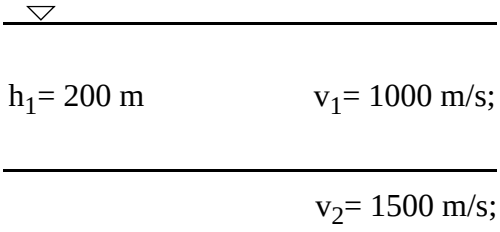
# Exercise for Reflection seismic 1 - Excercise 1 (08.11.2004)

**(1) Given is the following horizontally layered medium:**




(a) Calculate the reflection and transmission coefficients (R, T, $E_R$ and $E_T$) for the vertically travelling P waves.
(b) Calculate the $t_0$-time, critical distance $x_{crit}$, and the crossover distance $x_{cross}$.
(c) Construct a traveltime diagram (direct Wave, Reflection and Refraction).
(d) A seismic wave is incident normally on a reflector with a reflection coefficient R of 0.01. What is the proportion of the incident energy transmitted?

**(3) Waves**

Assume 3 geophones oriented so that one records only the vertical component of a seismic wave, another records only the horizontal component in the direction of the shot, and the third records only the horizontal component at right angles to this. Assume a simple wave shape and draw the responses of the three geophones for the following cases:
(a) a P wave traveling directly from the shot to the geophones
(b) a P wave reflected from a deep horizon
(c) an S wave generated by reflection of a P wave at an interface
(d) a Rayleigh wave generated by the shot
(e) a Love wave generated by the shot

**(2) Given is the following layered earth.**

| | |
|---|---|
| $h_1$= 15 m | $v_1$= 600 m/s |
| $h_2$= 40 m | $v_2$= 1500 m/s |
| $h_3$= 100 m | $v_3$= 2300 m/s |
| $h_4$= 150 m | $v_4$= 3000 m/s |

$h_i$ is the height of each layer

(a) What is the root-mean-square velocity in reflection surveying, and how is it related to the interval velocity and to stacking velocity?
(b) Determine the RMS-velocity for each layer.
(c) Determine from the RMS-velocities the interval velocities for each separate layer.

---

Hand in at 22.11.2004

**Questions?:**

Jan van der Kruk, ETH-Hönggerberg, HPP, O6
Tel.: (01) 633 2659, E-Mail: jvdkruk@aug.ig.erdw.ethz.ch