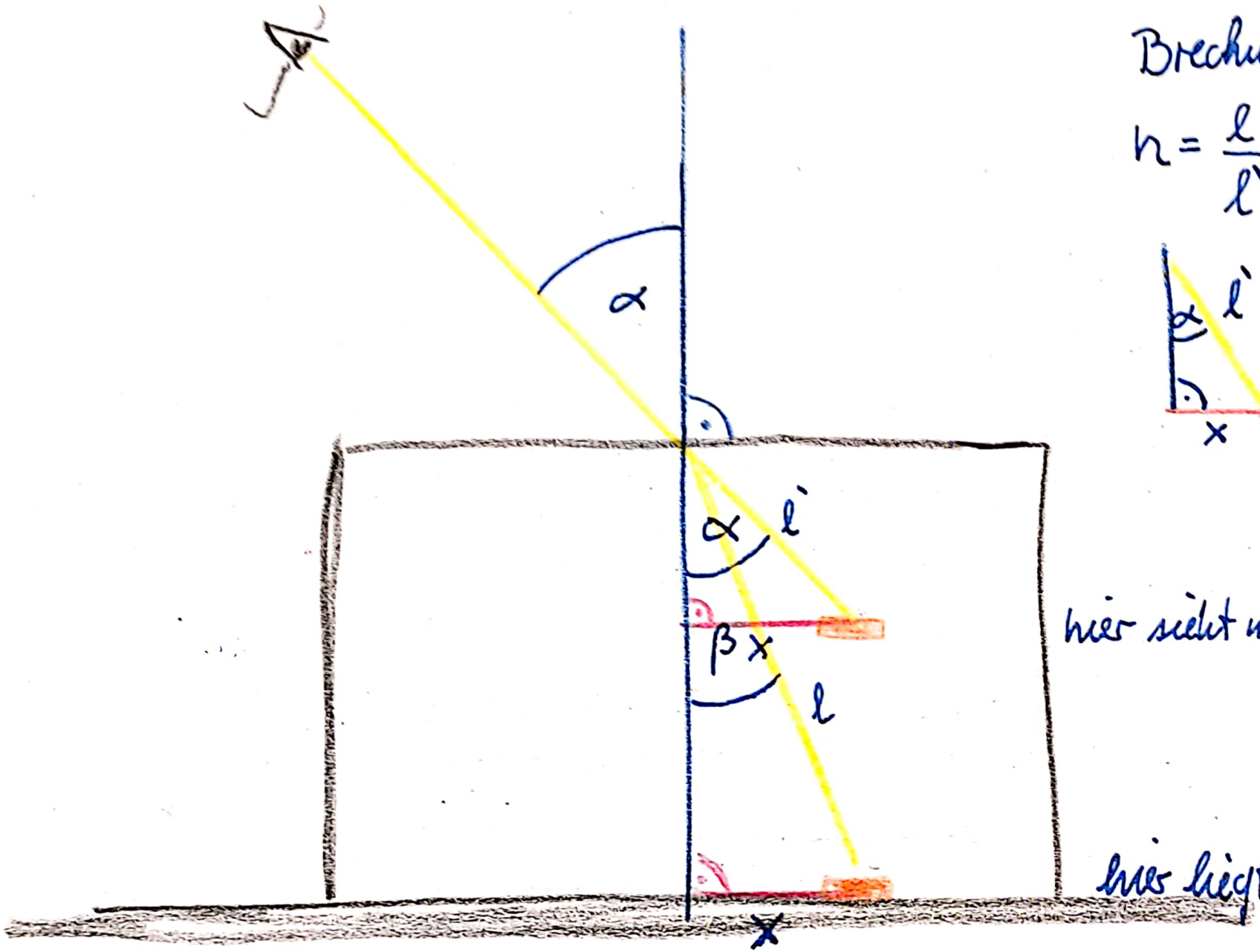
Brechung des Lichts am dichteren Medium



Brechungsindex

$$n = \frac{l}{l'}$$

hier sieht man die Münze

hier liegt sie

optischer Raum: l' Testraum: l

Brechungs-index $n = \frac{l}{l'}$

$\sin\alpha = \frac{x}{l'} \mid \cdot l'$ $\sin\beta = \frac{x}{l} \mid \cdot l$

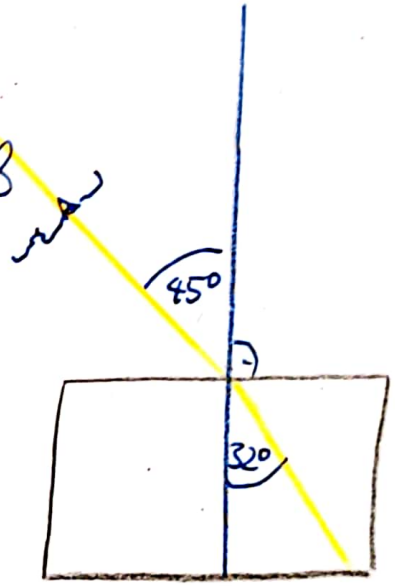
$l' \cdot \sin\alpha = x$ $l \cdot \sin\beta = x$

$l' \cdot \sin\alpha = l \cdot \sin\beta \mid : l'$

$\sin\alpha = \frac{l \cdot \sin\beta}{l'} \mid : \sin\beta$

$\sin = \frac{\text{Gegenk.}}{\text{Hyp.}}$

$n = \frac{\sin\alpha}{\sin\beta} = \frac{l}{l'}$

