

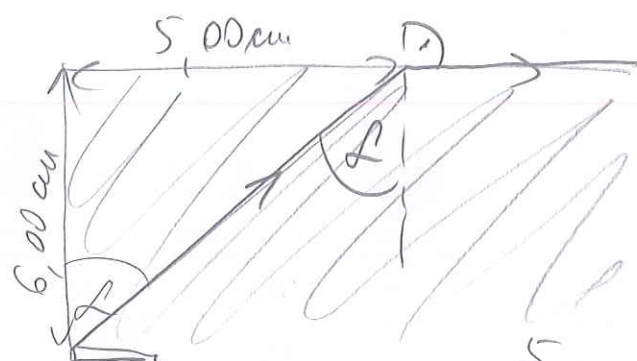
1.  $u = 1,57 \cdot 10^7$   
 $v = ?$

$u = \frac{c}{v} \Rightarrow v = \frac{c}{u} = \underline{19,11 \text{ m/s}}$

2.  $d_1 = 6,20 \text{ km}$   
 $d_2 = 3,40 \text{ km}$   
 $u_2 = ?$

$v = \frac{d}{t}$   
 $\frac{u_2}{u_1} = \frac{\frac{c}{v_2}}{\frac{c}{v_1}} = \frac{v_1}{v_2} \quad (u_{\text{vak}} = 1)$   
 $u_2 = \frac{\frac{d_1}{t}}{\frac{d_2}{t}} = \frac{d_1}{d_2} = \frac{6,20}{3,40} = \underline{1,82}$

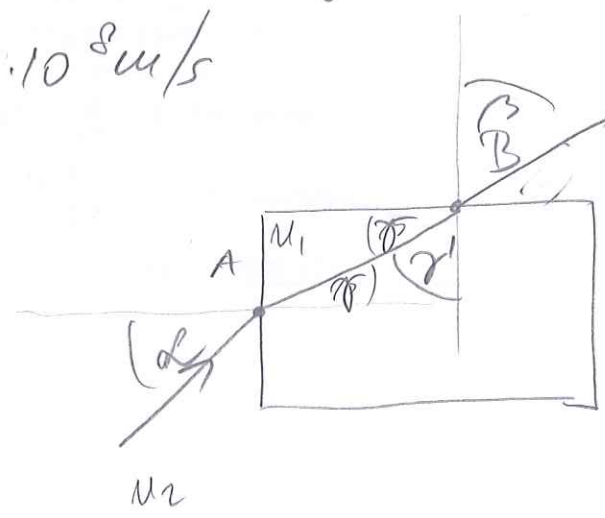
3.  $\frac{\sin \alpha}{\sin \beta} = \frac{1}{u}$   
 $u = \frac{\sin \beta}{\sin \alpha} = \frac{1}{\sin \alpha}$   
 $u = 1,56$   
 $u = \frac{c}{v} \Rightarrow v = \frac{c}{u}$



$\tan \alpha = \frac{5}{6} \Rightarrow \alpha = 39,806^\circ$

$v = 1,92 \cdot 10^8 \text{ m/s}$

4.  $u_1 = 1,52$   
 $u_2 = 1,63$   
 $\alpha = 30,0^\circ$   
 $\beta = ?$



$\frac{\sin \alpha}{\sin \beta} = \frac{u_1}{u_2}$   
 $\sin \beta = \frac{\sin \alpha \cdot u_2}{u_1}$

$\frac{\sin \beta}{\sin \gamma'} = \frac{u_1}{u_2} \Rightarrow \sin \beta = \sin \gamma' \cdot \frac{u_1}{u_2} = \sin(90 - \gamma) \cdot \frac{u_1}{u_2}$   
 $\beta = 51,92^\circ$

$$\text{5.) } \begin{array}{l} \angle = 60,0^\circ \\ n = 1,523 \end{array} \quad \begin{array}{l} n_1 = 1,000 \\ n_2 = 1,333 \end{array} \quad \beta = 90^\circ$$

$$\text{a) } \frac{\sin \angle}{\sin \beta} = \frac{n_1}{n} \Rightarrow \sin \angle_0 = \frac{n_1}{n} \Rightarrow \angle_0 = 41,04^\circ$$

