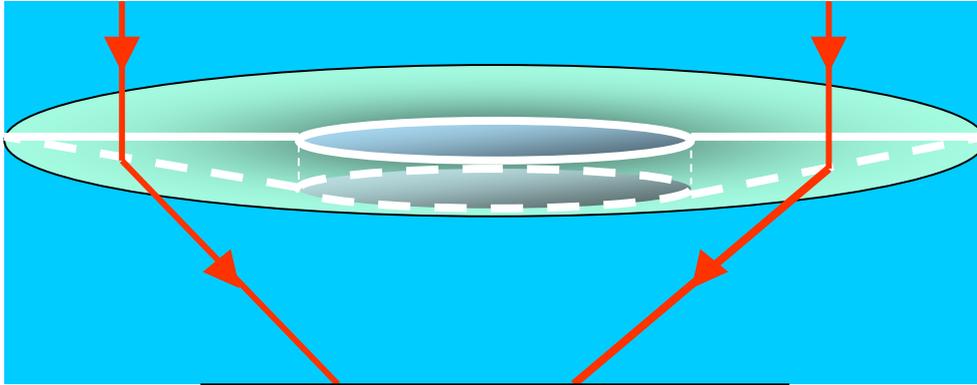


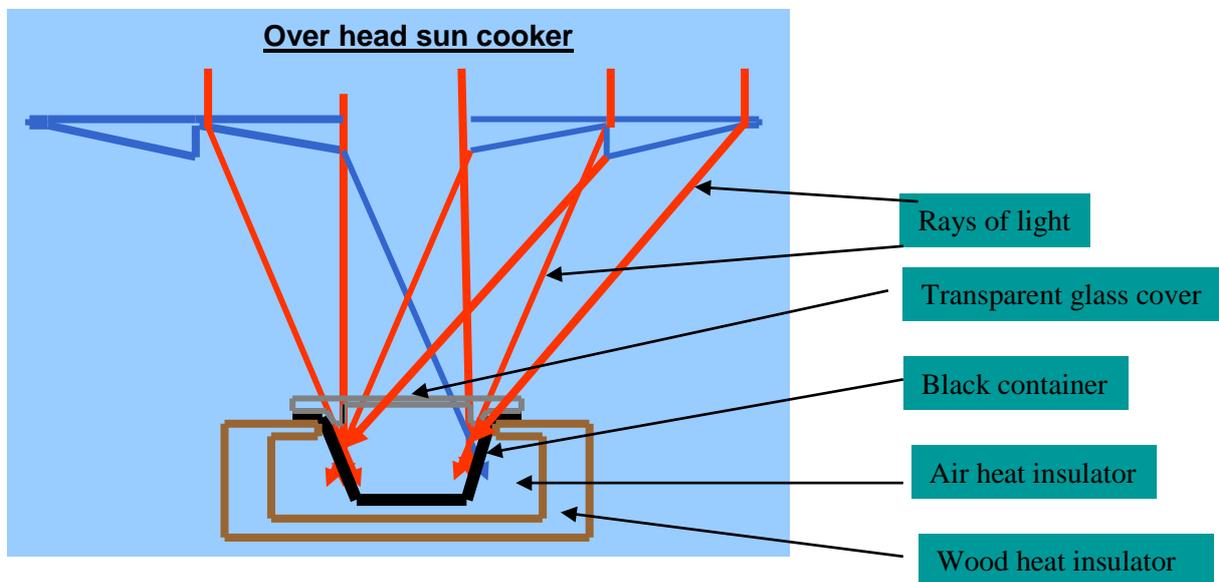
Over head sun cooker

Design Joseph NDURIRI Toulouse France 2018-11-09

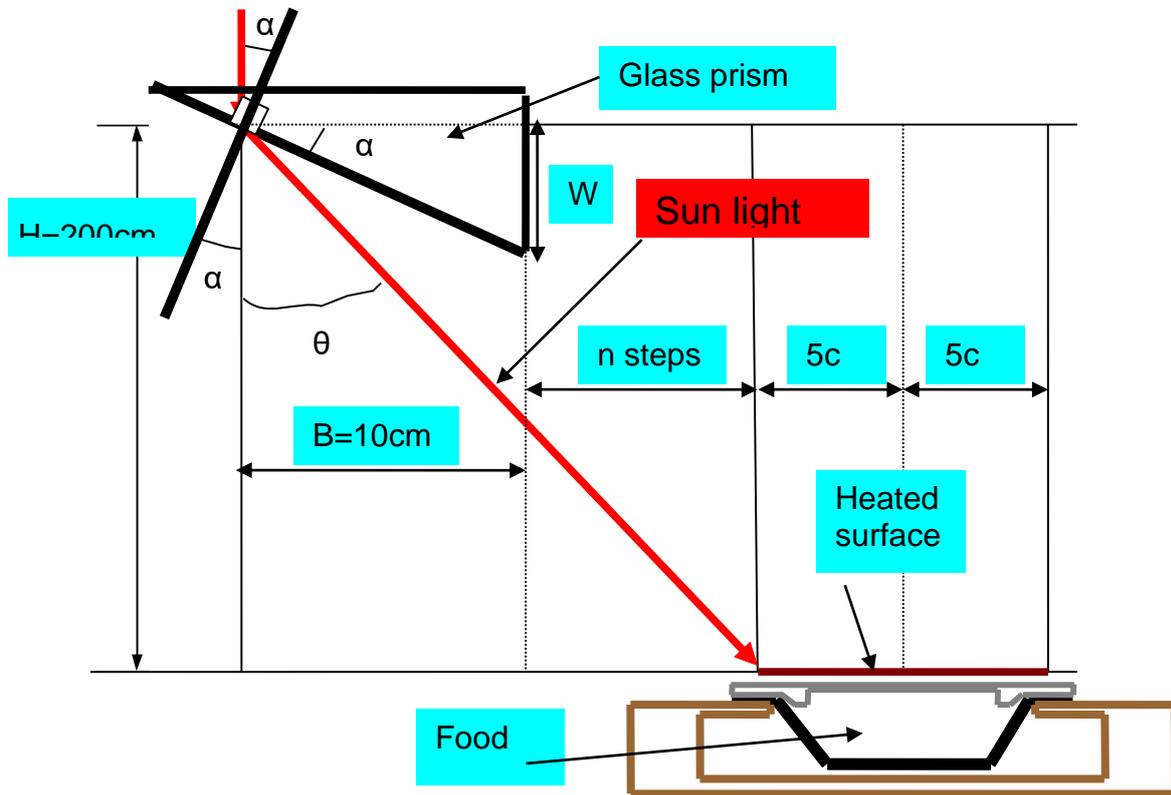
The over head sun cooker is composed of edge circular rings lens (FRESNEL LENS) that focus the sunlight on a narrow area to cook food as shown in the diagram below.



Since the food being cooked is composed of an area of a diameter of 30cm and since this cooker is used between 9/15 hours its centre has a hollow part of a diameter of 20cm.



Detailed diagram



See the diagram above

$$\tan(\Theta) = (B+n \times \text{step}) / H, \quad \text{step} = 10\text{cm}$$

Where n = number of edge circular rings.

$n \in [1, 2, 3, 4, \dots]$

$$\tan(\alpha) = W/\text{step}$$

$$W = \text{step} \times \tan(\alpha)$$

$$H = 200 \text{ cm}$$

Where n = number of edge circular rings.

