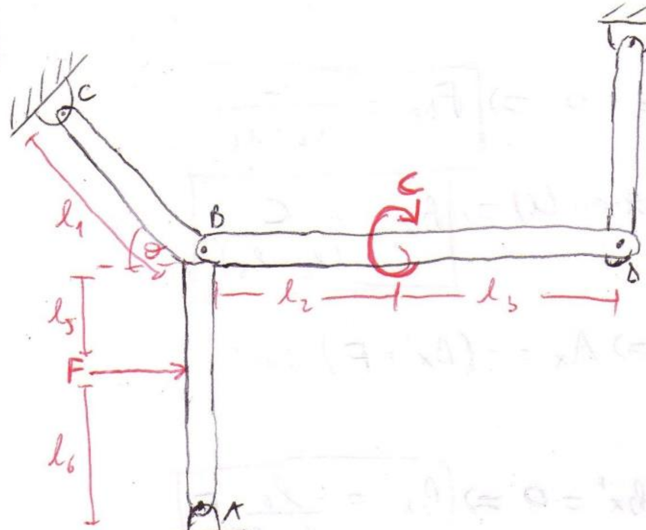
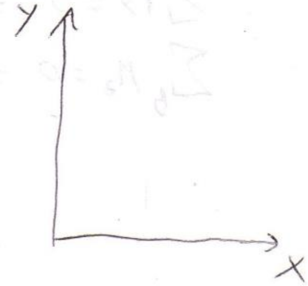
P1

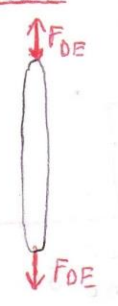


$l_1 = 6$ m
$l_2 = 3$ m
$l_3 = 4$ m
$l_4 = 5$ m
$l_5 = 2$ m
$l_6 = 4$ m
$\theta = 40°$
$F = 1000$ N
$C = 400$ N·m



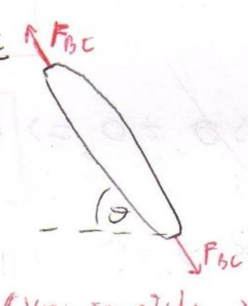
· DCLs

DE



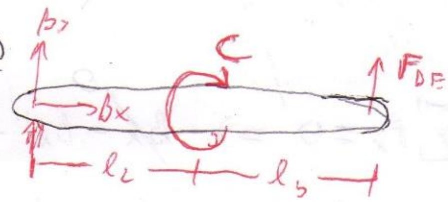
(Viga sometida a dos fuerzas)

BC

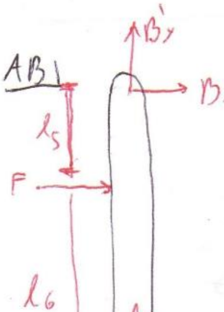


(Viga sometida a dos fuerzas)

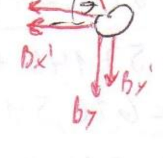
BD



AB



Pasador B



• Estática (Balance de Fzas. y Momentos)

BD| $\sum F_x = 0 \Rightarrow \boxed{B_x = 0}$

$\sum F_y = 0 \Rightarrow B_y = -F_{DE}$ (i)

$\sum_B M_z = 0 \Rightarrow -C + (l_2+l_3)F_{DE} = 0 \Rightarrow \boxed{F_{DE} = \frac{C}{(l_2+l_3)}}$

$*$ en (i) $\Rightarrow \boxed{B_y = -\frac{C}{(l_2+l_3)}}$

AB| $\sum F_x = 0 \Rightarrow F + A_x + B_x' = 0 \Rightarrow A_x = -(B_x'+F)$ (ii)

$\sum F_y = 0 \Rightarrow A_y = -B_y'$ (iii)

$\sum_A M_z = 0 \Rightarrow -l_6 \cdot F - (l_5+l_6)B_x' = 0 \Rightarrow \boxed{B_x' = \frac{-l_6}{(l_5+l_6)}F}$

