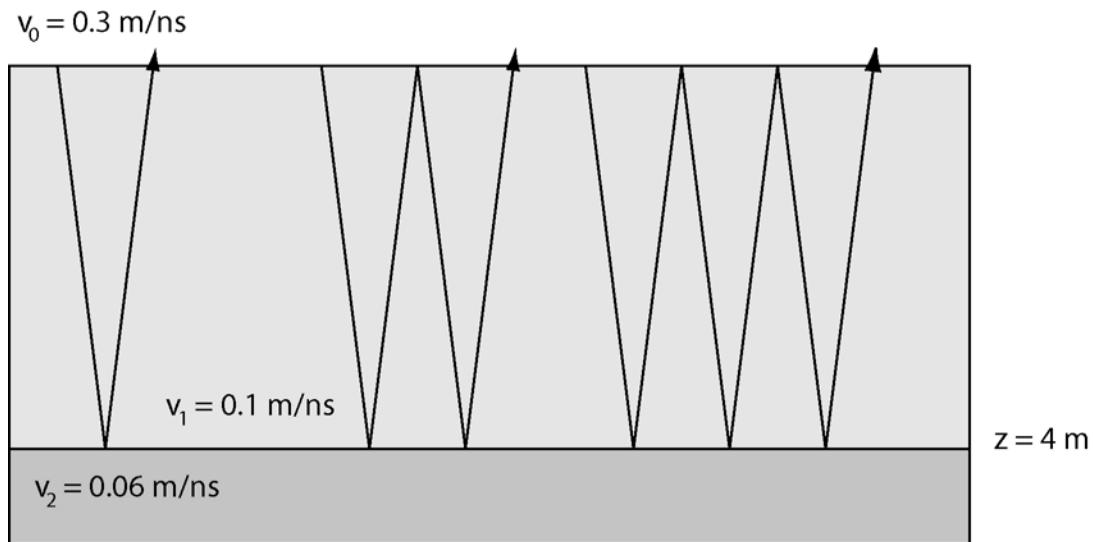


## Geophysics 223 Assignment 5

This assignment is for review and will not be graded. Solutions will be provided in the review class on April 21 2009.