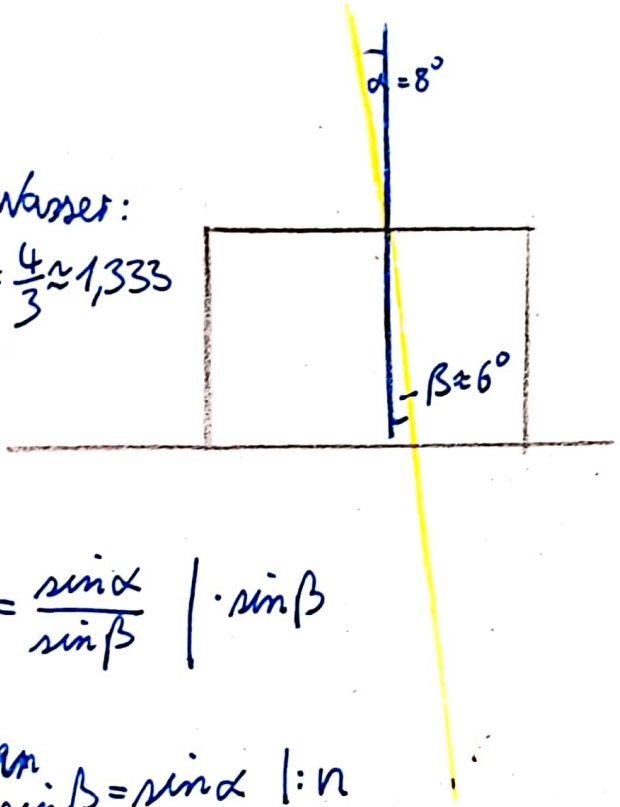


Wasser: $n \approx \frac{4}{3} = 1{,}333$ Annahme: $\alpha = 45°$

$n = \frac{4}{3} = \frac{\sin 45°}{\sin\beta} \mid \cdot \sin\beta$ $\frac{4}{3} \cdot \sin\beta = \sin 45° \mid \cdot \frac{3}{4}$ $\sin\beta = \frac{3}{4} \cdot \sin\alpha = 0{,}5303$

$\sin\beta = \frac{3}{4} \cdot \sin 45°$ $\beta = \sin^{-1}(0{,}5303) = 32{,}03°$

2. Beispiel: $\alpha = 8°$ (steil von oben hineingeschaut)



Wasser:

$n = \frac{4}{3} \approx 1{,}333$

$$n = \frac{\sin\alpha}{\sin\beta} \quad | \cdot \sin\beta$$

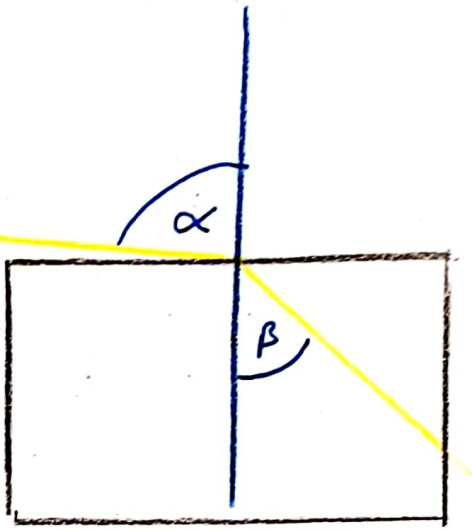
$$n \cdot \sin\beta = \sin\alpha \quad | : n$$

