Practice Test *5*

Time Allowed: 4 hours

Passing Score: 70% (88 out of 125 questions correct)

Instructions:

- Read each question carefully and select the BEST answer
- Mark your answers on a separate sheet
- You may use a calculator for mathematical calculations
- Answer all questions - there is no penalty for guessing
- Review your answers if time permits

SECTION 1: PLANNING AND ESTIMATING (Questions 1-19)

1. What is the purpose of a constructability review?

A. Reviewing contractor qualifications

B. Evaluating design for ease of construction and identifying potential problems

C. Checking building codes only

D. Estimating final costs

2. What is fast-tracking in construction scheduling?

A. Working overtime

B. Hiring more workers

C. Using faster equipment

D. Overlapping design and construction phases to shorten schedule

3. What is a cost code in construction accounting?

A. Numbering system for organizing and tracking project costs by category

B. Building code requirements

C. Secret pricing information

D. Discount codes

4. What is the purpose of percent complete tracking?

A. Student grades

B. Employee evaluations

C. Measuring work progress for billing and schedule monitoring

D. Quality ratings

5. What is earned value in project management?

A. Employee bonuses

B. Value of work actually completed compared to planned value

C. Final profit

D. Owner satisfaction

6. What is the difference between actual cost and committed cost?

A. No difference

B. Currency exchange rates

C. Accounting methods

D. Actual cost is spent; committed cost is obligated but not yet paid

7. When should allowances be finalized in a project?

A. As early as possible before construction to prevent delays and cost overruns

B. After project completion

C. During final inspection

D. Never finalize them

8. What is a cost proposal for change orders?

A. Original bid

B. Final payment

C. Detailed breakdown of costs for proposed changes for owner approval

D. Insurance claim

9. What is time and materials billing?

A. Fixed price contract

B. Payment based on actual time worked and materials used plus markup

C. Lump sum payment

D. No payment method

10. What is a not-to-exceed (NTE) amount?

A. Minimum payment

B. Average cost

C. Suggested price

D. Maximum cost limit for work

11. What is backcharging in construction?

A. Reversing payment

B. Late fees

C. Returning materials

D. Refunding money

12. What is project float in scheduling?

A. Floating materials

B. Water on site

C. Flexibility in schedule; difference between early and late completion dates

D. Concrete finishing

13. What does it mean when an activity is on the critical path?

A. Optional activity

B. Zero float; any delay directly impacts project completion

C. Can be deleted

D. Unimportant activity

14. What is a baseline in project management?

A. Foundation line

B. Starting point

C. Bottom line

D. Original approved plan used for measuring progress and changes

E.

15. What is scope creep?

A. Slow workers

B. Foundation settlement

C. Concrete defects

D. Budget reduction

16. What is the difference between a quotation and an estimate?

A. No difference

B. Different formats

C. Quotation is firm price offer; estimate is approximate calculation

D. Different contractors

17. What is the purpose of a quantity takeoff?

A. Removing materials

B. Measuring and counting materials needed from plans for pricing

C. Material delivery

D. Waste removal

18. What is contingency in a construction budget?

A. Emergency plan

B. Backup contractor

C. Extra materials

D. Reserve funds for unforeseen costs or changes

19. What is the purpose of construction draws?

A. Drawing plans

B. Sketching details

C. Design work

D. Selecting colors

SECTION 2: FRAMING AND STRUCTURAL COMPONENTS (Questions 20-44)

