

PET110

Samples of short-answer questions

1. If a signal amplitude is attenuated (reduced) by a factor of 10, what is the attenuation in decibels?

$$\text{log. att'n} = 20 \log_{10} \left(\frac{A_0}{A_1} \right) \quad \frac{A_0}{A_1} = 10 \quad \underline{\underline{20 \text{ dB}}}$$

2. To represent a seismic signal without aliasing, how densely must it be sampled if the highest frequency in the signal is 500 Hz?

Sampling frequency f_s

$$f_s = 2 \times f_{\text{max}}; \quad \Delta t_s = \frac{1}{f_s} \quad \Delta t = 0.001 \text{ s} = \underline{\underline{1 \text{ ms}}}$$

3. Wavelet A has a much broader amplitude spectrum than wavelet B. What can you say about the two wavelets themselves?

Wavelet A much narrower than B.

4. What do we call the elastic modulus that is equal to pressure divided by volumetric strain?

incompressibility - or - bulk modulus

5. What kind of seismic wave is most analogous to a vibrating guitar string?

S

6. How would the P-wave velocity of a porous, water-saturated sandstone change if some of the water were replaced by natural gas?

reduces

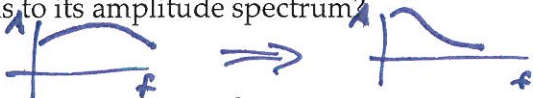
7. How would the S-wave velocity of a porous, water-saturated sandstone change if some of the water were replaced by natural gas?

~ no change

8. A seismic wavelet, generated by an airgun, propagates in all directions through a layered rock medium. What mechanisms will be active in decreasing the amplitude of wavelets recorded back at the surface after reflection at some depth?

attenuation or ϵ absorption / geometric spreading / partitioning
or internal friction / or spherical divergence / or reflection & transmission

9. As a seismic wavelet propagates further and further through a rock medium, what happens to its amplitude spectrum?



ampl. sp. narrower due to loss of higher f

10. When a P-wave strikes the interface between two rock layers at some oblique angle (e.g., angle of incidence = 30°), what happens? That is, what waves travel on from there?

In gen'l: reflected P and S transmitted P and S

11. Write down an equation that expresses Snell's law.

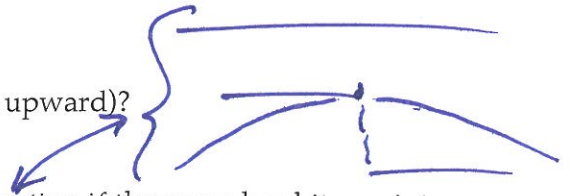
$$\frac{\sin \theta_1}{v_1} = \frac{\sin \theta_2}{v_2}$$

$$D = \frac{\sin \theta}{v} = \text{const}$$

12. If a seismic reflector (i.e., a layer boundary) has a reflection coefficient of R, what is the factor (in terms of R) that quantifies the effect on wave amplitude due to transmission

$$T_{\downarrow} = 1 - R \quad T_{\uparrow} = 1 + R \quad (1 - R)(1 + R) = 1 - R^2$$

through the boundary twice (once downward, once upward)?



13. What kind of pattern do we often see on a seismic section if the wave has hit a point, or an edge (like the termination of a reflecting boundary at a fault)?

diffraction (hyperbola)

14. What kind of mathematical curve (or function) might we see for the traveltime curve on a seismic shot gather representing the reflection from the horizontal base of a single layer?

hyperbola

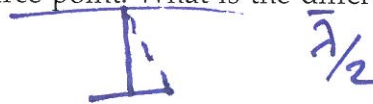
15. What do we call a seismic gather for which the halfway point between source and receiver locations is the same for all traces?

CMP

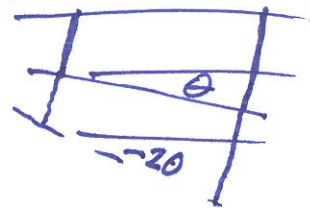
16. What do we call a seismic gather in which each trace was recorded at the same receiver location?

common-receiver gather

17. Consider two seismic travel paths. Along one path a wavelet travels straight down (to the centre of a Fresnel zone), then reflects and returns straight up to the source point. Along the other, the wavelet travels obliquely downward to the edge of the Fresnel zone, then reflects and returns to the source point. What is the difference between the lengths of these two-way paths?



18. On a marine seismic line, the seafloor reflection is dipping at an angle θ . What dip will be observed on the seafloor multiple (i.e., down and up twice)?



19. What is another name for f - k filtering?

velocity f / frequency-wavenumber

20. What do the letters VSP stand for?

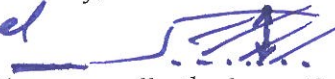
vertical seismic profiling

21. In a marine gravity survey, what observations does one have to acquire in order to be able to carry out the Eötvös correction?

v of ship, bearing, latitude

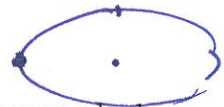
22. If you apply the Bouguer correction in a gravity survey, what does it correct for?

mass between gbs'n level & ref. level

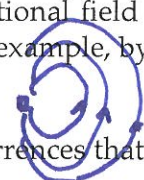
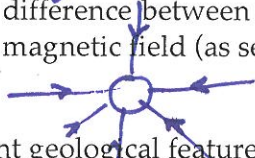


23. Where on the Earth is the gravitational acceleration normally the lowest?

~ equator



24. What is the basic difference between a gravitational field (as set up, for example, by a point mass) and a magnetic field (as set up, for example, by a small bar magnet)?



single pole dipole field

25. Name two different geological features or occurrences that you might be able to map by carrying out a gravity survey.

salt body / carb. reef / faults w. vertical throws

