

GEOTECHNICAL CIVIL PE EXAM PREP

100-QUESTION PRACTICE EXAM 17

Standalone PDF - U.S. customary units unless noted
Answer key and worked solutions included

UNOFFICIAL PRACTICE MATERIAL

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Candidate Instructions

- Complete all 100 questions before consulting the answer key or solutions.
- Suggested pacing: 10 hours total, or two timed 50-question sessions.
- Select the single best answer. The official CBT examination may also use alternative item types.
- Use the official NCEES PE Civil Reference Handbook and design standards applicable to your exam date.
- Round to the nearest listed answer and record errors by concept, formula, units, reference navigation, or pacing.

Blueprint

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Site Characterization

1. A geotechnical review board verifies the design. a 5-ft rock core run yields 42 ft of core. determine the core recovery?

- A. 860%
- B. 828%
- C. 850%
- D. 840%

Answer: A B C D

2. During a comprehensive project risk assessment, a 6-ft rock core run yields 48 ft of core. determine the core recovery?

- A. 810%
- B. 800%
- C. 788%
- D. 820%

Answer: A B C D

3. While validating subsurface data against design assumptions, a 5-ft rock core run yields 36 ft of core. determine the core recovery?

- A. 730%
- B. 720%
- C. 708%
- D. 740%

Answer: A B C D

4. An independent technical auditor evaluates this condition. a 5-ft rock core run yields 44 ft of core. determine the core recovery?

- A. 880%
- B. 900%
- C. 868%
- D. 890%

Answer: A B C D

5. Before certifying the final geotechnical recommendations, a 24-in core run contains 18 in of sound core pieces at least twice the core diameter. determine the RQD?

- A. 55%
- B. 85%
- C. 65%
- D. 75%

Answer: A B C D

6. A geotechnical review board verifies the design. a 30-in core run contains 20 in of sound core pieces at least twice the core diameter. determine the RQD?

- A. 47%
- B. 57%
- C. 67%
- D. 77%

Answer: A B C D

7. During a comprehensive project risk assessment, a 25-in core run contains 15 in of sound core pieces at least twice the core diameter. determine the RQD?

- A. 70%
- B. 60%
- C. 40%
- D. 50%

Answer: A B C D

8. While validating subsurface data against design assumptions, a 28-in core run contains 22 in of sound core pieces at least twice the core diameter. determine the RQD?

- A. 89%
- B. 79%
- C. 69%
- D. 59%

Answer: A B C D

9. An independent technical auditor evaluates this condition. which field method most directly provides a near-continuous profile of tip resistance and sleeve friction?

- A. Cone penetration test
- B. Standard penetration test
- C. Field vane test
- D. Plate load test

Answer: A B C D

10. Before certifying the final geotechnical recommendations, which sampler is generally preferred for obtaining a relatively undisturbed sample of soft cohesive soil?

- A. Grab sampler
- B. Rock core barrel
- C. Split-spoon sampler
- D. Thin-walled Shelby tube

Answer: A B C D

11. A geotechnical review board verifies the design. a soil has 58% passing No. 200, LL = 42, and PI = 18. Under USCS, its broad classification is most likely:

- A. Organic peat
- B. Well-graded gravel
- C. Clean sand
- D. Silty or clayey fine-grained soil

Answer: A B C D

12. During a comprehensive project risk assessment, for locating the groundwater surface in a borehole after pore pressures equilibrate, the most appropriate device is a:

- A. Standpipe piezometer
- B. Settlement plate
- C. Pressuremeter
- D. Inclinator

Answer: A B C D

Soil Mechanics, Laboratory Testing, and Analysis

13. While validating subsurface data against design assumptions, a soil has water content 18%, $G_s = 2.70$, and void ratio $e = 0.65$. determine its degree of saturation?

- A. 85%
- B. 60%
- C. 95%
- D. 75%

Answer: A B C D

14. An independent technical auditor evaluates this condition. a soil has water content 22%, $G_s = 2.65$, and void ratio $e = 0.75$. determine its degree of saturation?

- A. 78%
- B. 63%
- C. 88%
- D. 98%

Answer: A B C D

15. Before certifying the final geotechnical recommendations, a soil has water content 15%, $G_s = 2.68$, and void ratio $e = 0.55$. determine its degree of saturation?

- A. 58%
- B. 73%
- C. 83%
- D. 93%

Answer: A B C D

16. A geotechnical review board verifies the design. a soil has water content 25%, $G_s = 2.72$, and void ratio $e = 0.82$. determine its degree of saturation?

- A. 68%
- B. 83%
- C. 100%
- D. 93%

Answer: A B C D

17. During a comprehensive project risk assessment, at 15 ft depth, total vertical stress is based on an average unit weight of 120 pcf and pore pressure is 500 psf. determine vertical effective stress?

- A. 800 psf
- B. 1,800 psf
- C. 2,300 psf
- D. 1,300 psf

Answer: A B C D

18. While validating subsurface data against design assumptions, at 20 ft depth, total vertical stress is based on an average unit weight of 118 pcf and pore pressure is 800 psf. determine vertical effective stress?

- A. 760 psf
- B. 2,360 psf
- C. 1,560 psf
- D. 3,160 psf

Answer: A B C D

19. An independent technical auditor evaluates this condition. at 12 ft depth, total vertical stress is based on an average unit weight of 125 pcf and pore pressure is 420 psf. determine vertical effective stress?