$\angle > \angle_0 \Rightarrow$  događa se totalna refleksija  
u A  $\Rightarrow$  u točki B upadne svetlost  $30^\circ < \angle_0 \Rightarrow$  izlazi

$$\text{b) } \sin \angle_0 = \frac{n_2}{n} \Rightarrow \angle_0 = 61,07^\circ \Rightarrow \angle < \angle_0 \Rightarrow \text{izlazi}$$

u točki A

$$\text{6.) } \begin{array}{l} n_g = 1,544 \\ \angle = 34^\circ \end{array}$$

P = totalna refleksija

$$n_t = ?$$

$$\frac{\sin \angle}{\sin \beta} = \frac{n_g}{n_t} \Rightarrow \sin \beta = \frac{n_t}{n_g} \cdot \sin \angle = \frac{n_t}{1,544} \cdot \sin 34^\circ$$

$$\frac{\sin(90^\circ - \beta)}{\sin 90^\circ} = \frac{n_t}{n_g} \Rightarrow \sin(90^\circ - \beta) = \frac{n_t}{n_g} = \cos \beta$$

$\sin \beta = 0,3622 \cdot n_t$

$$\cos \beta = \frac{n_t}{n_g} = \sqrt{1 - \sin^2 \beta} = \sqrt{1 - 0,1312 n_t^2}$$

$$\frac{n_t^2}{1,544^2} = 1 - 0,1312 n_t^2$$

$$\frac{n_t^2}{1,544^2} + 0,1312 n_t^2 = 1$$

$$n_t^2 \left( \frac{1}{1,544^2} + 0,1312 \right) = 1$$

$$n_t = 1,348$$

7.]  $\angle_{AB_t} = 36,5^\circ$

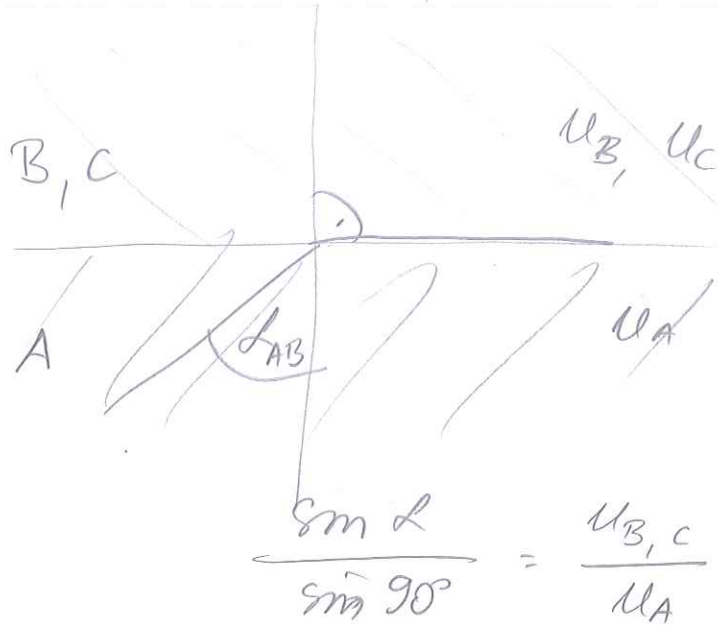
$$\angle AC_t = 47,0^\circ$$

$$\frac{u_B}{u_c} = ?$$

$$\sin 36,5^\circ = \frac{u_B}{u_A}$$

$$\sin 47,0^\circ = \frac{u_c}{u_A}$$

$$\frac{\sin 76,5^\circ}{\sin 47,0^\circ} = \frac{\frac{v_B}{v_A}}{\frac{v_C}{v_A}} = \frac{v_B}{v_C} \Rightarrow \frac{v_B}{v_C} = \underline{\underline{0,813}}$$