20. What is the purpose of a bond beam in masonry construction?

A. Adhesive beam

B. Insurance requirement

C. Reinforced horizontal beam in masonry walls distributing loads and tying walls together

D. Decorative element

21. What is a lintel in masonry construction?

A. Interior finish

B. Horizontal support above openings carrying loads

C. Vertical support

D. Foundation component

22. What is the typical overhang for bird's mouth cuts on rafters?

A. No overhang

B. 6 inches

C. 24 inches

D. Varies but typically creates proper seat on top plate with tail for overhang

23. What is a bird's mouth cut in rafter framing?

A. Decorative cut

B. Mistake in cutting

C. Ventilation opening

D. Waste cutoff

24. What is the plumb cut on a rafter?

A. Level cut

B. Horizontal cut

C. Vertical cut at top of rafter where it meets ridge

D. Bottom cut

25. What is the seat cut on a rafter?

A. Decorative cut

B. Horizontal cut at bird's mouth where rafter sits on top plate

C. Top cut

D. Ridge cut

26. What is the purpose of hurricane straps?

A. Temporary supports

B. Decorative elements

C. Weather protection

D. Metal connectors securing roof framing to walls against wind uplift

27. What is a purlin in roof framing?

A. Roofing material

B. Horizontal beam supporting rafters between ridge and wall

C. Ridge board

D. Vertical support

28. What is a strut in roof framing?

A. Decorative trim

B. Roofing felt

C. Angled or vertical support bracing rafters or roof members

D. Fascia board

29. What is a cathedral ceiling?

A. Church ceiling only

B. Drop ceiling

C. Low ceiling

D. Sloped ceiling following roof line without attic space

30. What is the purpose of collar ties in roof framing?

A. Resisting rafter uplift and spreading in upper third of roof

B. Decorative beams

C. Supporting ceilings

D. Temporary bracing

31. What is a soffit in construction?

A. Soft material

B. Roofing material

C. Underside of roof overhang or other overhead surface

D. Wall covering

32. What is fascia?

A. Siding material

B. Vertical board at roof edge covering rafter ends

C. Roofing material

D. Foundation trim

33. What is the purpose of drip edge on roofs?

A. Decorative trim

B. Gutter support

C. Temporary cover

D. Directing water away from fascia into gutters preventing rot

34. What is the minimum roof pitch for asphalt shingles in most applications?

A. 2:12 (2 inches rise per 12 inches run)

B. 12:12

C. 1:12

D. Flat

35. What is a low-slope roof?

A. Any roof

B. Flat roof only

C. Roof with pitch less than 3:12 requiring special waterproofing

D. Steep roof

36. What is EPDM roofing?

A. Asphalt shingles

B. Rubber membrane roofing commonly used on low-slope roofs

C. Metal roofing

D. Tile roofing

37. What is TPO roofing?

A. Metal roofing

B. Asphalt roofing

C. Wood shakes

D. Single-ply thermoplastic membrane roofing for flat/low-slope roofs

38. What is the purpose of roof crickets?

A. Insect control

B. Ventilation

C. Decoration

D. Pest prevention

39. What is flashing in construction?

A. Lightning protection

B. Electrical wiring

C. Material preventing water penetration at joints and intersections

D. Light fixtures

40. What is counterflashing?

A. Backup flashing

B. Upper layer of flashing covering and protecting lower flashing

C. Decorative trim

D. Temporary covering

41. What is parapet wall?

A. Interior wall

B. Foundation wall

C. Temporary wall

D. Wall extending above roof line

42. What is a cap plate?

A. Foundation component

B. Decorative cap

C. Bottom plate

D. Top plate of wall or cap on parapet wall

43. What is shear strength in wood framing?

A. Cutting ease

B. Weight capacity

C. Resistance to forces parallel to grain causing sliding or tearing

D. Bending resistance

44. What is withdrawal resistance?

A. Taking back offers

B. Resistance to fasteners pulling out perpendicular to surface

C. Compression strength

D. Bending capacity

SECTION 3: CORE TRADES (Questions 45-82)

45. What is a thermostatic mixing valve (TMV)?

A. Paint mixer

B. Concrete mixer

C. Electrical device

D. Valve automatically mixing hot and cold water to safe temperature

46. What is the purpose of an expansion tank in water heater systems?

A. Storing extra water

B. Increasing capacity

C. Decoration

D. Filtering water

47. What is a check valve in plumbing?

A. Inspection valve

B. Decorative valve

C. One-way valve allowing flow in only one direction

D. Shut-off valve

48. What is the purpose of a tempering valve?

A. Controlling water temperature

B. Mixing hot and cold water to safe temperature for fixtures

C. Increasing pressure

D. Filtering water

49. What is a pressure relief valve on water heaters?

A. Increasing pressure

B. Maintaining pressure

C. Measuring pressure

D. Safety device releasing pressure/temperature if they exceed safe limits

50. What is an anode rod in water heaters?

A. Heating element

B. Temperature sensor

C. Drain valve

D. Structural support

51. What is a dielectric union in plumbing?

A. Labor union

B. Regular pipe fitting

C. Decorative fitting

D. Electrical union

52. What is galvanic corrosion?

A. Normal wear

B. Chemical cleaning

C. Corrosion from electrical current between dissimilar metals in contact

D. Paint damage

53. What is potable water expansion?

A. Plumbing business growth

B. Water volume increase from heating requiring accommodation

C. Adding pipes

D. Water treatment

54. What is a hose bibb?

A. Baby's clothing

B. Decorative fixture

C. Indoor faucet

D. Outdoor faucet (sillcock)

55. What is an air gap in dishwasher drain?

A. Space above counter

B. Ventilation opening

C. Broken connection

D. Electrical gap

56. What is a dedicated return in electrical wiring?

A. Money back

B. Product return

C. Separate neutral wire for specific circuit preventing shared neutrals

D. Refund policy

57. What is a homerun in electrical wiring?

B. Direct circuit from panel to first device without splices or junctions

C. Baseball term

D. Long wire run

58. What is a pigtail in electrical connections?

A. Twisted wire

B. Electrical plug

C. Circuit breaker

D. Short wire connecting multiple wires to device terminal

59. What is wire nutting?

A. Wire storage

B. Insulation type

C. Connecting wires with twist-on wire connectors

D. Wire labeling

60. What is the purpose of anti-oxidant compound on aluminum wiring?

A. Preventing oxidation and improving connections on aluminum conductors

B. Paint

C. Insulation

D. Decorative coating

61. What is backstabbing in electrical wiring?

A. Unethical behavior

B. Push-in wire connection method on outlets and switches

C. Cutting wires

D. Removing insulation

62. What is a CAFCI breaker?

A. Regular breaker

B. GFCI breaker

C. Decorative breaker

D. Combination Arc Fault Circuit Interrupter protecting against both arc faults and ground faults

63. What is a split-receptacle?

A. Broken outlet

B. Damaged receptacle

C. Temporary outlet

D. Defective unit

64. What is a switched receptacle?

A. Electrical device

B. Broken switch

C. One or both outlets controlled by wall switch

D. Temporary connection

65. What is knob and tube wiring?

A. Modern wiring

B. Old wiring method using ceramic insulators and separate conductors

C. Plumbing method

D. HVAC installation

66. What is a zone system in HVAC?

A. Building area division

B. Temperature zone

C. Climate zone

D. System with multiple thermostats controlling separate areas independently

67. What is a damper in HVAC ductwork?

A. Moisture device

B. Soundproofing

C. Filter

D. Water control

68. What is a plenum in HVAC?

A. Small chamber

B. Filter box

C. Air distribution chamber where ductwork connects to air handler

D. Thermostat

69. What is static pressure in HVAC systems?

B. Resistance to airflow in duct system measured in inches of water column

C. Air weight

D. Temperature measurement

70. What is a heat recovery ventilator (HRV)?

A. Broken heater

B. Ventilation fan

C. Exhaust fan

D. System exchanging heat between exhaust and intake air improving efficiency

71. What is an energy recovery ventilator (ERV)?

A. Similar to HRV but also exchanges moisture improving comfort and efficiency

B. Backup generator

C. Solar panel

D. Battery storage

72. What is MERV rating for air filters?

A. Brand name

B. Size measurement

C. Minimum Efficiency Reporting Value indicating filter effectiveness

D. Cost rating

73. What is a heat strip in HVAC?

B. Electric resistance heating element providing auxiliary or emergency heat

C. Temperature sensor

D. Insulation

74. What is defrost mode in heat pumps?

A. System malfunction

B. Normal operation

C. Emergency operation

D. Refrigerator feature

75. What is ambient temperature?

A. Room temperature

B. Surrounding air temperature in given space

C. Hot temperature

D. Cold temperature

76. What is slump test for concrete?

A. Strength test

B. Age test

C. Measuring concrete consistency and workability

D. Color test

77. What is the cone used in slump testing?

A. Traffic cone

B. Ice cream cone

C. Funnel

D. Standard 12-inch high cone for measuring concrete slump

78. What is segregation in concrete?

A. Mixing thoroughly

B. Proper consistency

C. Uniform mixture

D. Even distribution

79. What is bleeding in concrete?

A. Color staining

B. Water rising to surface as heavier materials settle

C. Strength loss

D. Cracking pattern

80. What is consolidation in concrete placement?

A. Combining batches

B. Measuring concrete

C. Removing air voids and ensuring complete filling through vibration

D. Adding water

81. What is the purpose of a bulkhead in concrete forms?

A. Ship component

B. Roofing material

C. Decorative element

D. Temporary form closing off end of concrete pour

82. What is a construction joint in concrete?

A. Meeting point between separately placed concrete sections

B. Expansion joint

C. Control joint

D. Decorative joint

SECTION 4: FINISH TRADES (Questions 83-107)