- A. 660 psf
- B. 1,920 psf
- C. 1,500 psf
- D. 1,080 psf

Answer: A B C D

20. Before certifying the final geotechnical recommendations, at 18 ft depth, total vertical stress is based on an average unit weight of 115 pcf and pore pressure is 650 psf. determine vertical effective stress?

- A. 2,720 psf
- B. 2,070 psf
- C. 770 psf
- D. 1,420 psf

Answer: A B C D

21. A geotechnical review board verifies the design. a normally consolidated clay layer is 12 ft thick, $e_0=0.8$, $C_c=0.28$. Effective stress doubles by a factor of 2.0. Estimate primary consolidation settlement.

- A. 10.1 in
- B. 6.7 in
- C. 13.5 in
- D. 3.4 in

Answer: A B C D

22. During a comprehensive project risk assessment, a normally consolidated clay layer is 10 ft thick, $e_0=0.7$, $C_c=0.22$. Effective stress doubles by a factor of 1.8. Estimate primary consolidation settlement.

- A. 4.0 in
- B. 5.9 in
- C. 7.9 in
- D. 2.0 in

Answer: A B C D

23. While validating subsurface data against design assumptions, a normally consolidated clay layer is 15 ft thick, $e_0=0.9$, $C_c=0.30$. Effective stress doubles by a factor of 1.5. Estimate primary consolidation settlement.

- A. 2.5 in
- B. 5.0 in
- C. 7.5 in
- D. 10.0 in

Answer: A B C D

24. An independent technical auditor evaluates this condition. a normally consolidated clay layer is 8 ft thick, $e_0=0.6$, $C_c=0.18$. Effective stress doubles by a factor of 2.5. Estimate primary consolidation settlement.

- A. 2.1 in
- B. 6.4 in
- C. 4.3 in
- D. 8.6 in

Answer: A B C D

Construction Observation, Monitoring, QA/QC, and Safety

25. Before certifying the final geotechnical recommendations, a nuclear gauge reports wet density 126 pcf at 8% water content. Dry density is closest to:

- A. 117 pcf
- B. 108 pcf
- C. 126 pcf
- D. 136 pcf

Answer: A B C D

26. A geotechnical review board verifies the design. the laboratory maximum dry density is 121 pcf and field dry density is 116 pcf. Relative compaction is:

- A. 91.0%
- B. 95.9%
- C. 104.3%
- D. 100.0%

Answer: A B C D

27. During a comprehensive project risk assessment, which instrument is best suited to monitor lateral movement within an excavation support system?

- A. Vibrating-wire load cell only
- B. Inclinator
- C. Settlement plate
- D. Piezometer

Answer: A B C D

28. While validating subsurface data against design assumptions, a piezometer reading rises rapidly during embankment placement. The most appropriate immediate interpretation is:

- A. The fill is undercompacted
- B. Excess pore pressure is developing
- C. Soil strength has necessarily increased
- D. Settlement is complete

Answer: A B C D

29. An independent technical auditor evaluates this condition. for cohesive fill, the most representative routine acceptance test pairing is:

- A. Los Angeles abrasion and slump
- B. CPT and pressuremeter
- C. RQD and core recovery
- D. Field density/moisture and a laboratory moisture-density curve

Answer: A B C D

30. Before certifying the final geotechnical recommendations, a 6-ft-deep trench in Type C soil has no protective system. Under OSHA excavation rules, the condition is generally:

- A. Acceptable with a ladder only
- B. Acceptable if open less than one day
- C. Acceptable if soil is dry
- D. Not acceptable; cave-in protection is required unless in stable rock

Answer: A B C D

31. A geotechnical review board verifies the design. when proofrolling reveals rutting and pumping, the preferred first response is to:

- A. Ignore it if density tests passed
- B. Increase asphalt temperature
- C. Identify and remediate the unstable subgrade area
- D. Place thicker pavement immediately

Answer: A B C D

32. During a comprehensive project risk assessment, a settlement plate installed beneath an embankment primarily measures:

- A. Horizontal strain
- B. Pore pressure
- C. Vertical movement at its elevation
- D. Soil suction

Answer: A B C D

Earthquake Engineering and Dynamic Loads

33. While validating subsurface data against design assumptions, liquefaction susceptibility is generally greatest in:

- A. Stiff overconsolidated clay
- B. Dense dry gravel
- C. Intact granite
- D. Loose saturated clean sand

Answer: A B C D

34. An independent technical auditor evaluates this condition. for a pseudo-static slope analysis, seismic loading is commonly represented by:

- A. A vertical surcharge only
- B. Removal of groundwater
- C. A horizontal inertial force khW
- D. A permanent increase in cohesion

Answer: A B C D

35. Before certifying the final geotechnical recommendations, if $kh = 0.15$ and a potential sliding mass weighs 2,000 kips, the horizontal pseudo-static force is:

- A. 2,000 kips
- B. 300 kips
- C. 150 kips
- D. 30 kips

Answer: A B C D

36. A geotechnical review board verifies the design. which field parameter is routinely corrected for overburden and hammer energy before use in SPT-based liquefaction screening?

