1. Which of the following statements are true?
   (a) Higher dielectric permittivity results in faster propagation velocities for GPR signals
   (b) Higher dielectric permittivity results in a larger spatial lengths (i.e. thicker wavefronts)
   (c) a) and b) are true
   (d) The opposite of a) and b) are true

2. In order to use the slope of a hyperbolic radargram signature to obtain a layer velocity, what must the shape of the object be?
   (a) A point reflectors
   (b) A thick pipes
   (c) A rectangular block
   (d) Shape doesn't matter as long as we are far enough away

3. Which of the following scenarios results in "ringing"
   (a) When two very reflective objects are too close together
   (b) When the GPR signal hits a layer which is too thin
   (c) Poor calibration of the receiver antenna
   (d) a) and c) are correct

4. Which of the following statements is incorrect when considering skin depth in GPR
   (a) Skin depth is the distance at which the signal amplitude has decreased to 37% of its original amplitude.
   (b) Skin depth is dimensionless.
   (c) As conductivity increases, the skin depth decreases.
   (d) As electrical permittivity increases, the skin depth increases.
   (e) b and d are incorrect statements.

5. What is the most common GPR survey configuration?
   (a) common midpoint
   (b) common offset
   (c) common shot gather
   (d) transillumination configuration

6. Comparing GPR with seismic, which of the following statements is INCORRECT?
   (a) Ray path tracing holds for both of them.
   (b) Snells law holds for both of them.
   (c) When considering the reflection coefficient, the dielectric constant for GPR is analogous to the acoustic impedance in seismology.
   (d) The first arrival for both cases is always the wave propagating in the top layer of the earth.

7. What is the maximum amount of information that can be obtained by analyzing a hyperbolic curve on a GPR cross section?
   (a) Location of the target, velocity of the upper region and dielectric constant
   (b) Velocity of upper region and depth of the target
   (c) Conductivity, dielectric constant and velocity of the upper region
   (d) Horizontal and vertical location of the target

8. Which of the following is NOT a processing technique used to make returning GPR signals more easily visible
   (a) Stacking
   (b) Smoothing
   (c) Arrival time to depth conversion
   (d) Gain correction

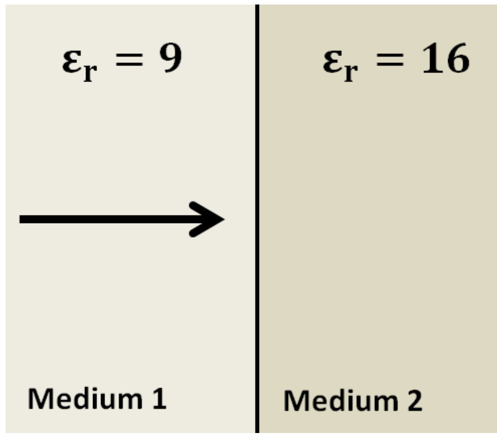
9. The probing distance for ice is much larger than other materials. Why?
   (a) It has a low conductivity
   (b) It has a low dielectric permittivity
   (c) It is non-permeable
   (d) The probing distance of ice doesn't depend on frequency

10. You want to perform a GPR survey. Which of the following would be the least helpful when designing your survey?
   (a) Knowing something about the local physical properties
   (b) Knowing how deep you needed to image into the Earth
   (c) Knowing the dimensions of the target of interest
   (d) Having your survey lines previously established

11. What is the expression for the arrival time of a critically refracted GPR signal at the Earth's surface?
   (a) $t = \dfrac{x}{c}$
   (b) $t = \dfrac{x}{v}$
   (c) $t = \dfrac{x}{c} + constant$
   (d) $t = \dfrac{\sqrt{x^2 + 4h^2}}{v}$

12. A GPR wavelet with a long pulse with will:
   (a) have a large bandwidth
   (b) have a large central frequency
   (c) short wavelength
   (d) none of the above

13. Consider the case below where a GPR signal is approaching a perpendicular interface. What is the transmission coefficient for the wave at this interface?



