# PRACTICE EXAM 6: 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 threestory commercial building has a Group B occupancy on the first and second floors and a Group A3 (library) occupancy on the third floor. The building uses separated occupancies per IBC Section 508.4. During a code review, the building official determines that the Group A3 occupancy on the third floor triggers a sprinkler requirement that the Group B occupancy alone would not. Under the separated occupancies approach, must the entire building be sprinklered or only the third floor?

A. Only the third floor containing the Group A3 occupancy must be sprinklered because each occupancy is evaluated independently

B. Neither floor requires sprinklers because the Group B occupancy exemption extends to the entire building

C. Sprinklers are required only in the corridors and exit stairways, not throughout the occupied spaces

D. The entire building must be sprinklered because when any portion of a building requires sprinklers under the separated occupancies approach, the system must extend throughout

2. A contractor is constructing a commercial building where the architect has specified a smokeproof enclosure for the exit stairway. Under the IBC, what distinguishes a smokeproof enclosure from a standard enclosed exit stairway?

A. A smokeproof enclosure requires fireresistancerated construction of at least 4 hours on all sides

B. A smokeproof enclosure includes vestibules or natural ventilation that prevents smoke from entering the stairway during a fire, providing a higher level of protection than a standard enclosed stair

C. A smokeproof enclosure is identical to a standard enclosed stairway but with an additional fire alarm pull station

D. A smokeproof enclosure eliminates the need for a sprinkler system within the stairway shaft

3. Under the IBC, the building official may issue a stopwork order when construction activity violates the code or poses a safety hazard. After a stopwork order is issued, what must occur before construction can resume?

A. The contractor may resume work after 72 hours regardless of whether the violation has been corrected

B. The contractor must appeal the stopwork order to the state licensing board before resuming any work

C. The violation must be corrected and the building official must authorize the resumption of work

D. The contractor may resume work immediately on unaffected portions of the building without authorization

4. A building designer is evaluating whether a proposed twostory Group M (mercantile) building in Type VB construction can qualify for an area increase by providing open frontage along the building perimeter. Under IBC Section 506.3, what condition must the frontage meet to qualify for an area increase?

A. The building must have open, unobstructed frontage along a minimum percentage of its perimeter with public ways or open spaces at least 20 feet wide providing access for fire department operations

B. The building must have a glass storefront on at least one side that provides visual access from the street

C. The building must have parking within 50 feet of the main entrance for customer convenience

D. The building must have a landscaped setback of at least 10 feet on all sides for aesthetic purposes

5. Under the IBC, a Group I2 (hospital) occupancy with patients who are incapable of selfpreservation requires specific corridor width minimums that exceed the standard 44inch requirement. What is the minimum corridor width in the patient sleeping area of a Group I2 occupancy?

A. 44 inches minimum corridor width, the same as all other commercial occupancies

B. 60 inches minimum corridor width for patient sleeping areas in Group I2 occupancies

C. 48 inches minimum corridor width for patient sleeping areas in Group I2 occupancies

D. 96 inches (8 feet) minimum corridor width for patient sleeping areas in Group I2 occupancies to accommodate bed movement

6. A contractor is reviewing the IBC requirements for a commercial kitchen exhaust hood system. The kitchen is located within a Group A2 (restaurant) occupancy. Under the IBC and IMC, what fire protection system is typically required within the commercial cooking exhaust ductwork?

A. A standard wetpipe sprinkler system identical to the building's main fire suppression system

B. A listed fire extinguishing system (typically a wet chemical or dry chemical system) designed specifically for commercial cooking operations and installed within the hood and duct

C. Portable fire extinguishers mounted on each side of the exhaust hood for manual suppression only

D. A carbon dioxide flooding system that fills the entire kitchen with CO2 upon fire detection

7. Under the IBC, when a building contains both a sprinklered portion and a nonsprinklered portion separated by a fire wall, how are the allowable height and area calculated for each portion?

A. Each portion separated by a fire wall is treated as a separate building for the purposes of calculating allowable height and area, with each side evaluated independently based on its own construction type and sprinkler status

B. The entire building must meet the most restrictive requirements of either portion regardless of the fire wall

C. The nonsprinklered portion receives the same area increase as the sprinklered portion because the fire wall provides equivalent protection

D. Fire walls cannot separate sprinklered and nonsprinklered portions — the entire building must have the same sprinkler status

8. A building inspector reviews a completed commercial building and discovers that several required exit signs have been installed but are not illuminated during normal building operation. Under the IBC, is this condition acceptable?

A. Exit signs need only be illuminated during fire alarm activation and may remain unlit during normal operation

B. Exit signs are required only during nighttime hours and may remain unlit during daytime business operations

C. Exit signs must be continuously illuminated at all times when the building is occupied, regardless of ambient lighting conditions or time of day

D. Exit signs are decorative elements with no illumination requirement as long as the sign face is visible

9. Under the IBC, what is the maximum occupant load factor (in net square feet per person) for assembly occupancies with standing space only, such as a concert venue general admission floor?

A. 15 net square feet per person for assembly standingspace occupancies

B. 5 net square feet per person for assembly standingspace occupancies

C. 7 net square feet per person for assembly standingspace occupancies

D. 30 net square feet per person for assembly standingspace occupancies

10. A contractor is constructing a commercial building with a mechanical penthouse on the roof that houses HVAC equipment. The penthouse extends 18 feet above the roof surface. Under the IBC, does the mechanical penthouse count as an additional story for building height calculations?

A. Yes, all structures above the roof are counted as stories regardless of their use or occupancy classification

B. Yes, mechanical penthouses exceeding 12 feet in height are always counted as additional stories

C. No, but only if the penthouse is occupied by fewer than 10 persons at any time during building operation

D. No, mechanical penthouses and similar structures used exclusively for building equipment are typically not counted as stories for height calculation purposes, subject to specific code limitations

11. A contractor reviews the fire protection plans and notices that the fire alarm control panel (FACP) is located in a janitor's closet that is locked during nonbusiness hours. Under the IBC and NFPA 72, is this location acceptable for the FACP?

A. The FACP must be located in a readily accessible location approved by the fire code official, typically near a building entrance where the fire department can access it immediately upon arrival

B. Any locked interior room is acceptable for the FACP as long as the room is on the ground floor

C. The FACP location is determined solely by the electrical contractor and has no coderequired location

D. The FACP must be located outdoors in a weatherproof enclosure adjacent to the fire department connection

12. Under the IBC, what is the minimum fireresistance rating required for a fire barrier used to enclose an exit passageway that connects an exit stairway to the exit discharge at grade level?

A. ½hour fireresistance rating for exit passageway enclosures at grade level

B. No fireresistance rating is required for exit passageways because they are at grade level

C. The exit passageway must have the same fireresistance rating as the exit stairway it serves — 1 hour for stairways connecting fewer than four stories, 2 hours for four or more stories

D. A 3hour fireresistance rating is required for all exit passageways regardless of the stairway rating

13. A building's plumbing design includes a drinking fountain with a bottlefilling station. Under the IBC and ADA, what percentage of drinking fountains must be accessible (mounted at wheelchairaccessible height)?

A. 25% of drinking fountains must be accessible with the remainder at standing height only

B. At least 50% of drinking fountains must be accessible, with the remaining units at standing height to serve both populations

C. 100% of all drinking fountains must be at wheelchairaccessible height with no standingheight units

D. Accessibility requirements do not apply to drinking fountains in commercial buildings under any code

14. A contractor is constructing a building where the specifications require a fireresistancerated shaft enclosure around an elevator hoistway. Under the IBC, what is the minimum fireresistance rating for an elevator hoistway enclosure in a building where the hoistway connects four or more stories?

A. ½hour fireresistance rating for elevator hoistway enclosures connecting any number of stories

B. 1hour fireresistance rating for elevator hoistway enclosures regardless of the number of stories

C. No fireresistance rating is required for elevator hoistway enclosures if the building is fully sprinklered

D. 2hour fireresistance rating for elevator hoistway enclosures connecting four or more stories

15. Under the IBC, what is the minimum required distance between a building's property line and an unprotected opening (such as an unrated window) in an exterior wall facing the property line?

A. The IBC limits unprotected openings based on the distance from the property line — at distances less than 3 feet, no unprotected openings are permitted; at greater distances, the permitted area of openings increases proportionally

B. There is no restriction on unprotected openings regardless of the distance to the property line

C. Unprotected openings are prohibited on any wall within 20 feet of a property line without exception

D. The minimum distance is 10 feet for all commercial buildings regardless of construction type

16. A contractor is building a Group R2 (apartment) occupancy with individual dwelling units. Under the IBC, what sound transmission class (STC) rating is required for wall and floor/ceiling assemblies separating dwelling units from each other and from public spaces?

A. STC 35 minimum for all assemblies separating dwelling units in Group R2 occupancies

B. No minimum STC rating is required by the IBC for assemblies between dwelling units

C. STC 50 minimum for wall and floor/ceiling assemblies separating dwelling units from each other and from public or service areas

D. STC 65 minimum for all assemblies in residential occupancies including singlefamily homes

17. Under the IBC, an automatic sprinkler system installed in a onestory Group A4 (arena) occupancy surrounded by 60 feet of open space on all sides qualifies the building for unlimited area. However, the sprinkler system must meet a specific NFPA installation standard. Which NFPA standard governs the design and installation of automatic sprinkler systems for commercial buildings?

A. NFPA 72, which is the National Fire Alarm and Signaling Code for all fire detection systems

B. NFPA 13, which is the Standard for the Installation of Sprinkler Systems for commercial buildings

C. NFPA 101, which is the Life Safety Code governing means of egress and fire protection features

D. NFPA 30, which is the Flammable and Combustible Liquids Code for hazardous materials storage18. A contractor discovers that the architectural drawings show a corridor deadend of

55 feet in a nonsprinklered Group B office building. Under the IBC, what is the maximum permitted deadend corridor length in a nonsprinklered building?

A. 50 feet maximum deadend corridor in nonsprinklered buildings for all occupancy types

B. 75 feet maximum deadend corridor in nonsprinklered buildings for Group B occupancies only

C. 35 feet maximum deadend corridor in nonsprinklered buildings for all occupancy types

D. 20 feet maximum deadend corridor in nonsprinklered buildings

19. Under the IBC, firerated glazing installed in fireresistancerated walls must comply with specific testing standards. What is the primary concern that firerated glazing must address beyond maintaining structural integrity during a fire?

A. Firerated glazing must limit the temperature rise on the nonfire side to prevent radiant heat from igniting combustible materials or injuring occupants on the protected side of the wall

B. Firerated glazing must change color during a fire to visually alert occupants to the fire's location

C. Firerated glazing must maintain its transparency throughout the entire duration of the rated fire exposure

D. Firerated glazing must amplify fire alarm signals to improve audibility in adjacent spaces

20. A commercial building has a basement level with a single exit stairway and a horizontal exit to an adjacent building through a fire wall. Under the IBC, does this configuration satisfy the twoexit requirement for the basement?

A. No, a horizontal exit cannot serve as one of the required exits from a basement level under any condition

B. No, both required exits must be enclosed stairways for all belowgrade levels without exception

C. Yes, a horizontal exit through a fire wall may serve as one of the required exits, provided the refuge area in the adjacent building meets the capacity and separation requirements

D. Yes, but only if the basement occupant load is fewer than 25 persons and the travel distance is under 100 feet

21. Under the IBC, what is the minimum fireresistance rating required for floor construction (the floor/ceiling assembly) in a Type VA building?

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

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

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

D. 1½hour fireresistance rating for floor construction in Type VA buildings

22. A contractor is constructing a commercial building and the plans show a fire department connection (FDC) on the exterior wall. Under the IBC, what is the purpose of the FDC, and where should it be located?

A. The FDC is an emergency exit hatch for firefighters to enter the building from the exterior

B. The FDC is a communications antenna that allows firefighter radios to operate inside the building

C. The FDC is used to connect the building's electrical system to fire department generators during outages

D. The FDC allows the fire department to supplement the building's sprinkler system water supply by pumping water into the system from their apparatus, and it must be located near the building entrance in a visible, accessible location

23. Under the IBC, a mezzanine must meet specific criteria to be classified as a mezzanine rather than as a separate story. In addition to the area limitation (onethird of the room area, onehalf if sprinklered), what other requirement must a mezzanine meet?