- A. N value
- B. Hydraulic conductivity
- C. Atterberg limit
- D. RQD

Answer: A B C D

37. During a comprehensive project risk assessment, a saturated sand deposit densifies during shaking but drainage is too slow. The immediate consequence is generally:

- A. Cementation
- B. Negative pore pressure
- C. Excess positive pore pressure and reduced effective stress
- D. Increased effective stress

Answer: A B C D

38. While validating subsurface data against design assumptions, site amplification of earthquake motions is commonly greater for:

- A. Hard rock
- B. Shallow bedrock only
- C. Soft soil deposits
- D. Massive concrete

Answer: A B C D

39. An independent technical auditor evaluates this condition. the cyclic resistance ratio represents:

- A. Post-liquefaction settlement only
- B. Demand imposed by the earthquake
- C. Static bearing capacity
- D. Soil resistance to liquefaction triggering

Answer: A B C D

Earth Structures, Ground Improvement, and Pavement

40. Before certifying the final geotechnical recommendations, for a trial planar slide, normal force is 180 kips, driving shear is 90 kips, $\phi' = 30^\circ$, $c' = 0$ ksf, and plane length is 120 ft. determine the factor of safety?

- A. 1.44
- B. 1.15
- C. 0.81
- D. 1.73

Answer: A B C D

41. A geotechnical review board verifies the design. for a trial planar slide, normal force is 190 kips, driving shear is 90 kips, $\phi' = 32^\circ$, $c' = 0$ ksf, and plane length is 140 ft. determine the factor of safety?

- A. 1.98
- B. 1.32
- C. 0.92
- D. 1.65

Answer: A B C D

42. During a comprehensive project risk assessment, for a trial planar slide, normal force is 170 kips, driving shear is 90 kips, $\phi' = 28^\circ$, $c' = 5$ ksf, and plane length is 100 ft. determine the factor of safety?

- A. 6.56
- B. 4.59
- C. 8.20
- D. 9.84

Answer: A B C D

43. While validating subsurface data against design assumptions, for a trial planar slide, normal force is 210 kips, driving shear is 90 kips, $\phi' = 35^\circ$, $c' = 0$ ksf, and plane length is 160 ft. determine the factor of safety?

- A. 2.45
- B. 1.63
- C. 1.14
- D. 2.04

Answer: A B C D

44. An independent technical auditor evaluates this condition. which ground-improvement method is most directly used to accelerate consolidation of a thick soft clay layer beneath a surcharge?

- A. Rock bolts
- B. Prefabricated vertical drains
- C. Dynamic compaction only
- D. Vibrocompaction alone

Answer: A B C D

45. Before certifying the final geotechnical recommendations, lime treatment is generally most effective for:

- A. Organic peat with very high organic content
- B. Clean gravel
- C. Intact rock
- D. Plastic clay

Answer: A B C D

46. A geotechnical review board verifies the design. a geotextile placed between aggregate base and weak subgrade primarily to prevent intermixing serves as:

- A. Cathodic protection
- B. Separation
- C. A vapor barrier
- D. Reinforcement only

Answer: A B C D

47. During a comprehensive project risk assessment, for a geotextile filter, the opening size should primarily balance:

- A. UV resistance and density
- B. Creep and thermal expansion only
- C. Tensile strength and color
- D. Soil retention and adequate permeability

Answer: A B C D

48. While validating subsurface data against design assumptions, a reinforced-soil slope obtains improved stability mainly from:

- A. Elimination of pore pressure
- B. Reduced soil unit weight to zero
- C. Tensile resistance mobilized in reinforcement
- D. Increased rainfall infiltration

Answer: A B C D

49. An independent technical auditor evaluates this condition. preloading a compressible foundation before final construction is intended to:

- A. Reduce effective stress
- B. Induce settlement before service
- C. Raise groundwater permanently
- D. Increase future primary settlement

Answer: A B C D

50. Before certifying the final geotechnical recommendations, for flexible pavement, a weaker subgrade generally requires:

- A. Greater structural thickness
- B. Lower compaction
- C. No base course
- D. Less structural thickness

Answer: A B C D

51. A geotechnical review board verifies the design. the most effective first-line control for seepage-related instability in an earth embankment is often:

- A. Increase infiltration
- B. Provide properly designed filters and drains
- C. Use open joints
- D. Remove downstream toe support

Answer: A B C D

52. During a comprehensive project risk assessment, at a landfill liner interface, stability should be checked using:

- A. Concrete compressive strength
- B. SPT refusal
- C. The weakest relevant interface shear strength
- D. Only the soil's internal friction angle

Answer: A B C D

53. While validating subsurface data against design assumptions, aggregate piers improve soft ground primarily by:

- A. Eliminating all settlement
- B. Dissolving clay minerals
- C. Providing stiffer inclusions and drainage
- D. Creating voids

Answer: A B C D

Groundwater and Seepage

54. An independent technical auditor evaluates this condition. using Darcy's law, $k=0.002$ ft/s, hydraulic gradient $i=0.5$, and flow area $A=100$ ft². determine discharge?

- A. 0.100 ft³/s
- B. 0.050 ft³/s
- C. 1.000 ft³/s
- D. 0.200 ft³/s

Answer: A B C D

55. Before certifying the final geotechnical recommendations, using Darcy's law, $k=0.001$ ft/s, hydraulic gradient $i=0.8$, and flow area $A=150$ ft². determine discharge?