g)  $x = 0,476 \text{ m}$

$d = 7$

$$M_1 = 1,000$$

$$u_2 = 1,523$$

Brewster's but so polarizingly

$$\tan^2 \beta = \frac{n_2}{n_1}$$

$$\lg v_B = \frac{\varphi}{X} = \frac{n_2}{n_1} \Rightarrow d = \frac{n_2}{n_1} \cdot X$$
$$d = 0,725 \text{ m}$$

g.  $\Delta_B = 29,9^\circ$

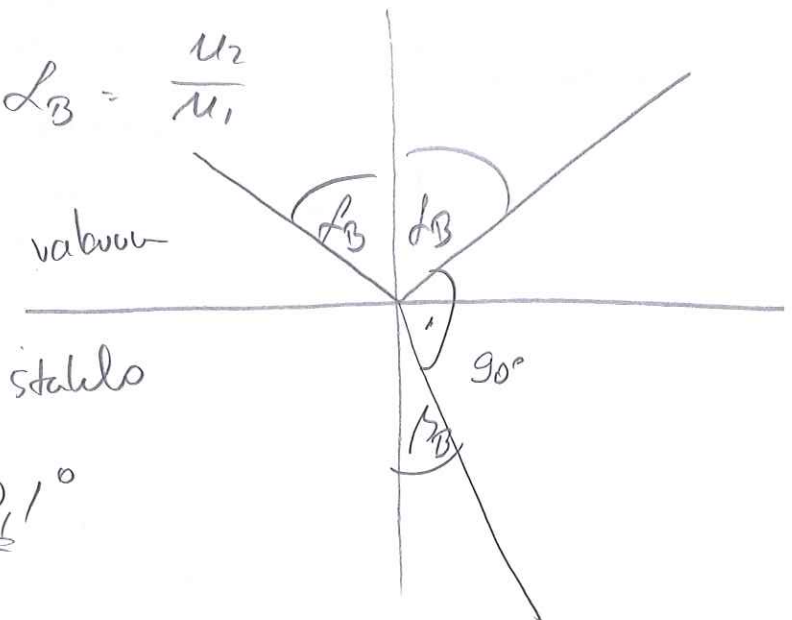
a)  $L_B = ?$

b)  $u_1 = ?$

$$a) \angle B + 90^\circ + \angle C = 180^\circ$$

$$\angle_B = 90^\circ - \beta_B = \underline{\underline{60,1^\circ}}$$

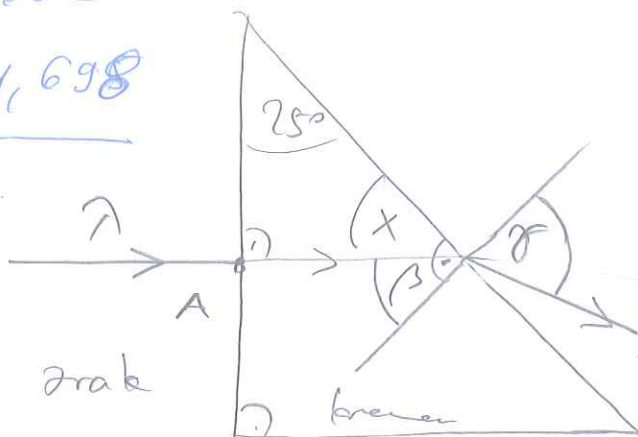
$$b) \frac{\sin \alpha_B}{\sin \beta_B} = \frac{n_s}{1} \Rightarrow n_s = \underline{\underline{1,239}}$$



10.)  $\lambda_c = 660 \text{ nm}$ ,  $n_c = 1,662$   
 $\lambda_g = 410 \text{ nm}$ ,  $n_g = 1,698$

$\gamma_c, \gamma_g = ?$

$\Rightarrow$  u tački A se ne  
 lomni jer je  $\angle = 0^\circ$  zrak



$\Rightarrow$  da li se moжда dogodi totalna refleksija?

