minutes for compliance with firerated assembly requirements

D. The thickness of the steel sheet used to form the frame, with lower gauge numbers indicating thicker steel

69. Under the IBC, what type of glazing is required in locations where human impact with the glass is likely, such as doors, sidelights adjacent to doors, and glazing near floor level?

A. Safety glazing (tempered or laminated glass) is required in hazardous locations where human impact is likely

B. Wired glass is the only acceptable glazing type for all commercial door and sidelight applications

C. Standard annealed float glass may be used in all glazing locations without restriction in commercial buildings

D. Insulated glass units are required in all locations regardless of impact hazard for energy code compliance

70. A contractor is installing a curtain wall system on a midrise commercial office building. What structural characteristic distinguishes a curtain wall from a conventional window system?

A. Curtain walls are structural loadbearing wall systems that support the floors and roof above

B. A curtain wall is a nonstructural facade system that spans between floor slabs and is supported by the building's structural frame rather than bearing any building loads

C. Curtain walls are identical to conventional window systems but use larger glass panels for aesthetics

D. Curtain walls are installed only on the ground floor of commercial buildings as storefront entrance systems

DOMAIN 9: FINISHES (Questions 71–75)

71. A contractor is constructing a commercial building where the architect specifies a 2hour fireresistancerated wall assembly. The wall will use steel studs. What role does Type X gypsum board play in achieving this fire rating?

A. Type X board is used only for aesthetic purposes and does not contribute to the fireresistance rating

B. Type X board serves as a decorative veneer that conceals the fireresistant steel stud structure behind it

C. Type X board is optional in firerated steel stud assemblies because the steel studs provide the full rating

D. Type X board provides the fire resistance through its gypsum core with glass fiber additives that maintain integrity under fire exposure, with multiple layers used for higher ratings

72. A drywall contractor notices that the power screwdriver is consistently driving screws too deep, breaking through the paper face of the gypsum board. What is the consequence of this overdriving condition?

A. Overdriven screws have no structural effect because the gypsum core provides all of the holding capacity

B. Overdriven screws that break through the paper face lose their holding power and provide essentially zero structural value

C. Overdriven screws improve the holding capacity by compressing the gypsum core around the screw head

D. Overdriven screws are cosmetically undesirable but functionally equivalent to properly driven screws

73. A commercial building's interior design specifies polished concrete floors in the lobby and common areas. What is the general process for achieving a polished concrete floor finish?

A. The concrete surface is ground with progressively finer diamond abrasives, then sealed with a chemical densifier and polished to the desired sheen level

B. A separate layer of decorative epoxy is poured over the structural slab and polished after curing

C. Standard concrete is painted with a highgloss polyurethane coating to simulate the appearance of polished stone

D. Polished concrete is achieved by floating the surface excessively during placement to bring excess paste to the top

74. A contractor is selecting flooring for a commercial kitchen where slip resistance is a critical safety requirement. Which characteristic of the flooring material is most important for this application?

A. The flooring must have a high gloss sheen level to facilitate cleaning and sanitation protocols

B. The flooring must have the lowest possible cost per square foot to meet the project budget constraints

C. The flooring must have a high coefficient of friction when wet to prevent slips and falls in the cooking area

D. The flooring must be available in the widest range of colors and patterns for aesthetic design flexibility

75. A commercial building specification requires Level 1 gypsum board finish in the space above a suspended acoustic ceiling. What does Level 1 finish consist of, and why is it appropriate for this location?

A. Level 1 finish consists of no tape and no joint compound — bare board only — for uninspected concealed spaces

B. Level 1 finish consists of three coats of joint compound with full sanding for smooth concealed ceilings

C. Level 1 finish consists of a full skim coat over the entire board surface for maximum quality in all locations

D. Level 1 finish consists of tape embedded in joint compound only — sufficient for concealed areas like aboveceiling plenums where appearance is not a concern

**DOMAIN 10: MECHANICAL AND PLUMBING SYSTEMS (Questions 76–81)**

76. A contractor is constructing a large commercial building with a centralized chilled water HVAC system. What component of the chilled water system is responsible for rejecting heat from the refrigeration cycle to the outdoor environment?

A. The air handling units located throughout the building on each occupied floor

B. A cooling tower, typically installed on the roof, which rejects heat from the condenser water loop to the outdoor air through evaporation

C. The chilled water pumps, which generate heat through friction and reject it through the pipe insulation

D. The building's potable water supply, which absorbs condenser heat and discharges it through the sanitary drain

77. Under the International Plumbing Code, a drinking fountain must be provided at a minimum ratio based on the building's occupant load. What is the typical minimum requirement for drinking fountains in most commercial occupancies?

A. 1 drinking fountain per 100 occupants with a minimum of 1 per floor in most commercial occupancies

B. 1 drinking fountain per 25 occupants with bottlefilling stations at every other drinking fountain location

C. 1 drinking fountain per 500 occupants with no minimum perfloor requirement for any occupancy

D. Drinking fountains are not required by the plumbing code and are provided only at the owner's discretion

78. A plumbing contractor is installing a reduced pressure zone (RPZ) backflow preventer at the fire sprinkler system connection to the domestic water supply. Why is an RPZ device required at this connection rather than a simpler double check valve?

A. RPZ devices are less expensive to install than double check valves for fire sprinkler connections

B. RPZ devices are required by the fire code for all sprinkler connections regardless of hazard level

C. The fire sprinkler system is classified as a highhazard connection because it may contain stagnant water, corrosion byproducts, or chemical additives that could contaminate the potable water supply

D. Double check valves are prohibited by the plumbing code for all commercial applications without exception

79. A commercial building is designed with a belowgrade parking garage. The fire protection engineer specifies a dry pipe sprinkler system for the garage. What delay occurs between the activation of a sprinkler head and the initial discharge of water in a dry pipe system?

A. Water discharges immediately upon head activation, identical to a wet pipe system operation

B. A 5 to 10minute delay while the system pressurizes from the municipal water main supply

C. A delay of 15 to 30 seconds while the building automation system verifies the alarm signal

D. A delay of approximately 30 to 60 seconds while pressurized air exhausts from the piping and water fills the system from the dry pipe valve

80. Under the International Plumbing Code, what is the maximum flow rate permitted for lavatory faucets installed in public commercial restrooms?

A. 0.5 gallons per minute maximum flow rate for lavatory faucets in public commercial restrooms

B. 1.5 gallons per minute maximum flow rate for lavatory faucets in public commercial restrooms

C. 2.2 gallons per minute maximum flow rate for lavatory faucets in public commercial restrooms

D. There is no flow rate restriction for lavatory faucets in commercial restrooms under the plumbing code

81. A contractor is coordinating the installation of a fire alarm system in a new commercial building. Under NFPA 72, what must be completed before the building can receive a certificate of occupancy?

A. The fire alarm system must have been in operation for a minimum of 30 days without any false alarms

B. The fire alarm system must be inspected, tested, and acceptancetested to verify proper operation of all components before the certificate of occupancy is issued

C. Only the manual pull stations need to be tested — automatic detectors are tested during the first year warranty

D. The fire alarm system testing may be deferred until 90 days after occupancy to allow for system stabilization

**DOMAIN 11: ELECTRICAL SYSTEMS (Questions 82–84)**

82. A contractor is reviewing the electrical plans for a commercial building and notices that the service entrance includes a "main disconnect." Under the NEC, what is the purpose of the main disconnect, and who must have access to it?