- A. 0.120 ft³/s
- B. 1.200 ft³/s
- C. 0.060 ft³/s
- D. 0.240 ft³/s

Answer: A B C D

56. A geotechnical review board verifies the design. using Darcy's law, $k=0.003$ ft/s, hydraulic gradient $i=0.4$, and flow area $A=80$ ft². determine discharge?

- A. 0.192 ft³/s
- B. 0.048 ft³/s
- C. 0.960 ft³/s
- D. 0.096 ft³/s

Answer: A B C D

57. During a comprehensive project risk assessment, boiling or piping at the base of an excavation occurs when:

- A. Upward seepage force approaches the submerged soil weight
- B. Total stress increases
- C. Soil is dry
- D. Downward gradient is zero

Answer: A B C D

58. While validating subsurface data against design assumptions, for lowering groundwater in a permeable sand excavation, a common system is:

- A. Settlement plates
- B. Compaction grouting only
- C. Soil nails only
- D. Wellpoints

Answer: A B C D

59. An independent technical auditor evaluates this condition. a cutoff wall beneath an earth dam primarily reduces seepage by:

- A. Removing the downstream filter
- B. Shortening the flow path
- C. Lengthening the flow path and intercepting permeable strata
- D. Increasing hydraulic head

Answer: A B C D

Problematic Soil and Rock Conditions

60. Before certifying the final geotechnical recommendations, an expansive clay poses the greatest heave risk when:

- A. Its moisture content increases after construction
- B. Its moisture content remains constant
- C. It is replaced by clean aggregate
- D. It is isolated from water

Answer: A B C D

61. A geotechnical review board verifies the design. collapsible soil typically experiences sudden settlement when it is:

- A. Dried under no load
- B. Frozen
- C. Wetted while stressed
- D. Densified before loading

Answer: A B C D

62. During a comprehensive project risk assessment, frost heave requires frost-susceptible soil, freezing temperatures, and:

- A. Intact rock
- B. A water supply
- C. High salinity only
- D. Dry conditions

Answer: A B C D

63. While validating subsurface data against design assumptions, in karst terrain, the investigation should emphasize:

- A. Potential solution cavities and variable rockhead
- B. Uniform bedrock elevation
- C. Only surface soil color
- D. Pavement markings

Answer: A B C D

64. An independent technical auditor evaluates this condition. for a potentially corrosive soil around buried metal, which test is most directly relevant?

- A. RQD
- B. Soil resistivity
- C. Slump
- D. Liquid limit only

Answer: A B C D

65. Before certifying the final geotechnical recommendations, a practical rockfall mitigation measure for a steep jointed rock cut is:

- A. Scaling and anchored mesh/catchment
- B. Add surcharge at crest
- C. Remove all drainage
- D. Undercut the toe indiscriminately

Answer: A B C D

Retaining Structures

66. A geotechnical review board verifies the design. a level-backfill wall is 12 ft high. Soil has $\phi'=30^\circ$, $\gamma=120$ pcf, $c'=0$, and no surcharge. Using Rankine active pressure, what is the resultant lateral force per foot of wall?

- A. 2.3 kip/ft
- B. 4.6 kip/ft
- C. 1.4 kip/ft
- D. 3.5 kip/ft

Answer: A B C D

67. During a comprehensive project risk assessment, a level-backfill wall is 15 ft high. Soil has $\phi'=32^\circ$, $\gamma=118$ pcf, $c'=0$, and no surcharge. Using Rankine active pressure, what is the resultant lateral force per foot of wall?

- A. 3.1 kip/ft
- B. 4.6 kip/ft
- C. 1.8 kip/ft
- D. 6.1 kip/ft

Answer: A B C D

68. While validating subsurface data against design assumptions, a level-backfill wall is 10 ft high. Soil has $\phi'=28^\circ$, $\gamma=125$ pcf, $c'=0$, and no surcharge. Using Rankine active pressure, what is the resultant lateral force per foot of wall?

- A. 1.1 kip/ft
- B. 3.8 kip/ft
- C. 2.9 kip/ft
- D. 1.9 kip/ft

Answer: A B C D

69. An independent technical auditor evaluates this condition. a level-backfill wall is 14 ft high. Soil has $\phi'=35^\circ$, $\gamma=115$ pcf, $c'=0$, and no surcharge. Using Rankine active pressure, what is the resultant lateral force per foot of wall?

- A. 3.0 kip/ft
- B. 2.0 kip/ft
- C. 1.2 kip/ft
- D. 4.0 kip/ft

Answer: A B C D

70. Before certifying the final geotechnical recommendations, a level-backfill wall is 18 ft high. Soil has $\phi'=30^\circ$, $\gamma=122$ pcf, $c'=0$, and no surcharge. Using Rankine active pressure, what is the resultant lateral force per foot of wall?