????? correct here below

If $n = 11$

$$\rightarrow B = 7.5\text{cm} + 5 \times 11\text{cm} = 7.5\text{cm} + 55\text{cm} = \underline{\underline{62.5 \text{ cm}}}$$

$$\rightarrow \tan(\Theta) = 62.5/200 = 0.3125$$

$$\rightarrow \Theta = \underline{\underline{17.3540^\circ}}$$

In accordance with the optics law of refraction, see the diagram above;

$$n_g \sin(\alpha_g) = \sin(\alpha_a), \text{ where } n_g = \text{glass indices.}$$

$$\alpha_a = \alpha_g + \Theta < \frac{1}{2} \Pi$$

$$\rightarrow n_g \sin(\alpha_g) = \sin(\alpha_g + \Theta) = \sin(\alpha_g) \cos(\Theta) + \cos(\alpha_g) \sin(\Theta)$$

$$\rightarrow n_g \tan(\alpha_g) = \tan(\alpha_g) \cos(\Theta) + \sin(\Theta)$$

$$\rightarrow \tan(\alpha_g) \cdot [n_g - \cos(\Theta)] = \sin(\Theta)$$

$$\rightarrow \tan(\alpha_g) = \sin(\Theta) / [n_g - \cos(\Theta)]$$

$$\rightarrow \alpha_g = \underline{28.6685^\circ}$$

We verify that $\alpha_a = \alpha_g + \Theta < \frac{1}{2} \Pi$, $\alpha_a = 46.0225^\circ < \frac{1}{2} \Pi$,

A =

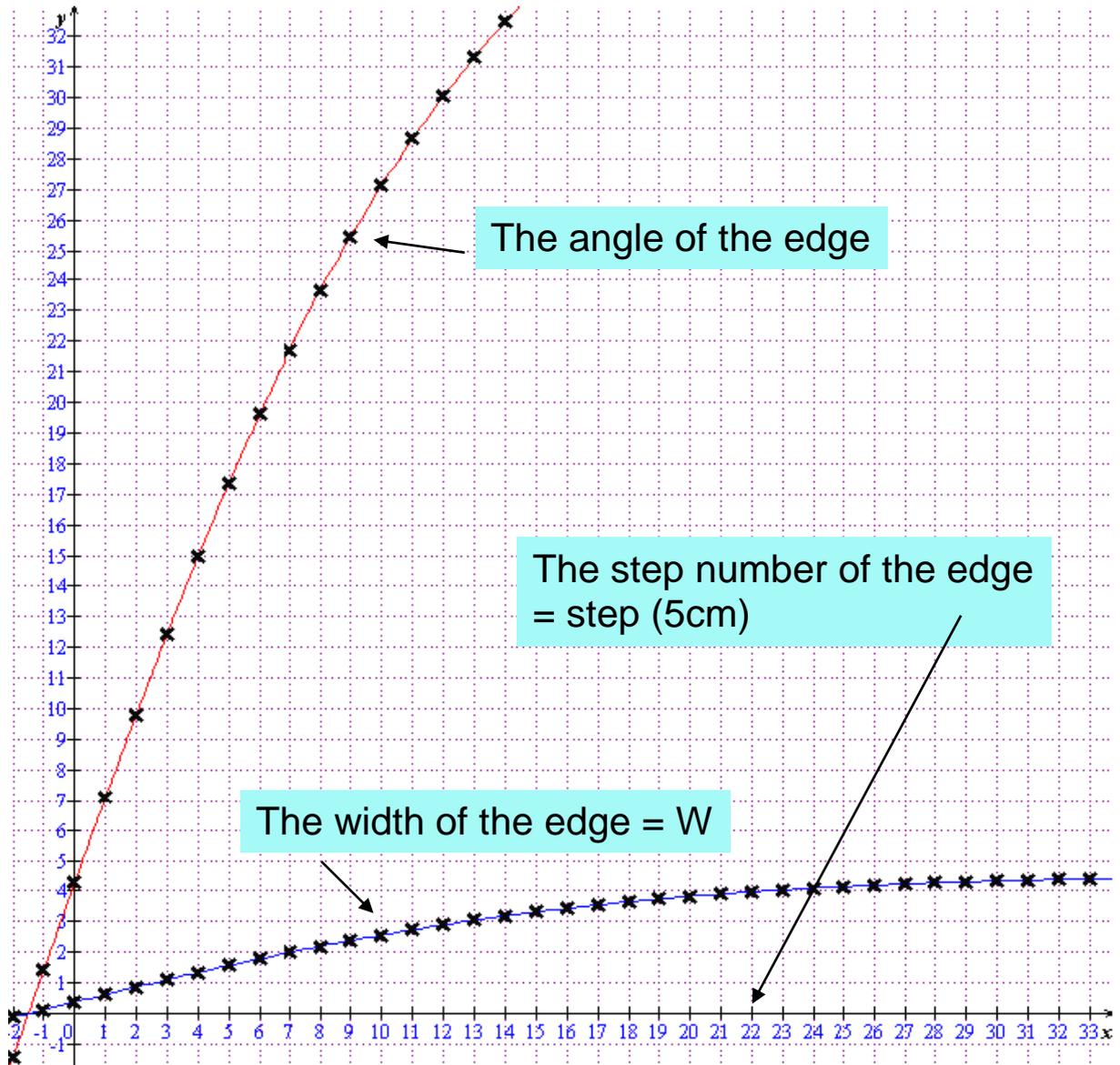
$$\arctan(\sin(\arctan((7.5+5X)/200)) / (1.5 - \cos(\arctan((7.5+5X)/200))))$$