A. The main disconnect is a convenience switch for the building maintenance staff to turn off lights during cleaning

B. The main disconnect serves as the building's primary light switch and is located at the main entrance for visitor access

C. The main disconnect is a circuit breaker or fused switch that can disconnect all electrical power to the building and must be accessible to the building owner, electrical contractor, and fire department

D. The main disconnect is an optional component that is installed only in buildings exceeding 50,000 square feet

83. Under the NEC, what type of wiring method is generally NOT permitted in commercial buildings above three stories?

A. Electrical metallic tubing (EMT) with setscrew fittings is not permitted above three stories

B. Metalclad (MC) cable with interlocking metal armor is not permitted above three stories

C. Rigid metal conduit (RMC) with threaded connections is not permitted above three stories

D. Nonmetallic sheathed cable (Romex/NM cable), which is the standard residential wiring method

84. A contractor must install temporary electrical power on a construction site before permanent service is established. Under OSHA, what protection must be provided for all temporary wiring and receptacles on the construction site?

A. Groundfault circuit interrupter (GFCI) protection must be provided for all temporary wiring, or an assured equipment grounding conductor program must be in place

B. All temporary wiring must be buried underground at a minimum depth of 24 inches for protection

C. Temporary wiring is exempt from all safety requirements because it will be removed before occupancy

D. Only 240volt receptacles require protection — 120volt temporary receptacles are exempt from GFCI

**DOMAIN 12: PROCUREMENT AND CONTRACTING REQUIREMENTS (Questions 85–115)**

85. A project owner is evaluating project delivery methods and wants maximum control over the design process while maintaining competitive pricing for construction. Which delivery method best satisfies both of these objectives?

A. Designbuild, because the single contract gives the owner direct control over all design decisions

B. Integrated project delivery, because the multiparty agreement ensures the lowest possible price

C. CM as advisor, because the construction manager guarantees both design quality and construction price

D. Designbidbuild, because the owner controls the design through a separate designer contract and obtains competitive pricing through the bid process

86. Under AIA A201, the contractor must submit a schedule of values to the architect before the first application for payment. What happens if the architect finds the schedule of values unacceptable?

A. The contractor proceeds with billing using the rejected schedule until a revised version is submitted

B. The architect may withhold certification of the first pay application until an acceptable schedule of values is provided

C. The schedule of values is automatically accepted if the architect does not respond within 7 days

D. The contractor may file a claim against the owner for delay caused by the architect's rejection

87. A contractor is preparing a bid for a project with specifications organized by the CSI MasterFormat system. What is the purpose of the MasterFormat organizational structure?

A. MasterFormat establishes the maximum contract price that may be bid for each category of construction work

B. MasterFormat provides a standardized numbering and organizational framework for construction specifications

C. MasterFormat determines the sequence in which construction activities must be performed on the project

D. MasterFormat assigns specific subcontractors to each trade division based on their licensing classification

88. Under a standard construction contract, the contractor submits shop drawings for the architect's review. If the architect returns the shop drawings marked "Approved as Noted," what is the contractor's obligation?

A. The contractor must incorporate the architect's noted revisions and may proceed with fabrication per the markedup shop drawings

B. The contractor must resubmit the shop drawings for a second review before any fabrication may begin

C. The notation "Approved as Noted" has no contractual significance and the contractor may ignore the notes

D. The contractor must file a formal claim if they disagree with any of the architect's noted revisions

89. A general contractor wants to protect against the financial risk of a subcontractor failing to complete their portion of the work. What type of bond should the contractor require from the subcontractor?

A. A bid bond guaranteeing the subcontractor will honor the original quote submitted during bidding

B. A payment bond guaranteeing the subcontractor will pay its own suppliers and lowertier subcontractors

C. A license bond guaranteeing the subcontractor holds a valid and current state contractor's license

D. A performance bond guaranteeing the subcontractor will complete the work per the subcontract documents

90. Under AIA A201, the owner is required to provide the contractor with certain information before and during construction. Which of the following is an owner obligation under the general conditions?

A. The owner must provide all construction materials and equipment needed for the contractor's work

B. The owner must furnish surveys describing the physical characteristics, legal limits, and utility locations of the site

C. The owner must hire and supervise all subcontractors directly rather than through the general contractor

D. The owner must provide daily onsite supervision of the contractor's workforce and construction methods

91. A contractor on a commercial project receives a proposal from the owner to extend the project schedule by 30 days at no additional cost to the owner. The extension will increase the contractor's general conditions costs. What should the contractor do?

A. Accept the extension without question because the owner has the unilateral right to extend the schedule

B. Reject the extension outright and demand that the original completion date remain unchanged

C. Submit a change order proposal that documents the additional general conditions cost resulting from the 30day extension and negotiate appropriate compensation

D. File an immediate mechanics' lien against the property to protect against the financial impact of the delay

92. Under a unit price contract, the contractor provides unit prices for specific items of work. If the actual quantity of an item varies significantly from the estimated quantity, what provision typically allows for price adjustment?

A. Most unit price contracts include a quantity variation clause that permits renegotiation of the unit price when actual quantities exceed or fall below the estimated quantity by a specified percentage, typically 15% to 25%

B. Unit prices are fixed regardless of quantity variations and can never be adjusted under any circumstances

C. Quantity variations are absorbed entirely by the subcontractor performing the work without any price adjustment

D. The owner must rebid the entire project if any single item quantity varies by more than 5% from the estimate

93. A contractor is preparing closeout documentation and the specifications require submission of "asbuilt" (record) drawings. What information must asbuilt drawings document?

A. The contractor's original bid estimate and the actual cost of each line item in the schedule of values

B. The architect's design development drawings showing the evolution of the design from concept to final documents

C. The actual installed conditions of all building systems, including any deviations from the original design, field changes, and RFI resolutions

D. The subcontractor's daily labor reports showing the number of workers and hours worked on each activity

94. Under AIA A201, the contractor is required to provide a warranty for the construction work. What is the standard duration of the contractor's warranty from the date of substantial completion?

A. One year from the date of substantial completion as the standard contractor warranty period

B. Two years from the date of substantial completion as the standard contractor warranty period

C. Five years from the date of substantial completion as the standard contractor warranty period

D. Six months from the date of final completion as the standard contractor warranty period

95. A contractor submits a pay application that includes a line item for "costs in excess of billings." What does this term mean in construction accounting?

A. The contractor has billed the owner for more work than has actually been completed to date

B. The contractor has exceeded the total contract price and the overage is being billed to the owner

C. The contractor has performed administrative work that was not included in the original contract scope

D. The contractor has completed more work than has been billed, meaning the contractor has underbilled relative to actual progress

96. A public project requires all bidders to submit a list of major subcontractors with their bids. After the bid is submitted, the apparent low bidder wants to substitute one of the listed subcontractors with a different firm. Under typical public bidding law, is this substitution permitted?

A. Yes, the contractor may freely substitute any subcontractor at any time before the contract is executed

B. Subcontractor substitution after bid submission is generally restricted and permitted only for specific documented reasons such as the listed subcontractor's failure to execute the subcontract or loss of licensure

C. The contractor may substitute subcontractors only if the replacement provides a lower price than the original

D. Subcontractor substitution is permitted as long as the owner and architect both consent in writing

97. Under AIA A201, what is the contractor's obligation when the architect issues a minor change in the work through a written order (Architect's Supplemental Instruction)?

A. The contractor may refuse to comply with any architect's supplemental instruction without owner approval

B. The contractor must submit a formal change order request and wait for approval before performing any work

C. The contractor must carry out the minor change promptly, provided it does not involve an adjustment in contract price or time

D. The contractor must file a claim within 7 days of receiving the supplemental instruction to preserve their rights

98. A contractor is working under a costplusfee contract and the owner requests detailed backup documentation for every cost item. Under a standard costplus contract, what documentation is the contractor typically required to provide?