83. What is the difference between paint and stain penetration?

A. No difference

B. Same products

C. Paint forms surface film; stain penetrates wood fibers

D. Price difference

84. What is wood conditioner used for before staining?

A. Strengthening wood

B. Promoting even stain absorption in porous or soft woods

C. Paint primer

D. Wood preservation

85. What is gel stain?

A. Liquid stain

B. Spray stain

C. Water-based stain

D. Thick stain that doesn't penetrate deeply providing more uniform color

86. What is the purpose of wood filler?

A. Adding weight

B. Strengthening wood

C. Decoration

D. Preventing rot

87. What is grain filler?

A. Agricultural product

B. Concrete filler

C. Paste filling open-grain wood pores for smooth finish

D. Decorative filler

88. What is tack cloth?

A. Adhesive tape

B. Sticky cloth removing fine dust before finishing

C. Fabric material

D. Cleaning rag

89. What is the purpose of polyurethane finish?

A. Paint color

B. Wood primer

C. Stain

D. Plastic remover

90. What is the difference between oil-based and water-based polyurethane?

A. No difference

B. Color only

C. Price only

D. Oil-based is more durable but yellows; water-based dries faster and stays clear

91. What is a French cleat?

A. European fastener

B. Decorative molding

C. Interlocking beveled mounting system for heavy items like cabinets

D. Temporary support

92. What is European hinge?

A. Old-style hinge

B. Decorative hinge

C. Exterior hinge

D. Traditional hinge

93. What is soft-close hardware?

A. Gentle closure

B. Mechanism slowing cabinet doors and drawers preventing slamming

C. Weak hardware

D. Broken mechanism

94. What is a drawer box?

A. Storage container

B. Decorative box

C. Shipping container

D. Structural cabinet drawer excluding face

95. What is dovetail joint?

A. Bird joint

B. Simple joint

C. Interlocking joint with wedge-shaped tenons for strong drawer construction

D. Temporary joint

96. What is cabinet rail and stile construction?

A. Transportation method

B. Temporary support

C. Frame with vertical stiles and horizontal rails forming cabinet doors

D. Modern construction

97. What is a shaker style cabinet?

A. Earthquake-resistant

B. Simple flat-panel door design with clean lines

C. Ornate style

D. Temporary cabinet

98. What is overlay in cabinet doors?

A. Extra material

B. Door design

C. Paint technique

D. How much door extends beyond cabinet face frame

99. What is full overlay versus partial overlay?

A. Paint coverage

B. Color intensity

C. Full overlay covers entire frame; partial overlay reveals some frame

D. Material thickness

100. What is frameless cabinet construction?

A. Broken cabinets

B. European-style cabinets without face frames using thicker sides

C. Temporary cabinets

D. Incomplete cabinets

101. What is the standard thickness for kitchen countertops?

A. 1/2 inch

B. 1-1/2 inches (1-1/4 for laminate with buildup)

C. 3 inches

D. 1/4 inch

102. What is a laminate countertop?

A. Solid surface

B. Stone countertop

C. Wood countertop

D. Decorative plastic layer bonded to substrate like particle board

103. What is post-forming for laminate countertops?

A. After installation changes

B. Final finishing

C. Repair method

D. Custom shaping

104. What is a drip groove under countertop overhangs?

A. Water damage

B. Design flaw

C. Groove on underside preventing water from running back to cabinets

D. Decorative element

105. What is butcher block countertop?

A. Cutting board

B. Wood strips glued together forming solid wood countertop

C. Stone surface

D. Laminate product

106. What is the standard height for kitchen wall cabinets above countertop?

A. 6 inches

B. 12 inches

C. 24 inches

D. 18 inches (standard backsplash area)

107. What is toe kick space under cabinets?

A. Kick plate

B. Recessed space at bottom of cabinets for toe room

C. Decorative trim

D. Storage space

SECTION 5: SAFETY (Questions 108-125)