$*$ en (ii) $\Rightarrow \boxed{A_x = \frac{-l_5}{l_5+l_6}F}$

Pasador B| $\sum F_x = 0 \Rightarrow -\cancel{B_x}^{0} - B_x' - F_{BC}\cos\theta = 0 \Rightarrow \boxed{F_{BC} = \frac{-B_x'}{\cos\theta}}$

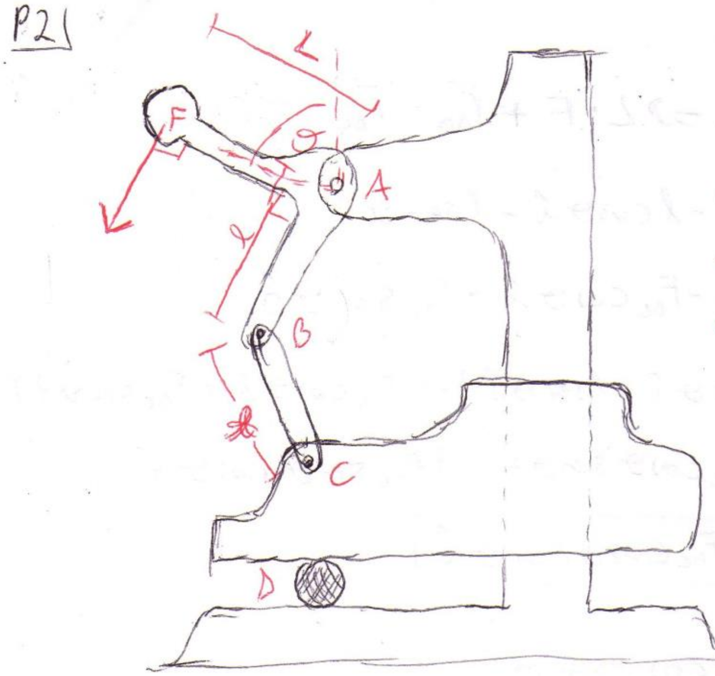
$\sum F_y = 0 \Rightarrow -B_y - B_y' + F_{BC}\,\text{sen}\,\theta = 0 \Rightarrow \boxed{B_y' = -B_y + F_{BC}\cdot\text{sen}\,\theta}$

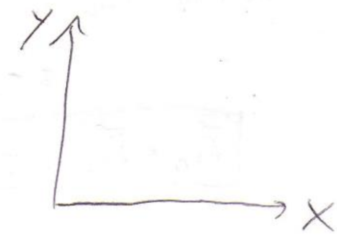
$*$ en (iii) $\Rightarrow \boxed{A_y = -F_{BC}\cdot\text{sen}\,\theta + B_y}$

Reemplazando valores:

$B_x = 0$	$A_x = -333{,}383\,[N]$
$F_{DE} = 57{,}143\,[N]$	$F_{BC} = 870{,}272\,[N]$
$B_y = -57{,}143\,[N]$	$B_y' = 57{,}143 + 870{,}272\,\text{sen}\,\theta = 616{,}543\,[N]$
$B_x' = -666{,}667\,[N]$	$A_y = -616{,}543\,[N]$

P2)