A. Complete documentation of all costs including labor time sheets, material invoices, equipment logs, and subcontractor invoices, because costplus contracts are openbook arrangements

B. Only a monthly summary of total costs with no detailed backup documentation required by the contractor

C. Documentation is required only for costs exceeding $5,000 per individual line item or purchase order

D. The contractor provides documentation only at the end of the project during the final accounting reconciliation

99. A project specification includes an alternates section that lists five alternates. Alternate #3 reads: "Add covered walkway connecting Building A to Building B — Add $___." If the owner accepts this alternate after bid opening, how is it incorporated into the contract?

A. The alternate price is treated as a separate contract between the owner and the contractor independent of the base bid

B. The contractor may renegotiate the alternate price after bid opening to account for current market conditions

C. The alternate is incorporated into the base contract by change order or by reference in the ownercontractor agreement

D. The accepted alternate automatically modifies the contract price without requiring any formal documentation or agreement

100. Under standard construction contract provisions, what is the difference between "substantial completion" and "final completion"?

A. Substantial completion and final completion occur simultaneously when the last piece of work is installed

B. Substantial completion occurs when the work is sufficiently complete for the owner to occupy and use the building; final completion occurs when all punch list items are corrected, all closeout documents are submitted, and all contract requirements are fulfilled

C. Substantial completion refers to the structural frame only; final completion refers to the building envelope

D. Substantial completion is declared by the contractor; final completion is declared by the building official

101. A contractor includes a "no damages for delay" clause in a subcontract agreement. What does this clause mean for the subcontractor?

A. The subcontractor waives the right to claim monetary damages for delays caused by the general contractor or owner, typically limiting the remedy to a time extension only

B. The subcontractor is guaranteed that no delays will occur during the project under any circumstances

C. The general contractor agrees to pay the subcontractor liquidated damages for every day of contractorcaused delay

D. The clause prohibits the subcontractor from requesting any schedule extensions for any reason during the project

102. A contractor is reviewing a project specification that includes both "or equal" and "no substitution" clauses for different product categories. What is the difference between these two specification approaches?

A. "Or equal" specifications name a specific product but allow the contractor to submit equivalent alternatives for approval

B. "Or equal" and "no substitution" are identical terms that both allow unlimited product flexibility

C. "Or equal" and "no substitution" both require the contractor to use only the named product without exception

D. "No substitution" specifications allow the contractor to select any product while "or equal" limits choices

103. Under AIA A201, what is the effect of the owner's acceptance of nonconforming work?

A. Acceptance of nonconforming work releases the contractor from all warranty obligations for the accepted work

B. Acceptance automatically reduces the contractor's performance bond amount by the value of the nonconforming work

C. Acceptance of nonconforming work has no effect because the contractor must always replace it at no cost

D. The owner may accept nonconforming work with an appropriate reduction in the contract price, and such acceptance does not waive the owner's right to pursue other remedies

104. A contractor submits a monthly pay application and the architect certifies a reduced amount, withholding payment for a disputed item. The contractor disagrees with the architect's decision. Under AIA A201, what is the contractor's remedy?

A. The contractor must accept the architect's certification without any right to dispute or appeal the decision

B. The contractor may submit a claim under the dispute resolution provisions of the contract while continuing to perform the work

C. The contractor must immediately stop all work on the project until the payment dispute is fully resolved

D. The contractor may file a mechanics' lien against the property for the disputed amount without first pursuing contract remedies

105. A contractor needs to determine the amount of bid security required for a public project bid. The instructions to bidders specify a bid bond. What is the typical amount of a bid bond relative to the bid price?

A. 5% to 10% of the bid price is the typical amount for a bid bond on public construction projects

B. 100% of the bid price, matching the requirement for performance and payment bonds

C. 1% of the bid price as a nominal administrative fee for the bid processing procedure

D. 25% of the bid price to demonstrate the contractor's financial commitment to the project

106. Under a standard construction contract, what obligation does the contractor have regarding the safety of persons and property at the construction site?

A. Safety is exclusively the responsibility of each individual subcontractor for their own workers only

B. The contractor has no safety obligations beyond providing hard hats and safety glasses to visitors

C. The contractor has primary responsibility for initiating, maintaining, and supervising safety precautions and programs for the protection of all persons and property at the site

D. Safety is solely the building official's responsibility and the contractor need only comply with inspection findings

107. A contractor receives a specification requiring submittal of product data sheets for all mechanical equipment before installation. What is the difference between product data and shop drawings?

A. Product data and shop drawings are identical documents with different names used interchangeably

B. Product data is submitted by the owner while shop drawings are submitted by the contractor exclusively

C. Product data is required only for change order work while shop drawings are required for base contract work

D. Product data consists of manufacturer's standard literature, performance charts, and technical specifications; shop drawings are custompreparedrawings showing specific fabrication and installation details for the project

108. Under AIA A201, the contractor must maintain certain insurance coverages during the project. If the contractor's insurance lapses during construction, what are the potential consequences?

A. Insurance lapses have no contractual consequences as long as the contractor reinstates coverage within 30 days

B. An insurance lapse may constitute a material breach of the contract, potentially giving the owner grounds for termination, and leaves the contractor exposed to uninsured claims

C. The architect's professional liability insurance automatically covers the contractor during any gap in coverage

D. The owner's builder's risk policy replaces the contractor's lapsed coverage without any contractual consequences

109. A contractor is evaluating two competing bids for the roofing trade package. Bidder A offers a price of $285,000 with a 5year warranty. Bidder B offers $310,000 with a 20year manufacturer's warranty. What analysis should the contractor perform beyond comparing the initial prices?

A. The contractor should evaluate the total cost of ownership including warranty coverage, expected maintenance costs, roof life expectancy, and the financial stability and track record of each bidder

B. The contractor must always select the lowest bidder regardless of warranty or quality considerations

C. Warranty terms are irrelevant because the general contractor's 1year warranty supersedes all manufacturer warranties

D. The contractor should reject both bids and selfperform the roofing work to maximize profit margin

110. A contractor on a public project discovers that the project specifications contain a restrictive specification that limits the acceptable product to a single manufacturer with no "or equal" option. What concern does this raise?

A. Singlesource specifications are always prohibited on public projects and the contractor must refuse to bid

B. Singlesource specifications eliminate competition for the specified item and may violate public procurement requirements

C. Singlesource specifications automatically increase the project cost by exactly 25% above the competitive market price

D. Singlesource specifications are preferred on public projects because they eliminate confusion and ensure quality

111. Under standard construction contract provisions, what is the purpose of a preconstruction meeting held after contract award but before construction begins?

A. The preconstruction meeting is a social event to introduce the project team and has no contractual significance

B. The preconstruction meeting establishes communication protocols, reviews the project schedule, clarifies administrative procedures, coordinates logistics, and identifies potential issues before construction begins

C. The preconstruction meeting is held solely to allow the contractor to negotiate changes to the contract price

D. The preconstruction meeting is required only on projects exceeding $10 million in total contract value

112. A contractor provides a conditional waiver on progress payment and an unconditional waiver on progress payment. Under construction lien law, what is the critical difference between these two documents?

A. Conditional waivers apply only to the contractor while unconditional waivers apply only to subcontractors

B. Conditional waivers are valid for 30 days while unconditional waivers are valid for 12 months

C. Conditional waivers may be revoked at any time while unconditional waivers may be revoked within 10 days

D. A conditional waiver becomes effective only upon actual receipt of the payment, while an unconditional waiver takes effect immediately upon signing regardless of whether payment is received

113. A general contractor is required to provide a performance bond on a commercial project. If the contractor defaults and the surety is called upon to complete the project, what options does the surety typically have?

