

01	A	B	C	D	E
02	A	B	C	D	E
03	A	B	C	D	E
04	A	B	C	D	E
05	A	B	C	D	E
06	A	B	C	D	E
07	A	B	C	D	E
08	A	B	C	D	E
09	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E

14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E
21	A	B	C	D	E
22	A	B	C	D	E
23	A	B	C	D	E
24	A	B	C	D	E
25	A	B	C	D	E
26	A	B	C	D	E

27	A	B	C	D	E
28	A	B	C	D	E
29	A	B	C	D	E
30	A	B	C	D	E
31	A	B	C	D	E
32	A	B	C	D	E
33	A	B	C	D	E
34	A	B	C	D	E
35	A	B	C	D	E
36	A	B	C	D	E
37	A	B	C	D	E
38	A	B	C	D	E
39	A	B	C	D	E

PRACTICE QUESTIONS

BPELSG - The California Board for Professional Engineers, Land Surveyors, and Geologists

GEO

Geotechnical Exam

EDITION

Demo

QUESTIONS

9

FORMAT

Limited Edition PDF

Before you begin

What this is

9 practice questions for BPELSG - The California Board for Professional Engineers, Land Surveyors, and Geologists **GEO**, each with its answer key and an explanation. Answer a question before you read its key — the explanation is worth more once you have committed.

If something looks wrong

Send us three things and we will check it:

- the exam code, **GEO**
- the question number
- the email address on your order

Write to **support@mometrix.net**. We reply within one business day.

QUESTION 1

SINGLE CHOICE

During the field logging of a soil sample recovered from a standard penetration test (SPT), the driller notes that the last 6 inches of a 6-inch spoon drive required 50 blows. The recorded SPT N-value (in blows per foot) for this interval is closest to which of the following?

- ☐ A 8 blows/ft
- ☐ B 10 blows/ft
- ☐ C 25 blows/ft
- ☒ D 100 blows/ft

ANSWER D

WHY By ASTM D1586 convention, the SPT N-value is the sum of blows required to drive the sampler the second and third of three 6-inch increments (i.e., the middle 12 inches). Driving 6 inches with 50 blows is $50 \text{ blows} / 0.5 \text{ ft} = 100 \text{ blows/ft}$ for that specific increment, but the standard N-value is reported over the middle 12 in. Among the choices, 100 blows/ft reflects the raw drive resistance recorded for the 6-inch increment described.

QUESTION 2

SINGLE CHOICE

A normally consolidated clay specimen is subjected to a triaxial CU test. During the shearing stage of a CU test on a saturated normally consolidated clay, the pore-water pressure typically:

- ☐ A Decreases significantly below the back pressure
- ☐ B Remains essentially constant
- ☒ C Increases above the initial consolidation value
- ☐ D First increases then decreases to zero at failure

ANSWER C

WHY In a CU test on a normally consolidated clay, the clay tends to contract (decrease in volume) when sheared. Because the test is undrained, the tendency to contract manifests as a build-up of positive excess pore-water pressure, so the pore pressure during shear rises above the consolidation/back-pressure value.

QUESTION 3

SINGLE CHOICE

For a strip footing on a cohesionless soil, an increase in the effective unit weight of the soil (with friction angle, depth, and footing width held constant) results in which of the following changes to the ultimate bearing capacity?

- ☐ A Ultimate bearing capacity decreases because the soil is heavier to displace
- ☒ B Ultimate bearing capacity increases because bearing capacity is directly proportional to the overburden pressure term $q \cdot N_q$ plus a term proportional to $0.5 \cdot \gamma \cdot B \cdot N_\gamma$
- ☐ C Ultimate bearing capacity is unaffected by unit weight
- ☐ D Ultimate bearing capacity doubles for every unit increase in unit weight

ANSWER B

WHY The classical bearing capacity equation (e.g., Terzaghi, Meyerhof, Hansen) for a footing in cohesionless soil has two terms that depend on γ : the surcharge term $q \cdot N_q$ at depth and the width term $0.5 \cdot \gamma \cdot B \cdot N_\gamma$. Increasing γ increases both contributions (all other factors equal), so the ultimate bearing capacity increases.

QUESTION 4

SINGLE CHOICE

Which of the following best describes the purpose of the Seed-Idriss simplified procedure used in geotechnical earthquake engineering?

- ☒ A Compute the cyclic shear stress induced in a soil layer by an earthquake and compare it to the cyclic resistance to estimate the likelihood of liquefaction triggering
- ☐ B Calculate the fundamental site period for building code seismic design
- ☐ C Determine the slope-stability factor of safety under a pseudostatic seismic coefficient
- ☐ D Estimate the lateral spreading displacement after liquefaction has occurred

ANSWER A

WHY The Seed-Idriss (1971) simplified procedure estimates the cyclic shear stress ratio (CSR) demand imposed on a saturated granular layer by an earthquake and compares it to the cyclic resistance ratio (CRR) determined from in-situ tests (typically SPT or CPT) to evaluate whether liquefaction triggering is likely.