$F = 150\ N$

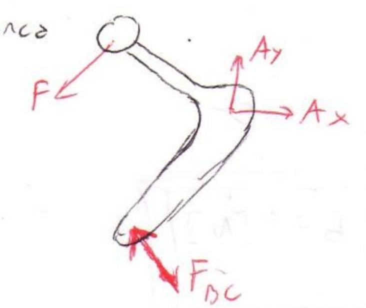
$L = 20\ cm = 0{,}2\ m$

$l = 10\ cm = 0{,}1\ m$

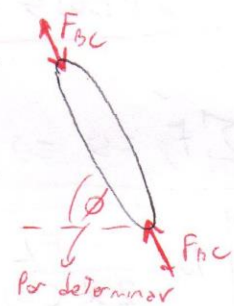
$\theta = 70°$

DCLs

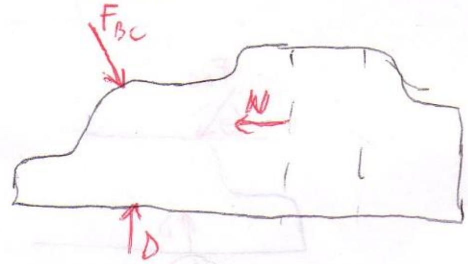
• Palanca



• BC



• Mandíbula

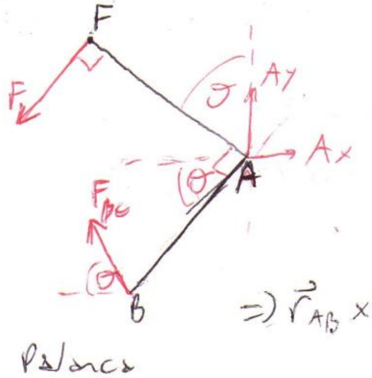


$d\phi! \rightsquigarrow$ Triángulo ABC $\Rightarrow$

$\rightsquigarrow \frac{\pi}{2} + \theta + \alpha = \pi \Rightarrow \alpha = \frac{\pi}{2} - \theta$

$\rightsquigarrow \alpha + \phi = \frac{\pi}{2} \Rightarrow \frac{\pi}{2} - \theta + \phi = \frac{\pi}{2} \Rightarrow \boxed{\phi = \theta}$

• Balance de fuerzas y momentos



$$\sum_A M_z = 0 \Rightarrow L \cdot F + \vec{r}_{AB} \times \vec{F}_{BC} = 0$$

$$\vec{r}_{AB} = -l\cos\theta\,\hat{\imath} - l\,\text{sen}\,\theta\,\hat{\jmath}$$

$$\vec{F}_{BC} = -F_{BC}\cos\theta\,\hat{\imath} + F_{BC}\,\text{sen}\,\theta\,\hat{\jmath}$$

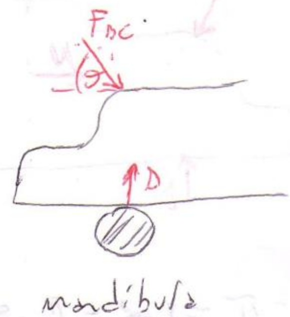
$$\Rightarrow \vec{r}_{AB} \times \vec{F}_{BC} = (-l\cos\theta\,\hat{\imath} - l\,\text{sen}\,\theta\,\hat{\jmath}) \times (-F_{BC}\cos\theta\,\hat{\imath} + F_{BC}\,\text{sen}\,\theta\,\hat{\jmath})$$

$$= -lF_{BC}\cos\theta\cdot\text{sen}\,\theta\,\hat{k} - lF_{BC}\,\text{sen}\,\theta\cdot\cos\theta\,\hat{k}$$

$$\boxed{\vec{r}_{AB} \times \vec{F}_{BC} = -2lF_{BC}\cos\theta\,\text{sen}\,\theta\,\hat{k}}$$

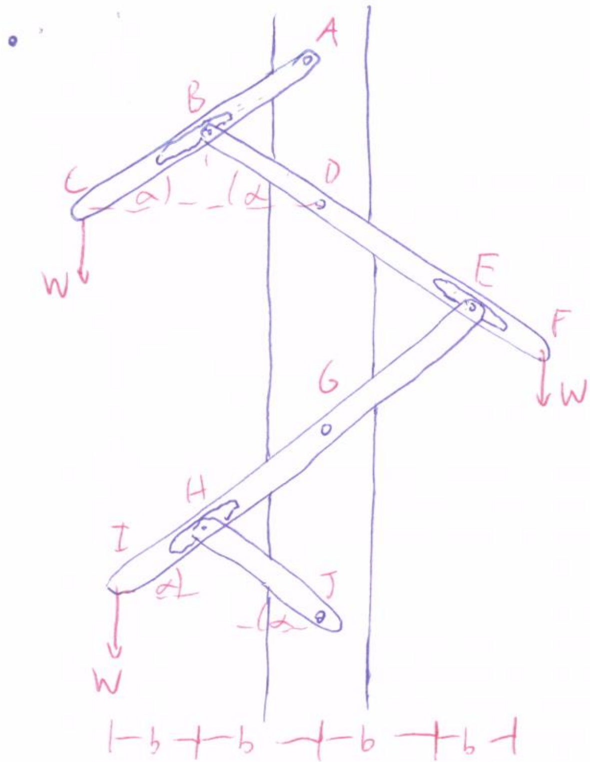
$$\Rightarrow \sum_A M_z = 0 \rightsquigarrow F \cdot L + 2lF_{BC}\cos\theta\,\text{sen}\,\theta = 0$$