108. What is the purpose of barricades on construction sites?

A. Decoration

B. Storage

C. Preventing unauthorized access to hazardous areas

D. Wind barriers

109. What is the proper way to store compressed gas cylinders?

A. Laying down

B. Upright and secured with caps on

C. Any position

D. In sunlight

110. What is the safety rule for cylinder storage and flames?

A. No restrictions

B. Close together acceptable

C. 5 feet separation

D. Keep cylinders at least 20 feet from flames or sparking

111. What is the purpose of a safety data sheet (SDS)?

A. Providing information about hazardous materials and safe handling

B. Employee schedules

C. Daily reports

D. Inspection forms

112. How long must SDS be kept on site?

A. One day

B. One week

C. Available while materials are in use and accessible to workers

D. Not required

113. What is the universal symbol for hazardous materials?

A. Smiley face

B. Diamond shape with color coding and hazard information

C. Circle

D. Triangle only

114. What is the purpose of a permit-required confined space program?

A. Parking permits

B. Work permits

C. Building permits

D. Ensuring safe entry procedures for hazardous confined spaces

115. What is a competent person for trenches?

A. Anyone

B. Newest worker

C. Equipment operator

D. Any available person

116. How often must trenches be inspected?

A. Once per project

B. Never

C. Daily before work and after any changes that could affect safety

D. Weekly

117. What is the purpose of a trench box?

A. Tool storage

B. Material storage

C. Protective shield preventing cave-ins around workers

D. Temporary office

118. What must be tested before entering tanks or vessels?

A. Nothing

B. Temperature only

C. Pressure only

D. Atmospheric conditions including oxygen and toxic gases

119. What is the proper oxygen level for safe confined space entry?

A. 19.5-23.5% oxygen

B. 10% oxygen

C. 50% oxygen

D. Any level

120. What type of ventilation is required for confined spaces?

A. No ventilation needed

B. Natural ventilation only

C. Mechanical ventilation with continuous air supply

D. Windows only

121. When can you enter a permit-required confined space?

A. Anytime

B. After completing permit procedures, testing atmosphere, and establishing safety measures

C. When convenient

D. Never enter

122. What is the purpose of a safety harness in confined spaces?

A. Decoration

B. Comfort

C. Weight distribution

D. Identification

123. What is the role of a confined space attendant?

A. Monitoring entrants from outside, maintaining communication, and initiating rescue

B. Entering to help

C. Taking breaks

D. Operating equipment

124. What is the minimum diameter for manhole openings?

A. 12 inches

B. 18 inches

C. 22 inches (24 inches preferred) to allow rescue

D. 36 inches

125. What rescue equipment must be available for confined space entry?

A. None required

B. Retrieval systems, harnesses, and means to extract workers without entering

C. Fire extinguisher only

D. First aid kit only

Answer Key with Explanations

1. B - Constructability reviews bring experienced builders into the design phase to evaluate whether designs can actually be built efficiently. They identify potential problems like impossible sequencing, difficult access, expensive methods, or conflicts between systems. Fixing problems on paper is far cheaper than discovering them in the field.

2. D - Fast-tracking overlaps design and construction phases starting construction before designs are complete. You might start foundations while upper floors are still being designed. This shortens overall project time but increases risk of conflicts, changes, and rework.

3. A - Cost codes are numbering systems organizing and tracking costs by category—labor codes, material codes, equipment codes, subcontractor codes. They let you analyze where money goes, compare costs between projects, and identify problems early. Good cost coding is essential for financial control.

4. C - Percent complete tracking measures actual work progress against planned progress. If you're scheduled to be 50% done but only 30% complete, you're behind. It's essential for accurate billing (progress payments), schedule monitoring, and identifying problems requiring corrective action.

5. B - Earned value measures the value of work actually completed compared to what was planned and what was spent. If you planned to spend $100k and be 50% done, but spent $120k and are only 40% done, earned value analysis reveals you're over budget and behind schedule.

6. D - Actual costs are money already spent—checks written, invoices paid. Committed costs are obligations not yet paid—purchase orders issued, contracts signed, subcontractors started work. Both impact your budget even though committed costs haven't left your account yet.

7. A - Finalize allowances as early as possible to prevent delays and surprises. Allowances are placeholders for owner selections like fixtures, flooring, or appliances. If owners delay selecting, you can't order materials, installations get delayed, and prices may increase.

8. C - Cost proposals for change orders provide detailed breakdowns of material costs, labor hours and rates, equipment, subcontractor pricing, overhead, and profit. This transparency lets owners understand costs and make informed decisions about whether to proceed with changes.

9. B - Time and materials (T&M) billing pays based on actual hours worked at specified rates plus materials at cost plus markup. You track time carefully and provide receipts for materials. It's used when scope is uncertain but requires trust and good documentation.

10. D - Not-to-exceed (NTE) amounts set maximum cost limits. You might work time and materials but with a $50,000 NTE cap—you can't bill more than $50k regardless of actual costs. This gives owners cost certainty while allowing T&M flexibility.

11. A - Backcharging (also called charge-back) means one contractor charges another for work they had to do because the other contractor didn't fulfill obligations. If a plumber damages drywall and the general contractor repairs it, the general backcharges the plumber for repair costs.

12. C - Project float is schedule flexibility—the difference between early and late completion dates without impacting the final deadline. If an activity can finish anytime between May 1 and May 15 without delaying the project, it has 15 days of float.

13. B - Critical path activities have zero float—any delay directly extends project completion. They're "critical" because they determine minimum project duration. You must focus on critical path activities staying on schedule. Activities with float can slip without impacting completion.

14. D - Baselines are original approved plans (schedule, budget, scope) used as reference points for measuring progress and changes. As work progresses, you compare actual performance to baseline to see if you're on track or deviating. Baselines help identify trends and problems early.

15. A - Scope creep is gradual expansion of project scope through small undocumented changes. "While you're here, can you also..." adds up. Each change seems minor but collectively they consume budgets and schedules. Control scope creep through formal change order processes.

16. C - Quotations are firm price offers binding for specified periods—"We'll do this work for $10,000 good for 30 days." Estimates are approximate calculations—"This will probably cost around $10,000 but could vary." Quotes commit you; estimates don't.

17. B - Quantity takeoffs measure and count all materials needed from plans for pricing—how many square feet of flooring, linear feet of pipe, cubic yards of concrete. Takeoffs are the foundation of accurate estimates. Mistakes here multiply through pricing causing significant cost errors.

18. D - Contingency is reserve money for unforeseen costs, site conditions, minor changes, or estimating uncertainties. Most projects include 5-10% contingency. It's not profit or padding—it's realistic acknowledgment that surprises happen and provides buffer for managing them.

19. A - Construction draws are periodic payments (progress payments) from lenders or owners to contractors based on work completed. You submit draw requests with documentation of completed work, lender or owner approves, and funds release. Draws provide cash flow during long projects.

20. C - Bond beams are reinforced horizontal courses in masonry walls—concrete-filled courses with rebar running through them. They distribute loads, tie walls together, resist lateral forces, and provide support for roof and floor systems bearing on walls.

21. B - Lintels are horizontal supports above masonry openings (doors, windows) carrying loads from above around the opening down to the sides. They're typically steel angles, precast concrete, or reinforced masonry. Without lintels, masonry above openings would collapse.

22. D - Rafter overhangs vary by design but typically the bird's mouth positions the rafter seat properly on the plate with the tail extending beyond for desired overhang (12-24 inches typically). The overhang protects walls from weather and provides shade.

23. A - A bird's mouth is a notch cut in rafters where they sit on wall top plates. It has two parts: the seat cut (horizontal, resting on plate) and the plumb cut (vertical, against the wall). The bird's mouth gives rafters solid bearing and proper positioning.