- A. 5.3 kip/ft
- B. 10.6 kip/ft
- C. 3.2 kip/ft
- D. 7.9 kip/ft

Answer: A B C D

71. A geotechnical review board verifies the design. the resultant of a triangular active earth-pressure distribution acts at:

- A. $H/3$ above base
- B. $H/2$ above base
- C. At the top
- D. $2H/3$ above base

Answer: A B C D

72. During a comprehensive project risk assessment, for a uniform surcharge q behind a wall, the added active pressure is:

- A. Equal to γH
- B. Uniform with magnitude $K_a q$
- C. Triangular, maximum at base
- D. Zero

Answer: A B C D

73. While validating subsurface data against design assumptions, passive earth resistance in front of a wall should often be used cautiously because:

- A. It is independent of soil strength
- B. It is always zero
- C. Large movement may be required to mobilize it and soil may be removed
- D. It acts upward only

Answer: A B C D

74. An independent technical auditor evaluates this condition. a drainage layer behind a retaining wall is intended primarily to:

- A. Reduce wall weight
- B. Increase surcharge
- C. Prevent buildup of hydrostatic pressure
- D. Increase hydrostatic pressure

Answer: A B C D

75. Before certifying the final geotechnical recommendations, the external stability checks for a gravity retaining wall include:

- A. Only nail pullout
- B. Sliding, overturning, and bearing
- C. Only tensile rupture
- D. Only corrosion

Answer: A B C D

76. A geotechnical review board verifies the design. an anchored excavation support wall gains lateral restraint from:

- A. Tiebacks transferring load beyond the active zone
- B. Reducing wall stiffness to zero
- C. Settlement plates
- D. Surface paint

Answer: A B C D

77. During a comprehensive project risk assessment, for a braced cut, struts primarily carry:

- A. Torsion only
- B. Hydrostatic uplift only
- C. Compression
- D. Tension only

Answer: A B C D

78. While validating subsurface data against design assumptions, underpinning is used primarily to:

- A. Remove all adjacent structures
- B. Increase excavation inflow
- C. Measure pore pressure
- D. Support or transfer loads from an existing foundation

Answer: A B C D

79. An independent technical auditor evaluates this condition. a soil nail wall is generally constructed:

- A. Underwater without facing
- B. Bottom-up with driven piles only
- C. By preloading the entire wall
- D. Top-down in staged excavations

Answer: A B C D

Shallow Foundations

80. Before certifying the final geotechnical recommendations, for a strip footing, use $q_{ult}=cN_c+qN_q+0.5\gamma B N_\gamma$. Given $c=0$ ksf, $N_c=30$, $q=1000$ psf, $N_q=18$, $\gamma=120$ pcf, $B=6$ ft, $N_\gamma=15$, and $FS=3$, estimate allowable gross bearing pressure.

- A. 11.7 ksf
- B. 3.9 ksf
- C. 23.4 ksf
- D. 7.8 ksf

Answer: A B C D

81. A geotechnical review board verifies the design. for a strip footing, use $q_{ult}=cN_c+qN_q+0.5\gamma B N_\gamma$. Given $c=1$ ksf, $N_c=25$, $q=800$ psf, $N_q=16$, $\gamma=118$ pcf, $B=5$ ft, $N_\gamma=12$, and $FS=3$, estimate allowable gross bearing pressure.

- A. 16.4 ksf
- B. 8.2 ksf
- C. 5.5 ksf
- D. 2.7 ksf

Answer: A B C D

82. During a comprehensive project risk assessment, for a strip footing, use $q_{ult}=cN_c+qN_q+0.5\gamma B N_\gamma$. Given $c=0$ ksf, $N_c=28$, $q=900$ psf, $N_q=17$, $\gamma=125$ pcf, $B=8$ ft, $N_\gamma=14$, and $FS=3$, estimate allowable gross bearing pressure.

- A. 3.7 ksf
- B. 7.4 ksf
- C. 22.3 ksf
- D. 11.2 ksf

Answer: A B C D

83. While validating subsurface data against design assumptions, for a strip footing, use $q_{ult}=cN_c+qN_q+0.5\gamma B N_\gamma$. Given $c=0$ ksf, $N_c=32$, $q=1100$ psf, $N_q=20$, $\gamma=115$ pcf, $B=7$ ft, $N_\gamma=18$, and $FS=3$, estimate allowable gross bearing pressure.

- A. 29.2 ksf
- B. 9.7 ksf
- C. 4.9 ksf
- D. 14.6 ksf

Answer: A B C D

84. An independent technical auditor evaluates this condition. a footing loaded eccentrically should be checked for bearing using:

- A. Pile skin friction
- B. The full area regardless of eccentricity
- C. Only concrete density
- D. An effective area and resulting contact-pressure distribution

Answer: A B C D

85. Before certifying the final geotechnical recommendations, immediate settlement is generally most important in:

- A. Only organic soils
- B. Only frozen soils
- C. Intact rock with no joints
- D. Granular soils

Answer: A B C D

86. A geotechnical review board verifies the design. primary consolidation settlement is generally most important in:

- A. Dry clean gravel
- B. Saturated low-permeability clay
- C. Open-graded base
- D. Massive granite

Answer: A B C D

87. During a comprehensive project risk assessment, if a footing influence zone overlaps a compressible clay layer, increasing footing width generally:

- A. Extends the stress influence deeper
- B. Prevents all settlement
- C. Makes groundwater irrelevant
- D. Eliminates stress increase

Answer: A B C D

88. While validating subsurface data against design assumptions, for a square footing under a centered vertical load, increasing footing area while holding load constant generally:

- A. Decreases average contact pressure
- B. Does not affect pressure
- C. Reverses load direction
- D. Increases average contact pressure

Answer: A B C D

Deep Foundations

89. An independent technical auditor evaluates this condition. a pile has unit tip resistance 80 ksf over 4 ft² and average unit side resistance 1.2 ksf over 180 ft². Neglect downdrag. determine nominal axial compression resistance?