A. The surety may finance the defaulting contractor to complete the work, hire a replacement contractor, or pay the owner the cost to complete — and then seeks reimbursement from the original contractor

B. The surety has no obligation beyond paying the owner a flat fee equal to 10% of the bond amount

C. The surety may only pay the owner cash and is prohibited from hiring a replacement contractor

D. The surety's obligation is limited to mediating a settlement between the owner and the defaulting contractor

114. Under AIA A201, the architect observes the contractor's work during periodic site visits. What is the scope and purpose of the architect's observations?

A. The architect performs daily fulltime inspection of all construction activities as the owner's quality control agent

B. The architect is responsible for supervising the contractor's means, methods, techniques, and sequences of construction

C. The architect makes periodic visits to observe the progress and quality of the work for general conformance with the contract documents, but does not supervise construction or guarantee that the work is defectfree

D. The architect observes only the exterior finishes and has no authority to review structural or mechanical work

115. A contractor's bid includes an allowance of $25,000 for landscaping. During construction, the actual landscaping cost is determined to be $32,000. How is the $7,000 difference handled under the contract?

A. The contractor must absorb the $7,000 difference because the allowance was included in the fixed bid price

B. A change order is issued to adjust the contract price by $7,000 (plus the contractor's applicable overhead and profit markup on the additional cost) to reflect the difference between the allowance and the actual cost

C. The owner pays the $7,000 difference directly to the landscaping subcontractor without any contract adjustment

D. The allowance amount is renegotiated retroactively to match the actual cost with no markup permitted

## Practice Exam 3: Answer Key and Explanations

**1.** B — IBC Section 507 permits unlimited floor area for Group M (Mercantile) occupancies when the building is no more than two stories, is fully sprinklered in accordance with NFPA 13, and is surrounded on all sides by at least 60 feet of open space. Group M is specifically listed alongside Groups A4, B, F, and S as eligible occupancies. This provision is widely used for large retail stores and warehouses.

**2.** D — Under the nonseparated occupancies approach (IBC Section 508.3), the entire building must comply with the most restrictive height, area, and construction type requirements applicable to any occupancy present. If Group S1 requires Type IIA construction and Group B permits Type IIB, the entire building must meet Type IIA. This conservative approach is the tradeoff for not providing physical fire separation between occupancies.

**3.** A — The IBC occupant load factor for assembly areas without fixed seats in an unconcentrated arrangement (tables and chairs) is 15 net square feet per person. The key word is "net" — only the actual occupied floor space is counted, excluding corridors, kitchens, mechanical rooms, and restrooms. Concentrated seating (chairs only, no tables) uses the higherdensity factor of 7 net square feet per person.

**4.** C — IBC Table 508.4 typically requires a 1hour fireresistancerated separation between Group A3 and Group B occupancies in sprinklered buildings, or a 2hour separation in nonsprinklered buildings. The table crossreferences occupancy groups to determine the required separation, and sprinkler protection allows a reduction in the required rating for most occupancy pairs.

**5.** D — Smoke barriers are fireresistancerated assemblies (minimum 1hour rating) designed specifically to restrict the migration of smoke through a building. They are required in Group I2 (hospitals) and I3 (detention facilities) to create smoke compartments that enable horizontal evacuation — moving patients or inmates to an adjacent safe compartment on the same floor rather than attempting vertical evacuation.

**6.** A — IBC Table 601 requires a 2hour fireresistance rating for the structural frame of Type IB construction. Type IA requires the highest rating at 3 hours, and Type IB is the next most restrictive at 2 hours. Both Type I subtypes require noncombustible construction throughout, with the difference being the fireresistance rating levels.

**7.** C — Installing an automatic sprinkler system in accordance with NFPA 13 provides significant code benefits including an increase of one story in the allowable building height (IBC Section 504.2) and a substantial increase in the allowable floor area per story (IBC Section 506.3). Sprinklers do not eliminate fireresistance requirements, fire alarms, or egress requirements — they supplement them.

**8.** B — The IBC permits unrated corridors in Group B occupancies when the building is equipped with an automatic sprinkler system throughout. Without sprinklers, Group B corridors require a 1hour rating when serving an occupant load greater than 30. The sprinkler tradeoff recognizes that the sprinkler system provides an alternative level of protection that compensates for the unrated corridor walls.

**9.** D — ICC A117.1 requires handrails on accessible ramps to be mounted at a height between 34 inches and 38 inches, measured vertically from the ramp surface to the top of the handrail. This is the same height range required for handrails on exit stairways, providing consistency throughout the building's accessible route.

**10.** A — Firerated doors must be selfclosing or automaticclosing and may not be held open by unauthorized means such as rubber wedges, doorstops, or blocks. Holding fire doors open defeats their purpose — they cannot prevent the passage of fire and smoke if they are not in the closed position when a fire occurs. Automaticclosing doors may be held open by devices connected to the fire alarm that release upon alarm activation.

**11.** C — IBC Table 1017.2 specifies a maximum exit access travel distance of 300 feet for Group F2 (lowhazard factory) occupancies without sprinkler protection. With sprinklers, this increases to 400 feet. Group F2 receives a more generous travel distance than most occupancies because its noncombustible contents present a lower fire hazard.

**12.** B — ICC A117.1 requires a minimum landing length of 60 inches (5 feet) at the top and bottom of every accessible ramp run. The landing must be at least as wide as the ramp and must provide a level surface for wheelchair users to rest, turn, or transition between the ramp and the adjacent walking surface.

**13.** D — Group H1 (detonation hazard) occupancies have the most restrictive travel distance of any occupancy group — a maximum of 75 feet even with an approved automatic sprinkler system. This extremely limited travel distance reflects the catastrophic hazard posed by materials capable of detonation, requiring occupants to reach an exit as quickly as possible.

**14.** A — IBC Chapter 11 requires that at least 60% of all public entrances to a commercial building be accessible, and this 60% must include the main entrance. The remaining 40% of entrances may be nonaccessible, but the most prominent and frequently used entrance must always be part of the accessible set.

**15.** C — IBC Section 1011.2 permits exit stairways serving an occupant load of fewer than 50 persons to have a minimum clear width of 36 inches. Stairways serving 50 or more occupants require a minimum of 44 inches. The reduced width is permitted for lowoccupancy conditions where the narrower stair can accommodate the expected flow of evacuating occupants.

**16.** B — IBC Table 601 requires a 1hour fireresistance rating for floor construction in Type IIA buildings. Type IIA requires 1hour ratings for all major building elements — structural frame, bearing walls, floor construction, and roof construction. Type IIB requires no ratings for any element, making it the least restrictive of the two Type II subtypes.

**17.** D — The common path of egress travel is the distance an occupant must travel from the most remote point in a space before two separate egress paths become available. The IBC limits this distance by occupancy type (typically 75 to 100 feet) to ensure that occupants have access

to alternative escape routes within a reasonable distance, preventing them from being trapped in a deadend condition.

**18.** A — A change of occupancy triggers compliance with all code requirements for the new occupancy classification, including fire protection, egress, structural capacity, and accessibility. Even without physical construction, the new use may impose requirements that the existing building does not meet. The building official must approve the change of occupancy before the new use begins.