A. The mezzanine must be open to the room below on at least one side and must have at least two means of egress if the occupant load exceeds the singleexit threshold

B. The mezzanine must be completely enclosed by fireresistancerated walls on all four sides

C. The mezzanine must be no more than 6 feet above the floor below to qualify as a nonstory element

D. The mezzanine must serve only as storage and cannot be occupied by people at any time

24. A contractor is reviewing the accessibility requirements for a threestory commercial office building with each floor being 2,500 square feet. The building has a single stairway and no elevator. Under the IBC, is an elevator required for accessibility?

A. No, the elevator exemption applies because the building has fewer than three stories or each story is less than 3,000 square feet — and Group B occupancies qualify for this exemption

B. Yes, all commercial buildings over one story must have an elevator for accessibility without any exception

C. No, elevators are never required in commercial buildings regardless of height or floor area

D. Yes, but only if the building has more than 50 employees on any single floor during peak occupancy

25. Under the IBC, construction safeguards (Chapter 33) require specific protections during the construction phase. Which of the following is a requirement during construction of a commercial building?

A. All construction workers must hold individual building permits for their specific trade discipline

B. The building owner must reside onsite for the duration of all construction activities for daily oversight

C. Pedestrians and adjacent properties must be protected from falling debris and other construction hazards through appropriate barriers, covered walkways, or other approved protective measures

D. All construction activities must cease during periods when the ambient temperature exceeds 100°F

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

26. A contractor is constructing a building pad that requires 10,000 cubic yards of structural fill. The geotechnical engineer recommends that the fill material have a plasticity index (PI) of less than 15 to minimize shrinkswell potential. What does the plasticity index measure?

A. The temperature at which the soil particles begin to melt under extreme heat conditions

B. The compressive strength of the soil when tested in an unconfined compression apparatus

C. The pH level of the soil indicating its acidity or alkalinity for environmental compliance

D. The range of moisture content over which a finegrained soil behaves as a plastic (moldable) material — higher PI indicates greater susceptibility to volume change with moisture fluctuation

27. A contractor is performing compaction testing and the nuclear density gauge reads a wet density of 128 pcf and a moisture content of 8%. What is the dry density of the compacted fill?

A. 136.0 pcf, calculated by adding the moisture content percentage to the wet density reading

B. 118.5 pcf, calculated by dividing the wet density by (1 + moisture content expressed as a decimal): 128 ÷ 1.08 = 118.5 pcf

C. 128.0 pcf, because the dry density always equals the wet density regardless of moisture content

D. 120.0 pcf, calculated by subtracting the moisture content percentage from the wet density reading

28. A contractor encounters a layer of soft, highly compressible organic silt at a depth of 6 feet during foundation excavation. The geotechnical engineer recommends surcharging the site before constructing the foundation. What does surcharging accomplish?

A. Surcharging removes the organic material by washing it away with a highpressure water system

B. Surcharging chemically stabilizes the soil by injecting grout under high pressure throughout the layer

C. Surcharging accelerates consolidation settlement by placing a temporary load (typically a mound of fill) on the compressible soil, forcing water out of the soil pores and increasing density before the permanent structure is built

D. Surcharging refers to applying an electrical charge to the soil to increase its bearing capacity

29. Under OSHA, excavation work near overhead power lines requires maintaining minimum clearance distances between equipment and the power lines. For power lines carrying up to 50 kilovolts (kV), what is the minimum required clearance distance?

A. 10 feet minimum clearance from overhead power lines carrying up to 50 kV for all equipment and personnel

B. 5 feet minimum clearance from overhead power lines carrying up to 50 kV for rubbertired equipment

C. 20 feet minimum clearance from overhead power lines carrying up to 50 kV in all conditions

D. 3 feet minimum clearance from overhead power lines carrying up to 50 kV if a spotter is present

30. A contractor is installing driven steel Hpiles for a commercial building foundation. The pile driving log shows that Pile #15 achieved the required driving resistance (blow count) at a depth of 45 feet, but Pile #16 did not reach the required resistance even at 60 feet. What is the most likely explanation for Pile #16's failure to reach refusal?

A. Pile #16 is longer than Pile #15, which automatically provides more capacity regardless of resistance

B. Pile #16 was installed with a heavier hammer that prevented it from reaching driving refusal

C. Both piles have identical subsurface conditions and the difference is caused by the time of day

D. The subsurface conditions at Pile #16's location differ from those at Pile #15 — the bearing stratum may be deeper, absent, or weaker at that location, requiring evaluation by the geotechnical engineer

31. A contractor is reviewing the stormwater management plan for a commercial development and notes that the engineer has specified a bioswale along the parking lot perimeter. How does a bioswale differ from a standard drainage swale?

A. A bioswale and a standard drainage swale are identical — the terms are interchangeable with no difference

B. A bioswale incorporates engineered soil media, specific vegetation, and an underdrain system designed to filter pollutants from stormwater runoff in addition to conveying it, while a standard swale primarily conveys runoff

C. A bioswale is a concretelined channel while a standard swale uses only natural vegetation

D. A bioswale handles only roof drainage while a standard swale handles only surface runoff from parking areas

32. A contractor must install a temporary dewatering system for a deep excavation. The most common dewatering method for sandy soils with a moderate water table is a wellpoint system. How does a wellpoint system work?

A. A wellpoint system consists of a series of smalldiameter wells (wellpoints) connected by a common header pipe to a vacuum pump that draws groundwater out of the soil around the excavation, lowering the water table below the excavation bottom

B. A wellpoint system uses a single large well in the center of the excavation connected to a submersible pump

C. A wellpoint system freezes the groundwater in place by circulating liquid nitrogen through pipes in the soil

D. A wellpoint system redirects surface water away from the excavation using a series of berms and channels

33. A contractor is installing a gravity sanitary sewer lateral from a commercial building to the municipal sewer main. The lateral must maintain a minimum velocity to prevent solids from settling in the pipe. What is this minimum velocity commonly called?

A. Terminal velocity — the maximum speed at which wastewater can flow before it damages the pipe walls

B. Laminar velocity — the speed at which water flows in smooth, parallel layers without turbulence

C. Selfcleaning velocity — approximately 2 feet per second, the minimum flow speed that prevents solids from settling and accumulating in the pipe

D. Critical velocity — the speed at which the pipe begins to vibrate and produce noise during peak flow

34. A contractor discovers that the geotechnical report for the project site classifies the native soil as CH (highplasticity clay) under the Unified Soil Classification System. What construction challenges does CH soil typically present?

A. CH soil is ideal for construction because its high plasticity makes it easy to compact to any density

B. CH soil drains extremely well and may require extra water during compaction to achieve optimum moisture

C. CH soil has no construction implications and behaves identically to sandy gravel in all applications

D. CH soil exhibits high shrinkswell potential, becomes very soft when wet, is extremely hard when dry, has low permeability, and is generally unsuitable for structural fill without modification

35. A contractor is constructing a commercial building in an area prone to seismic activity. The geotechnical report identifies a soil layer susceptible to liquefaction. What is soil liquefaction?

A. Liquefaction occurs when rocks melt due to friction between tectonic plates during an earthquake

B. Liquefaction is a phenomenon in which saturated, loose granular soil loses its shear strength during earthquake shaking and behaves temporarily like a liquid, potentially causing foundations to settle, tilt, or sink

C. Liquefaction refers to the melting of ice lenses in frozen soil during spring thaw conditions

D. Liquefaction is the process of injecting grout into the soil to increase its bearing capacity permanently

36. A contractor is installing a retaining wall to support a 10foothigh cut along the property line of a commercial building site. What type of pressure does the retained soil exert against the retaining wall?

A. Lateral earth pressure — the horizontal force exerted by the soil mass against the retaining wall, which increases with depth and varies depending on the soil type, moisture content, and whether the wall can yield

B. Atmospheric pressure — the same pressure exerted by the air column above the retained soil

C. Hydrostatic pressure — the pressure exerted by standing water within the soil regardless of soil type

D. Vertical bearing pressure — the same pressure the soil exerts downward against the foundation below

37. A contractor is performing a proof roll on a completed building pad and the loaded dump truck causes visible deflection (pumping) in one area approximately 30 feet by 30 feet. What corrective action should the contractor take before foundation work begins?

A. No action is needed because proof rolling is only an advisory test with no contractual significance

B. Apply a 2inch layer of gravel over the soft area and proceed with foundation construction immediately

C. Excavate the soft area, replace the unsuitable material with properly compacted structural fill, and reproof roll the repaired area to verify adequate bearing capacity

D. Reduce the building load by eliminating one story from the design to compensate for the weak soil

38. A contractor is installing underground storm drainage piping and the specifications call for HDPE (highdensity polyethylene) corrugated pipe. What advantage does HDPE pipe offer over reinforced concrete pipe (RCP) for storm drainage applications?

A. HDPE pipe has significantly higher compressive strength than RCP and can support heavier traffic loads

B. HDPE pipe is lightweight, flexible, corrosionresistant, and available in longer lengths that reduce the number of joints compared to RCP sections

C. HDPE pipe is the only pipe material approved by the IPC for storm drainage in commercial applications

D. HDPE pipe requires no bedding material and can be placed directly on native soil at the trench bottom

39. A contractor is constructing a large commercial parking lot and the pavement design calls for fulldepth asphalt construction. What does "fulldepth asphalt" mean?

A. Fulldepth asphalt uses asphalt material for all structural layers above the subgrade, eliminating the granular base and subbase courses used in conventional pavement design

B. Fulldepth asphalt means the asphalt surface course is the same thickness as a conventional section

C. Fulldepth asphalt refers to applying asphalt to both the top and bottom of the aggregate base course

D. Fulldepth asphalt means the asphalt extends the full depth of the excavation to the bottom of the subgrade

40. A contractor is grading a building site and the specifications require a tolerance of plus or minus 0.1 feet for the finished building pad elevation. The survey crew takes grade shots and determines that one area of the pad is 0.25 feet high. What must the contractor do?

A. The contractor must regrade the area to bring it within the specified tolerance of plus or minus 0.1 feet, removing approximately 0.15 feet of material from the high area

B. No action is needed because the grade is close enough and 0.25 feet is within standard industry tolerance

C. The contractor should add material to the low areas surrounding the high spot to bring them up to match

D. The tolerance applies only to the final floor elevation and does not govern the building pad subgrade

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

41. A contractor is reviewing the concrete specification for an elevated parking structure. The specification calls for a maximum watercement ratio of 0.40, a minimum compressive strength of 5,000 psi at 28 days, and air entrainment of 5% to 7%. The contractor asks why all three requirements are specified rather than just the compressive strength. What is the reason for specifying all three parameters?

A. Only the compressive strength matters — the watercement ratio and air content are informational only

B. The three parameters are mutually exclusive and cannot be achieved simultaneously in the same mix

C. Each parameter controls a different performance characteristic: the watercement ratio controls permeability, the compressive strength controls structural capacity, and the air entrainment controls freezethaw durability

D. The three parameters are specified only for legal liability purposes and have no technical significance

42. A concrete contractor is forming a deep foundation wall and plans to place the entire 16foot height in a single continuous pour. The structural engineer expresses concern about the formwork design. What specific loading condition should the formwork designer evaluate for this tall wall pour?

A. The vertical weight of the reinforcing steel, which exceeds the weight of the concrete in tall walls

B. The maximum lateral pressure of the fresh concrete, which increases with the rate of placement and the height of fluid concrete in the forms

C. The weight of the cured concrete wall, which will bear on the forms until the concrete reaches 28day strength

D. The wind load on the forms, which is the only significant loading condition for wall formwork design

43. A contractor is placing concrete in cold weather and the specification requires the concrete temperature at the time of placement to be between 50°F and 65°F. The batch plant heats the mixing water and aggregates to achieve this temperature. Why is there an upper limit of 65°F on the concrete temperature in cold weather?

A. Concrete above 65°F will not bond properly with the cold reinforcing steel in the formwork

B. Concrete above 65°F produces more greenhouse gases during hydration than cooler concrete

C. There is no technical reason for the upper limit — it is an arbitrary specification with no practical purpose

D. Concrete placed at excessively high temperatures (even in cold weather) sets too quickly, loses workability prematurely, and develops thermal gradients between the warm concrete core and cold form surfaces that can cause cracking

44. A concrete contractor is constructing a tiltup wall panel. The panel will be cast horizontally on the floor slab, cured, and then tilted up into its vertical position. What critical design consideration differentiates tiltup panels from conventional castinplace walls?