- A. 1072 kips
- B. 268 kips
- C. 804 kips
- D. 536 kips

Answer: A B C D

90. Before certifying the final geotechnical recommendations, a pile has unit tip resistance 100 ksf over 3 ft² and average unit side resistance 1.0 ksf over 200 ft². Neglect downdrag. determine nominal axial compression resistance?

- A. 500 kips
- B. 1000 kips
- C. 750 kips
- D. 250 kips

Answer: A B C D

91. A geotechnical review board verifies the design. a pile has unit tip resistance 60 ksf over 5 ft² and average unit side resistance 1.5 ksf over 160 ft². Neglect downdrag. determine nominal axial compression resistance?

- A. 1080 kips
- B. 270 kips
- C. 540 kips
- D. 810 kips

Answer: A B C D

92. During a comprehensive project risk assessment, a pile has unit tip resistance 90 ksf over 4 ft² and average unit side resistance 1.1 ksf over 220 ft². Neglect downdrag. determine nominal axial compression resistance?

- A. 602 kips
- B. 903 kips
- C. 1204 kips
- D. 301 kips

Answer: A B C D

93. While validating subsurface data against design assumptions, negative skin friction on a pile occurs when:

- A. The pile is unloaded
- B. Surrounding soil settles more than the pile
- C. The pile settles more than surrounding soil
- D. Groundwater is absent

Answer: A B C D

94. An independent technical auditor evaluates this condition. a static pile load test most directly provides:

- A. Groundwater chemistry
- B. Soil color
- C. Only concrete slump
- D. Load-movement behavior

Answer: A B C D

95. Before certifying the final geotechnical recommendations, dynamic pile testing during driving is commonly used to estimate:

- A. Atterberg limits
- B. Capacity and driving stresses
- C. Rock mineralogy
- D. Consolidation index only

Answer: A B C D

96. A geotechnical review board verifies the design. crosshole sonic logging is used primarily to assess:

- A. Concrete integrity between access tubes in drilled shafts
- B. Wall earth pressure
- C. Soil classification
- D. Pile axial load directly

Answer: A B C D

97. During a comprehensive project risk assessment, a pile group in clay may need capacity checked as:

- A. A retaining wall only
- B. A shallow footing only
- C. Individual piles only
- D. Both sum of individual capacities and a block

Answer: A B C D

98. While validating subsurface data against design assumptions, for laterally loaded piles, near-surface soil response is important because:

- A. Tip resistance alone controls
- B. Axial friction is zero
- C. Bending and deflection are strongly influenced by upper soil resistance
- D. The pile has no stiffness

Answer: A B C D

99. An independent technical auditor evaluates this condition. driven displacement piles installed in loose sand commonly cause:

- A. Densification and possible heave of nearby piles
- B. Loss of all shaft resistance
- C. No ground movement
- D. Liquefaction in every case

Answer: A B C D

100. Before certifying the final geotechnical recommendations, a drilled shaft socketed into rock develops resistance from:

- A. Only pile cap weight
- B. Hydrostatic pressure only
- C. Side shear and/or base resistance, depending on design assumptions
- D. Only buoyancy

Answer: A B C D

Answer Key

1	2	3	4	5	6	7	8	9	10
D	B	B	A	D	C	B	B	A	D
11	12	13	14	15	16	17	18	19	20
D	A	D	A	B	B	D	C	D	D
21	22	23	24	25	26	27	28	29	30
B	A	B	C	A	B	B	B	D	D
31	32	33	34	35	36	37	38	39	40
C	C	D	C	B	A	C	C	D	B
41	42	43	44	45	46	47	48	49	50
B	A	B	B	D	B	D	C	B	A
51	52	53	54	55	56	57	58	59	60
B	C	C	A	A	D	A	D	C	A
61	62	63	64	65	66	67	68	69	70
C	B	A	B	A	A	A	D	B	A
71	72	73	74	75	76	77	78	79	80
A	B	C	C	B	A	C	D	D	B
81	82	83	84	85	86	87	88	89	90
D	A	C	D	D	B	A	A	D	A
91	92	93	94	95	96	97	98	99	100
C	A	B	D	B	A	D	C	A	C

Use this score as a study diagnostic, not as a predicted licensing result. Review correct guesses as well as missed questions.

Worked Solutions

Site Characterization

1. D - Recovery = recovered length/run length $\times 100 = 42/5 \times 100 = 840\%$.
2. B - Recovery = recovered length/run length $\times 100 = 48/6 \times 100 = 800\%$.
3. B - Recovery = recovered length/run length $\times 100 = 36/5 \times 100 = 720\%$.
4. A - Recovery = recovered length/run length $\times 100 = 44/5 \times 100 = 880\%$.
5. D - RQD = qualifying sound-core length/run length $\times 100 = 18/24 \times 100 = 75\%$.
6. C - RQD = qualifying sound-core length/run length $\times 100 = 20/30 \times 100 = 67\%$.
7. B - RQD = qualifying sound-core length/run length $\times 100 = 15/25 \times 100 = 60\%$.
8. B - RQD = qualifying sound-core length/run length $\times 100 = 22/28 \times 100 = 79\%$.
9. A - CPT provides a nearly continuous sounding of cone tip resistance and sleeve friction.
10. D - A thin-walled tube minimizes disturbance in soft cohesive soils.
11. D - More than 50% passing No. 200 makes the soil fine-grained; LL and PI then distinguish silt/clay.
12. A - A standpipe piezometer measures hydraulic head/groundwater elevation.