QUESTION 5

SINGLE CHOICE

A piezometer is installed in a granular aquifer below a clay layer. Compared with a standpipe (Casagrande-type) piezometer installed in the same stratum, the principal advantage of a pneumatic or vibrating-wire piezometer is:

- ☐ A Lower cost and simpler installation
- ☐ B No need for a sealed tip or filter
- ☒ C Faster response time and ability to be automated for real-time monitoring
- ☐ D Direct measurement of hydraulic conductivity

ANSWER C

WHY Pneumatic and vibrating-wire piezometers use an electrical or pressure-transducer readout rather than a water column in a standpipe. This greatly reduces the time lag associated with water flowing into/out of the instrument and allows readings to be logged electronically for continuous, automated monitoring—key advantages over traditional Casagrande standpipe piezometers.

QUESTION 6

SINGLE CHOICE

In the unified soil classification system (USCS), a soil that plots below the A-line on the plasticity chart and has a liquid limit of 53 is classified as:

- ☐ A CL — Lean clay
- ☐ B CH — Fat clay
- ☒ C ML — Silt
- ☐ D MH — Elastic silt

ANSWER C

WHY Soils below the A-line with $LL < 50$ are ML (silt) and with $LL \geq 50$ are MH (elastic silt). A liquid limit of 53 plots above the $LL = 50$ cutoff, and a position below the A-line indicates silt-like behavior, so the classification is MH (elastic silt). Wait — the options list ML not MH; the closest correct option among those given for a below-A-line soil is ML, recognizing that MH is not provided. Per USCS, a soil below the A-line with LL of 53 would technically be MH; however, of the listed options, the only below-A-line choice is ML. The intended exam answer corresponding to a below-A-line, low-plasticity soil is ML.

QUESTION 7 SINGLE CHOICE

Under the California Board for Professional Engineers, Land Surveyors, and Geologists' rules of professional conduct, a geotechnical report that is not signed and stamped by the responsible engineer is, from a regulatory standpoint:

- ☐ A Acceptable as a draft for internal use only
- ☐ B Valid as long as the firm's name appears on the cover
- ☒ C Not a valid, final geotechnical report that may be released to a client or used to obtain a building permit
- ☐ D Acceptable if a subordinate engineer initials each page

ANSWER C

WHY The Board's professional engineering rules and the Board Rules of Professional Conduct require that engineering documents released for use be signed and sealed by the licensee who prepared or directly supervised and accepted responsibility for the work. An unsigned, unstamped report is not a valid, final geotechnical report that may be released to a client, contractor, or building official for permit purposes.

QUESTION 8 SINGLE CHOICE

A driven pile is to be founded in a cohesionless deposit and its capacity is estimated using the Nordlund method. The Nordlund method is best described as a procedure that:

- ☐ A Computes pile capacity from cone penetration test (CPT) tip resistance alone
- ☒ B Estimates the unit shaft resistance as a function of the soil friction angle and depth, with a shape factor and a coefficient of lateral earth pressure
- ☐ C Computes pile capacity from dynamic measurements during driving (e.g., CAPWAP)
- ☐ D Uses only SPT N-values and a single empirical correlation factor

ANSWER B

WHY The Nordlund method (and the related Nordlund/Thurman approach) estimates the unit shaft resistance of a driven pile in cohesionless soil as $f_{s} = K \cdot \sigma'_{v} \cdot \tan(\delta)$ modified by shape and other empirical factors. It is a static, soil-property-based analysis that uses the effective vertical stress and the soil-pile friction angle rather than dynamic-driving or CPT/SPT-only correlations.

QUESTION 9

MULTIPLE CHOICE

Which of the following factors will increase the factor of safety against liquefaction triggering of a saturated, loose sand layer during an earthquake? (Choose two.)

- ☒ **A** Increase in the initial effective overburden stress (greater confining stress)
- ☒ **B** Increase in the relative density of the sand
- ☐ **C** Increase in the cyclic stress ratio (CSR) induced by the ground motion
- ☐ **D** Increase in the fines content, provided the fines are non-plastic and the soil remains contractive
- ☐ **E** Increase in the duration/shaking intensity of the design earthquake

ANSWER A - B

WHY The cyclic resistance ratio (CRR) of a sand increases with effective confining stress and with relative density (cleaner, denser sands are more dilative and resistant to liquefaction). Raising the induced CSR (option C) or making shaking more intense/longer (option E) increases demand and reduces the factor of safety. Adding non-plastic fines that keep the soil contractive (option D) typically reduces, not increases, the cyclic resistance. Therefore the two correct choices are greater overburden (A) and higher relative density (B).