A. Tiltup panels must be designed for the stresses imposed during the lifting and tilting operation, including the bending moments and shear forces that occur when the panel is rotated from horizontal to vertical using crane pick points

B. Tiltup panels do not require reinforcing steel because the casting bed provides support during curing

C. Tiltup panels must be cast using Type V cement exclusively to resist the sulfate exposure during ground contact

D. Tiltup panels are always unreinforced concrete because the horizontal casting process prevents rebar placement

45. A contractor is placing concrete for a posttensioned elevated slab and the specifications prohibit the use of calcium chloride accelerating admixture. What is the reason for prohibiting calcium chloride in posttensioned concrete?

A. Calcium chloride reduces the compressive strength of posttensioned concrete by 50% compared to standard concrete

B. Calcium chloride causes the posttensioning tendons to expand and break their anchorage devices

C. Chloride ions from calcium chloride accelerate corrosion of the highstrength posttensioning tendons, potentially causing stress corrosion cracking and catastrophic tendon failure

D. Calcium chloride reacts with the polyethylene tendon sheathing and dissolves the protective coating

46. A concrete contractor is placing a large industrial floor slab and the specification calls for fiberreinforced concrete. The mix includes synthetic (polypropylene) fibers at a dosage rate of 1.5 pounds per cubic yard. What is the primary function of synthetic fibers in concrete at this dosage rate?

A. Synthetic fibers replace all structural reinforcement and eliminate the need for rebar or WWR in the slab

B. Synthetic fibers at this dosage rate primarily reduce plastic shrinkage cracking during the initial curing period by providing distributed crack control before the concrete hardens

C. Synthetic fibers increase the compressive strength of the concrete by approximately 50% above the base mix

D. Synthetic fibers provide freezethaw resistance equivalent to airentraining admixture at this dosage rate

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

47. A masonry contractor is constructing a multistory brick veneer wall with shelf angles at each floor level. What is the structural function of the shelf angles in this wall system?

A. Shelf angles provide aesthetic relief in the brick facade by creating horizontal shadow lines between floors

B. Shelf angles provide thermal insulation between floors by interrupting the thermal bridge in the brick

C. Shelf angles support the weight of the brick veneer above each floor level, transferring the brick load to the structural frame and preventing the cumulative weight of multiple stories of brick from bearing on the foundation

D. Shelf angles serve as attachment points for the building's window washing equipment at each floor level

48. A masonry contractor discovers that previously laid mortar joints on an exterior CMU wall were not tooled before the mortar hardened. The joints are rough and uncompressed. What is the consequence of failing to tool mortar joints before they harden?

A. Untooled joints have greater compressive strength than tooled joints due to the rougher surface profile

B. Untooled joints have no functional difference from tooled joints and the omission is purely cosmetic

C. Untooled joints will cause the CMU blocks to crack due to excess mortar pressure in the joint

D. Untooled joints provide poor weather resistance because the mortar is not compressed against the masonry units, leaving a porous surface that allows water to penetrate the wall

49. A masonry specification calls for ASTM C476 coarse grout for reinforced CMU wall cores. The specification states that the grout must achieve a minimum compressive strength of 2,000 psi at 28 days. What is the maximum aggregate size typically used in coarse masonry grout?

A. 1½inch maximum aggregate size for coarse masonry grout in large CMU cores

B. ¾inch maximum aggregate size for coarse masonry grout in standard applications

C. No aggregate is used in coarse grout — the term "coarse" refers to the grout's rough texture

D. ⅜inch (pea gravel) maximum aggregate size for coarse masonry grout in CMU wall cores

50. A masonry contractor is building a CMU wall in a region with seismic design requirements. The structural engineer specifies that all cores containing vertical reinforcement must be grouted, and additional horizontal reinforcement must be provided in bond beam courses at closer intervals than normally required. Why are these enhanced reinforcement requirements specified for seismic areas?

A. The enhanced reinforcement provides additional thermal mass to regulate indoor temperatures during earthquakes

B. Reinforced and grouted masonry walls have greater ductility, shear resistance, and energy dissipation capacity than unreinforced walls, enabling them to resist the cyclic lateral forces generated by seismic ground motion without catastrophic collapse

C. The additional reinforcement is required only for aesthetic purposes to create a uniform wall appearance

D. Seismic reinforcement requirements are identical to nonseismic requirements with no additional provisions

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

51. A contractor is reviewing the structural drawings for a commercial building and notices that the engineer has specified momentresistant connections (moment frames) for certain

beamtocolumn connections. What structural function do moment connections provide that standard shear connections do not?

A. Moment connections transfer bending forces (moments) from the beam to the column, providing lateral stability to the frame and resistance to lateral loads from wind and seismic forces, while standard shear connections transfer only vertical shear

B. Moment connections only transfer vertical gravity loads and provide no lateral resistance to the frame

C. Moment connections are decorative connections used only on architecturally exposed structural steel

D. Moment connections are identical to standard shear connections with the same bolts and configuration

52. A structural steel fabricator submits mill test reports (MTRs) for the structural steel to be used on a commercial project. What information do mill test reports provide, and why are they important?

A. MTRs report only the country of origin of the steel and have no relevance to structural performance

B. MTRs certify that the steel was manufactured using recycled content and meets sustainability requirements

C. MTRs certify the actual chemical composition and mechanical properties (yield strength, tensile strength, elongation) of each heat of steel produced, verifying that the material meets the specified ASTM grade requirements

D. MTRs report only the weight and dimensions of each piece and provide no information about material properties

53. A contractor is installing metal roof decking on a commercial steel building. The decking must be attached to the supporting steel purlins. The specifications call for selfdrilling screws rather than puddle welds for deck attachment. What advantage do selfdrilling screws offer over puddle welds for roof deck attachment?

A. Selfdrilling screws are the only attachment method approved by the IBC for metal roof decking

B. Selfdrilling screws can be installed without hot work (welding), eliminating fire risk during installation on combustible roof insulation, and they allow faster installation with less skilled labor

C. Selfdrilling screws provide a stronger connection than puddle welds in every application and loading condition

D. Selfdrilling screws are required by OSHA for all roof decking installations regardless of building type

54. A contractor is reviewing the specifications for a parking garage and sees that the structural engineer has specified weathering steel (ASTM A588) for exposed structural members. The garage is located near the ocean. Is weathering steel appropriate for this application?

A. Yes, weathering steel is suitable for all environments including coastal locations with saltwater exposure

B. Yes, weathering steel performs better near saltwater because the salt accelerates the formation of the protective patina

C. Weathering steel is appropriate for any application where the steel will be painted with a marine coating

D. No, weathering steel is not appropriate for environments with saltwater exposure because the salt prevents the formation of the stable protective patina and causes accelerated corrosion

55. A contractor is erecting structural steel and the erection plan calls for temporary guy wires to stabilize the first columns erected before beams and bracing can be connected. What is the purpose of the guy wires?

A. Guy wires prevent the columns from being plumb, allowing them to lean at the correct architectural angle

B. Guy wires provide a safety net system for workers performing connections at height on the steel

C. Guy wires distribute gravity loads from the columns to the surrounding soil for temporary foundation support

D. Guy wires provide temporary lateral support to prevent the unbraced columns from overturning due to wind, construction loads, or accidental impact before permanent bracing is installed

56. A contractor is reviewing specifications for a commercial building that includes an architecturally exposed structural steel (AESS) frame in the main lobby. What additional requirements does AESS impose on the fabrication and erection of the steel beyond standard structural steel?

A. AESS members require no additional fabrication or erection requirements beyond standard structural steel

B. AESS requires the steel to be manufactured from a different alloy than standard structural steel

C. AESS imposes tighter tolerances for member straightness, surface quality, weld appearance, connection detailing, and the grinding and finishing of visible welds, bolts, and surfaces to achieve the architect's aesthetic intent

D. AESS requires all connections to be concealed within the building structure with no visible bolts or welds

**DOMAIN 6: WOOD (Questions 57–61)**

57. A contractor is framing a commercial building and the specifications call for all exterior wall sheathing to be structural. The estimator is comparing plywood and OSB for this application. Both carry the same APA span rating. What is one notable difference between plywood and OSB performance in exterior wall sheathing applications?

A. Plywood and OSB perform identically in every respect with no differences in any property

B. OSB tends to swell more at the edges when exposed to moisture and is slower to dry after wetting compared to plywood, which has better moisture tolerance due to its crosslaminated veneer construction

C. Plywood is significantly weaker than OSB in shear strength and should not be used for shear walls

D. OSB costs significantly more than plywood in all markets and is rarely used for costsensitive projects

58. A contractor is installing wood trusses for a commercial roof system. The truss manufacturer provides a truss placement plan showing the exact location of each truss and the required permanent bracing layout. What is the difference between temporary bracing installed during erection and the permanent bracing shown on the placement plan?

A. Temporary bracing and permanent bracing are the same system and are never differentiated

B. Temporary bracing is removed after erection and replaced by the building's permanent structural elements

C. Temporary bracing remains in place permanently and serves as the only bracing for the truss system

D. Temporary bracing stabilizes individual trusses during erection until the permanent bracing (sheathing, purlins, and diagonal bracing specified by the truss designer) is installed to provide longterm lateral stability to the truss system

59. A contractor is framing a loadbearing wall and the structural plans show a triple 2×12 header over a 10foot garage door opening. The contractor has only double 2×12 lumber available onsite. Can the contractor substitute a double 2×12 for the specified triple 2×12?

A. No, reducing the header from triple to double 2×12 reduces the loadcarrying capacity and requires approval from the structural engineer before any substitution

B. Yes, double 2×12 headers are structurally equivalent to triple 2×12 for all spans up to 12 feet

C. Yes, the third member is always a spacer with no structural function and may be omitted freely

D. No, but the contractor may add a steel flitch plate between the two 2×12s as an acceptable substitute

60. A contractor is constructing a woodframed building and the building inspector asks about the crosssectional dimensions of the fire blocking installed in the wall cavities. The contractor used 2×4 lumber turned flat (1½ inches × 3½ inches) in a 2×6 wall cavity (5½ inches deep). Does this fire blocking comply with the IBC?

A. No, fire blocking must match the full depth of the wall cavity to completely fill the space

B. No, only noncombustible materials may be used for fire blocking in commercial construction

C. Yes, 2×4 lumber is acceptable for fire blocking in 2×6 walls because the IBC requires 2× nominal lumber, which the 2×4 satisfies, though the blocking must be installed to fill the cavity completely

D. Yes, fire blocking is not required in 2×6 walls because the wider cavity provides inherent fire resistance

61. A contractor is reviewing a specification that requires all structural connections in a heavy timber (Type IVHT) building to be concealed within the wood members or protected by the wood itself. What is the purpose of this requirement?

A. The requirement is purely aesthetic and has no fire safety or structural purpose in heavy timber buildings

B. The requirement prevents moisture from reaching the metal connectors and causing corrosion damage

C. The requirement improves the acoustic performance of the heavy timber connections and reduces vibration

D. Concealed connections are protected from fire exposure by the surrounding wood, which chars slowly during a fire, maintaining the connection's structural capacity for a longer period than exposed metal connectors would

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

62. A contractor is installing rigid insulation on the exterior of a belowgrade foundation wall. The specification calls for extruded polystyrene (XPS) rather than expanded polystyrene (EPS) for this application. What property of XPS makes it more suitable than EPS for belowgrade use?

A. XPS is available in more colors than EPS, providing better aesthetic appearance below grade

B. XPS has a higher compressive strength, lower moisture absorption rate, and maintains its Rvalue more consistently when in prolonged contact with soil moisture compared to EPS

C. XPS is less expensive than EPS in all belowgrade applications and thicknesses available

D. XPS has a higher Rvalue per inch than closedcell spray foam, making it the highestperforming insulation

63. A commercial building roof assembly includes, from bottom to top: structural steel deck, vapor retarder, rigid insulation, and singleply membrane. The building is located in Alabama (Climate Zone 3). Under what conditions is a vapor retarder recommended beneath the roof insulation in this climate zone?

A. A vapor retarder is always required in every roof assembly regardless of climate zone or building use

B. A vapor retarder is never required in any commercial roof assembly in Climate Zone 3

C. A vapor retarder is required in all roof assemblies only when the roof slope exceeds 3:12 pitch

D. A vapor retarder beneath the roof insulation may be recommended when the building has high interior humidity (such as swimming pools, commercial kitchens, or laundries) to prevent moisture from migrating upward and condensing within the insulation

64. A contractor is installing a standing seam metal roof on a commercial building. How do standing seam panels accommodate thermal expansion and contraction?

