

Instructions

Here are some instructions

- Instruction 1
- Instruction 2

1. Which of the following statements is TRUE about P-waves and S-waves?
 - (a) Particle motion for P-waves is parallel to the propagation direction and particle motion for S-waves is transverse.
 - (b) P-waves can't propagate through fluids
 - (c) S-waves propagate faster than P-waves
 - (d) Both the P-wave and S-wave velocities depend on the bulk modulus

2. With regards to magnetic susceptibility, which of the following is INCORRECT?
 - (a) Magnetic susceptibility is a unitless quantity.
 - (b) The magnetic susceptibility of a rock is dependent on the concentration of susceptible minerals (magnetite) within the rock.
 - (c) The magnetic susceptibility of a rock depends on its size.
 - (d) Magnetic susceptibility describes the linear relationship between induced magnetism and the inducing magnetic field.
 - (e) Both a) and c) are incorrect.

3. You would like to perform a geophysical survey to differentiate magnetite-rich rock from a background rock type. What would be the most useful diagnostic physical properties to consider?
 - (a) Dielectric permittivity
 - (b) Magnetic susceptibility
 - (c) Density
 - (d) b) and c) are correct
 - (e) a), b) and c) are correct

4. Which of the following are CORRECT statements about the dielectric permittivity?
 - (a) Dielectric permittivity has units Farads/m but the relative permittivity is unitless
 - (b) Dielectric permittivity determines how strongly a material is electrically polarized when subjected to an electric field
 - (c) Dielectric permittivity is an important physical property for GPR
 - (d) b) and c) are correct
 - (e) a), b) and c) are correct

5. What is the correct seven-step process?
 - (a) Setup, surveys, data, processing, properties, interpretation, synthesis
 - (b) Setup, properties, surveys, data, processing, interpretation, synthesis
 - (c) Properties, setup, surveys, data, processing, interpretation, synthesis
 - (d) Setup, properties, surveys, data, processing, synthesis, interpretation

6. Geophysical surveys provide information about the distribution of a physical property. Why can't geophysical surveys be used to differentiate different rock types directly?
 - (a) Because you need information about the rock's chemical structure first.
 - (b) Because different rock types can have different values for the same physical property.
 - (c) Because different rock types can have the same value for a diagnostic physical property.
 - (d) Because a single rock unit is described by multiple physical property values.

7. Which statement in the list below is TRUE:
 - (a) A geophysical target is detectable so long as it has non-zero physical property values.
 - (b) A geophysical target is detectable so long as there is a physical property contrast between itself and the surrounding rocks.
 - (c) A geophysical target is detectable if its dimensions are larger than its depth of burial.
 - (d) A geophysical target is detectable if it has two physical properties that are not the same.

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8. When learning about ground penetrating radar (GPR), which electromagnetic property did we NOT consider?
- (a) Magnetic permeability
 - (b) Dielectric permittivity
 - (c) Electrical conductivity
 - (d) We didn't consider magnetic permeability or electrical conductivity
9. Which of the following properties are diagnostic physical properties in geophysics? (circle them):
- (a) density
 - (b) clay content
 - (c) location of rock type
 - (d) hardness
 - (e) grain size distribution
 - (f) electrical conductivity
 - (g) magnetic susceptibility
10. Consider the path which electrical current takes through a rock. Which of the following statements is true?
- (a) All of the electrical current flows through the mineral grains in the rock
 - (b) If the rock is saturated, all of the current flows through pore water
 - (c) Electrical current flows through the pore water and through mineral grains to varying degrees
 - (d) Electrical current flows through the pore water and through the mineral grains in equal amounts
11. You measure a resistance of $16 \text{ k}\Omega$ between two parallel faces of a $2\text{cm} \times 2\text{cm} \times 2\text{cm}$ cube. Determine the resistivity.
- (a) $320 \text{ }\Omega\text{m}$
 - (b) $800000 \text{ }\Omega\text{m}$
 - (c) $32000 \text{ }\Omega\text{m}$
 - (d) $8000 \text{ }\Omega\text{m}$

12. Why does a water-saturated sandstone typically have a higher P-wave velocity than a dry sandstone? A saturated sandstone:
 - (a) is more dense.
 - (b) has a larger bulk modulus.
 - (c) has a larger shear modulus.
 - (d) has a higher tensile strength.

13. When considering minerals that contain metallic elements, which out of the following statements is TRUE?
 - (a) Minerals that contain metallic elements arent always dense, susceptible or conductive.
 - (b) Minerals that contain metallic elements arent always dense or susceptible but they are conductive.
 - (c) Minerals that contain metallic elements arent always dense or conductive but they are susceptible.
 - (d) Minerals that contain metallic elements arent always susceptible or conductive but they are dense.

14. What is NOT done during the synthesis step?
 - (a) We look for structures within the models created using geophysical inversion.
 - (b) Our interpretation is compared against other known information about the problem.
 - (c) We assess whether our geophysical survey was successful
 - (d) We assess whether our current understanding of the geophysical target is sufficient

15. What do we mean when we say a rock is "chargeable"?
 - (a) It turns electrical current into magnetization
 - (b) It always has a large clay content
 - (c) It likely contains clays and/or sulphide minerals
 - (d) It experiences a build-up of ionic charges when a voltage is applied
 - (e) d) and e) are correct

16. You would like to use geophysical surveying to locate a near-surface network of caves within a large unit of limestone. For the following survey methods, state whether they would be an appropriate choice (Yes/No). In one sentence, justify your answer using a comparison in physical property values.
- (i) Would a DC resistivity survey be appropriate? Why?
 - (a) Yes. The void space of the cave is infinitely more resistive than the host limestone.
 - (ii) Would a magnetic survey be appropriate? Why?
 - (b) No. Neither the air or limestone is susceptible.
 - (iii) Would a gravity survey be appropriate? Why?
 - (c) Yes. The density of the void space is lower than the host limestone
 - (iv) Would a GPR survey be appropriate?
 - (d) Yes. There is sufficient contrast in dielectric permittivity between free space and limestone