Soil Mechanics, Laboratory Testing, and Analysis

13. D - $S = wGs/e = 0.18(2.70)/0.65 = 0.748$, or 75%.
14. A - $S = wGs/e = 0.22(2.65)/0.75 = 0.777$, or 78%.
15. B - $S = wGs/e = 0.15(2.68)/0.55 = 0.731$, or 73%.
16. B - $S = wGs/e = 0.25(2.72)/0.82 = 0.829$, or 83%.
17. D - $\sigma'_v = \sigma_v - u = 120(15) - 500 = 1,300$ psf.
18. C - $\sigma'_v = \sigma_v - u = 118(20) - 800 = 1,560$ psf.
19. D - $\sigma'_v = \sigma_v - u = 125(12) - 420 = 1,080$ psf.
20. D - $\sigma'_v = \sigma_v - u = 115(18) - 650 = 1,420$ psf.
21. B - $S = H C_c / (1+e_0) \log_{10}(\sigma'_f / \sigma'_0) = 12(0.28) / (1+0.8) \log_{10}(2.0) = 6.7$ in.
22. A - $S = H C_c / (1+e_0) \log_{10}(\sigma'_f / \sigma'_0) = 10(0.22) / (1+0.7) \log_{10}(1.8) = 4.0$ in.
23. B - $S = H C_c / (1+e_0) \log_{10}(\sigma'_f / \sigma'_0) = 15(0.3) / (1+0.9) \log_{10}(1.5) = 5.0$ in.
24. C - $S = H C_c / (1+e_0) \log_{10}(\sigma'_f / \sigma'_0) = 8(0.18) / (1+0.6) \log_{10}(2.5) = 4.3$ in.

Construction Observation, Monitoring, QA/QC, and Safety

25. A - $\gamma_d = \gamma / (1+w) = 126 / 1.08 = 116.7$ pcf.
26. B - $RC = 116 / 121 \times 100 = 95.9\%$.
27. B - An inclinometer measures lateral deformation versus depth.
28. B - Rapid loading of low-permeability soil generates excess pore pressure and reduces effective stress.
29. D - Compaction acceptance compares field dry density and moisture with a laboratory Proctor curve.
30. D - Protective systems are generally required at 5 ft or deeper unless the excavation is entirely in stable rock.
31. C - Proofrolling is intended to identify unstable zones requiring undercutting, drying, stabilization, or other remediation.
32. C - The plate provides a reference for vertical settlement of the underlying foundation/fill.

Earthquake Engineering and Dynamic Loads

33. D - Loose, saturated, cohesionless soils are most susceptible to cyclic pore-pressure buildup.
34. C - The pseudo-static method applies an equivalent inertial force, commonly khW .
35. B - $F_h = khW = 0.15(2,000) = 300$ kips.
36. A - Measured SPT N is normalized, including energy and overburden corrections.
37. C - Contractive tendency under undrained cyclic loading raises pore pressure and reduces effective stress.
38. C - Soft deposits commonly amplify motions and lengthen site period relative to rock.
39. D - CRR is the soil's cyclic resistance; it is compared with cyclic stress ratio demand.

Earth Structures, Ground Improvement, and Pavement

40. B - $FS = (c' L + N \tan \phi') / T = [0(120) + 180 \tan 30^\circ] / 90 = 1.15$.

41. B - $FS = (c' + N \tan \phi')/T = [0(140) + 190 \tan 32^\circ]/90 = 1.32$.
42. A - $FS = (c' + N \tan \phi')/T = [5(100) + 170 \tan 28^\circ]/90 = 6.56$.
43. B - $FS = (c' + N \tan \phi')/T = [0(160) + 210 \tan 35^\circ]/90 = 1.63$.
44. B - Vertical drains shorten the drainage path and accelerate consolidation under surcharge.
45. D - Lime reduces plasticity and improves workability/strength in many clayey soils.
46. B - Separation maintains aggregate-base integrity by limiting mixing with subgrade.
47. D - A filter must retain the base soil while allowing drainage without excessive clogging.
48. C - Reinforcement supplies tensile resistance across potential failure surfaces.
49. B - Surcharge/preloading causes consolidation in advance, reducing postconstruction settlement.
50. A - Lower subgrade support requires additional pavement/base structural capacity.
51. B - Filters and drains control pore pressures while preventing migration of soil particles.
52. C - Sliding may localize along the weakest geosynthetic/soil or geosynthetic/geosynthetic interface.
53. C - Aggregate piers reinforce the soil mass, share load, and may provide drainage.

Groundwater and Seepage

54. A - $Q = k_i A = 0.002(0.5)(100) = 0.100 \text{ ft}^3/\text{s}$.
55. A - $Q = k_i A = 0.001(0.8)(150) = 0.120 \text{ ft}^3/\text{s}$.
56. D - $Q = k_i A = 0.003(0.4)(80) = 0.096 \text{ ft}^3/\text{s}$.
57. A - At the critical upward gradient, seepage force offsets submerged unit weight and effective stress approaches zero.
58. D - Closely spaced wellpoints are commonly used to lower groundwater in sands.
59. C - A low-permeability cutoff lengthens/intercepts the seepage path and reduces flow.