A. Standing seam panels are installed with fixed clips at every attachment point that rigidly prevent all movement

B. Standing seam panels are installed with oversized holes that allow the panels to slide freely in any direction

C. Standing seam panels cannot accommodate thermal movement and will buckle in hot weather without exception

D. Standing seam panels use concealed clips that allow the panels to slide longitudinally along their length as they expand and contract with temperature changes, preventing buckling and fastener stress

65. A contractor is reviewing the specifications for a commercial building's belowgrade waterproofing system. The engineer specifies a "positiveside" waterproofing application. What does "positiveside" waterproofing mean?

A. Positiveside waterproofing is applied to the interior face of the foundation wall after construction is complete

B. Positiveside waterproofing is applied within the concrete mix as an integral waterrepellent admixture

C. Positiveside waterproofing is applied to the exterior (soil) side of the foundation wall, the side that faces the source of water pressure, which is the most effective location for preventing water entry

D. Positiveside waterproofing refers to any waterproofing system that carries a positive manufacturer warranty

66. A contractor is installing a commercial roof and the specifications require tapered insulation to create positive drainage on a structurally flat roof deck. How does tapered insulation create roof slope?

A. Tapered insulation boards are manufactured with a wedgeshaped profile that increases in thickness from one end to the other, and when installed in a planned layout pattern, they create a sloped surface that directs water to roof drains

B. Tapered insulation is the same thickness throughout and the slope is created by shimming the insulation with wood blocks

C. Tapered insulation is installed only at the perimeter of the roof and the center remains flat and unsloped

D. Tapered insulation refers to standard flat insulation boards installed at an angle by cutting the steel deck below

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

67. A contractor is installing commercial hollow metal doors and notices that the specification calls for doors with a "positivepressure fire test" rating. What does a positivepressure fire test evaluate that a standard fire test does not?

A. A positivepressure fire test evaluates the door's ability to resist forced entry by intruders

B. A positivepressure fire test subjects the door to the positive pressure conditions that occur during an actual fire (as hot gases expand), testing the door's ability to remain in the frame and prevent the passage of flame and hot gases under realistic fire conditions

C. A positivepressure fire test evaluates the door's ability to withstand wind pressure from hurricanes

D. A positivepressure fire test measures the door's Rvalue and thermal performance under heated conditions

68. A contractor is installing a commercial storefront glazing system. The architect specifies tempered glass for all glazing below 18 inches from the floor and within 24 inches of door openings. Why is tempered glass required in these locations?

A. Tempered glass is required because it provides better thermal insulation than annealed glass

B. Tempered glass is required because it is less expensive than annealed glass in large commercial panels

C. Tempered glass is required because these are hazardous locations where human impact is likely, and tempered glass breaks into small, relatively harmless fragments rather than sharp, dangerous shards

D. Tempered glass is required because it provides superior sound transmission control near doors

69. A contractor is installing a revolving door at the main entrance of a commercial building. Under the IBC, can a revolving door serve as a required means of egress?

A. A revolving door may be credited with only a portion of the required egress width, and a conforming swinging door must be located adjacent to each revolving door to provide the remainder of the required egress capacity

B. Revolving doors may serve as the sole means of egress from any commercial building without restriction

C. Revolving doors are prohibited in commercial buildings and cannot be installed under any circumstance

D. Revolving doors count as two exits because they can serve people entering and exiting simultaneously

70. A contractor is installing exterior windows on a commercial building and the specifications require a "thermal break" window frame. The contractor notices that the window manufacturer offers both "pour and debridge" and "crimped barrier" thermal break profiles. Both create a thermal break. What is the common structural element in both thermal break methods?

A. Both methods use a layer of foam insulation adhesively bonded to the exterior of the aluminum frame

B. Both methods use a wood insert within the aluminum frame to provide thermal resistance and structural support

C. Both methods use two separate glass panes with a sealed air space between them for thermal resistance

D. Both methods use a nonconductive material (typically nylon or polyurethane) that physically separates the interior and exterior aluminum sections of the frame, interrupting the conductive heat transfer path

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

71. A contractor is installing a suspended acoustic ceiling tile (ACT) system in a commercial office building. The ceiling grid must be installed level within specific tolerances. What is the typical industry tolerance for suspended ceiling grid levelness?

A. ±¼ inch in 10 feet, which is the standard tolerance for commercial suspended ceiling installations

B. ±⅛ inch in 10 feet as the standard tolerance for commercial suspended ceiling grid levelness

C. ±1 inch in 10 feet, which is the standard tolerance for all commercial ceiling installations

D. ±½ inch per foot of grid length, with no cumulative tolerance limit over the entire ceiling area

72. A contractor is specifying floor tile for a commercial restroom. The architect requires slipresistant tile that meets the minimum dynamic coefficient of friction (DCOF) requirements. Under ANSI A326.3, what is the minimum DCOF value recommended for level interior wet areas?

A. A minimum DCOF of 0.42 is recommended by ANSI A326.3 for level interior floors that may be walked on when wet

B. A minimum DCOF of 0.20 is recommended for all commercial floor surfaces regardless of wet conditions

C. A minimum DCOF of 0.80 is required for all commercial floor tile installations without exception

D. DCOF testing is not applicable to ceramic tile and is used only for resilient flooring products

73. A painting contractor is preparing to paint the exterior of a commercial building that has unpainted concrete masonry block walls. What surface preparation is required before applying paint to new, unpainted CMU?

A. No surface preparation is required — paint may be applied directly to new CMU without any treatment

B. The CMU surface must be covered with ½inch gypsum board before any paint can be applied

C. The CMU surface must be cleaned, allowed to cure for at least 28 days, and primed with a masonry primer or block filler that fills the porous surface and provides a uniform base for the topcoat

D. The CMU surface must be sandblasted to remove all surface texture before paint application

74. A contractor is installing luxury vinyl plank (LVP) flooring in a commercial space with radiant floor heating. What limitation must the contractor verify before installing LVP over a radiant heating system?

A. LVP cannot be installed over any radiant floor heating system under any circumstances or conditions

B. LVP is compatible with all radiant heating systems at any temperature without restriction or limitation

C. The contractor must apply a 2inch concrete overlay over the radiant system before installing LVP

D. The contractor must verify that the radiant system's maximum floor surface temperature does not exceed the LVP manufacturer's specified limit (typically 80°F to 85°F) to prevent warping, discoloration, and adhesive failure

75. A contractor is installing ceramic tile on a commercial building's exterior entrance landing. The tile will be exposed to rain, snow, and freezing temperatures. What critical property must the tile possess for this exterior freezethaw application?

A. The tile must have a smooth, polished surface to shed water and prevent ice from adhering

B. The tile must have very low water absorption (typically less than 0.5% for porcelain tile) to prevent water from being absorbed into the tile body, freezing, and causing spalling or cracking

C. The tile must be a minimum of 1 inch thick to resist cracking from thermal expansion and contraction

D. The tile must be installed without grout joints to prevent water from entering the assembly through joints

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

76. A contractor is constructing a commercial building with a large open office floor plan. The mechanical engineer specifies variable air volume (VAV) boxes for the HVAC distribution system. How does a VAV system regulate the temperature in individual zones?

A. VAV systems vary the volume of conditioned air delivered to each zone by modulating a damper in the VAV box based on the zone thermostat's demand, delivering more air when more cooling or heating is needed and less when the setpoint is satisfied

B. VAV systems maintain constant airflow to all zones and vary the temperature of the supply air at each box

C. VAV systems use individual compressors at each zone box to produce cooling independently

D. VAV systems operate at a single fixed airflow rate throughout the building with no zonelevel control

77. A plumbing contractor is installing a water supply system for a commercial building. The specifications call for a pressurereducing valve (PRV) at the service entrance. Under what condition is a PRV required?

A. A PRV is required on all commercial water services regardless of the incoming pressure from the main

B. A PRV is required whenever the building has more than two stories to prevent excessive pressure at fixtures

C. A PRV is required when the incoming water pressure from the municipal main exceeds the maximum pressure permitted by the plumbing code (typically 80 psi) to protect piping, fixtures, and appliances from damage

D. A PRV is required only on hot water lines to prevent thermal expansion from creating excessive pressure

78. A contractor is installing fire protection piping in a commercial building. The fire protection contractor requests a hydrostatic test of the completed sprinkler system before the system is placed in service. What is the purpose of a hydrostatic pressure test on a sprinkler system?

A. The hydrostatic test verifies that the sprinkler heads activate at the correct temperature during a fire

B. The hydrostatic test pressurizes the system with water above the normal operating pressure to verify that all piping, fittings, and joints are leakfree and structurally sound before the system is placed in service

C. The hydrostatic test measures the flow rate of water from each sprinkler head to ensure adequate coverage

D. The hydrostatic test is a visual inspection of the pipe supports and hangers for proper spacing and alignment

79. A contractor is coordinating the installation of HVAC ductwork in a commercial building with a 2hour fireresistancerated floor assembly. A supply duct must penetrate the rated floor assembly to serve the floor below. Under the IMC and IBC, what fire protection device is required at this penetration?

A. A check valve that prevents air from flowing backward through the duct during a fire alarm activation

B. A motorized damper that opens and closes on a scheduled basis to regulate airflow during normal operation

C. No fire protection device is required at duct penetrations through firerated floor assemblies if the building is sprinklered

D. A fire damper rated to match the floor assembly's fireresistance rating must be installed in the duct at the point of penetration to prevent fire spread through the duct opening

80. A commercial building's plumbing design includes a sewage ejector pump in the basement. Why is a sewage ejector pump required in this location?

A. The basement fixtures are located below the elevation of the building's gravity sewer connection to the municipal main, and wastewater must be pumped upward to the gravity drain system because it cannot flow by gravity

B. The sewage ejector pump increases the water pressure to basement fixtures for adequate supply

C. The sewage ejector pump treats the wastewater before it enters the municipal sewer system

D. The sewage ejector pump is required by code in all basements regardless of the sewer connection elevation

81. A contractor is installing a splitsystem HVAC unit in a commercial building. The outdoor condensing unit and the indoor air handler are connected by refrigerant piping (line set). What are the two lines in a standard residential/light commercial split system line set?

A. A hot water supply line and a hot water return line connecting the boiler to the air handler

B. A chilled water supply line and a condensate drain line connecting the chiller to the fan coil

C. A suction line (larger diameter, insulated, carrying cool gas back to the compressor) and a liquid line (smaller diameter, carrying warm liquid refrigerant from the condenser to the evaporator)

D. Two identical gas lines of the same diameter carrying refrigerant in opposite directions simultaneously

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

82. A contractor is reviewing the electrical design for a commercial building and notices that the panel schedule shows separate "normal" and "emergency" electrical panels. Under the NEC, what loads are typically served by the emergency electrical system?

A. All convenience receptacles throughout the building are connected to the emergency panel for reliability

B. The building's HVAC system and domestic water heaters are connected exclusively to the emergency system

C. The emergency panel serves all kitchen and break room circuits for occupant convenience during outages

D. Emergency panels serve life safety systems including exit lighting, emergency lighting, fire alarm, fire pump, and smoke control systems that must remain operational during a power failure

83. A contractor is installing a commercial electrical system and the NEC requires that certain electrical panels maintain specific working clearances in front of the panel for safe access and maintenance. What is the minimum required working clearance depth in front of a 120/208V panelboard?

A. 36 inches minimum clear working space depth in front of the electrical panel for 120/208V equipment

B. 24 inches minimum clear working space depth in front of the electrical panel for all voltage levels

C. 48 inches minimum clear working space depth in front of the electrical panel for all commercial panels

D. 12 inches minimum clear working space depth in front of the electrical panel for lowvoltage panels only

84. A contractor notices that the electrical plans show a "dedicated circuit" for each piece of commercial HVAC equipment. What does a dedicated circuit provide that a shared circuit does not?

A. A dedicated circuit uses a higher voltage than a shared circuit for the same equipment rating

B. A dedicated circuit serves a single piece of equipment exclusively, preventing other loads from affecting its power supply and ensuring that the equipment's overcurrent protection is properly sized for that specific load

C. A dedicated circuit eliminates the need for a disconnect switch at the equipment because the panel breaker serves as the only disconnect required by code

D. A dedicated circuit is wired with a special type of conductor not used in shared circuits for safety

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

85. A contractor has been awarded a commercial construction project and is preparing to mobilize. The contract requires the contractor to submit a list of proposed subcontractors for the owner's review. Under what authority can the owner reject a proposed subcontractor?

