

a) Valtoluokien peruslaskenta: $v_1 = \lambda_1 f = 0,032 \text{ m} \cdot 7,1 \frac{1}{\text{s}} = 0,2272 \frac{\text{m}}{\text{s}}$
 $= 0,23 \frac{\text{m}}{\text{s}}$

b) Rajajännäsen taajuuksi on muuttu $\Rightarrow f = 7,1 \text{ Hz}$
 $v_2 = \lambda_2 f = 0,026 \text{ m} \cdot 7,1 \frac{1}{\text{s}} = 0,1846 \frac{\text{m}}{\text{s}} = 0,18 \frac{\text{m}}{\text{s}}$

c) Tulokulma: $\alpha_1 = 90^\circ - \alpha = 90^\circ - 30^\circ = 60^\circ$
 Taittumislaki:

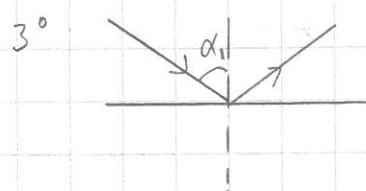
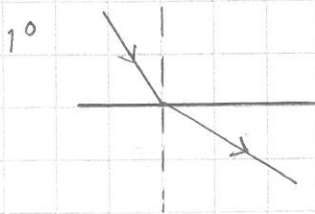
$$\frac{\sin \alpha_1}{\sin \alpha_2} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2} \quad | \nearrow$$

$$\Rightarrow \sin \alpha_1 \cdot \lambda_2 = \sin \alpha_2 \cdot \lambda_1 \quad | : \lambda_1$$

$$\Rightarrow \sin \alpha_2 = \frac{\lambda_2 \sin \alpha_1}{\lambda_1} = \frac{2,6 \text{ cm} \cdot \sin 60^\circ}{3,2 \text{ cm}} \Rightarrow \alpha_2 = 44,7202^\circ = \underline{45^\circ}$$

Koronaheijestuminen

Vallo tulee alhaalla - epillisesti tiheämmästä välestä harveempaan
 \rightarrow taittuminen normaalisti pois päin

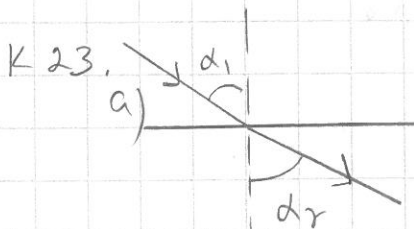


rajatilanne:

$$\frac{\sin \alpha_n}{\sin 90^\circ} = \frac{v_1}{v_2}$$

$$\Rightarrow \sin \alpha_n = \frac{v_1}{v_2}$$

$\alpha_i > \alpha_n \Rightarrow$ alhaalla heijastun koronaan \Rightarrow koronahai-heijestuminen



$$\alpha_1 = 59^\circ$$

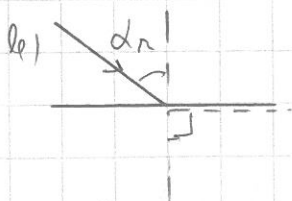
$$v_1 = 6300 \frac{\text{m}}{\text{s}}$$

$$v_2 = 7200 \frac{\text{m}}{\text{s}}$$

Taittumislaki: $\frac{\sin \alpha_1}{\sin \alpha_2} = \frac{v_1}{v_2}$

$$\Rightarrow \sin \alpha_2 = \frac{v_2 \sin \alpha_1}{v_1} = \frac{7200 \frac{\text{m}}{\text{s}} \cdot \sin 59^\circ}{6300 \frac{\text{m}}{\text{s}}} = 0,97562$$

$$\Rightarrow \alpha_2 = 78,41^\circ = \underline{78^\circ}$$



Taittumislaki, rajatilanne:

$$\frac{\sin \alpha_n}{\sin 90^\circ} = \frac{v_1}{v_2}$$

$$\Rightarrow \sin \alpha_n = \frac{v_1}{v_2} = \frac{6300 \frac{\text{m}}{\text{s}}}{7200 \frac{\text{m}}{\text{s}}}$$

$$\Rightarrow \alpha_n = 61,045^\circ = \underline{61^\circ}$$