$\sin \theta_{c0} = \frac{1}{1,662} \Rightarrow \theta_{c0} = 37,0^\circ$

$X + 25^\circ + 90^\circ = 180^\circ \Rightarrow X = 90^\circ - 25^\circ = 65^\circ$

$\beta \neq X = 90^\circ \Rightarrow \beta = 25^\circ < \theta_{c0}$

$\hookrightarrow$  za obje valne dužine

$\Rightarrow \frac{\sin \beta}{\sin \gamma} = \frac{1}{n} \Rightarrow \sin \gamma = n \cdot \sin \beta$

c:  $\sin \gamma_c = n_c \cdot \sin \beta \Rightarrow \gamma_c = 44,62^\circ$

g:  $\sin \gamma_g = n_g \cdot \sin \beta \Rightarrow \gamma_g = 45,75^\circ$

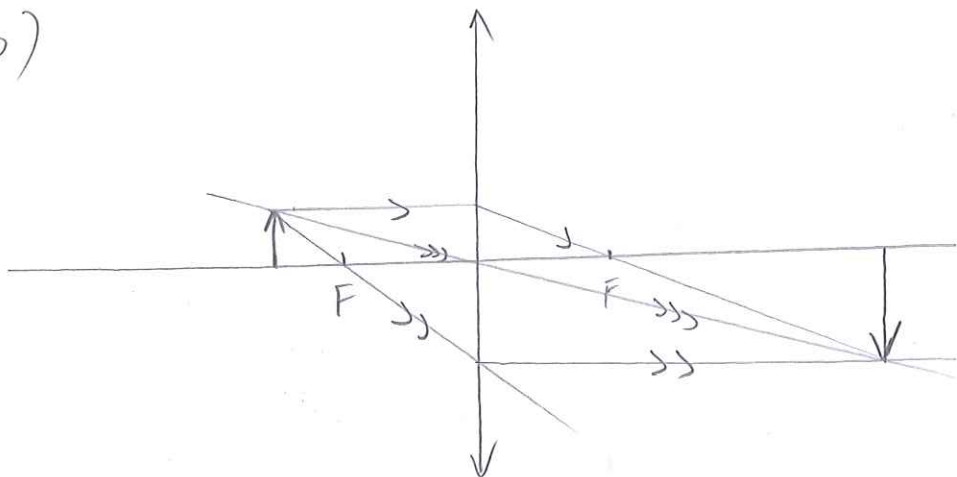
11.)  $a = 9,0 \text{ cm}$  ( $\times 3$ )  
 $f = 6,0 \text{ cm}$