A. The owner has no authority to reject any subcontractor and must accept whoever the contractor selects

B. The owner may reject subcontractors only if they are not properly licensed in the state of Alabama

C. Under AIA A201, the owner may reject a proposed subcontractor for reasonable cause, such as poor past performance, financial instability, inadequate qualifications, or safety concerns, and the contractor must propose an acceptable substitute

D. The owner may reject subcontractors only if the proposed firm has been debarred from federal contracting

86. A contractor is reviewing a project specification that includes a "contingency allowance" of $50,000 within the GMP contract. How does a contingency allowance within a GMP differ from a contractor's markup for overhead and profit?

A. The contingency is a fund within the GMP used to cover unforeseen costs and minor scope gaps, while the contractor's overhead and profit markup is the contractor's compensation for managing the project — the contingency benefits the project while the markup benefits the contractor

B. The contingency and the markup are identical line items with different names on the schedule of values

C. The contingency is the owner's profit on the project while the markup is the contractor's profit

D. The contingency replaces the need for change orders on the project and no change orders may be issued

87. Under AIA A201, the contractor is required to keep the project site clean during construction. At project completion, what level of cleaning is the contractor required to perform?

A. No cleaning is required — the owner is responsible for all cleaning before occupancy

B. Only the contractor's own trash and debris must be removed, with no cleaning of installed finishes

C. A basic broomclean condition is the only requirement, with no cleaning of windows or fixtures

D. The contractor must perform final cleaning including removal of all waste, debris, and temporary materials, and must leave the project in a condition ready for occupancy unless a separate cleaning specification provides otherwise

88. A contractor is evaluating a project where the owner requires the contractor to carry pollution liability insurance in addition to the standard CGL policy. Under what circumstances is pollution liability insurance typically required?

A. Pollution liability insurance is required on every commercial construction project regardless of scope

B. Pollution liability insurance is typically required when the project involves demolition or renovation of older buildings that may contain hazardous materials, work near environmentally sensitive areas, or site remediation activities

C. Pollution liability insurance is identical to the standard CGL policy and provides no additional coverage

D. Pollution liability insurance is required only on projects exceeding $10 million in total contract value

89. A contractor submits a change order proposal for additional work caused by a design error in the structural drawings. The architect disputes the claim, asserting that the contractor should have identified the error during the document review period. Under AIA A201, what is the contractor's obligation regarding document review?

A. The contractor must carefully study the documents and report errors to the architect but is not required to perform a professional design review, and errors that are not reasonably discoverable by a contractor remain the designer's responsibility

B. The contractor has no obligation to review the documents for errors under any standard contract

C. The contractor is responsible for all design errors regardless of discoverability once the contract is signed

D. The contractor must hire an independent engineer to verify the entire design before construction begins

90. A project owner wants to use a fasttrack delivery approach on a commercial building. What does fasttracking mean, and what risk does it create?

A. Fasttracking means using prefabricated building components exclusively to accelerate construction

B. Fasttracking means hiring additional subcontractors to work overtime shifts every day of the week

C. Fasttracking means completing the design phase twice as fast by reducing the architect's review time

D. Fasttracking means overlapping the design and construction phases so that construction begins before the design is complete, which compresses the schedule but creates the risk of design changes affecting work already under construction

91. Under standard construction contract provisions, the contractor is responsible for protecting completed work from damage during subsequent construction activities. If a completed ceiling finish is damaged by a subcontractor installing ductwork, who bears the repair cost?

A. The building owner bears all repair costs for completed work damaged during construction activities

B. The general contractor is responsible for the repair cost and may backcharge the subcontractor whose work caused the damage

C. The architect is responsible because the damage was caused by a design that required the ductwork to cross the ceiling

D. No one is responsible — damage to completed work during construction is considered an acceptable loss

92. A contractor is preparing a time impact analysis (TIA) to support a claim for a schedule extension due to ownerdirected changes. What does a time impact analysis demonstrate?

A. A TIA calculates the total project cost overrun resulting from all changes and expresses it as a daily rate

B. A TIA measures the contractor's labor productivity loss caused by adverse weather conditions

C. A TIA demonstrates the effect of a specific change or delay event on the project's critical path and overall completion date by inserting the delay activity into the asbuilt schedule and calculating the resulting impact

D. A TIA is a financial report showing the contractor's monthly cash flow disruption from change orders

93. Under AIA A201, the contractor must provide written notice to the architect and owner when the contractor becomes aware of conditions that will affect the project cost or schedule. This duty to notify is ongoing throughout the project. What is the practical significance of this ongoing notification obligation?

A. The obligation is purely administrative and failure to notify has no contractual consequences for anyone

B. Timely notification allows the owner and architect to investigate the condition, evaluate options, and take steps to minimize the cost and schedule impact — while failure to notify may waive the contractor's right to claim the resulting costs

C. The notification obligation applies only to changes directed by the owner and not to any other conditions

D. The notification obligation is satisfied by a single notice at the beginning of the project covering all potential issues

94. A contractor is reviewing a contract that includes a "warranty exclusion" for work performed by the owner's own forces or separate contractors. What does this exclusion mean?

A. The exclusion means the contractor's warranty covers only electrical and plumbing work installed by subcontractors

B. The exclusion means all warranty obligations are eliminated from the contract for the entire project

D. The exclusion means the owner must provide a warranty to the contractor for any work performed by others

C. The exclusion means the contractor's warranty does not cover defects caused by work performed by the owner's own forces or separate contractors hired directly by the owner, because the contractor did not control that work

95. A contractor completes a project and the owner moves in at substantial completion. Six months later, an unusual odor develops in several office areas. Investigation reveals that the adhesive used for carpet tile installation is offgassing volatile organic compounds (VOCs). Under the contractor's warranty, is this a covered defect?

A. Yes, the use of an adhesive that produces ongoing VOC offgassing after installation may constitute a material defect covered by the contractor's warranty, particularly if the adhesive does not meet the VOC limits specified in the contract documents

B. No, odors are never covered by construction warranties under any circumstances

C. No, the warranty covers only structural defects and not any interior finish or material issues

D. Yes, but only if the odor is detectable within the first 30 days after substantial completion

96. A contractor is evaluating the financial implications of a potential project delay. The original project duration is 12 months, and the delay will extend the project by 2 months. The contractor's general conditions cost is $40,000 per month. What is the contractor's additional general conditions cost attributable to the 2month delay?

A. $40,000 because only one month of the delay is compensable under standard contract provisions

B. $20,000 because general conditions costs are reduced by 50% during delay periods by contract

C. $120,000 because the delay cost equals three times the monthly general conditions rate

D. $80,000, calculated as 2 months × $40,000 per month in extended general conditions costs

97. Under standard construction contract provisions, the owner retains retainage from each progress payment. At what project milestone is the retainage typically released to the contractor?

A. Retainage is released at the 50% completion milestone when the project is half finished

B. Retainage is typically released at or after substantial completion, less amounts needed to cover incomplete punch list items, outstanding claims, or other contractual obligations

C. Retainage is never released — it is permanently retained by the owner as a project completion incentive

D. Retainage is released monthly in equal installments beginning at the 75% completion milestone

98. A contractor is reviewing a specification that requires "commissioning" of the building's HVAC and lighting control systems. The specification designates a thirdparty commissioning agent (CxA) hired by the owner. What is the contractor's role in the commissioning process?

A. The contractor has no role in commissioning because it is entirely the CxA's and owner's responsibility

B. The contractor must perform all commissioning tests and write all commissioning reports independently

C. The contractor must cooperate with the CxA by providing access to systems, supporting functional testing, correcting deficiencies identified during testing, and providing required documentation

D. The contractor must hire and pay for the CxA as part of the general conditions cost on every project

99. A contractor is preparing a claim for constructive acceleration. What conditions must exist for a constructive acceleration claim to be valid?

A. The contractor must demonstrate that the owner denied a legitimate time extension request, effectively requiring the contractor to accelerate (compress the remaining schedule) to meet the original completion date, and the contractor incurred additional costs as a result

B. Constructive acceleration requires the owner to issue a written acceleration directive before the claim is valid

C. Constructive acceleration claims are valid only on federal government construction contracts

D. Constructive acceleration occurs whenever the contractor works overtime, regardless of the reason

100. Under AIA A201, the contractor is required to maintain certain records during the project. Which of the following records must the contractor maintain onsite and make available for review?

A. The contractor's annual tax returns and corporate financial statements for the past five fiscal years

B. The personal employment records of all subcontractor employees including home addresses and salaries

C. The contractor's proprietary bid estimates and markup calculations from the original bid submission

D. A current set of contract documents (drawings and specifications) including all addenda, change orders, and other modifications, maintained at the site and marked to show actual installed conditions

101. A contractor is working on a phased construction project where the owner will occupy the first phase while construction continues on the second phase. Under AIA A201, what additional responsibility does the contractor have when the owner occupies part of the building during ongoing construction?

A. The contractor has no additional responsibilities when the owner occupies a portion of the building

B. The contractor must cease all construction activities during the owner's business hours in the occupied area

C. The contractor must maintain adequate separation, safety barriers, noise control, dust control, and security between the occupied and construction areas to protect the occupants and allow the owner's operations to continue

D. The contractor must provide a fulltime security guard at the entrance to the occupied area at contractor expense

102. A contractor is reviewing a project where the owner has requested a cost estimate for potential change order work. The contractor provides a "nottoexceed" (NTE) estimate. What does a nottoexceed estimate mean?

A. The NTE establishes a maximum cost for the changed work — the contractor will perform the work and bill actual costs up to the NTE amount, but the total will not exceed the stated maximum

B. The NTE is a guarantee that the actual cost will be exactly equal to the estimated amount

C. The NTE is a nonbinding preliminary estimate with no contractual significance or cost limitation

D. The NTE means the contractor will perform the work for free if the actual cost exceeds the estimate

103. Under standard construction contract provisions, what is the contractor's obligation when encountering hazardous materials (such as asbestos or lead paint) during renovation of an existing building?

A. The contractor must remove the hazardous materials immediately using the project's laborers

B. The contractor must conceal the hazardous materials behind new construction and continue working

C. The contractor has no obligation regarding hazardous materials and may continue work without interruption

D. The contractor must stop work in the affected area immediately, report the condition to the owner and architect, and not resume work until a qualified environmental professional has assessed and remediated the condition

104. A general contractor on a commercial project is managing 15 subcontractors. Two subcontractors have overlapping scope boundaries — both believe the other is responsible for installing fire caulking at MEP penetrations through firerated walls. Under AIA A201, who is responsible for resolving this scope gap?

A. The architect must redesign the firerated assemblies to eliminate the need for fire caulking entirely

B. The general contractor is responsible for coordinating the work of all subcontractors and resolving scope gaps, either by assigning the work to the appropriate subcontractor or by performing the work with the contractor's own forces and backcharging the responsible subcontractor

C. The building official must resolve the scope gap by issuing a directive to one of the subcontractors

D. The owner must hire a separate contractor to perform the fire caulking work independently

105. A contractor is preparing a proposal for a negotiated commercial project and the owner requests a detailed breakdown of the contractor's general conditions costs. Which of the following items would typically be included in the general conditions breakdown?

A. The cost of structural steel fabrication and erection for the building's primary structural frame

B. The cost of the roofing subcontractor's labor and materials for the complete roof installation

C. Project supervision salaries, temporary facilities (trailer, toilets, fencing), temporary utilities (power, water), safety equipment, project insurance, site cleanup, and dumpster/hauling costs

D. The cost of all concrete materials including readymix concrete, reinforcing steel, and formwork lumber

106. A contractor is working under a contract that includes a dispute review board (DRB) as part of the dispute resolution process. How does a DRB function?

A. A DRB is a panel of three neutral professionals who visit the project regularly, remain informed about project issues, and provide nonbinding recommendations for resolving disputes in real time, before they escalate to formal claims

B. A DRB is a government agency that enforces construction contract compliance through legal action

C. A DRB is a committee of the contractor's employees who review internal quality control issues

D. A DRB is the same as binding arbitration and its decisions are final and nonappealable

107. Under standard construction contract provisions, the contractor is required to furnish and maintain a project schedule. If the schedule shows that the project will not be completed by the contractual completion date, what obligation does the contractor have?

A. The contractor has no obligation to take action as long as actual work continues at a reasonable pace

B. The contractor must immediately file a claim for additional time regardless of the cause of the delay

C. The contractor must notify the owner and submit a revised schedule with a recovery plan only if requested

D. The contractor must promptly notify the owner and architect, identify the cause of the delay, and develop a recovery plan with specific measures to bring the project back on schedule or request a time extension if the delay is excusable

108. A contractor completes a project and submits the final pay application including a request for release of all retainage. The owner's attorney advises withholding retainage pending receipt of final lien waivers from all subcontractors. Is this a valid reason to withhold retainage?