$$\sin\beta = \frac{\sin\alpha}{n}$$

$$\sin\beta = \frac{\sin 8°}{\frac{4}{3}} = 0{,}1044$$

$$\beta = \sin^{-1}(0{,}1044) = 5{,}99° \approx 6°$$

Aufgabe:
Berechne und zeichne die Lichtbrechungslinien für $\alpha = 85°$



$$\sin\beta = \frac{\sin\alpha}{n} = \frac{\sin 85°}{\frac{4}{3}} = 0{,}7471$$

$$\beta = \sin^{-1}(0{,}7471)$$

$$\beta = 48{,}34°$$

dichteres Medium

⇒ Blicke wird zum Lot hin gebrochen ($\beta < \alpha$)

$$\sin^{-1}\left(\frac{3}{4}\sin(85)\right) = 48{,}34°$$

Laser im Wasser

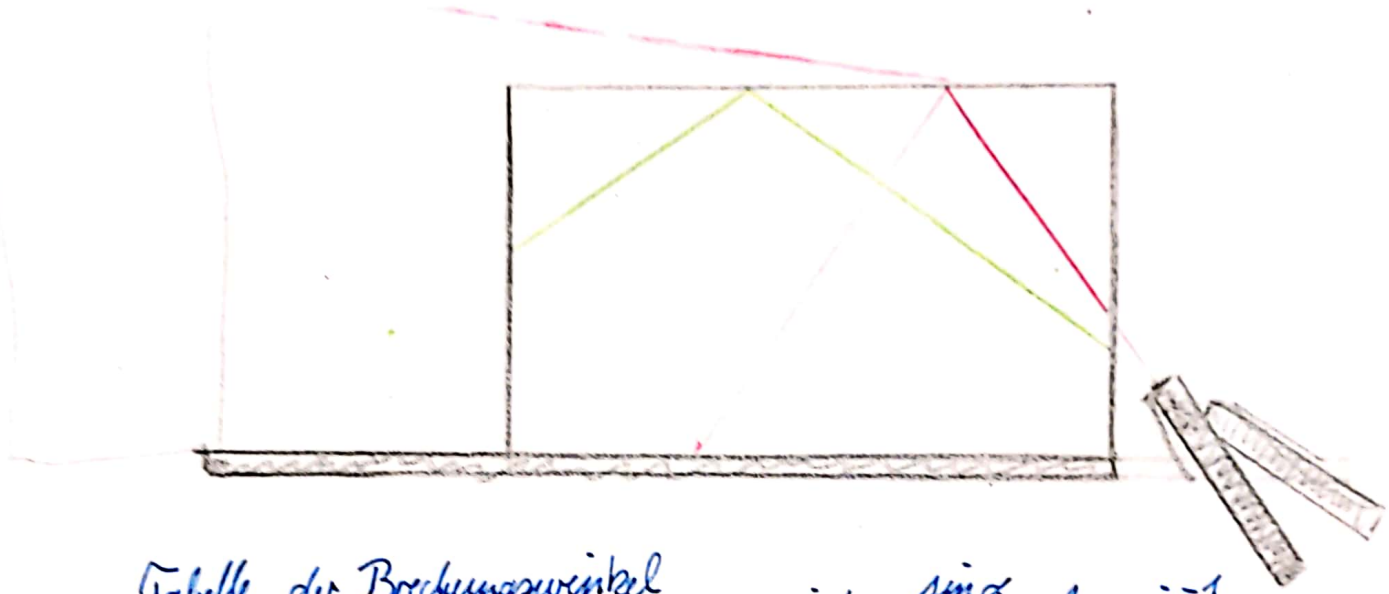


Tabelle der Brechungswinkel

α in °	β in °
0	0
5	3,75
10	7,48
15	11,19
20	14,86
30	22,02
45	32,03
60	40,51
80	47,61
90	48,59

$\sin\beta = \frac{\sin\alpha}{n}$ $\beta = \sin^{-1}$

in eine Formel

$\beta = \sin^{-1}\left(\frac{\sin\alpha}{n}\right)$

Wasser: $n = \frac{4}{3}$

Taschenrechner:

Tabelle $f(x) = \sin^{-1}\left(\frac{\sin x}{\frac{4}{3}}\right)$

Start 0 End 90 Step 5

Frage: Machen 95° noch Sinn?