$b = ?$

$\frac{1}{a} + \frac{1}{b} = \frac{1}{f}$

$\frac{1}{b} = \frac{1}{f} - \frac{1}{a}$

$b = 18 \text{ cm}$



$$\underline{12.)} \quad a = 20,0 \text{ cm}$$

$$f = -20,0 \text{ cm}$$


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$$b, \quad u = ?$$

$$\frac{1}{a} + \frac{1}{b} = \frac{1}{f}$$

$$\frac{1}{b} = \frac{1}{-20} - \frac{1}{20}$$

$$b = -10 \text{ cm}$$

$$u = -\frac{b}{a} = -\frac{-10}{20} = +0,5$$

$$\underline{14.)} \quad a = 155,0 \text{ cm}$$

$$f = 88,00 \text{ cm}$$

$$y = 13,0 \text{ cm}$$


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$$a) \quad b = ?$$

b) realna ili virtualna

$$c) \quad y' = ?$$

$$a) \quad \frac{1}{a} + \frac{1}{b} = \frac{1}{f}$$

$$\frac{1}{b} = \frac{1}{88} - \frac{1}{155}$$

$$b = 203,58 \text{ cm}$$

b)  $b > 0$  realna

$$c) \quad u = -\frac{b}{a} = \frac{y'}{y}$$

$$y' = -\frac{b}{a} \cdot y = -13,02 \text{ cm}$$

↓  
obrnuta

$$\underline{13.)} \quad u = -0,5$$

$$a + b = 90,0 \text{ cm}$$


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$$a) \quad a = ?$$

$$b) \quad f = ?$$

$$a) \quad \frac{1}{a} + \frac{1}{b} = \frac{1}{f}$$

$$u = -\frac{b}{a} = -0,5$$

$$b = 0,5a = 30 \text{ cm}$$

$$a + 0,5a = 90 \quad \uparrow$$

$$1,5a = 90$$

$$a = 60,0 \text{ cm}$$

$$b) \quad \frac{1}{60} + \frac{1}{30} = \frac{1}{f}$$

$$f = 20,0 \text{ cm}$$

$$\underline{15.)} \quad a = 18 \text{ cm}$$

$$f = -12 \text{ cm}$$

$$u' = \frac{1}{2} u$$


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$$a' = ?$$

$$u = -\frac{b}{a}$$

$$u' = -\frac{b'}{a'}$$

$$\frac{b'}{a'} = \frac{b}{2a}$$

$$a' = \frac{2ab'}{b}$$

$$\frac{1}{a} + \frac{1}{b} = \frac{1}{f} \Rightarrow \frac{1}{b} = \frac{1}{f} - \frac{1}{a} \Rightarrow$$

$$b = -7,2 \text{ cm}$$

$$\frac{1}{a'} + \frac{1}{b'} = \frac{1}{f} \Rightarrow \frac{1}{\frac{2ab'}{b}} + \frac{1}{b'} = \frac{1}{f}$$

$$\frac{b}{2ab'} + \frac{1}{b'} = \frac{1}{f}$$

$$\frac{b+2a}{2ab'} = \frac{1}{f} \Rightarrow b' = \frac{f \cdot (b+2a)}{2a} = \frac{-12 \cdot (-7,2 + 2 \cdot 18)}{2 \cdot 18}$$

$$b' = -9,6 \text{ cm}$$

$$a' = \frac{2ab'}{b} = \frac{2 \cdot 18 \cdot (-9,6)}{-7,2} =$$

$$a' = \underline{\underline{48 \text{ cm}}}$$

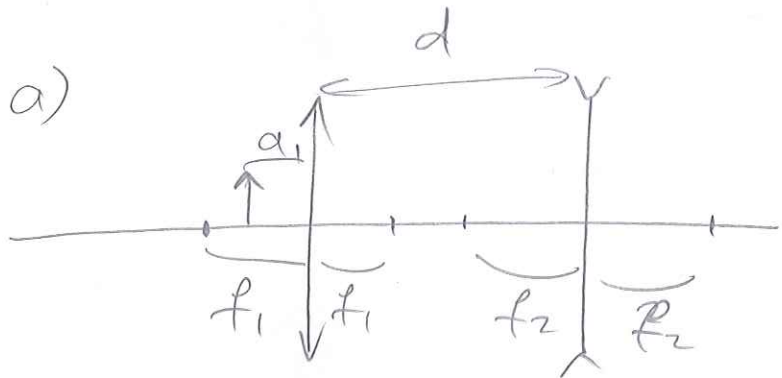
16.  $f_1 = 15,00 \text{ cm}$

$f_2 = -20,00 \text{ cm}$

$a_1 = 10,0 \text{ cm}$

$d = 50,0 \text{ cm}$

$b_2 = ?$



$$\frac{1}{a_1} + \frac{1}{b_1} = \frac{1}{f_1} \Rightarrow \frac{1}{b_1} = \frac{1}{f_1} - \frac{1}{a_1} = \frac{1}{15} - \frac{1}{10}$$

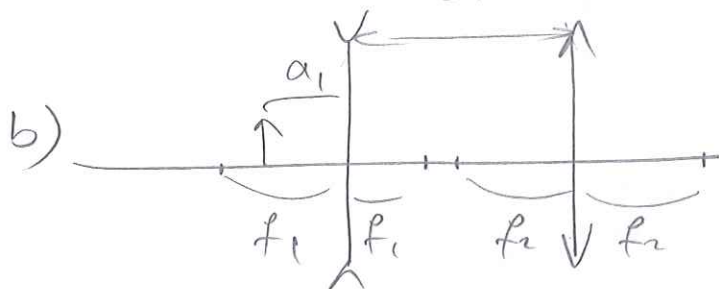
$$b_1 = \underline{\underline{-30 \text{ cm}}}$$