A. No, the owner must release all retainage immediately upon the contractor's request without conditions

B. Yes, withholding retainage pending receipt of final lien waivers is a standard and reasonable practice that protects the owner from mechanics' liens filed by unpaid subcontractors after final payment is released to the contractor

C. No, lien waivers are optional documents with no contractual or legal significance in commercial construction

D. Yes, but the owner may withhold retainage for a maximum of 7 calendar days and must release it automatically after that period regardless of lien waiver status

109. A contractor on a commercial project receives a verbal directive from the owner's representative to perform additional work not included in the contract documents. The contractor performs the work without obtaining a written change order. Under AIA A201, is the contractor entitled to compensation for this work?

A. The contractor is automatically entitled to full compensation for any verbally directed work without documentation

B. The owner's representative has unlimited authority to authorize additional work verbally without a written order

C. The contractor may have difficulty recovering compensation because AIA A201 requires written authorization for changes — verbal directives without written confirmation create dispute risk and the contractor should have requested a written change order before performing the work

D. Verbal directives are equivalent to written change orders under all standard construction contract provisions

110. A contractor is reviewing a project specification that requires a "performance mockup" for the curtain wall system. The mockup must undergo laboratory testing at an independent testing facility. What performance characteristics are typically tested in a curtain wall mockup test?

A. Air infiltration resistance, water penetration resistance, structural load resistance (wind pressure), and thermal performance are the primary characteristics tested in a curtain wall mockup evaluation

B. Only the aesthetic appearance and color consistency of the curtain wall system are evaluated

C. Only the weight of the curtain wall panels is measured to verify structural loading calculations

D. Only the acoustic performance of the curtain wall system is tested in the mockup evaluation

111. A contractor on a large commercial project has subcontracted approximately 75% of the work by value to specialty subcontractors. What risk does this high percentage of subcontracted work create for the general contractor?

A. A high subcontractor percentage reduces the contractor's risk because subcontractors assume all liability

B. A high subcontractor percentage has no effect on the contractor's risk profile or management responsibilities

C. A high subcontractor percentage eliminates the need for project supervision by the general contractor

D. The contractor remains fully responsible for all subcontractor work under the prime contract with the owner — a high subcontractor percentage increases coordination complexity, cost control challenges, and the contractor's exposure to subcontractor performance failures

112. Under AIA A201, what is the contractor's obligation regarding the protection of the owner's property and adjacent properties during construction?

A. The contractor has no obligation to protect adjacent properties and is responsible only for the building site

B. The contractor must take reasonable precautions to protect the owner's property and adjacent properties from damage caused by construction activities, and must repair any damage resulting from the contractor's operations

C. Only the individual subcontractors are responsible for protecting adjacent properties near their work areas

D. The owner must carry separate insurance to cover all potential damage to adjacent properties

113. A contractor discovers that a significant quantity of structural steel delivered to the site does not match the mill test reports — the actual yield strength is lower than the minimum required by the specification. What action must the contractor take?

A. The contractor must reject the nonconforming steel, notify the structural engineer and the fabricator, and ensure that only steel meeting the specified ASTM grade requirements is used in the structure — the nonconforming steel must not be installed

B. The contractor may install the steel if the difference in yield strength is less than 5% of the specified value

C. The contractor should blend the nonconforming steel with conforming steel to average out the properties

D. The contractor should install the steel and request a change order for the reduced material cost savings

114. A contractor is working on a LEEDcertified project and the specifications require construction indoor air quality (IAQ) management during construction per LEED requirements. What measures does a construction IAQ management plan typically require?

A. The plan requires the building to remain fully sealed during all construction activities with no ventilation

B. The plan requires all workers to wear respiratory protection at all times regardless of the activity

C. The plan requires protection of stored and installed HVAC equipment from contamination, use of MERV 8 filters during construction, control of moisture on absorptive materials, and protection of ductwork openings to prevent construction dust and debris from entering the HVAC system

D. The plan requires the installation of permanent air monitoring equipment that remains in place after occupancy

115. A contractor is closing out a commercial project and the specifications require the contractor to provide the owner with a "building owner's manual" in addition to the standard O&M manuals for individual equipment. What information does a building owner's manual typically contain?

A. The contractor's original bid estimate and all subcontractor quotes from the bidding phase

B. A single document containing the architect's design development drawings and all rejected alternatives

C. A log of all construction delays and weather events that occurred during the project

D. A comprehensive guide to the building's overall systems, maintenance schedules, warranty information, emergency procedures, recommended service providers, and instructions for operating the building as an integrated facility

# Practice Exam 6: Answer Key and Explanations

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

**1.** D — When any portion of a building requires an automatic sprinkler system under the IBC's separated occupancies provisions, the sprinkler system must extend throughout the entire building. The IBC does not permit partial sprinkler installations — the system must protect all areas to maintain the fire safety assumptions underlying the occupancy separation requirements.

**2.** B — A smokeproof enclosure provides a higher level of protection than a standard enclosed exit stairway by incorporating vestibules with automaticclosing doors or natural ventilation openings that prevent smoke from entering the stairway shaft during a fire. This design keeps the stairway tenable for evacuation even when adjacent floors are heavily smokefilled.

**3.** C — After a stopwork order is issued, all construction must cease until the specific violation identified in the order has been corrected and the building official has inspected the correction and authorized the resumption of work. Continuing work after a stopwork order is a serious violation subject to additional fines and penalties.

**4.** A — IBC Section 506.3 allows an area increase for buildings with open, unobstructed frontage along a qualifying percentage of the perimeter, provided the frontage abuts public ways or open spaces at least 20 feet wide. The open frontage provides fire department access for suppression operations, justifying the increased allowable area.

**5.** D — IBC Section 407.4.1 requires a minimum corridor width of 96 inches (8 feet) in the patient sleeping areas of Group I2 (hospital) occupancies to accommodate the movement of hospital beds during emergencies and routine patient transport. This is significantly wider than the standard 44inch corridor minimum for other occupancies.

**6.** B — Commercial cooking exhaust systems require a listed fire extinguishing system (typically wet chemical or dry chemical) designed specifically for cooking operations, installed within the hood, duct, and over the cooking appliances. These systems are distinct from the building's main sprinkler system and are designed to suppress grease fires and protect the exhaust ductwork.

**7.** A — A fire wall creates separate buildings for code purposes. Each portion on either side of the fire wall is evaluated independently for allowable height, area, and construction type

requirements. One side may be sprinklered and receive the sprinkler area increase while the other side is evaluated without the sprinkler benefit.

**8.** C — IBC Section 1013 requires exit signs to be continuously illuminated at all times when the building is occupied. Exit signs must maintain visibility during both normal operation and emergency conditions. Unlit exit signs during occupied hours are a code violation because occupants must be able to identify exit locations at all times.

**9.** B — The IBC assigns an occupant load factor of 5 net square feet per person for assembly occupancies with standing space only. This is the highestdensity factor in the IBC occupant load table, reflecting the tightly packed conditions of standingroomonly events such as general admission concert floors and nightclub dance floors.

**10.** D — Mechanical penthouses and other rooftop structures used exclusively for building equipment (elevator machine rooms, cooling towers, stair access enclosures) are generally not counted as stories for building height calculations under the IBC, provided they do not exceed specified area and height limitations and are not used for human occupancy.

**11.** A — The fire alarm control panel must be located in a readily accessible location approved by the fire code official, typically near a building entrance where the fire department can access it immediately upon arrival. A locked janitor's closet does not meet this accessibility requirement and could delay emergency response operations.

**12.** C — An exit passageway must have the same fireresistance rating as the exit stairway it serves because it is a continuation of the protected exit path. If the stairway requires a 2hour enclosure (connecting four or more stories), the exit passageway must also be 2hour rated. The passageway maintains the same level of protection as the stairway through to the exit discharge.

**13.** B — At least 50% of drinking fountains must be accessible at wheelchairaccessible height, and the remaining units should be at standing height to serve both ambulatory users and wheelchair users. This dualheight approach ensures that all building occupants can comfortably use the drinking fountain facilities.

**14.** D — IBC Section 713.4 requires a 2hour fireresistance rating for elevator hoistway enclosures connecting four or more stories, consistent with the requirement for exit stairway enclosures connecting the same number of stories. Hoistways connecting fewer than four stories require a 1hour rating. The shaft prevents vertical fire and smoke spread through the hoistway.

**15.** A — The IBC limits unprotected openings in exterior walls based on the fire separation distance — the distance from the building face to the property line or centerline of a public way. At distances less than 3 feet, no unprotected openings are permitted. The permitted area of openings increases as the distance increases, reaching unlimited at 30 feet.

**16.** C — IBC Section 1207 requires a minimum Sound Transmission Class (STC) rating of 50 for wall and floor/ceiling assemblies separating dwelling units from each other and from public or service areas in Group R2 occupancies. The STC 50 rating ensures adequate sound privacy between apartments, reducing noise complaints and improving resident quality of life.

**17.** B — NFPA 13 (Standard for the Installation of Sprinkler Systems) is the nationally recognized standard that governs the design, installation, and maintenance of automatic sprinkler systems in commercial buildings. The IBC references NFPA 13 as the required installation standard whenever sprinklers are mandated.

**18.** D — The IBC limits deadend corridors to 20 feet in nonsprinklered buildings. A 55foot deadend in a nonsprinklered building exceeds this limit by 35 feet and does not comply. In fully sprinklered buildings, the limit increases to 50 feet. The deadend limitation prevents occupants from traveling too far in the wrong direction during an emergency.

**19.** A — Firerated glazing must limit the temperature rise on the nonfire side of the assembly to prevent radiant heat from igniting combustible materials or injuring occupants. Standard firerated glass may maintain structural integrity but transmit dangerous levels of radiant heat. Temperatureriselimiting glazing (such as fireresistive glazing) addresses this concern for wall applications.

**20.** C — A horizontal exit through a fire wall may serve as one of the required exits from a floor, including a basement level. The refuge area on the opposite side of the fire wall must have adequate capacity to accommodate the occupants from both sides, and the fire wall must meet all fire wall requirements including structural independence.

**21.** B — IBC Table 601 requires a 1hour fireresistance rating for floor construction in Type VA buildings. Type VA requires 1hour ratings for all major building elements, while Type VB requires no ratings. Both Type V subtypes permit combustible structural materials, with the difference being the fireresistance rating requirement.

**22.** D — The fire department connection (FDC) allows firefighters to pump water from their apparatus into the building's sprinkler and/or standpipe system, supplementing the building's water supply during fire operations. The FDC must be located near the building entrance, clearly visible and accessible, with signage identifying the system it serves.

**23.** A — In addition to the area limitation, a mezzanine must be open to the room below on at least one side (with exceptions for certain conditions), must provide adequate means of egress, and must comply with the applicable guard, handrail, and accessibility requirements. If the mezzanine exceeds the area limitation or does not meet these criteria, it is classified as a separate story.

**24.** A — IBC Section 1104.4 provides an elevator exemption for buildings that have fewer than three stories OR where each story is less than 3,000 square feet — and the exemption applies to Group B occupancies among others. This threestory building qualifies because each floor is only 2,500 square feet, which is less than the 3,000 square foot threshold.

**25.** C — IBC Chapter 33 (Safeguards During Construction) requires contractors to protect pedestrians and adjacent properties from construction hazards including falling debris, dust, noise, and other constructionrelated dangers. Protective measures include barriers, covered walkways (sidewalk bridges), fencing, safety nets, and debris containment systems.

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

**26.** D — The plasticity index (PI) measures the range of moisture content over which a finegrained soil behaves as a plastic (moldable) material. It is calculated as the liquid limit minus the plastic limit. Higher PI values indicate greater susceptibility to volume change with moisture fluctuation, making highPI soils problematic for structural fill.

**27.** B — Dry density is calculated by dividing the wet density by (1 + moisture content expressed as a decimal): 128 ÷ 1.08 = 118.5 pcf. The dry density isolates the weight of the solid soil particles from the water weight, providing the correct basis for comparison against the Proctor test's maximum dry density to determine the compaction percentage.

**28.** C — Surcharging accelerates the consolidation settlement of compressible soils by placing a temporary load (usually a mound of imported fill material) on the site. The weight of the surcharge forces water out of the soil pores, increasing the soil's density and bearing capacity. After the target settlement is achieved, the surcharge is removed and the foundation is built on the preconsolidated soil.

