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PRACTICE QUESTIONS

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

PGP

Professional Geophysicist

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 **PGP**, 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, **PGP**
- the question number
- the email address on your order

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

QUESTION 1

SINGLE CHOICE

A seismic refraction survey is performed over a two-layer earth in which the deeper layer has a higher P-wave velocity than the shallower layer. Which statement correctly describes the head-wave (refracted) arrival recorded at geophones offset beyond the crossover distance?

- ☐ **A** It travels along a direct path through the upper layer at the velocity of the upper layer.
- ☐ **B** It travels downward and upward entirely within the lower layer, obeying Snell's law at the refracting interface.
- ☒ **C** It travels along the top of the lower layer at the velocity of the lower layer, with energy continuously refracted back to the surface along the interface.
- ☐ **D** It is always the first arrival regardless of source-to-receiver offset.

ANSWER C

WHY In seismic refraction, a head wave travels along the top of a higher-velocity deeper layer at that layer's velocity, with energy being continuously refracted (at the critical angle) back to the surface detectors. Option A describes the direct wave, option B confuses the head wave with a reflection path, and option D is incorrect because the direct wave arrives first at short offsets (before the crossover distance).

QUESTION 2

SINGLE CHOICE

Which correction must be applied to a land gravity measurement in order to remove the effect of the elevation of the station above or below the geoid (i.e., the variation in gravitational attraction due purely to the distance from Earth's center)?

- ☐ A Bouguer correction
- ☐ B Latitude correction
- ☒ C Free-air correction
- ☐ D Terrain correction

ANSWER C

WHY The free-air correction accounts for the decrease (or increase) in gravitational attraction simply because the station is above (or below) the reference datum, with no slab correction applied. The Bouguer correction additionally subtracts the attraction of an infinite horizontal slab of rock between the station and datum. Latitude correction removes the centrifugal and reference-ellipsoid effect, and the terrain correction removes the effect of surface relief around the station.

QUESTION 3

SINGLE CHOICE

In a time-domain electromagnetic (TDEM) survey, what physical quantity is measured directly by the receiver coil after the transmitter current is abruptly turned off?

- ☐ A The primary magnetic field from the transmitter loop
- ☒ B The induced voltage proportional to the time rate of change of the secondary magnetic field
- ☐ C The static electric potential between two grounded electrodes
- ☐ D The phase shift between two frequencies transmitted simultaneously

ANSWER B

WHY TDEM systems measure the transient decay of the secondary magnetic field produced by eddy currents induced in the subsurface. Because the receiver coil responds to dB/dt (Faraday's law), the measured quantity is the induced voltage proportional to the time rate of change of the secondary field. Option A describes a continuous-wave (frequency-domain) primary measurement, option C describes resistivity/IP, and option D describes a frequency-domain EM measurement.

QUESTION 4

SINGLE CHOICE

Which borehole geophysical log directly measures the natural radioactivity of the formation and is therefore commonly used as a shale (clay) indicator?

- ☒ **A** Gamma-ray log
- ☐ B Spontaneous potential (SP) log
- ☐ C Sonic (acoustic) log
- ☐ D Neutron porosity log

ANSWER A

WHY The gamma-ray log measures natural gamma radiation emitted principally by potassium-40 and by the uranium and thorium series, which are concentrated in clay minerals and shales. The SP log measures natural electrochemical potentials, the sonic log measures interval transit time of compressional waves, and the neutron log responds primarily to hydrogen content (porosity).

QUESTION 5

SINGLE CHOICE

In seismic reflection processing, what is the primary purpose of the normal moveout (NMO) correction applied to common-midpoint (CMP) gathers?

- ☐ A To convert reflection times from two-way time to one-way time
- ☐ B To convert from absolute amplitude to relative amplitude using a spreading-loss factor
- ☒ **C To flatten reflection events by removing the effect of source-to-receiver offset, approximating a zero-offset section**
- ☐ D To migrate dipping reflectors to their true subsurface positions

ANSWER C

WHY NMO correction removes the additional traveltimes caused by the source-to-receiver offset on a reflection event so that arrivals in a CMP gather align at an approximate zero-offset (two-way vertical) traveltime. This stacking preparation is distinct from migration, which repositions dipping events laterally; amplitude corrections; or one-way/time conversions.

QUESTION 6

SINGLE CHOICE

In a magnetotelluric (MT) sounding, the depth of investigation is primarily controlled by which property of the natural source signal?

- ☐ A The amplitude of the magnetic field
- ☐ B The polarization direction of the electric field
- ☒ C The period (frequency) of the variation—longer periods probe deeper
- ☐ D The geographic latitude of the recording site

ANSWER C

WHY MT depth of investigation is governed by the skin depth, which is proportional to the square root of the period (inverse square root of frequency) of the electromagnetic variation. Long-period signals diffuse to greater depths and therefore sense deeper structure, while short-period signals sense shallow structure. Magnetic-field amplitude, polarization, and latitude are not the primary depth controls.

QUESTION 7

SINGLE CHOICE

In linear inverse theory, an inverse problem is described as 'underdetermined' when:

- ☐ A The number of independent data points exceeds the number of model parameters, and the solution is overdetermined.
- ☐ B The number of model parameters equals the number of data points, and the solution is unique if the system is non-singular.
- ☒ C The number of model parameters exceeds the number of independent data, so the system has infinitely many solutions and additional constraints (e.g., damping or smoothing) must be imposed to choose one.
- ☐ D The forward operator is non-linear, regardless of the relative number of data and parameters.

ANSWER C

WHY An underdetermined problem has fewer independent equations (data) than unknowns (parameters), producing a non-unique (infinite) family of solutions; additional criteria such as minimum-norm, damping, or smoothness regularization must be applied. Option A is the definition of an overdetermined problem, option B describes an even-determined system, and option D confuses non-linearity with the data-to-parameter count.

QUESTION 8 SINGLE CHOICE

Under the California Board for Professional Engineers, Land Surveyors, and Geologists practice act, a Professional Geophysicist may seal and sign geophysical work only when:

- ☐ A The work was performed by any subordinate employee, regardless of supervision.
- ☐ B The work was performed by others but merely checked for arithmetic correctness.
- ☒ C The geophysicist either personally performed the work or provided adequate supervision and control of the work, and is competent to perform that work.
- ☐ D The client accepts the report, even if the geophysicist has not reviewed the underlying assumptions.

ANSWER C

WHY California professional practice regulations require that a geophysicist seal only work that he or she either personally performed or that was performed under adequate direct supervision and responsible charge, and only within the geophysicist's area of competence. Sealing unchecked work, work outside one's competence, or work merely accepted by a client is not permitted.

QUESTION 9 SINGLE CHOICE

In a seismic refraction survey over a two-layer earth, the crossover distance is defined as the surface distance at which:

- ☐ A The direct wave arrival time equals the head wave arrival time
- ☒ B The refracted wave from the second layer first appears as a first arrival
- ☐ C The reflection from the first interface equals the direct wave arrival time
- ☐ D The head wave velocity equals the direct wave velocity

ANSWER B

WHY The crossover distance is the source-to-receiver offset at which the head wave (refracted along the top of the higher-velocity second layer) overtakes the direct wave and becomes the first arrival on the travel-time curve. It marks the transition between the segment dominated by the direct wave and the segment dominated by the refracted wave, and it is used graphically (or analytically) together with the intercept time to compute the depth to the refractor.