Université Paul Sabatier. L2 - Physique. partiel d'Optique - Barème. 12 Déc. 03.

I. (2pts)

1. $i > i_0 = \text{Arc sin}\left(\frac{n_2}{n_1}\right) \simeq 81{,}89°$ réflexion totale.

2. $O.N. = n_0 \sin\theta_0 = 1 \times \sin\theta_0 = n_1 \sin\alpha_0$ où $\alpha_0 = 90° - 81{,}89 \simeq 8{,}11°$

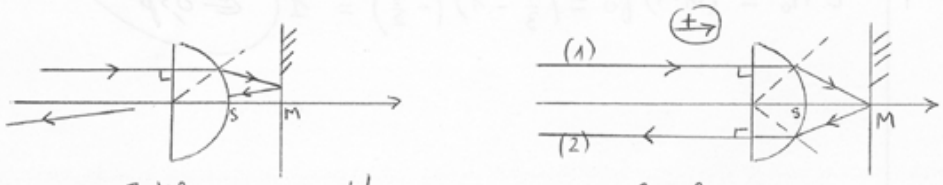
$O.N = \sin\theta_0 \simeq 0{,}204 \Rightarrow \theta_0 = 11{,}80° \Rightarrow 2\theta_0 = 23{,}6°$ (1pt)

3. $(AH)_{mini} = (AH)_{i_0} = R_1 \tan i_0$; trajectoire du rayon $= AB = \frac{R_1}{\cos i_0}$ (1pt)

$$\frac{d_{max}}{d} = \frac{AB}{AH)_m} = \frac{R_1}{\cos i_0} \cdot \frac{1}{R_1 \tan i_0} = \frac{1}{\sin i_0} = \frac{n_1}{n_2} = 1{,}01$$ (2pt)

II. (2)

1.



$z \neq z_1$ $\qquad$ $z = z_1$ (1pt)

2. $\frac{n_i}{p_i} - \frac{n_0}{p_0} = \frac{n_i - n_0}{\bar{R}} \Rightarrow \left[\frac{1}{(p_i = SM)} - \frac{n}{(p_0 \to \infty)} = \frac{1-n}{-1}\right] \Leftrightarrow \frac{1}{z_1} = \frac{1}{1{,}8} = \frac{1-n}{-1} = n - 1 = 0{,}555$ (0,5pt) (1pt)

$\Rightarrow n = 1{,}555$ (0,5pt)

III. (5)

1. a) $f_{01} = \overline{OF_{01}} = \frac{R_1 n_0}{n_0 - n_i} = \frac{-1 \times 1{,}5}{1{,}5 - 1} = -3\,cm$; $f_{i1} = \frac{R_1 n_i}{n_i - n_0} = \frac{-1 \times 1}{-0{,}5} = 2\,cm$ (1pt)

b) $\frac{1}{(p_1)} - \frac{1{,}5}{(-1)} = \frac{n_i - n_0}{\bar{R}_1} = \frac{1 - 1{,}5}{-1} = 0{,}5 \Rightarrow \frac{1}{p_1} = -1 \Rightarrow p_1 = -1 = \overline{OA_1}$ (1pt)

$\overline{OA_0}$

c) grandissement $= 1{,}5$ confirmé par la construction : (0,5pt)

$\frac{A_1B_1}{A_0B_0} = \frac{A_0F_{i1}}{OF_{i1}} = 1{,}5$ (0,5pt)

(1pt) construction

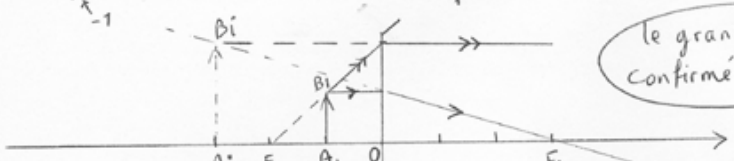
(1pt)

2. a) $f_{02} = \overline{OF_{02}} = \frac{\bar{R}_2 n_0}{n_0 - n_i} = \frac{1 \times 1}{1 - 1{,}5} = -2\,cm$; $f_{i2} = \frac{\bar{R}_2 n_i}{n_i - n_0} = \frac{1 \times 1{,}5}{0{,}5} = 3\,cm$. (1pt)

b) $\frac{1{,}5}{p_i} - \frac{n_0}{p_0} = \frac{1{,}5 - 1}{1} = 0{,}5 \Rightarrow \frac{1{,}5}{p_i} = -1 + 0{,}5 = -0{,}5 \Rightarrow p_i = -3\,cm$ (1pt)

$p_0 = -1$

c)



le grandissement $= 1{,}5$ confirmé par : (0,5pt)

construction (1pt)

$\frac{A_iB_i}{A_1B_1} = \frac{A_iF_{i2}}{A_1F_{i2}}$ (0,5pt)

3.

4

3. $\overline{T(ES)} = \begin{pmatrix} 1 & 3/2 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -0,5 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -0,5 & 1 \end{pmatrix} \begin{pmatrix} 1 & 3/2 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{3} & 0 \\ -1 & \frac{1}{3} \end{pmatrix}$

translation OS — D_2 — D_1 — translation EO — refractions = 1 pt. — 1 pt

$V = 1$; $f_o = -\frac{n_o}{V} = -1,5$; $f_i = \frac{n_i}{V} = 1,5$ — 0,5 pt — 0,5 pt

$\overline{SH_i} = (a-1) f_i = \left(\frac{1}{3} - 1\right) \cdot \frac{3}{2} = -1$ — 0,5 pt

$\overline{EH_o} = (d-1) f_o = \left(\frac{1}{3} - 1\right)\left(-\frac{3}{2}\right) = 1$ — 0,5 pt

Total ≡ 22 points.