**29.** A — OSHA requires a minimum clearance distance of 10 feet between equipment, materials, and workers and overhead power lines carrying up to 50 kV. For lines carrying more than 50 kV, the clearance increases by 4 inches for each additional 10 kV above 50 kV. Contact with overhead power lines is one of the leading causes of electrocution on construction sites.

**30.** D — Variations in subsurface conditions across a building site are common. Pile #16's failure to reach refusal indicates that the bearing stratum (the competent soil or rock layer) is either deeper, thinner, or absent at that location. The geotechnical engineer must evaluate the condition and may recommend driving the pile deeper, adding additional piles, or redesigning the foundation.

**31.** B — A bioswale incorporates engineered soil media (a specially designed blend of sand, compost, and soil), specific vegetation selected for pollutant uptake, and often an underdrain system. Unlike a standard drainage swale that primarily conveys runoff, a bioswale is designed to filter pollutants from stormwater through biofiltration as the water percolates through the engineered media.

**32.** A — A wellpoint system uses a series of smalldiameter wells (wellpoints) installed around the perimeter of the excavation, connected by a common header pipe to a vacuum pump. The pump creates suction that draws groundwater from the surrounding soil into the wellpoints and through the header to a discharge point, lowering the water table below the excavation bottom.

**33.** C — Selfcleaning velocity is approximately 2 feet per second — the minimum flow velocity needed to keep solid waste particles suspended in the wastewater stream and prevent them from settling in the pipe. If velocity drops below this threshold, solids accumulate, causing blockages, odor, and potential pipe damage. The minimum pipe slope ensures this velocity is maintained.

**34.** D — CH (highplasticity clay) soil exhibits extreme shrinkswell behavior, becoming very soft and plastic when wet and extremely hard and brittle when dry. It has very low permeability, making drainage difficult, and is generally unsuitable for structural fill without modification. CH soils require special foundation design, moisture management, and often lime or cement stabilization.

**35.** B — Soil liquefaction occurs when saturated, loose, granular soil loses its shear strength during earthquake shaking and temporarily behaves like a liquid. The ground shaking causes the soil particles to lose contact with each other and the soil's loadbearing capacity drops to near zero. Foundations on liquefiable soil may settle, tilt, or sink during a seismic event.

**36.** A — Retained soil exerts lateral earth pressure against the retaining wall — a horizontal force that increases with depth below the top of the wall. The magnitude of the lateral pressure depends on the soil type, moisture content, and whether the wall is rigid (atrest pressure) or can yield slightly (active pressure). Proper retaining wall design must resist this lateral force.

**37.** C — The soft area identified by the proof roll must be excavated to remove the unsuitable material, replaced with properly compacted structural fill meeting the project specifications, and reproof rolled to verify adequate bearing capacity. Building a foundation over a known soft area without correction would result in differential settlement and potential structural failure.

**38.** B — HDPE corrugated pipe is significantly lighter than reinforced concrete pipe, making it easier to handle and install. It is flexible (accommodating minor ground movement without cracking), corrosionresistant, and available in longer lengths that reduce the number of joints. These advantages reduce installation time and labor costs compared to RCP.

**39.** A — Fulldepth asphalt construction uses hotmix asphalt for all structural layers above the subgrade, eliminating the separate granular base and subbase courses used in conventional flexible pavement design. The asphalt provides all the structural capacity needed to distribute traffic loads to the subgrade. Fulldepth construction is efficient when quality aggregate is expensive or unavailable.

**40.** A — The specification requires the finished pad elevation to be within ±0.1 feet. At 0.25 feet high, the area exceeds the tolerance by 0.15 feet and must be regraded to bring it within the specified range. Grading tolerances ensure that the foundation is constructed at the correct elevation for structural performance and drainage.

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

**41.** C — Each parameter controls a distinct performance characteristic. The watercement ratio controls permeability (resistance to chloride and moisture penetration). The compressive strength controls structural capacity (ability to support loads). The air entrainment controls freezethaw durability (resistance to scaling and spalling from deicing chemicals). All three are needed for the harsh parking structure environment.

**42.** B — The critical loading condition for tall wall formwork is the maximum lateral pressure of the fresh concrete, which depends on the rate of placement (feet per hour), the concrete temperature, and the concrete's unit weight. A 16foot continuous pour generates very high lateral pressures at the form base, and the formwork must be designed to resist these pressures without deflection or failure.

**43.** D — Even in cold weather, concrete placed at excessively high temperatures sets too quickly, loses workability before it can be properly consolidated and finished, and develops thermal gradients between the warm concrete core and the cold form surfaces. These thermal differentials cause internal stresses that can crack the concrete during early curing.

**44.** A — Tiltup panels must be designed for the lifting and tilting stresses that occur when the panel is rotated from horizontal to vertical using crane pick points. These temporary stresses — particularly bending moments at the pick point locations — may be more severe than the panel's permanent inservice loads and govern the reinforcement design.

**45.** C — Calcium chloride is prohibited in posttensioned concrete because chloride ions cause stress corrosion cracking of the highstrength prestressing tendons. The tendons operate at very high sustained stress levels, making them particularly vulnerable to chlorideinduced corrosion. Tendon failure due to stress corrosion cracking can cause catastrophic structural collapse.

**46.** B — Synthetic fibers at the specified dosage rate (typically 1 to 2 pounds per cubic yard) primarily reduce plastic shrinkage cracking — the surface cracks that develop during the first few hours after placement when evaporation exceeds the bleed water rate. At this low dosage, synthetic fibers do not replace structural reinforcement and provide negligible structural benefit.

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

**47.** C — Shelf angles support the weight of the brick veneer above each floor level, transferring the cumulative brick load to the structural building frame at each floor. Without shelf angles, the weight of multistory brick veneer would accumulate on the foundation, potentially exceeding the capacity of the foundation and the masonry at the base.

**48.** A — Untooled mortar joints have a rough, porous surface that does not compress the mortar against the masonry units. Proper tooling (performed when the mortar reaches thumbprint consistency) compresses and densifies the mortar surface, improving the bond between the mortar and the masonry units and creating a weatherresistant profile that sheds water.

**49.** D — ASTM C476 coarse masonry grout typically uses pea gravel with a maximum aggregate size of ⅜ inch. This small maximum size ensures that the grout can flow into and completely fill the CMU cores (typically 2 to 3 inches in minimum dimension) and surround the reinforcing steel without bridging or creating voids.

**50.** B — Reinforced and grouted masonry walls have significantly greater ductility, shear resistance, and energy dissipation capacity than unreinforced walls. During an earthquake, the reinforced wall can flex and deform without catastrophic failure, absorbing and dissipating seismic energy through controlled cracking and yielding of the reinforcement rather than sudden brittle collapse.

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

**51.** A — Moment connections transfer both vertical shear forces and bending moments (rotational forces) from the beam to the column, creating a rigid frame that resists lateral loads from wind and earthquakes. Standard shear connections transfer only vertical forces and allow the beam to rotate freely at the connection, providing no lateral resistance to the frame.

**52.** C — Mill test reports certify the actual chemical composition and mechanical properties (yield strength, tensile strength, percent elongation) of each heat of steel produced at the mill. MTRs verify that the steel meets the requirements of the specified ASTM grade, providing

documented evidence of material compliance that is essential for quality control and structural reliability.

**53.** B — Selfdrilling screws can be installed without hot work (welding), eliminating the fire risk associated with welding on combustible roof insulation. They also require less skilled labor and can be installed faster than puddle welds. This makes screw attachment the preferred method for roof deck installation on buildings with combustible roof assemblies.

**54.** D — Weathering steel requires alternating wetdry cycles to develop its stable, protective patina. In coastal environments, salt spray prevents the patina from forming properly and instead causes accelerated corrosion. Weathering steel should not be used within close proximity to saltwater or in environments where it cannot develop the protective oxide layer.

**55.** D — Temporary guy wires provide lateral support to the first columns erected before beams and bracing can be connected. Without guy wires, the unbraced columns could overturn due to wind loads, construction loads, or accidental impact from equipment. The guy wires are removed after permanent bracing is installed and the frame is selfstable.

**56.** C — Architecturally exposed structural steel requires tighter fabrication and erection tolerances, smoother surface finishes, higherquality weld appearance (including grinding and finishing of visible welds), concealed or detailed bolted connections, and additional finishing operations compared to standard concealed structural steel. These requirements increase both fabrication cost and erection time.

**DOMAIN 6: WOOD (Questions 57–61)**

**57.** B — OSB tends to swell more at the panel edges when exposed to moisture (from rain during construction or condensation in service) and is slower to release absorbed moisture and return to its original dimensions. Plywood's crosslaminated veneer construction provides better dimensional stability under moisture exposure, making it more tolerant of temporary wetting.

**58.** D — Temporary bracing stabilizes individual trusses during the erection process — preventing them from toppling laterally before permanent lateral support is provided. Permanent bracing (roof sheathing, purlins, and diagonal bracing specified by the truss designer) provides longterm lateral stability after erection. Temporary bracing is removed only after permanent bracing is fully installed.

**59.** A — Reducing the header from a specified triple 2×12 to a double 2×12 removes approximately onethird of the header's crosssectional area and loadcarrying capacity. This substitution must be approved by the structural engineer because the triple header was sized for the specific span and load conditions. Unauthorized header reductions can cause structural sagging and failure.

**60.** C — The IBC requires 2× nominal lumber for fire blocking, and a 2×4 satisfies this requirement. However, the fire blocking must be installed to completely fill the wall cavity — the 2×4 must be positioned and any gaps filled with additional approved material to prevent fire and gas passage through the cavity. The key requirement is complete cavity blockage.

**61.** D — In heavy timber (Type IVHT) construction, connections concealed within the wood members are protected from direct fire exposure by the surrounding wood. Heavy timber chars

slowly during a fire (approximately 1.5 inches per hour), and the charred layer insulates the interior. Concealed metal connectors remain protected by the uncharred wood, maintaining structural capacity longer than exposed connectors.

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

**62.** B — XPS has a closedcell structure that absorbs very little moisture, maintains its Rvalue consistently even when in prolonged contact with soil moisture, and has higher compressive strength than EPS to resist the lateral pressure of backfill soil. EPS has an opencell structure that absorbs more moisture over time, reducing its effective Rvalue in belowgrade applications.

**63.** D — A vapor retarder beneath the roof insulation is recommended when the building has high interior humidity levels, such as swimming pools, commercial laundries, or commercial kitchens. In these buildings, moistureladen interior air can migrate upward through the roof assembly and condense within the cold insulation during winter, causing damage and reducing insulation performance.

**64.** D — Standing seam metal roof panels are attached to the purlins or deck with concealed clips that grip the seam but allow the panel to slide longitudinally as it expands and contracts with temperature changes. This floating attachment prevents thermal stresses from buckling the panels, pulling out fasteners, or fatiguing the seam connections.

**65.** C — Positiveside waterproofing is applied to the exterior (soil) side of the foundation wall — the side that faces the source of hydrostatic water pressure. This is the most effective location because the waterproofing prevents water from reaching the concrete wall in the first place. Negativeside (interior) waterproofing attempts to block water that has already penetrated the concrete.

**66.** A — Tapered insulation boards are manufactured with a wedgeshaped profile — thin at one end and thick at the other. When installed in a planned layout pattern (typically a cricket or saddle configuration), the varying thickness creates a sloped surface that directs water toward roof drains, scuppers, or gutters on a structurally flat roof deck.

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

**67.** B — A positivepressure fire test subjects the door assembly to the positive pressure conditions that occur during an actual building fire, as hot gases expand and create pressure against the door. This test evaluates whether the door remains in the frame and prevents flame and hot gas passage under realistic fire conditions, unlike older tests that used neutral or negative pressure.

**68.** C — Tempered glass is required in hazardous locations (near floor level, adjacent to doors, in shower enclosures) because it breaks into small, relatively harmless cubeshaped fragments rather than the large, sharp, daggerlike shards produced by standard annealed glass. This significantly reduces the risk of serious lacerations when people accidentally impact the glass.

**69.** A — Under the IBC, a revolving door may be credited with only a portion of the required egress width, and a conforming swinging door must be located adjacent to each revolving door to provide the required egress capacity. This ensures that occupants who cannot use the revolving door (wheelchair users, people carrying large items) have an accessible alternative.

**70.** D — Both pouranddebridge and crimpedbarrier thermal break methods use a nonconductive material (typically nylon or polyurethane) that physically separates the interior and exterior aluminum sections of the window frame. This thermal break interrupts the conductive heat transfer path through the highly conductive aluminum, dramatically reducing the frame's Ufactor.