**19.** C — The IBC requires smoke detectors within each Group R1 (hotel) guest room, typically located on the ceiling in the sleeping area. Smoke detectors provide early warning to sleeping occupants who might not otherwise detect a fire until it is too late. The detectors may be connected to the building fire alarm system or may be standalone singlestation units.

**20.** B — A horizontal exit is a passage through a fire wall into an adjacent building or through a fire barrier into a separate fire area on the same floor, providing refuge for occupants without requiring vertical travel through stairways. Horizontal exits are particularly valuable in hospitals and detention facilities where vertical evacuation is difficult or impossible for the building's occupants.

**21.** A — IBC Section 1011.5.4 limits the maximum variation between the largest and smallest riser height within a single flight of stairs to ⅜ inch. This tight tolerance prevents tripping hazards caused by unexpected changes in riser height — the human body develops a rhythm during stair descent, and even small variations in riser height can cause a misstep and fall.

**22.** D — ICC A117.1 requires a minimum width of 60 inches for a standard accessible toilet stall. This width provides adequate clearance for a wheelchair user to enter, position alongside the water closet, and perform the lateral transfer from the wheelchair to the toilet using the grab bars on the side and rear walls.

**23.** C — IBC Table 1006.3.4 requires 4 exits from any story with an occupant load exceeding 1,000 persons. The table specifies 2 exits for 1500 occupants, 3 exits for 5011,000, and 4 exits for more than 1,000. At 1,200 occupants, 4 exits are required to provide adequate egress capacity and path redundancy for the large occupant population.

**24.** C — IBC Section 1014.6 requires handrails on exit stairways to extend horizontally at least 12 inches beyond the top riser and at least one tread depth beyond the bottom riser. These extensions provide a stable handhold for occupants transitioning between the stair and the landing, reducing the risk of falls at the top and bottom of each flight.

**25.** A — IBC Section 1020.2 requires a minimum corridor width of 44 inches when the corridor serves an occupant load of 50 or more persons. At 36 inches, the corridor in this Group E occupancy serving 100 occupants does not comply. The 44inch width ensures adequate flow capacity for the expected number of evacuating occupants.

**DOMAIN 2: SITE CONSTRUCTION (Questions 26–40)**

**26.** C — A Phase I Environmental Site Assessment (ESA) evaluates the property's history through records review, site inspection, and interviews to identify potential contamination from previous uses. A former gasoline station is a recognized environmental concern due to

underground storage tanks and potential fuel releases. Phase II sampling may follow if Phase I identifies recognized environmental conditions.

**27.** D — OSHA requires that ladders used for egress from trenches 4 feet deep or greater extend at least 3 feet above the top of the excavation. This extension provides a secure handhold for workers climbing out of the trench, reducing the risk of falls during the transition from the ladder to the ground surface at grade level.

**28.** A — A mat foundation (also called a raft foundation) is a large, thick reinforced concrete slab that supports the entire building footprint, distributing all column and wall loads uniformly to the bearing soil below. Mat foundations are used when individual spread footings would be so large they would nearly overlap, or when heavy loads on weak soil require maximum load distribution.

**29.** B — A nuclear density gauge measures two properties of compacted fill: the inplace wet density (the total density of the soil including moisture) and the moisture content of the compacted material. These two values are used to calculate the dry density, which is compared to the maximum dry density from the Proctor test to determine the compaction percentage.

**30.** C — Water in an excavation saturates the bearing soil, reducing its shear strength and loadcarrying capacity. Under OSHA, any soil from which water is freely seeping is automatically classified as Type C regardless of its other properties, requiring the flattest slopes (1½:1) or the most robust protective systems. Dewatering removes groundwater to restore soil strength and permit safe excavation.

**31.** D — Organic material (roots, vegetation, topsoil) decomposes over time when buried beneath structural fill. As the organic matter breaks down, it creates voids in the fill that cause uneven settlement of the foundation and structure above. This differential settlement can crack foundations, distort structural frames, and cause progressive structural damage that is extremely costly to repair.

**32.** A — The IBC generally requires a geotechnical investigation for commercial buildings to characterize subsurface soil conditions and provide foundation design recommendations. The investigation includes soil borings at multiple locations across the building footprint, laboratory testing of soil samples, and engineering analysis. Only the simplest structures on wellcharacterized soils may use presumptive bearing values.

**33.** B — Helical piles are screwed into the ground using hydraulic torque motors, producing no vibration and minimal soil disturbance. This makes them ideal for work adjacent to existing occupied structures where pile driving vibrations could cause damage to foundations, underground utilities, and interior finishes. They are also suitable for environmentally sensitive sites.

**34.** D — Tire washing is required when the crushed stone entrance pad alone cannot remove enough mud from vehicle tires to prevent tracking of sediment onto public roads. The determination is based on actual site conditions — if excessive mud is being tracked despite the stone pad, the contractor must implement tire washing to prevent sediment from reaching the public road and storm drainage system.

**35.** C — OSHA specifies a maximum allowable slope of ¾ horizontal to 1 vertical (¾:1, or 53° from horizontal) for Type A soil excavations. Type A is the strongest soil classification under OSHA and permits the steepest slopes. Type B requires 1:1 (45°) and Type C requires 1½:1 (34°). These slope limits apply only when sloping is the chosen protective system.

**36.** A — The filter fabric (geotextile) wrapped around the gravel envelope prevents fine soil particles from the surrounding backfill from migrating into the gravel drainage layer and clogging the perforated drain pipe over time. Without filter fabric, fine particles gradually fill the void spaces in the gravel, reducing drainage capacity and eventually rendering the foundation drain system ineffective.

**37.** B — The International Plumbing Code requires a minimum slope of ⅛ inch per foot for drain pipes 4 inches and larger in diameter. Pipes 3 inches and smaller require a steeper minimum slope of ¼ inch per foot. The flatter slope for larger pipes is sufficient because the greater crosssectional area maintains adequate selfcleaning velocity at lower gradients.

**38.** D — Detention systems temporarily store stormwater and release it at a controlled rate — the water eventually leaves the site through a regulated outlet. Retention systems permanently keep water onsite through infiltration into the ground or evaporation — the water does not leave as surface runoff. This is one of the most commonly confused distinctions in stormwater management.

**39.** A — Settlement of the backfill material against the foundation is the most common cause of ponding water at the building perimeter after construction. Fill material placed against the foundation wall compresses and consolidates over time, reversing the positive drainage slope established during finish grading and directing surface water toward the building rather than away from it.

**40.** C — The geotechnical engineer or their authorized representative should inspect and approve the bearing soil at the bottom of every foundation excavation before concrete is placed. This verification confirms that the actual soil conditions match the assumptions used in the foundation design. If the soil differs from the geotechnical report, the structural engineer must be notified for potential redesign.

**DOMAIN 3: CONCRETE (Questions 41–46)**

**41.** B — Type IV portland cement generates the lowest heat of hydration among all standard cement types, making it the appropriate choice for massive concrete placements such as large mat foundations, dams, and thick structural elements. Excessive heat from hydration in mass pours can cause thermal cracking as the concrete core expands while the cooler exterior contracts.

**42.** A — Standard waterreducing admixtures reduce the water demand of a concrete mix by 5% to 10% while maintaining the same workability. The lower water content reduces the watercement ratio, producing stronger, more durable concrete. Highrange water reducers (superplasticizers) can reduce water demand by 12% to 30% for highstrength or flowing concrete applications.

**43.** C — ACI 318 requires that the average of any three consecutive 28day compressive strength tests must equal or exceed f'c, AND no individual test result may fall more than 500

psi below f'c. Both criteria must be satisfied simultaneously. Concrete that fails either criterion triggers an investigation, which may include core testing of the inplace concrete.

