Seismo 512 HW 6

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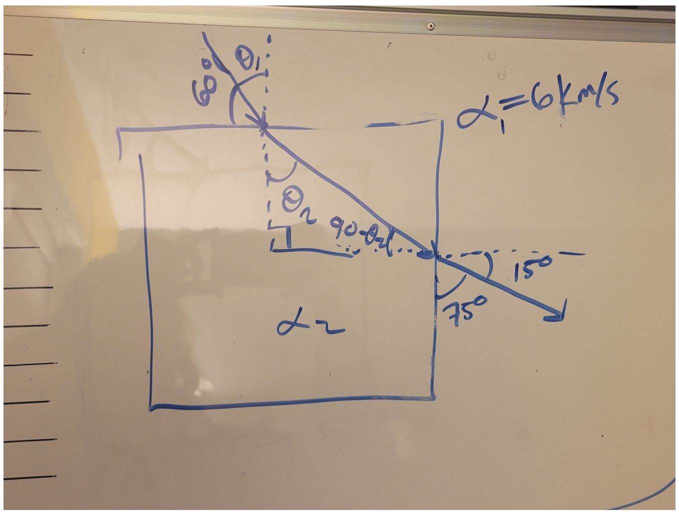

A downgoing P wave in a medium with a P velocity of 6 km/s travels through this "corner" shaped structure. If the incident ray is at an angle of 60° from the horizontal and the final ray is at an angle of 75° from the vertical, what is the P velocity within the corner-shaped medium?

Start with Snell's Law to find α_2 and write two equations for the two unkowns.

$$\frac{\sin\theta 1}{\alpha_1} = \frac{\sin\theta_2}{\alpha_2} \text{ and } \frac{(\sin 90-\theta_2)}{\alpha_2} = \frac{\sin\theta_3}{\alpha 1} \text{ where } \theta_1 = 30^\circ \text{ and } \theta_3 = 15^\circ \text{ and } \alpha_1 = 6.$$

$\alpha_2 = \frac{\alpha_1 \sin(90-\theta_2)}{\sin\theta_3} = \frac{\alpha_1\cos\theta_2}{\sin\theta_3}$ and $\alpha_2 = \frac{\alpha_1\sin\theta_2}{\sin\theta_1} \rightarrow \frac{\cancel{\alpha_1}\cos\theta_2}{\sin\theta_3} = \frac{\cancel{\alpha_1}\sin\theta_2}{\sin\theta_1} \Rightarrow \frac{\sin\theta_1}{\sin\theta_3} = \tan\theta_2 \Rightarrow \theta_2 = \tan^{-1}\frac{\sin\theta_1}{\sin\theta_3}$

$\alpha_2 = \alpha_1\frac{\cos(\theta_2)}{\sin\theta_3} = 10.66\frac{km}{s}$

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We can re-write μ in terms of β and ρ as $\mu = \beta^2\rho$. Now:

$$h\omega\sqrt{\frac{1}{\beta_1^2} - \frac{1}{c^2}} = \tan^{-1}\left[\frac{\beta_2^2\rho_2\sqrt{\frac{1}{c^2} - \frac{1}{\beta_2^2}}}{\beta_1^2\rho_1\sqrt{\frac{1}{\beta_1^2} - \frac{1}{c^2}}}\right] \Rightarrow \omega = \frac{\tan^{-1}\left[\frac{\beta_2^2\rho_2\sqrt{\frac{1}{c^2} - \frac{1}{\beta_2^2}}}{\beta_1^2\rho_1\sqrt{\frac{1}{\beta_1^2} - \frac{1}{c^2}}}\right]}{h\sqrt{\frac{1}{\beta_1^2} - \frac{1}{c^2}}}$$