$$a_2 = d + b_1 = 80 \text{ cm}$$

$$\frac{1}{a_2} + \frac{1}{b_2} = \frac{1}{f_2} \Rightarrow \frac{1}{b_2} = \frac{1}{f_2} - \frac{1}{a_2}$$

$$\frac{1}{b_2} = \frac{1}{-20} - \frac{1}{80}$$

$$b_2 = -16 \text{ cm}$$



$$\frac{1}{a_1} + \frac{1}{b_1} = \frac{1}{f_2} \Rightarrow \frac{1}{b_1} = \frac{1}{-20} - \frac{1}{10}$$

$$b_1 = \underline{\underline{-6,67 \text{ cm}}}$$

$$a_2 = d + b_1 = 56,7 \text{ cm}$$

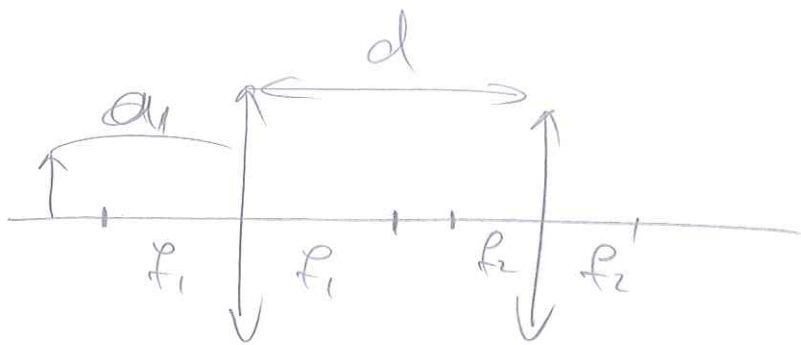
$$\frac{1}{a_2} + \frac{1}{b_2} = \frac{1}{f_2} \Rightarrow \frac{1}{b_2} = \frac{1}{15} - \frac{1}{56,7} \Rightarrow b_2 = \underline{\underline{20,4 \text{ cm}}}$$

12.]  $f_1 = 9,00 \text{ cm}$

$f_2 = 6,00 \text{ cm}$

$d = 18,0 \text{ cm}$

$a_1 = 12 \text{ cm}$



$b_2, m_s, \text{ slika} = ?$

$$\frac{1}{a_1} + \frac{1}{b_1} = \frac{1}{f_1} \Rightarrow \frac{1}{b_1} = \frac{1}{f_1} - \frac{1}{a_1} = \frac{1}{9} - \frac{1}{12} \Rightarrow$$

$$b_1 = +\underline{\underline{36 \text{ cm}}}$$

$$a_2 = d + b_1 = 18 - 36 = -18 \text{ cm}$$

$$\frac{1}{a_2} + \frac{1}{b_2} = \frac{1}{f_2} \Rightarrow \frac{1}{b_2} = \frac{1}{f_2} - \frac{1}{a_2} = \frac{1}{6} - \frac{1}{-18} \Rightarrow b_2 = +\underline{\underline{4,5 \text{ cm}}}$$

$$m_1 = -\frac{b_1}{a_1} = -\frac{36}{12} = -3,0$$

$$m_2 = -\frac{b_2}{a_2} = -\frac{4,5}{-18} = 0,25$$

$m_s = m_1 \cdot m_2 = -0,75$   
 Umañjena, realna,  
 obrnuta ( $m < 0$ )

13.]  $x_1 = 5,2 \text{ m} \Rightarrow b = -5,2 \text{ m}$

$x_2 = 12,0 \text{ m} \Rightarrow a = 12,0 \text{ m}$

$f = ?$

s iste str. su pa  
 je vrtedna  
 slika

$$\frac{1}{a} + \frac{1}{b} = \frac{1}{f} \Rightarrow f = -9,2 \text{ m (diverg, leća)}$$