### Question 1 – Multiple reflections in GPR data

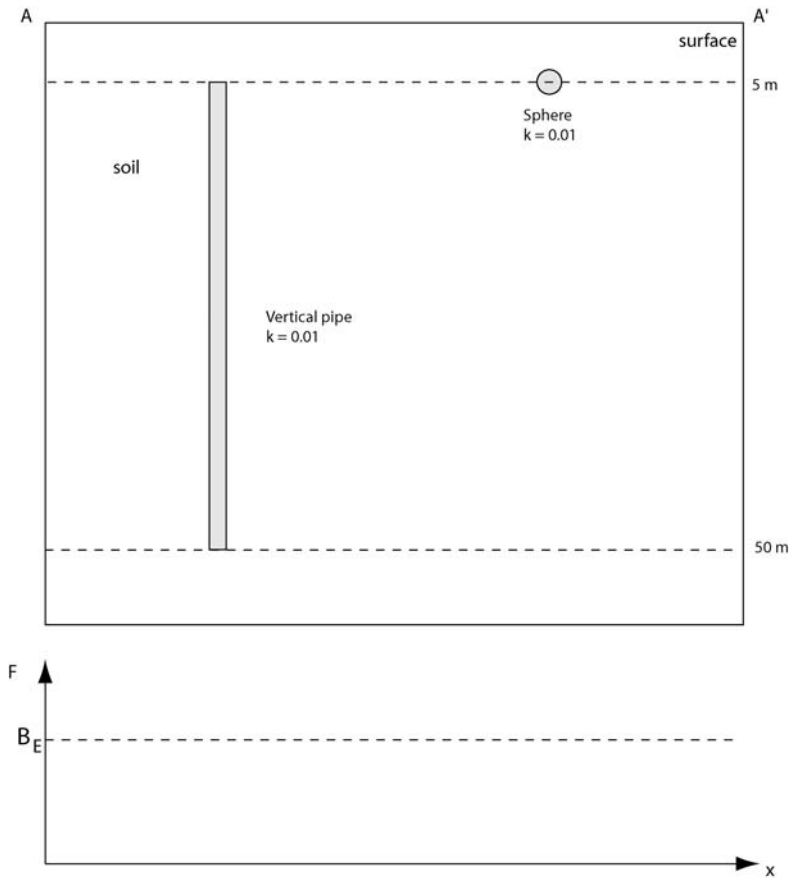


- Compute the amplitudes of the three reflections shown above in a GPR survey
- The upper layer has a resistivity of  $25 \Omega\text{m}$ . What is the highest radar frequency that could be used to detect the interface at 4 m depth?

### Question 2 – Electromagnetic and electrical methods

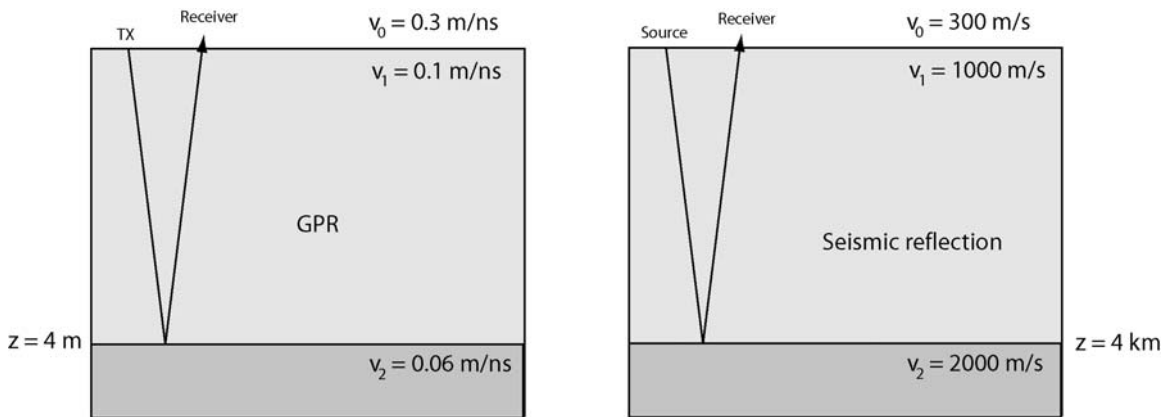
- Explain the basic difference between **time-domain** and **frequency domain** EM methods. Include a sketch of the primary, secondary and total magnetic fields as a function of time.
- Explain how a time domain electromagnetic survey can distinguish a region of **high resistivity** from one of **low resistivity**.
- What limits the **depth of exploration** in an EM31 survey? The soil resistivity is  $100 \Omega\text{m}$  and the frequency used is 9KHz.
- Why is an **oscillating** magnetic field used in an EM31 survey?
- Why is the electric current switched +/- in a DC resistivity survey?

**Question 3 – Magnetic anomalies**



- Sketch the **total magnetic field anomaly** observed along the profile A-A' for a survey at the North Magnetic Pole. Estimate the relative **half width** of the magnetic anomalies.
- Repeat for a magnetic survey at the Magnetic Equator where the direction AA' is parallel to magnetic North.
- Draw a **map** of the total magnetic field anomaly around the pipe and sphere for each case (a) and (b).
- Explain how a rock develops **detrital remnant magnetization**
- When was the **last reversal** of the Earth's magnetic field?
- How does the **Sun** influence magnetic surveys?

**Question 4 – Comparison of seismic reflection and GPR**



- (a) Sketch the travel time curves for the GPR survey. Show the air wave, ground wave and reflection. Consider the transmitter-receiver distance varying from 0 to 4 m.
- (b) Sketch the travel time curves for the seismic reflection survey. Show the air wave, ground wave and reflection. Consider the Source-receiver distance varying from 0 to 4 km.

**Question 5**

In the context of Geophysics 223, what do the following abbreviations stand for?

DC, HRAM, NMO, TDS, CEC, DNAPL, IGRF, VLF, INPUT, DIGHEM, PPM, UXO, VETEM, IP, GPR

Both serious and non-serious answers will be accepted