$$\boxed{\therefore F_{BC} = \frac{FL}{2l\cos\theta\cdot\text{sen}\,\theta}}$$

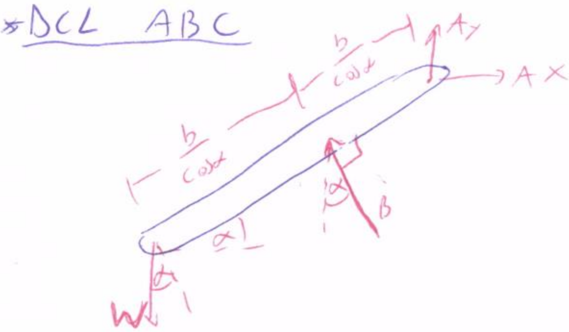


$$\sum F_y = 0 \Rightarrow D = F_{BC}\cdot\text{sen}\,\theta$$

$$\boxed{D = \frac{FL}{2l\cdot\cos\theta} = 438,571\,[N]}$$



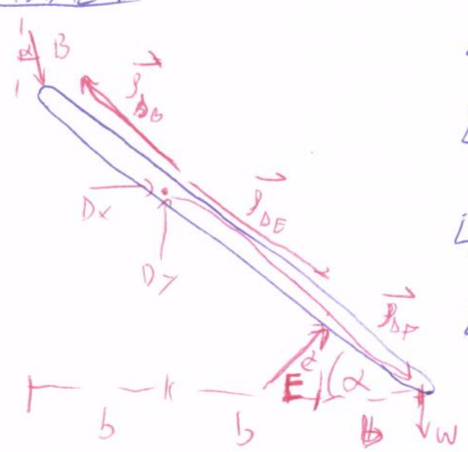
*DCL ABC



$$\sum_A M_z = 0 \Rightarrow W\cos\alpha \frac{2b}{\cos\alpha} - B\cdot\frac{b}{\cos\alpha} = 0$$

$$\boxed{\therefore B = 2W\cos\alpha \doteq 1732{,}05\ \text{Kgf}}$$

DCL BDEF



$$\sum_D M_z = 0 \Rightarrow \vec{\rho}_{DB}\times\vec{B} + \vec{\rho}_{DE}\times\vec{E} + \vec{\rho}_{DF}\times\vec{W} = 0$$

$\hookrightarrow \vec{\rho}_{DB} = -b\,\hat{\imath} + b\tan\alpha\,\hat{\jmath}$ $\left(\frac{b}{\cos\alpha}\cdot \operatorname{sen}\alpha = b\tan\alpha \right)$

$\hookrightarrow \vec{\rho}_{DE} = b\,\hat{\imath} - b\tan\alpha\,\hat{\jmath}$

$\hookrightarrow \vec{\rho}_{DF} = 2b\,\hat{\imath} - 2b\tan\alpha\,\hat{\jmath}$

$\hookrightarrow \vec{B} = B\operatorname{sen}\alpha\,\hat{\imath} - B\cos\alpha\,\hat{\jmath}$ // $\vec{E} = B\operatorname{sen}\alpha\,\hat{\imath} + B\cos\alpha\,\hat{\jmath}$ // $\vec{W} = -W\hat{\jmath}$

$$\Rightarrow \vec{\rho}_{DB}\times\vec{B} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ -b & b\tan\alpha & 0 \\ B\operatorname{sen}\alpha & -B\cos\alpha & 0 \end{vmatrix} = \hat{k}\,(Bb\cos\alpha - Bb\operatorname{sen}\alpha\tan\alpha)$$

$$\Rightarrow \vec{\rho}_{DE}\times\vec{E} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ b & -b\tan\alpha & 0 \\ E\operatorname{sen}\alpha & E\cos\alpha & 0 \end{vmatrix} = \hat{k}\,(-Eb\cos\alpha + Eb\operatorname{sen}\alpha\tan\alpha)$$