**44.** D — Spiral reinforcement in a concrete column provides lateral confinement that prevents the vertical (longitudinal) reinforcing bars from buckling outward under compressive load. The spiral continuously wraps around the vertical bars, restraining lateral movement and significantly increasing the column's ductility and loadcarrying capacity beyond what tied columns achieve.

**45.** D — ACI 306R requires that concrete be protected from freezing during early curing because water in the concrete pores can freeze and expand, permanently damaging the concrete's internal structure. Protection measures include insulating blankets, heated enclosures, hydronic heating tubes, and use of Type III cement or accelerating admixtures to speed early strength gain.

**46.** A — Bull floating is performed immediately after screeding to embed aggregate particles below the surface, smooth the slab, and close any open voids or ridges left by the screeding operation. Bull floating must be completed before bleed water appears on the surface — working bleed water back into the surface creates a weak, dusty finish layer.

**DOMAIN 4: MASONRY (Questions 47–50)**

**47.** A — Vertical reinforcing bars in reinforced masonry walls are typically spaced at 24, 32, or 48 inches on center, depending on the structural requirements determined by the engineer. Bars are always placed at corners, at each side of openings, and at regular intervals along the wall. Closer spacing provides greater strength; wider spacing is used for lightly loaded walls.

**48.** D — Horizontal joint reinforcement (ladder wire or truss wire) is typically placed in the mortar bed joints every 16 inches — which corresponds to every other course of standard 8inchhigh CMU blocks. This regular spacing provides continuous horizontal reinforcement for crack control and load distribution without requiring the construction of full bond beam courses.

**49.** B — Cleanout openings are required at the base of grouted CMU cells when the grout pour height exceeds 5 feet. The openings allow the mason to inspect the cells for mortar droppings and debris that accumulate during wall construction and to remove this material before grouting. Debris left in the cells can block grout flow and compromise the structural integrity of the wall.

**50.** C — The air space (cavity) in a multiwythe masonry wall serves primarily as a drainage channel. Water that penetrates the exterior brick veneer (through mortar joints, weep holes, and surface cracks) enters the cavity and flows downward by gravity to throughwall flashing installed at the wall base, shelf angles, and above openings. Weep holes at these flashing locations discharge the collected water to the exterior.

**DOMAIN 5: METALS (Questions 51–56)**

**51.** D — A complete joint penetration (CJP) groove weld fuses through the entire thickness of the connected members, producing a weld that is at least as strong as the base metal. CJP welds are required for critical connections such as beamtocolumn moment connections in seismic

forceresisting systems, where the connection must be capable of developing the full strength of the connected members.

**52.** A — AISC specifies a plumb tolerance of 1/500 of the column length for erected steel columns, and no individual column may deviate more than 1 inch from plumb at any elevation. These tight tolerances ensure that the structural frame is properly aligned and that accumulated deviations across multiple stories do not create unacceptable eccentricities that affect structural performance.

**53.** C — Headed shear studs welded through the floor deck to the top flanges of supporting beams transfer horizontal shear forces between the concrete slab and the steel beam, enabling composite action. The composite beamandslab section has significantly greater loadcarrying capacity and stiffness than the beam alone, allowing the use of lighter, more economical beam sizes.

**54.** B — Installing bracing early in the erection sequence provides lateral stability to the partially erected steel frame, preventing it from collapsing under wind loads, construction loads, or accidental impact. Without bracing, the partially erected frame is essentially a series of unbraced cantilevers that can sway and collapse. The erection plan specifies which bracing must be installed at each stage.

**55.** D — Intumescent coatings appear as ordinary paint under normal conditions but swell to many times their original thickness when exposed to heat, forming an insulating charred layer that protects the steel. Intumescent coatings are the appropriate choice for architecturally exposed structural steel (AESS) because they maintain the visible steel profile while providing the required fireresistance rating.

**56.** D — Slipcritical connections transfer forces through friction between the faying surfaces (the surfaces in contact) of the connected members, developed by the high clamping force of fully tensioned bolts. Bearingtype connections transfer forces through the bolt shanks bearing against the walls of the bolt holes. Slipcritical connections are required where slip would be detrimental to the structure's performance.

**DOMAIN 6: WOOD (Questions 57–61)**

**57.** B — SDRY (surfaced dry) or KD (kilndried) lumber has a moisture content of 19% or less at the time of surfacing. Lumber installed at this moisture level will experience minimal additional shrinkage within the building envelope, reducing the risk of nail pops, drywall cracks, floor squeaks, and joint gaps that occur when green lumber dries and shrinks after installation.

**58.** C — The rim joist (band joist) is a structural member placed at the perimeter of the floor frame, perpendicular to the floor joists, that encloses the joist ends. It provides a nailing surface for exterior wall sheathing and siding, transfers lateral (diaphragm) forces from the floor system to the shear walls below, and helps resist joist rollover at the bearing points.

**59.** D — The glulam designation "24F1.8E" indicates an allowable bending stress of 2,400 psi (the "24F" portion) and a modulus of elasticity of 1,800,000 psi (the "1.8E" portion). These values are the design properties used by the structural engineer to determine the beam size required for the given span and load conditions.

**60.** D — All work must stop immediately. Prefabricated wood trusses are engineered as complete structural systems — every member carries specific loads, and cutting any member (especially a chord) can cause catastrophic failure. No field modification is permitted without written approval from the truss designer or a registered professional engineer. This is one of the most critical safety rules in wood construction.

**61.** C — Interior wall studs in a climatecontrolled commercial office building do not require preservative treatment because they are enclosed within the building envelope, protected from moisture, and not in contact with concrete or the ground. Preservative treatment is required only when wood is exposed to conditions favorable for decay — ground contact, belowgrade installations, or proximity to exposed ground in crawl spaces.

**DOMAIN 7: THERMAL AND MOISTURE PROTECTION (Questions 62–66)**

**62.** B — Compressing fiberglass batt insulation significantly reduces its effective Rvalue because the insulation's thermal performance depends on the trapped air pockets within the fiber matrix. When the batts are compressed, the air pockets are squeezed out, and the reduced thickness provides less resistance to heat flow. Proper installation requires fullcavity fill without compression, gaps, or voids.

**63.** A — Closedcell spray polyurethane foam serves as both insulation (approximately R6.5 per inch) and an air barrier in a single application because it expands to fill every crack, gap, and irregularity in the framing. Fiberglass batts provide no airsealing benefit, building paper provides no insulation, and polyethylene sheeting provides negligible Rvalue.

**64.** D — A standard commercial builtup roofing (BUR) system consists of 3 to 4 plies of reinforcing felt, each mopped with hot bitumen (asphalt or coal tar), topped with a flood coat of bitumen and surfaced with gravel or a mineral cap sheet. A 4ply BUR is the traditional standard. Each ply adds waterproofing redundancy and increases the system's overall durability.

**65.** C — PVC (polyvinyl chloride) membrane has superior resistance to chemicals, grease, and animal fats compared to TPO and EPDM membranes. This makes PVC the preferred choice for restaurant roofs and other applications where the membrane may be exposed to kitchen exhaust containing grease, oils, and fats that would degrade other membrane types over time.

**66.** A — Fastener penetrations through continuous insulation create localized thermal bridges — points where the metal fastener conducts heat directly through the insulation layer. While each individual fastener has a minor effect, the cumulative impact of hundreds of fasteners across a large wall area can measurably reduce the effective Rvalue. Lowconductivity fasteners and thermally broken attachment systems minimize this effect.