Problematic Soil and Rock Conditions

60. A - Expansive minerals swell as water content increases.
61. C - Wetting destroys metastable bonding/fabric, producing collapse under load.
62. B - Water migration to the freezing front is essential for ice-lens growth.
63. A - Karst commonly features voids, pinnacles, sinkholes, and highly irregular rockhead.
64. B - Low soil resistivity is a key indicator of potential electrochemical corrosion.
65. A - Scaling removes loose blocks; mesh, anchors, and catchments control remaining hazards.

Retaining Structures

66. A - $K_a = (1 - \sin \phi)/(1 + \sin \phi) = 0.268$; $P_a = \frac{1}{2} K_a \gamma H^2 = 2.3 \text{ kip/ft}$, acting $H/3$ above the base.
67. A - $K_a = (1 - \sin \phi)/(1 + \sin \phi) = 0.231$; $P_a = \frac{1}{2} K_a \gamma H^2 = 3.1 \text{ kip/ft}$, acting $H/3$ above the base.
68. D - $K_a = (1 - \sin \phi)/(1 + \sin \phi) = 0.306$; $P_a = \frac{1}{2} K_a \gamma H^2 = 1.9 \text{ kip/ft}$, acting $H/3$ above the base.
69. B - $K_a = (1 - \sin \phi)/(1 + \sin \phi) = 0.176$; $P_a = \frac{1}{2} K_a \gamma H^2 = 2.0 \text{ kip/ft}$, acting $H/3$ above the base.
70. A - $K_a = (1 - \sin \phi)/(1 + \sin \phi) = 0.268$; $P_a = \frac{1}{2} K_a \gamma H^2 = 5.3 \text{ kip/ft}$, acting $H/3$ above the base.
71. A - The centroid of a triangle increasing with depth is $H/3$ above its base.
72. B - A uniform surcharge produces uniform lateral pressure $K_a q$.
73. C - Full passive resistance requires relatively large movement and may not remain available.
74. C - Drainage prevents water pressure from adding to lateral earth loads.
75. B - External stability includes sliding, overturning/eccentricity, and foundation bearing/global stability.
76. A - Anchors transfer tensile load into stable ground behind the potential failure zone.
77. C - Struts brace opposing walls and are principally compression members.
78. D - Underpinning provides deeper or supplemental support to protect existing foundations.
79. D - Soil nail walls are commonly built top-down with excavation lifts, nails, and facing.

Shallow Foundations

80. B - $q_{ult} = 23,400 \text{ psf}$; $q_{all} = q_{ult}/3 = 7,800 \text{ psf} = 3.9 \text{ ksf}$.
81. D - $q_{ult} = 16,365 \text{ psf}$; $q_{all} = q_{ult}/3 = 5,455 \text{ psf} = 2.7 \text{ ksf}$.
82. A - $q_{ult} = 22,300 \text{ psf}$; $q_{all} = q_{ult}/3 = 7,433 \text{ psf} = 3.7 \text{ ksf}$.
83. C - $q_{ult} = 29,245 \text{ psf}$; $q_{all} = q_{ult}/3 = 9,748 \text{ psf} = 4.9 \text{ ksf}$.
84. D - Eccentricity reduces effective bearing area and can create nonuniform contact pressure.

- 85. D - Granular soils drain rapidly, so settlement is predominantly immediate.
- 86. B - Slow dissipation of excess pore pressure governs time-dependent settlement in saturated clay.
- 87. A - Wider loaded areas influence stresses to greater depths.
- 88. A - Average contact pressure $q=P/A$ decreases as area increases.

Deep Foundations

- 89. D - $Q_n = q_p A_p + f_s A_s = 80(4) + 1.2(180) = 536$ kips.
- 90. A - $Q_n = q_p A_p + f_s A_s = 100(3) + 1.0(200) = 500$ kips.
- 91. C - $Q_n = q_p A_p + f_s A_s = 60(5) + 1.5(160) = 540$ kips.
- 92. A - $Q_n = q_p A_p + f_s A_s = 90(4) + 1.1(220) = 602$ kips.
- 93. B - Downward relative movement of soil drags the pile, adding downdrag load.
- 94. D - The test measures applied load and corresponding pile-head movement.
- 95. B - Wave measurements can estimate mobilized resistance, stresses, and hammer performance.
- 96. A - CSL identifies anomalous zones in drilled-shaft concrete between tubes.
- 97. D - Group failure may occur by individual pile resistance or as a block; the governing mode controls.
- 98. C - Lateral load transfer and maximum bending commonly involve the upper portion of the pile-soil system.
- 99. A - Displacement driving can densify sand and displace soil, sometimes heaving adjacent piles.
- 100. C - Rock sockets can mobilize side shear and base bearing subject to construction quality and design criteria.

Performance Tracker

Knowledge area	Correct	Total	Review notes
Site Characterization		12	
Soil Mechanics, Laboratory Testing, and Analysis		12	
Construction Observation, Monitoring, QA/QC, and Safety		8	
Earthquake Engineering and Dynamic Loads		7	
Earth Structures, Ground Improvement, and Pavement		14	
Groundwater and Seepage		6	
Problematic Soil and Rock Conditions		6	
Retaining Structures		14	
Shallow Foundations		9	
Deep Foundations		12	

Prioritize knowledge areas that remain below your overall average. Redo missed calculations without viewing the worked solution.