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

**71.** B — The typical industry tolerance for suspended ceiling grid levelness is ±⅛ inch in 10 feet. This tight tolerance ensures a visually level ceiling plane and proper fit of ceiling tiles, light fixtures, and diffusers within the grid. Greater deviations result in visible unevenness and poor tile seating.

**72.** A — ANSI A326.3 recommends a minimum dynamic coefficient of friction (DCOF) of 0.42 for level interior floors that may be walked on when wet. Tiles with DCOF values below 0.42 are considered too slippery for wetcondition use. Higher DCOF values are recommended for ramps and exterior surfaces.

**73.** C — New CMU surfaces must be cleaned of efflorescence, dust, and debris, allowed to cure for at least 28 days, and primed with a masonry primer or block filler. The block filler fills the porous texture of the CMU face, creating a uniform, sealed surface that prevents uneven paint absorption and provides proper adhesion for the topcoat.

**74.** D — LVP manufacturers specify a maximum floor surface temperature (typically 80°F to 85°F) for use over radiant heating systems. Exceeding this temperature can cause the LVP to warp, discolor, shrink, or delaminate from the adhesive. The contractor must verify compatibility and temperature limits before installation.

**75.** B — Exterior tile exposed to freezing temperatures must have very low water absorption (porcelain tile typically less than 0.5%) to prevent water from being absorbed into the tile body. If absorbed water freezes, it expands within the tile, causing internal stress that leads to spalling, cracking, and surface deterioration — a process called freezethaw damage.

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

**76.** A — VAV systems regulate zone temperature by varying the volume of conditioned air delivered through a modulating damper in each VAV box. When a zone's thermostat calls for cooling, the damper opens to increase airflow. When the setpoint is satisfied, the damper closes partially to reduce airflow. This provides efficient, individualized zone control.

**77.** C — A pressurereducing valve is required when the incoming water pressure from the municipal main exceeds the plumbing code's maximum permitted pressure, typically 80 psi. Excessive pressure can damage piping, fixtures, and appliances, cause water hammer, and waste water through higherthannecessary flow rates.

**78.** B — A hydrostatic pressure test pressurizes the completed sprinkler piping system with water at a pressure above the normal operating pressure (typically 200 psi for 2 hours) to verify that all piping, fittings, and joints are leakfree and structurally sound. Any pressure drop during the test indicates a leak that must be located and repaired before the system is placed in service.

**79.** D — A fire damper rated to match the floor assembly's fireresistance rating must be installed in the duct where it penetrates the rated floor assembly. The fire damper automatically closes when exposed to heat, preventing fire and smoke from spreading vertically through the duct opening. Smoke dampers may also be required depending on the assembly and the smoke control requirements.

**80.** A — Basement fixtures are located below the elevation of the building's gravity sewer connection, so wastewater cannot flow by gravity from the basement to the municipal sewer. A sewage ejector pump collects wastewater in a sealed basin and pumps it upward to the gravity drain system, from which it flows by gravity to the sewer main.

**81.** C — A standard splitsystem line set consists of two refrigerant lines: the suction line (larger diameter, insulated, carrying cool lowpressure refrigerant gas from the evaporator back to the compressor) and the liquid line (smaller diameter, uninsulated or minimally insulated, carrying warm highpressure liquid refrigerant from the condenser to the evaporator).

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

**82.** D — Emergency electrical panels serve life safety loads that must remain operational during a power failure, including exit lighting, emergency egress lighting, fire alarm systems, fire pumps, smoke control systems, and elevator recall circuits. These systems are powered by emergency generators or battery systems that activate automatically when normal power fails.

**83.** A — The NEC requires a minimum working clearance of 36 inches in front of electrical panels rated at 120/208V (0150 volts to ground). This clearance provides safe space for electricians to work on the panel without being pressed against walls or obstructions. Higher voltage panels (277/480V) may require greater clearances depending on the conditions.

**84.** B — A dedicated circuit serves a single piece of equipment exclusively, ensuring that the circuit breaker is properly sized for that specific equipment's electrical characteristics and that other loads on the circuit cannot affect the equipment's power supply. This prevents nuisance tripping, voltage drops, and interference from other equipment sharing the circuit.

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

**85.** C — Under AIA A201 Section 5.2, the owner may reject a proposed subcontractor for reasonable cause. Reasonable cause includes poor past performance, financial instability, inadequate qualifications, safety record concerns, or other documented deficiencies. The contractor must then propose an acceptable substitute without a change in the contract price.

**86.** A — The contingency is a fund within the GMP intended to cover unforeseen costs, estimating variances, and minor scope gaps that arise during construction. The contractor's overhead and profit markup is the contractor's compensation for managing the project. The contingency benefits the project by absorbing unexpected costs; the markup benefits the contractor as their fee.

**87.** D — The contractor must perform final cleaning to leave the project in a condition ready for occupancy. This includes removing all waste, debris, temporary materials, protection, and stains, and cleaning all surfaces, windows, fixtures, and equipment. The specification may

include additional cleaning requirements or delegate final cleaning to a separate cleaning contractor.

**88.** B — Pollution liability insurance is typically required when the project involves activities that create environmental contamination risk — demolition or renovation of older buildings (lead, asbestos), work near wetlands or waterways, brownfield redevelopment, or soil remediation. Standard CGL policies typically exclude pollutionrelated claims, making separate pollution coverage necessary.

**89.** A — AIA A201 requires the contractor to study the documents and report apparent errors but does not require the contractor to perform a professional design review. The contractor's review is from a construction perspective — identifying issues that a reasonably competent contractor would recognize. Latent design errors not reasonably discoverable by a contractor remain the designer's responsibility.

**90.** D — Fasttracking overlaps the design and construction phases so that foundation and structural work begins while interior design is still being completed. This compresses the overall project duration but creates the risk that design changes or design completion may affect work already under construction, potentially requiring rework and change orders.

**91.** B — The general contractor is responsible for coordinating all work and protecting completed work from damage. If a subcontractor damages completed work, the general contractor is responsible for the repair and may backcharge the responsible subcontractor for the cost. The GC's coordination responsibility includes sequencing work to minimize damage risk.

**92.** C — A time impact analysis inserts the specific delay event into the asbuilt or current update CPM schedule and calculates the resulting impact on the project's critical path and completion date. The TIA demonstrates a causal link between the delay event and the project extension, which is essential for supporting a schedule extension claim.

**93.** B — Timely notification gives the owner and architect the opportunity to investigate the condition, evaluate options, and mitigate the impact while evidence is fresh and corrective action is still possible. Failure to provide timely notice may waive the contractor's right to claim additional compensation because the delayed notification deprived the owner of the ability to mitigate.

**94.** C — The warranty exclusion for work performed by the owner's own forces or separate contractors means the general contractor is not responsible for defects in work that was outside the contractor's control. The contractor cannot warrant work it did not perform, supervise, or manage. This exclusion is a fair allocation of responsibility.

**95.** A — Ongoing VOC offgassing from construction adhesives may constitute a material defect if the adhesive does not meet the VOC limits specified in the contract documents or if the offgassing creates an unhealthy indoor air quality condition. The contractor's warranty covers defects in materials and workmanship, and using a noncompliant adhesive is a material defect.

**96.** D — Extended general conditions cost equals the monthly general conditions rate multiplied by the number of delay months: $40,000/month × 2 months = $80,000. This includes

the additional costs of supervision, temporary facilities, insurance, equipment rental, and other timedependent project overhead that continue during the delay period.

**97.** B — Retainage is typically released at or after substantial completion, less amounts needed to cover incomplete punch list items, outstanding warranty claims, or other contractual obligations. The specific retainage release provisions are stated in the contract and may include conditions such as receipt of final lien waivers and completion of closeout documentation.

**98.** C — The contractor's role in commissioning is to cooperate fully with the commissioning agent by providing access to all building systems, supporting functional performance testing by operating equipment as directed, correcting any deficiencies identified during testing, and providing all required documentation including O&M manuals and asbuilt drawings.

**99.** A — A constructive acceleration claim requires three elements: the contractor experienced an excusable delay entitling it to a time extension, the owner denied or failed to act on the legitimate time extension request, and the contractor was effectively forced to accelerate (add resources, work overtime) to meet the original completion date, incurring additional costs.

**100.** D — AIA A201 requires the contractor to maintain a current set of contract documents at the project site, including all addenda, change orders, and other modifications. These documents must be marked to show the actual installed conditions (asbuilt markups) and must be available for review by the owner, architect, and building officials throughout the project.

**101.** C — When the owner occupies part of a building during ongoing construction, the contractor must maintain separation barriers, safety protections, dust control, noise management, and security between the occupied and construction areas. The contractor must ensure that construction activities do not create hazards for the building occupants.

**102.** A — A nottoexceed estimate establishes a maximum cost ceiling for the changed work. The contractor performs the work and bills actual costs, but the total will not exceed the stated NTE amount. If the actual cost is less than the NTE, the owner pays only the actual cost plus applicable markup. If the work would exceed the NTE, the contractor must notify the owner before proceeding.

**103.** D — Under AIA A201 Section 10.3, when the contractor encounters hazardous materials not addressed in the contract documents, the contractor must stop work in the affected area, report the condition to the owner and architect, and not resume work until a qualified environmental professional has assessed the situation. Hazardous material removal requires licensed specialists.

**104.** B — The general contractor is responsible for coordinating all subcontractor work and resolving scope gaps between subcontractors. When two subcontractors dispute responsibility for a scope item, the GC must determine which subcontract covers the work, assign it accordingly, or perform the work directly and backcharge the responsible subcontractor.

**105.** C — General conditions costs include project supervision salaries, temporary facilities (job trailer, portable toilets, temporary fencing), temporary utilities (power, water, heating), safety equipment and programs, project insurance, site cleanup and dumpster service, project vehicles, quality control testing, and other indirect project management costs.

**106.** A — A dispute review board consists of three neutral professionals (typically experienced construction professionals) who visit the project regularly, remain informed about project issues, and provide nonbinding recommendations for resolving disputes in real time. DRBs are effective at resolving disputes quickly before they escalate to formal claims and litigation.

**107.** D — When the schedule shows the project will miss the completion date, the contractor must promptly notify the owner and architect, identify the cause of the delay, and either develop a recovery plan with specific acceleration measures or request a time extension if the delay is caused by excusable events. Silence about a known schedule problem may waive the contractor's remedies.

**108.** B — Withholding retainage pending receipt of final lien waivers from all subcontractors is a standard and reasonable practice. Final lien waivers confirm that all subcontractors and suppliers have been paid and have released their lien rights. Without these waivers, the owner risks having liens filed against the property after final payment is released to the contractor.

**109.** C — AIA A201 requires changes to be authorized in writing (through change orders or construction change directives). Verbal directives without written confirmation create significant dispute risk because the parties may disagree about what was directed, the scope of the work, and the agreed compensation. The contractor should always request written authorization before performing verbally directed work.

**110.** A — Curtain wall performance mockup testing typically evaluates air infiltration resistance (how much air leaks through the system under pressure), water penetration resistance (whether water enters the system under simulated winddriven rain), structural performance (whether the system withstands design wind pressures without failure), and thermal performance.

**111.** D — The general contractor remains fully responsible to the owner for all work under the prime contract, regardless of how much is subcontracted. A high subcontractor percentage increases coordination complexity, amplifies the impact of any single subcontractor's failure, and requires more intensive management of schedule, quality, cost, and safety across a larger number of independent firms.

**112.** B — Under AIA A201, the contractor must take reasonable precautions to protect both the owner's property and adjacent properties from damage caused by construction operations. If the contractor's activities cause damage (from vibration, dewatering, crane operations, debris, or other constructionrelated causes), the contractor must repair the damage at no additional cost.

**113.** A — Steel that does not meet the specified ASTM grade requirements (as verified by mill test reports) must be rejected and not installed in the structure. Using nonconforming steel compromises the structural integrity of the building because the design is based on the minimum material properties of the specified grade. The fabricator must replace the nonconforming material.

**114.** C — Construction IAQ management per LEED requirements includes protecting stored and installed HVAC equipment from contamination by sealing duct openings and equipment openings, using MERV 8 or higher filtration on air handlers during construction, controlling

moisture on absorptive materials (preventing mold), and maintaining a clean construction environment to protect indoor air quality for future occupants.

**115.** D — A building owner's manual provides a comprehensive guide to the building's overall systems, maintenance schedules, warranty contact information, emergency procedures, recommended service providers, and operational instructions. Unlike individual O&M manuals for specific equipment, the owner's manual addresses the building as an integrated facility and serves as the owner's primary operational reference.