24. C - The plumb cut is the vertical cut at the top of rafters where they meet the ridge board. It's perpendicular to the ground (plumb) and cut at an angle matching your roof pitch so rafters fit tightly against the ridge.

25. B - The seat cut is the horizontal portion of the bird's mouth where rafters sit flat on top plates. It provides bearing surface for transferring roof loads to walls. Proper seat cut depth is critical—too deep weakens rafters, too shallow reduces bearing.

26. D - Hurricane straps (also called hurricane ties, rafter ties, or truss clips) are metal connectors securing rafters or trusses to wall plates. They prevent wind uplift during hurricanes or severe storms. Properly installed straps significantly improve roof-to-wall connection strength.

27. B - Purlins are horizontal beams running perpendicular to rafters providing intermediate support between ridge and walls. They're common in pole buildings and metal roof structures. Purlins reduce rafter span allowing smaller rafters or longer overall spans.

28. C - Struts are angled or vertical compression members bracing rafters, trusses, or other roof components. They transfer loads and prevent sagging or spreading. Collar ties, for example, act as struts preventing rafters from spreading apart under load.

29. D - Cathedral ceilings slope upward following roof lines without attic space between ceiling and roof. They create dramatic open spaces but require careful insulation and ventilation planning since there's no attic. Structural ridge beams often support the rafters.

30. A - Collar ties connect opposing rafters in the upper third of roofs resisting uplift and spreading forces. They're different from ceiling joists which are lower and primarily resist rafter thrust. Collar ties help hold roof structures together under wind and snow loads.

31. C - Soffits are the undersides of roof overhangs or other overhead surfaces. The soffit is what you see looking up at your roof overhang from outside. Soffits often have vents providing attic ventilation. They also occur under stairs or dropped ceilings.

32. B - Fascia is the vertical board along roof edges covering rafter ends. It provides finished appearance, protects rafter ends from weather, and typically supports gutters. Fascia boards run along the eaves and rakes, mounted to the ends of rafters or trusses.

33. D - Drip edge is metal flashing along roof edges directing water away from fascia and into gutters. Without drip edge, water runs behind gutters or down fascia causing rot. It's one of those simple details that prevents major problems.

34. A - Asphalt shingles require minimum 2:12 pitch (2 inches rise per 12 inches run) in most applications. Flatter roofs need special installation and underlayment. Steeper pitches shed water better and shingles last longer. Below 2:12, you need different roofing systems.

35. C - Low-slope roofs have pitches less than 3:12. They're not truly flat but have minimal slope. They require special waterproofing membranes, not shingles. Many commercial buildings and additions use low-slope roofs because they're economical and easier to access.

36. B - EPDM (ethylene propylene diene monomer) is rubber membrane roofing commonly used on flat and low-slope roofs. It comes in large sheets welded or glued together creating waterproof membrane. EPDM is durable, UV-resistant, and economical for flat roofs.

37. D - TPO (thermoplastic polyolefin) is single-ply white membrane roofing for flat and low-slope roofs. Seams are heat-welded creating strong waterproof bonds. TPO reflects heat (white color) improving efficiency and has become very popular for commercial roofing.

38. A - Roof crickets (also called saddles) are small ridged structures behind chimneys or other roof penetrations diverting water around obstacles. Without crickets, water and debris collect behind chimneys causing leaks and ice dam problems. They're essential for proper drainage.

39. C - Flashing is sheet metal or other material preventing water penetration at vulnerable joints—where roofs meet walls, around chimneys, at valleys, around vents. Proper flashing is critical for waterproofing. Most roof leaks trace back to flashing failures, not roofing material failures.

40. B - Counterflashing is the upper layer of flashing protecting lower flashing. It's often used where roofs meet walls—base flashing goes up the wall, counterflashing embeds in wall mortar joints and covers base flashing. This two-part system allows movement while maintaining waterproofing.

41. D - Parapet walls extend above roof lines providing fire separation between buildings, architectural interest, fall protection, and screening for roof equipment. Parapets require special waterproofing at roof intersections since they're vulnerable to water penetration.

42. A - Cap plates (also called wall caps) are the top members on parapet walls protecting wall tops from weather. They're typically metal, concrete, or stone coping directing water away from wall faces. Without caps, water penetrates wall tops causing damage.

43. C - Shear strength is wood's resistance to forces parallel to grain trying to slide or tear fibers apart—like cutting across grain or forces trying to slide one piece past another. Shear strength is important in connections and beams where forces act parallel to grain.

44. B - Withdrawal resistance measures force required to pull fasteners out perpendicular to surfaces. Screws have much better withdrawal resistance than nails. This matters for connections subjected to pulling forces—decking, sheathing under uplift, or hardware subjected to tension.

45. D - Thermostatic mixing valves automatically mix hot and cold water to safe preset temperatures preventing scalding. They're required at fixtures accessible to vulnerable populations (children, elderly)

and increasingly required everywhere. TMVs maintain consistent temperatures despite pressure fluctuations.

46. A - Expansion tanks accommodate water volume increase as it heats. Water expands about 2% from cold to hot. In closed systems (with backflow prevention), this expanding water needs somewhere to go or pressure builds dangerously. Expansion tanks provide that space.

47. C - Check valves are one-way valves allowing flow in one direction only—like gate valves that only swing one way. They prevent backflow, stop siphoning, and protect pumps and equipment. Common on sump pumps, irrigation, and anywhere reverse flow would cause problems.

48. B - Tempering valves (also called mixing or TMVs) blend hot and cold water to safe temperatures for fixtures. They're essential for preventing scalding particularly where children, elderly, or vulnerable people access hot water. They automatically adjust mixing maintaining consistent output temperature.

49. D - Pressure relief valves (temperature and pressure relief valves or T&P valves) are critical safety devices on water heaters. If temperature or pressure exceeds safe limits, the valve opens releasing water preventing tank explosions. Never cap or plug T&P valves—they save lives.

50. A - Anode rods (also called sacrificial anodes) are metal rods inside water heater tanks that corrode instead of the tank. They're typically magnesium or aluminum. As they corrode, they protect steel tanks from rust. Replace anode rods every few years to extend tank life significantly.