**DOMAIN 8: DOORS, WINDOWS, AND GLAZING (Questions 67–70)**

**67.** B — Visible Transmittance (VT) of 0.55 means that 55% of visible light passes through the glazing from exterior to interior. Higher VT values provide more natural daylight, reducing the need for electric lighting during daytime hours. The ideal commercial window balances a low SHGC (blocking solar heat) with a high VT (admitting daylight).

**68.** D — The gauge designation indicates the thickness of the steel sheet, with lower gauge numbers indicating thicker (and therefore heavier and more durable) steel. An 18gauge frame is standard for commercial exterior doors, 16gauge is heavyduty, and 14gauge is maximumsecurity. The gauge system is inversely proportional — a lower number means thicker material.

**69.** A — The IBC requires safety glazing (tempered or laminated glass) in hazardous locations where human impact with the glass is likely. These locations include glass in doors, glass adjacent to doors (sidelights), glass near floor level, glass in shower and tub enclosures, and glass near stairways and ramps. Safety glazing breaks into small, relatively harmless pieces (tempered) or remains intact on a plastic interlayer (laminated).

**70.** B — A curtain wall is a nonstructural exterior facade system — it is supported by the building's structural frame (typically hung from the floor slabs at each level) and does not bear any structural loads from the floors or roof above. Curtain walls transfer only their own selfweight and wind loads to the structure. This distinguishes them from loadbearing wall systems.

**DOMAIN 9: FINISHES (Questions 71–75)**

**71.** D — Type X gypsum board provides fire resistance through its specially formulated gypsum core, which contains glass fibers and other additives that maintain the board's integrity under fire exposure for longer than standard gypsum board. In firerated steel stud assemblies, multiple layers of Type X board on each side build up the required rating — a single layer on each side provides 1 hour, and additional layers increase the rating.

**72.** B — Overdriven screws that break through the paper face of the gypsum board lose their holding power because the paper facing provides the majority of the screw's pullthrough resistance. Once the screw head punches through the paper, it can no longer hold the board against the framing, providing essentially zero structural value. Pneumatic screwdrivers must be properly adjusted to prevent this.

**73.** A — Polished concrete is achieved by grinding the concrete surface with progressively finer diamond abrasive pads (starting with coarse grits and advancing to very fine grits), applying a chemical densifier that hardens the surface, and continuing the polishing process to the desired sheen level. The result is a durable, lowmaintenance, highperformance floor suitable for commercial applications.

**74.** C — Slip resistance, measured by the coefficient of friction (COF), is the most critical flooring characteristic for commercial kitchen environments where water, grease, and food spills create hazardous walking surfaces. Flooring with a high COF when wet provides adequate traction to prevent slips and falls, which are among the most common injuries in food service environments.

**75.** D — Level 1 gypsum board finish consists of tape embedded in joint compound with no additional coats. This minimal finish is appropriate for concealed areas such as aboveceiling plenums, attic spaces, and areas that will not be visible to building occupants. The tape provides fire and smoke protection at the joints while avoiding the cost of additional finishing in spaces that no one will see.

**DOMAIN 10: MECHANICAL AND PLUMBING SYSTEMS (Questions 76–81)**

**76.** B — A cooling tower is the component that rejects heat from the condenser water loop to the outdoor environment through evaporative cooling. Hot condenser water from the chiller is pumped to the cooling tower, where it flows over fill media while outdoor air is drawn across the water, causing evaporation that removes heat. The cooled water returns to the chiller's condenser.

**77.** A — The IPC requires approximately 1 drinking fountain per 100 occupants, with a minimum of 1 per floor in most commercial occupancies. At least 50% of drinking fountains must be accessible (mounted at wheelchair height), and many jurisdictions now require bottlefilling stations at a portion of drinking fountain locations for environmental sustainability.

**78.** C — Fire sprinkler systems are classified as highhazard connections because the piping may contain stagnant water with bacterial growth, corrosion byproducts, and in some systems, chemical additives (antifreeze in dry systems, fire suppressant agents). An RPZ assembly provides a higher level of protection than a double check valve by incorporating an atmospheric vent that discharges to drain if the check valves fail.

**79.** D — In a dry pipe sprinkler system, the piping is filled with pressurized air rather than water. When a sprinkler head activates, the air must exhaust from the piping before the dry pipe valve opens and water fills the system. This process typically takes 30 to 60 seconds, creating a delay between head activation and water discharge that is the primary tradeoff of dry pipe versus wet pipe systems.

**80.** A — The IPC limits lavatory faucets in public commercial restrooms to a maximum flow rate of 0.5 gallons per minute. This metered or sensoractivated lowflow rate conserves water in highuse public facilities. Kitchen faucets are permitted higher flow rates (2.2 gpm) because they serve different functional needs.

**81.** B — NFPA 72 requires that the complete fire alarm system — including all manual pull stations, automatic detectors, notification appliances, and the fire alarm control panel — be inspected, tested, and acceptancetested to verify proper operation before the building can receive a certificate of occupancy. This ensures all life safety systems are fully functional before occupants enter the building.

**DOMAIN 11: ELECTRICAL SYSTEMS (Questions 82–84)**

**82.** C — The main disconnect is a circuit breaker or fused switch that can disconnect all electrical power to the building in a single operation. The NEC requires the main disconnect to be accessible to the building owner, the electrical contractor, and the fire department so that power can be shut off quickly in an emergency, preventing electrocution of firefighters and facilitating safe emergency operations.

**83.** D — Nonmetallic sheathed cable (NM cable, commonly known as Romex) is the standard wiring method for residential construction but is generally not permitted in commercial buildings above three stories or in commercial buildings not of Type III, IV, or V construction. Commercial buildings require more robust wiring methods such as EMT conduit, MC cable, or rigid conduit.

**84.** A — OSHA requires GFCI protection for all temporary wiring and receptacles on construction sites, or alternatively, an assured equipment grounding conductor program that includes regular testing and documentation. GFCI protection is the more common approach because it provides automatic protection without relying on inspectionbased compliance.

**DOMAIN 12: PROCUREMENT AND CONTRACTING REQUIREMENTS (Questions 85–115)**

**85.** D — Designbidbuild gives the owner maximum control over the design process through a separate contract with the architect, allowing the owner to direct the design without contractor involvement. The competitive bidding phase then produces the lowest responsible price for the completed design. This combination of design control and competitive pricing is the core advantage of DBB.

**86.** B — Under AIA A201, the architect may withhold certification of the first application for payment until the contractor submits an acceptable schedule of values. The schedule of values is the foundation for all subsequent progress billing, and the architect must be satisfied that it accurately reflects the distribution of work and cost across the project before certifying any payments.

**87.** C — CSI MasterFormat is the industry standard for organizing construction specifications into a consistent numbering system with 50 divisions covering all categories of construction work. MasterFormat provides a common language that architects, engineers, contractors, and suppliers use to organize, locate, and reference specification information, ensuring consistency across the construction industry.

**88.** A — "Approved as Noted" means the architect has reviewed the shop drawings, found them generally conforming to the design intent, and has marked specific revisions that must be incorporated. The contractor may proceed with fabrication incorporating the noted changes without resubmitting. If the shop drawings were marked "Revise and Resubmit," the contractor would need to resubmit corrected drawings before proceeding.

**89.** D — A subcontractor performance bond guarantees that the subcontractor will complete the subcontracted work in accordance with the subcontract documents. If the subcontractor defaults, the surety must arrange for completion — either by financing the defaulting subcontractor, hiring a replacement, or paying the general contractor the cost to complete. This protects the general contractor from subcontractor failure.