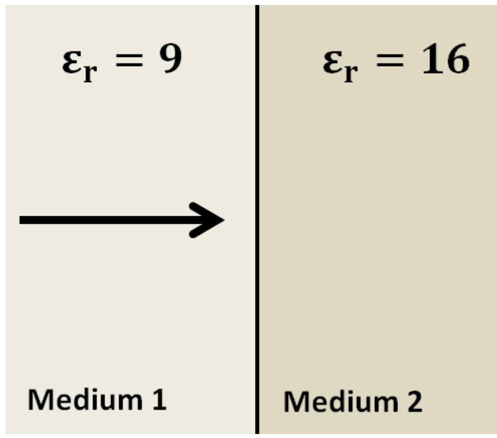
(a) 1.14

(b) 1.31

(c) 0.45

(d) 0.78

14. Consider the case below where a GPR signal is approaching a perpendicular interface. What can we say about this particular scenario?



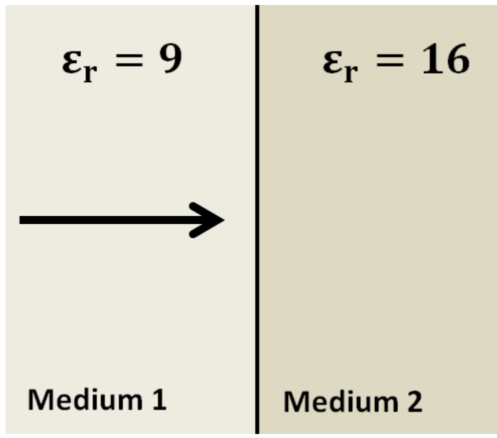
(a) Most of the wave is transmitted and the reflected signal experiences a reverse in polarity

(b) Most of the wave is transmitted and the reflected signal does not experience a reverse in polarity

(c) Most of the wave is reflected and the reflected signal experiences a reverse in polarity

(d) Most of the wave is reflected and the reflected signal does not experience a reverse in polarity

15. Consider the case below where a GPR signal is approaching an interface. What can we say about the GPR signals in each medium?



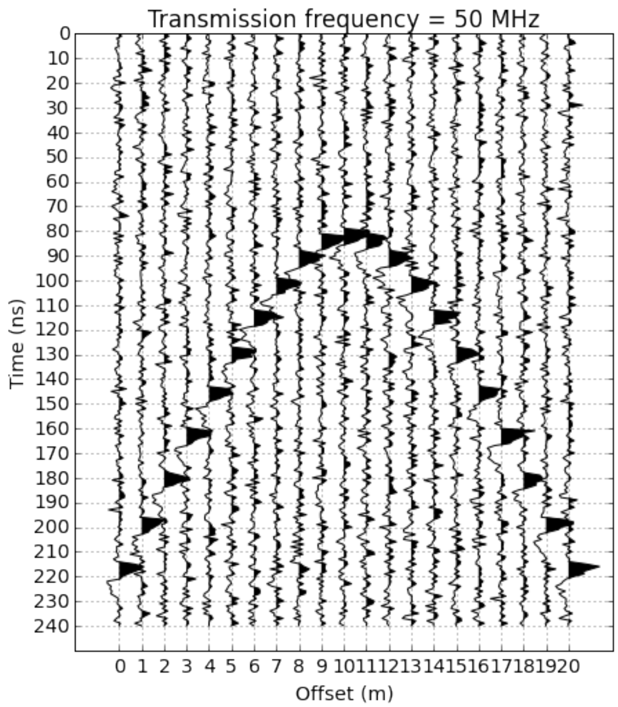
(a) GPR signals propagate slower through medium 1

(b) The resolution for distinguishing objects is better in medium 2

(c) The thickness of the wavefront is larger in medium 2

(d) As a portion of the wavefront is transmitted from medium 1 to medium 2, it will refract towards the horizontal

16. A zero-offset GPR survey was performed over a buried pipe. The acquisition line was perpendicular to the pipe. Below, we see the resulting radargram. The horizontal axis for the radargram is offset (or distance) from a particular location and **not** the Tx-Rx separation distance.



(a) Using this signature, estimate the propagation velocity and relative permittivity of the background medium (c = 0.3 m/ns).

(b) What is the depth and horizontal location of the pipe?

(c) If there happened to be a second pipe located near the first one, how far would the pipes need to be from one another horizontally to be distinguishable in the radargram?

(d) If the background conductivity was 0.01 S/m, would you be able to image the pipe with a 1000 MHz system? Defend your answer.