51. A - Dielectric unions join dissimilar metals (like copper and steel) while preventing galvanic corrosion. They have plastic or rubber insulators separating metals. Direct contact between dissimilar metals in water creates electrical current causing rapid corrosion. Dielectric fittings prevent this.

52. C - Galvanic corrosion occurs when dissimilar metals contact in the presence of electrolyte (water). Electrical current flows between metals and one corrodes rapidly. Common combinations causing problems: copper and steel, aluminum and copper. Dielectric unions or fittings prevent galvanic corrosion.

53. B - When water heats, it expands increasing volume and pressure. Closed plumbing systems (those with backflow prevention) trap this expanding water creating dangerous pressure without accommodation. Expansion tanks or pressure relief provide necessary space for expanding water preventing dangerous pressure buildup.

54. D - Hose bibbs (also called sillcocks or hose faucets) are outdoor faucets for connecting hoses. Frost-proof versions have valve stems extending into heated space preventing freezing. They need backflow prevention protecting potable water from contamination from hoses.

55. A - Dishwasher air gaps are visible fittings on countertops or sinks providing physical separation preventing wastewater from siphoning back into dishwashers. They're the most reliable backflow prevention and required by code in many areas. The gap provides absolute protection.

56. C - Dedicated returns (also called isolated or individual equipment grounding conductors) are separate neutral wires serving specific circuits preventing shared neutrals. They're required for certain circuits like multi-wire branch circuits and eliminate dangerous situations where neutral currents add unexpectedly.

57. B - A homerun is a direct uninterrupted circuit from the panel to the first device. No junction boxes, no splices, just continuous wire from breaker to first outlet or fixture. Homeruns simplify troubleshooting and reduce connection points where problems can occur.

58. D - Pigtails are short wires connecting multiple wires to device terminals. Instead of connecting two wires directly to one screw (unreliable), you splice wires together with a pigtail leading to the screw. This ensures solid connections even if the device is removed.

59. C - Wire nutting means connecting wires using twist-on wire connectors (commonly called wire nuts). You strip wires, hold them parallel, twist together, then twist on the connector. Proper wire nutting creates secure connections. Size connectors appropriately for wire gauges.

60. A - Anti-oxidant compound (also called joint compound or noalox) prevents oxidation on aluminum wire connections. Aluminum oxidizes rapidly creating poor connections and fire hazards. The compound keeps oxygen away from aluminum maintaining good electrical contact and preventing dangerous heat buildup.

61. B - Backstabbing (also called push-in connections) uses spring-loaded terminals accepting stripped wires pushed into holes on outlets and switches. It's fast but creates less reliable connections than screw terminals. Many electricians avoid backstabs preferring the reliability of screw terminals.

62. D - CAFCI (Combination Arc Fault Circuit Interrupter) breakers protect against both arc faults (sparking from damaged wires) and ground faults (like GFCI). They provide broader protection than AFCIs alone, protecting against multiple electrical hazards in single devices.

63. A - Split receptacles have each outlet (top and bottom) on separate circuits or one outlet switched while the other is hot continuously. You break the tab between hot terminals splitting the receptacle. Common for switched desk lamps while maintaining hot outlet for clocks or electronics.

64. C - Switched receptacles have one or both outlets controlled by wall switches. You break the tab between hot terminals, wire one side to switch, the other to continuous hot. This allows switching table or floor lamps without built-in switches via convenient wall switches.

65. B - Knob and tube wiring was used from 1880s-1940s using separate hot and neutral wires supported by ceramic knobs and running through ceramic tubes at joists and studs. It has no ground wire and insulation deteriorates. Most insurance companies refuse coverage without replacement.

66. D - Zone HVAC systems use multiple thermostats controlling separate areas independently. Dampers in ductwork direct airflow to zones needing heating or cooling while bypassing comfortable zones. This improves comfort and efficiency especially in homes with varying use patterns or sun exposure.

67. A - Dampers are adjustable plates in ductwork controlling airflow. Manual dampers adjust by hand for balancing. Motorized dampers open and close automatically for zone control. Dampers direct air where needed and prevent air from going where it's not needed.

68. C - Plenums are large air distribution chambers where main ductwork connects to air handlers or furnaces. Supply plenums distribute air to supply ducts. Return plenums collect air from return ducts. They're essentially distribution boxes for HVAC airflow.

69. B - Static pressure is resistance to airflow in duct systems measured in inches of water column. Higher static pressure means the system works harder moving air. Causes include dirty filters, undersized ducts, too many bends, or closed dampers. Measuring static pressure diagnoses airflow problems.

70. D - HRVs (Heat Recovery Ventilators) exchange heat between exhaust and incoming fresh air. In winter, warm exhaust air heats incoming cold air. In summer, cool exhaust air pre-cools incoming hot air. This recovers energy while ventilating, improving efficiency and comfort.

71. A - ERVs (Energy Recovery Ventilators) work like HRVs but also transfer moisture. In winter, they transfer moisture from exhaust to dry incoming air. In summer, they remove moisture from humid incoming air. ERVs provide better comfort control than HRVs in humid climates.

72. C - MERV (Minimum Efficiency Reporting Value) rates filter effectiveness from 1-16. MERV 1-4 catches large particles, MERV 8-13 captures most residential contaminants, MERV 14-16 approaches HEPA quality. Higher MERV improves air quality but may restrict airflow if system isn't designed for it.

73. B - Heat strips are electric resistance heating elements providing backup or emergency heat in heat pumps. When outdoor temperatures drop too low for efficient heat pump operation, or during defrost cycles, heat strips supplement heating. They're expensive to operate but provide reliable heat.

74. D - Defrost mode periodically melts frost accumulating on outdoor coils during heat pump heating. Frost buildup blocks airflow reducing efficiency. The system temporarily reverses to cooling mode, heating the outdoor coil and melting frost. Backup heat maintains indoor comfort during defrost.

75. B - Ambient temperature is the surrounding air temperature in a space—the temperature of the environment. HVAC technicians measure ambient temperature to diagnose system performance and verify proper operation. It's simply the air temperature around you.