**90.** B — Under AIA A201, the owner must furnish surveys describing the physical characteristics, legal limits, and utility locations of the site. The owner must also provide information about the site that is in the owner's possession and that the contractor needs to perform the work. This includes existing conditions, environmental reports, and known subsurface conditions.

**91.** C — A 30day schedule extension increases the contractor's general conditions costs (supervision, temporary facilities, insurance, equipment) even if no additional construction work is added. The contractor should submit a change order proposal documenting the additional timedependent costs and negotiate appropriate compensation before agreeing to the extension.

**92.** A — Most unit price contracts include a quantity variation clause that permits renegotiation of the unit price when actual quantities exceed or fall below the estimated quantity by a specified percentage (typically 15% to 25%). This provision recognizes that unit prices are based on estimated quantities, and significant quantity changes alter the economies of scale that influenced the original pricing.

**93.** C — Asbuilt (record) drawings document the actual installed conditions of all building systems, including any deviations from the original design, field changes authorized by the architect, RFI resolutions, and change order modifications. These drawings are essential for the owner's future maintenance, renovation, and repair activities because they show what was actually built, not just what was designed.

**94.** A — The standard contractor warranty under AIA A201 is one year from the date of substantial completion. During this period, the contractor must correct defective work at no additional cost to the owner. Specific building components may carry longer manufacturer warranties (roofing, windows, HVAC equipment), but the contractor's general warranty is one year.

**95.** D — "Costs in excess of billings" means the contractor has completed more work than has been billed to the owner — the contractor has underbilled. This appears as a current asset on the contractor's balance sheet because it represents earned revenue that has not yet been invoiced. The opposite condition, "billings in excess of costs," means the contractor has overbilled and appears as a current liability.

**96.** B — Subcontractor substitution after bid submission on public projects is generally restricted to specific documented reasons — such as the listed subcontractor's failure to execute the subcontract, loss of license, inability to provide required bonds, or the discovery that the listed subcontractor was not properly licensed at the time of bid. Free substitution would undermine the competitive bidding process.

**97.** C — Under AIA A201, the architect may issue written orders for minor changes in the work (Architect's Supplemental Instructions) that do not involve an adjustment in contract price or time. The contractor must carry out these changes promptly. If the contractor believes the change does affect cost or time, the contractor should notify the architect and proceed through the formal change order process.

**98.** A — Costplus contracts are openbook arrangements in which the owner pays the contractor's actual costs plus a fee. The contractor must provide complete documentation of all costs — labor time sheets, material invoices, equipment rental agreements, subcontractor invoices, and overhead calculations — to allow the owner to verify that all charged costs are legitimate, reasonable, and attributable to the project.

**99.** D — When the owner accepts an alternate after bid opening, the alternate is incorporated into the base contract. This is typically accomplished by referencing the accepted alternates in the ownercontractor agreement or by issuing a change order that adjusts the contract price by the alternate amount. The alternate becomes part of the contractor's contractual scope and price.

**100.** B — Substantial completion occurs when the work is sufficiently complete for the owner to occupy and use the building for its intended purpose, even if minor punch list items remain. Final completion occurs when all punch list items are corrected, all closeout documentation is

submitted, and every contractual requirement is fulfilled. The two milestones trigger different contractual consequences.

**101.** A — A "no damages for delay" clause waives the subcontractor's right to claim monetary damages (additional compensation) for delays caused by the general contractor or owner. The subcontractor's remedy is typically limited to a time extension only. These clauses shift the financial risk of delays to the subcontractor and are common in commercial construction subcontracts.

**102.** C — "Or equal" specifications name a specific product as the basis of design but allow the contractor to submit alternative products of equivalent quality for the architect's approval. "No substitution" specifications require the contractor to furnish only the named product with no alternatives permitted. The distinction determines the contractor's flexibility in product selection.

**103.** D — Under AIA A201, the owner may accept nonconforming work with an appropriate reduction in the contract price to reflect the diminished value. This acceptance does not waive the owner's right to pursue other remedies for the nonconformance. The price reduction is negotiated between the parties or, if they cannot agree, determined through the dispute resolution process.

**104.** B — Under AIA A201, the contractor may submit a formal claim under the contract's dispute resolution provisions if the contractor disagrees with the architect's payment certification. The contractor must continue performing the work while the claim is being resolved — stopping work over a payment dispute (unless the contract specifically permits it after proper notice) could constitute a breach.

**105.** A — Bid bonds are typically required in an amount of 5% to 10% of the bid price on public construction projects. The bid bond guarantees that the bidder will enter into the contract at the bid price if selected. If the bidder refuses, the surety pays the owner the difference between the low bid and the nextlowest bid, up to the bond amount.

**106.** C — Under AIA A201 and most standard construction contracts, the contractor has primary responsibility for safety at the construction site, including initiating, maintaining, and supervising all safety precautions and programs for the protection of all persons (workers, visitors, the public) and property. This responsibility cannot be delegated away, even when subcontractors are performing the work.

**107.** D — Product data consists of manufacturer's standard published information — catalog sheets, performance charts, technical specifications, installation instructions, and warranty information. Shop drawings are custom drawings prepared specifically for the project, showing fabrication details, dimensions, connections, and installation configurations tailored to the actual building conditions.

**108.** B — An insurance lapse may constitute a material breach of the contract because maintaining specified insurance coverage is a fundamental contractual obligation. The lapse exposes the owner, the contractor, and third parties to uninsured claims. The owner may have grounds for termination, and the contractor faces personal liability for any claims that occur during the coverage gap.

**109.** A — Responsible bid evaluation goes beyond comparing initial prices to assess total cost of ownership. A $25,000 price difference may be offset by the 20year warranty's value in avoided replacement and repair costs over the building's life. The contractor should evaluate warranty terms, expected service life, maintenance costs, the bidder's financial stability, and references from similar projects.

**110.** C — Restrictive singlesource specifications eliminate competition and may violate public procurement laws that require competitive bidding to protect taxpayer funds. Public project specifications should generally permit "or equal" substitutions unless the owner can justify that the specified product is the only one that meets a unique functional requirement. Singlesource restrictions raise concerns about favoritism and inflated pricing.

**111.** B — The preconstruction meeting establishes the administrative framework for the entire project — communication protocols, meeting schedules, submittal procedures, RFI processes, pay application procedures, schedule requirements, safety programs, quality control plans, and site logistics. This meeting aligns all parties on expectations and procedures before the first shovel hits the ground.

**112.** D — A conditional waiver becomes effective only upon actual receipt of the stated payment — if the check bounces or the payment never arrives, the waiver is void and lien rights remain intact. An unconditional waiver takes effect immediately upon signing, regardless of whether the corresponding payment is received. This makes unconditional waivers riskier for the signing party.

**113.** A — When a surety is called upon to fulfill a performance bond, the surety typically has three options: finance the defaulting contractor to complete the work, hire a replacement contractor to finish the project, or pay the owner the cost to complete (up to the bond amount). The surety then has the right to seek reimbursement (indemnification) from the original contractor for all amounts paid.

**114.** C — The architect makes periodic site visits to observe the progress and quality of the work and to determine, in general, whether the work is proceeding in conformance with the contract documents. The architect does not supervise construction, does not direct the contractor's means and methods, and does not guarantee that the work is defectfree. The architect's observations are for general conformance, not detailed inspection.

**115.** B — When the actual cost of an allowance item differs from the allowance amount included in the contract, a change order is issued to adjust the contract price. The contractor is entitled to the applicable markup (overhead and profit) on the difference — both increases and decreases. If the actual cost exceeds the allowance, the contract price increases; if the actual cost is less, the contract price decreases.