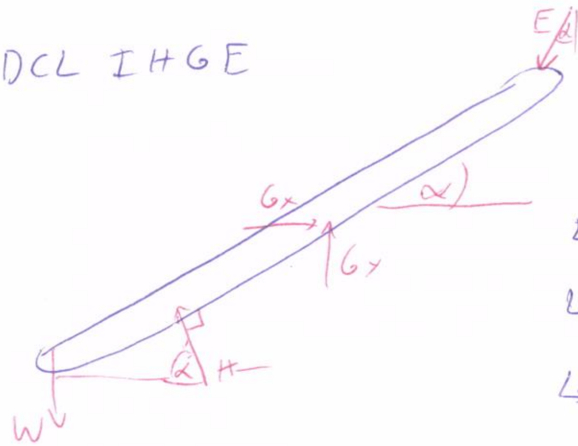
$$\Rightarrow \vec{\rho}_{DF} \times \vec{W} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2b & -2b\tan\alpha & 0 \\ 0 & -W & 0 \end{vmatrix} = \hat{k}(-2bW)$$

$$\Rightarrow \sum_D M_z = Bb(\cos\alpha - \text{sen}\,\alpha\tan\alpha) + Eb(\text{sen}\,\alpha\tan\alpha - \cos\alpha) - 2bW = 0$$

$$\therefore E = \frac{2W - B(\cos\alpha - \text{sen}\,\alpha\tan\alpha)}{\text{sen}\,\alpha\tan\alpha + \cos\alpha} = \cancel{\frac{2W}{\text{sen}\,\alpha\tan\alpha - \cos\alpha} + B}$$

$$\boxed{E = 866{,}03\ \text{kgf}}$$

DCL IHGE



$$\sum_G M_z = 0 \Rightarrow \vec{\rho}_{GE} \times \vec{E} + \vec{\rho}_{GH} \times \vec{H} + \vec{\rho}_{GI} \times \vec{W} = 0$$

$\hookrightarrow \vec{\rho}_{GE} = b\hat{i} + b\tan\alpha\,\hat{j}$

$\hookrightarrow \vec{\rho}_{GH} = -b\hat{i} - b\tan\alpha\,\hat{j}$

$\hookrightarrow \vec{\rho}_{GI} = -2b\hat{i} - 2b\tan\alpha\,\hat{j}$

$\vec{E} = -E\,\text{sen}\,\alpha\,\hat{i} - E\cos\alpha\,\hat{j}$ // $\vec{H} = -H\cos\alpha\,\hat{i} + H\,\text{sen}\,\alpha\,\hat{j}$ // $\vec{W} = -W\hat{j}$

$$\vec{\rho}_{GE} \times \vec{E} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ b & b\tan\alpha & 0 \\ -E\,\text{sen}\,\alpha & -E\cos\alpha & 0 \end{vmatrix} = \hat{k}(-bE\cos\alpha + bE\,\text{sen}\,\alpha\tan\alpha)$$

$$\vec{\rho}_{GH} \times \vec{H} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -b & -b\tan\alpha & 0 \\ -H\cos\alpha & H\,\text{sen}\,\alpha & 0 \end{vmatrix} = \hat{k}(-bH\,\text{sen}\,\alpha - bH\,\text{sen}\,\alpha)$$

$$\vec{\rho}_{GI} \times \vec{W} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -2b & -2b\tan\alpha & 0 \\ -2b\tan\alpha & -W & 0 \end{vmatrix} = \hat{k}\cdot 2bW$$

$$\Rightarrow \sum_O M_z = -bE\cos\alpha + bE\,\text{sen}\,\alpha\tan\alpha - 2bH\,\text{sen}\,\alpha + 2bW = 0$$

$$\Rightarrow H = \frac{1}{2b\,\text{sen}\,\alpha}\left(2bW - bE(\cos\alpha - \text{sen}\,\alpha\tan\alpha)\right)$$

$$\boxed{H = \frac{W}{\text{sen}\,\alpha} - \frac{E}{2}(\cot\alpha - \tan\alpha) \simeq 1500\ \text{Kgf})}$$