76. C - Slump tests measure concrete consistency and workability. Fresh concrete fills a cone (12 inches tall), the cone lifts off, and you measure how much the concrete slumps down. A 4-inch slump means concrete settled 4 inches from 12 inches—fairly stiff. Higher slumps flow easier but may be weaker.

77. D - The slump cone is a standard 12-inch tall metal cone (8-inch diameter base, 4-inch diameter top) used for slump testing. Concrete fills the cone in layers, each layer rodded. The cone lifts off and slump measures how much concrete settles below the 12-inch starting height.

78. A - Segregation is separation of concrete components—aggregate settles, cement and water rise, creating non-uniform concrete. It's caused by excessive vibration, high slump, poor mixing, or improper

handling. Segregated concrete has weak spots and poor appearance. Proper mixing, placement, and vibration prevent segregation.

79. B - Bleeding is water rising to concrete surfaces as heavier materials settle. Some bleeding is normal. Excessive bleeding indicates too much water weakening concrete. Let bleed water evaporate before finishing—working it into surfaces creates weak dusty areas that never cure properly.

80. C - Consolidation removes air voids and ensures concrete completely fills forms around reinforcement. Vibrators consolidate concrete, liquefying it temporarily so it flows into all spaces. Proper consolidation produces dense strong concrete without voids. Over-vibration causes segregation; under-vibration leaves voids.

81. D - Bulkheads are temporary forms closing ends of concrete pours creating construction joints. They're removed after concrete hardens allowing subsequent pours to continue. Bulkheads contain concrete during placement and create clean straight joints between pour sections.

82. A - Construction joints are planned stopping points between separately placed concrete sections. They're not cracks—they're intentional joints where one pour ends and the next begins. Proper construction joint preparation ensures good bond between sections. Keyways or roughened surfaces improve joint strength.

83. C - Paint forms opaque films on wood surfaces completely hiding grain and color. Stain penetrates wood fibers enhancing grain and color while remaining transparent or semi-transparent. Paint covers; stain enhances. You can't effectively stain over paint but can paint over stain.

84. B - Wood conditioner (also called pre-stain conditioner) seals wood pores in soft or porous woods like pine promoting more even stain absorption. Without conditioner, soft woods absorb stain unevenly creating blotchy appearance. Conditioner prevents blotching on problem woods.

85. D - Gel stain is thick like petroleum jelly, sitting on wood surfaces rather than penetrating deeply. It provides more uniform color control than penetrating stains, works well on problem woods and vertical surfaces, and can simulate more expensive wood species. It's easier for beginners.

86. A - Wood filler (also called wood putty) fills holes, cracks, gouges, and nail holes. It's thick paste accepting stain and paint. Apply filler after staining (for natural finishes) or before painting. Different formulations exist for paint-grade versus stain-grade work.

87. C - Grain filler (also called pore filler) is paste filling the open pores in open-grain woods like oak, mahogany, or walnut. It creates smooth glass-like surfaces for high-quality finishes. Without grain filler, pores remain visible and finishes have textured feel rather than smooth glossy surface.

88. B - Tack cloth is sticky resin-impregnated cloth removing fine dust between finishing coats. After sanding, wipe surfaces with tack cloth picking up dust particles that would mar finishes. Tack cloths are essential for professional-quality finishing—they remove dust regular cloths miss.

89. A - Polyurethane is durable clear finish protecting wood surfaces. Oil-based polyurethane is very durable but yellows over time. Water-based polyurethane stays clear but is slightly less durable. Polyurethane is available in gloss, semi-gloss, and satin sheens for various appearances.

90. D - Oil-based polyurethane is extremely durable, resists water and chemicals excellently, but yellows with time and UV exposure giving wood warm amber tones. Water-based polyurethane dries faster, cleans up with water, stays crystal clear but is slightly less durable and more expensive.

91. C - French cleats are interlocking beveled mounting systems. One beveled piece mounts to walls, the matching beveled piece attaches to cabinets or heavy items. The bevels interlock creating strong secure mounting easily adjusted for level. French cleats are ideal for heavy wall cabinets.

92. A - European hinges (also called cup hinges, concealed hinges, or Euro hinges) are adjustable hidden hinges mounting inside cabinet boxes. They're invisible when doors close, fully adjustable in three dimensions, and allow doors to open fully. They're standard in modern cabinet construction.

93. B - Soft-close hardware uses hydraulic or spring mechanisms slowing cabinet doors and drawers in the last few inches preventing slamming. They extend hardware life, reduce noise, prevent damage, and feel luxurious. Soft-close is increasingly standard on quality cabinets.

94. D - Drawer boxes are the structural cabinet drawers—the five-sided boxes (front, back, two sides, bottom) excluding decorative drawer faces. Quality drawer boxes use dovetail or dowel joints. The drawer face (decorative front) attaches separately allowing consistent appearance across all drawers.

95. C - Dovetail joints use interlocking wedge-shaped tenons creating extremely strong joints resisting pulling forces. Traditional drawer construction uses dovetails because drawers face pulling forces constantly. Machine-cut dovetails are common today; hand-cut dovetails indicate very high-quality craftsmanship.

96. A - Rail and stile construction creates cabinet door frames with vertical members (stiles) and horizontal members (rails) surrounding center panels. This traditional construction allows wood movement without cracking and provides classic appearance. The panel floats in grooves in the frame.

97. B - Shaker style cabinets feature simple flat-panel doors with clean lines and minimal ornamentation. The style originated with Shaker religious communities valuing simplicity and utility. Shaker doors remain popular for timeless appearance working in traditional or modern settings.

98. D - Overlay describes how much cabinet doors extend beyond face frames. Full overlay covers the entire frame showing only small gaps between doors. Partial overlay reveals portions of frames between doors. Inset doors fit inside frames. Overlay affects appearance and how much interior space is accessible.

99. C - Full overlay doors cover entire face frames leaving only small reveals between adjacent doors and drawers. Partial overlay (also called standard overlay) reveals about 1 inch of frame between doors. Full overlay provides cleaner modern appearance maximizing door size.

100. B - Frameless cabinets (European-style or Euro cabinets) have no face frames—doors attach directly to cabinet box sides which are thicker (3/4 inch) providing adequate strength and mounting surfaces. Frameless construction maximizes interior space and creates sleek modern appearance.

101. B - Standard countertop thickness is 1-1/2 inches for stone and solid surface, or 1-1/4 inches for laminate countertops (with edge buildup). Some modern designs use thicker countertops (2 inches or more) for dramatic appearance, but 1-1/2 inches is standard traditional thickness.

102. D - Laminate countertops have decorative plastic laminate (thin tough plastic sheet) bonded to substrate like particle board or plywood. Laminate offers countless colors and patterns, resists stains and heat moderately, and costs less than stone. Quality varies widely by laminate grade and substrate.

103. A - Post-forming heats laminate making it flexible enough to bend around curved edges forming smooth continuous surfaces without seams. Post-formed countertops have integral backsplashes and rolled front edges. The process creates seamless appearances impossible with flat laminate application.

104. C - Drip grooves are shallow grooves routed into undersides of countertop overhangs preventing water from running backward to cabinets. Without drip grooves, water following undersides soaks cabinet frames causing damage. Simple drip grooves prevent major water damage problems.

105. B - Butcher block countertops consist of wood strips (typically maple, oak, or walnut) edge-glued together forming thick solid wood surfaces. They're beautiful, warm, food-safe, and repairable but require regular oiling, are vulnerable to water damage, and scratch more easily than stone.

106. D - Standard clearance between countertops and bottom of wall cabinets is 18 inches providing workspace for small appliances, outlet access, and comfortable working height. This 18-inch space is the backsplash area. Some designs use 15 or 20 inches but 18 inches is standard.

107. B - Toe kick (also called toe space or kick space) is recessed area at cabinet bottoms (typically 3-4 inches tall and 3 inches deep) providing comfortable toe room when standing at counters. Without toe kicks, standing close to counters is uncomfortable. Toe kicks are essential ergonomic features.

108. C - Barricades prevent unauthorized access to hazardous areas creating physical barriers around open excavations, floor openings, dangerous equipment, or high-traffic work zones. They protect workers and the public from construction hazards and clearly mark danger zones.

109. B - Store compressed gas cylinders upright and secured (chained or strapped to walls, racks, or posts) with protective caps on when not in use. Upright storage prevents regulator damage and allows safe valve access. Securing prevents falling which could break valves creating uncontrolled rocket-like propulsion.

110. D - Keep compressed gas cylinders at least 20 feet from flames, sparks, or welding operations. Cylinders heated by flames can explode violently. Even non-flammable gases like oxygen support combustion intensely. The 20-foot rule provides adequate safety margin.

111. A - Safety Data Sheets provide comprehensive hazardous material information—health hazards, physical hazards, protective measures, safe handling, first aid, firefighting measures, and emergency

response. OSHA requires SDS for all hazardous materials and workers must have access to SDS for materials they work with.

112. C - SDS must be available on-site while hazardous materials are in use and accessible to all workers who might be exposed. You can't hide SDS in locked offices—workers need immediate access for emergencies. Many sites maintain SDS binders at central locations.

113. B - The NFPA 704 diamond uses four color-coded sections and numbers 0-4 indicating hazard levels: red for fire hazard, blue for health hazard, yellow for instability/reactivity, and white for special hazards. This visual system quickly communicates dangers at a glance.

114. D - Permit-required confined space programs establish procedures ensuring safe entry into spaces with atmospheric hazards, limited entry/exit, or not designed for continuous occupancy. Programs include hazard assessment, atmospheric testing, ventilation, permits, training, rescue, and attendant requirements.

115. A - Trench competent persons are trained to identify trench hazards including cave-in potential, protective system adequacy, atmospheric hazards, and water accumulation. They have authority to take immediate corrective action. Competent persons must inspect trenches daily and after any condition changes.

116. C - Trenches must be inspected daily before workers enter and after rain, vibration, or anything else that could affect safety. The competent person looks for cracks, sloughing, water, proper protective systems, and atmospheric hazards. Never enter uninspected trenches.

117. C - Trench boxes (also called trench shields) are steel or aluminum protective structures preventing cave-ins around workers. They don't prevent cave-ins but protect workers inside if surrounding soil collapses. Trench boxes must be properly sized and positioned protecting all workers.

118. D - Test confined space atmospheres before entry checking oxygen levels (19.5-23.5%), flammable gases (below lower explosive limit), and toxic gases (below permissible exposure limits). Continuous monitoring during entry is required. Atmospheres change—initial safety doesn't guarantee continued safety.

119. A - Safe oxygen levels for confined space entry are 19.5-23.5%. Below 19.5% causes oxygen deficiency (hypoxia) leading to impairment, unconsciousness, and death. Above 23.5% creates fire and explosion risks. Normal air is 20.9% oxygen. Verify oxygen levels before every entry.

120. C - Mechanical ventilation with continuous fresh air supply is required for most confined space entries. Natural ventilation is inadequate. Ventilation removes contaminants, provides oxygen, and prevents atmospheric hazards from accumulating. Never rely on opening manholes for ventilation—use powered blowers.

121. B - Enter permit-required confined spaces only after completing entry permits documenting atmospheric testing, establishing ventilation, briefing entrants and attendants, verifying rescue equipment is ready, and confirming all safety measures are in place. Permits ensure nothing gets forgotten.

122. D - Safety harnesses in confined spaces allow retrieval without entering. Harnesses connect to retrieval lines extending outside allowing attendants or mechanical systems to extract workers without rescue entry. This is critical because most confined space deaths are would-be rescuers.

123. A - Confined space attendants remain outside maintaining continuous communication with entrants, monitoring conditions, preventing unauthorized entry, tracking who's inside, and initiating rescue if problems develop. Attendants never enter—their job is outside protecting entrants and calling for help.

124. C - Manhole openings must be minimum 22 inches diameter (24 inches preferred) allowing emergency rescue equipment to fit through. Smaller openings trap injured workers preventing rescue. The size must accommodate workers wearing harnesses and rescue equipment passing through.

125. B - Retrieval systems including harnesses with D-rings, retrieval lines, and mechanical or manual lifting systems must be available for confined space entry. These allow extracting workers without entry. Non-entry rescue is always preferred—most confined space deaths are rescuers who entered without proper protection.