arctan(

sin(arctan((7.5+5X)/200)) /

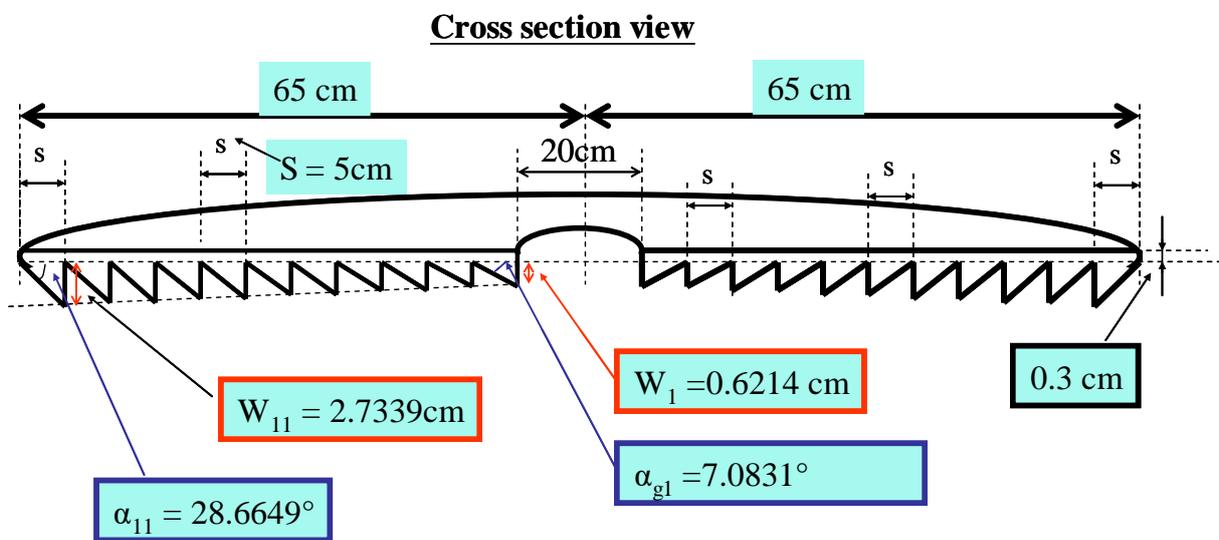
(1.5- cos(arctan((7.5+5X)/200)))

)



Step number Angle in degrees Width in cm

step	α_g	W
1,0000	7,0831	0,6214
2,0000	9,8147	0,8651
3,0000	12,4507	1,1041
4,0000	14,9714	1,3373
5,0000	17,3620	1,5635
6,0000	19,6120	1,7818
7,0000	21,7155	1,9916
8,0000	23,6703	2,1921
9,0000	25,4774	2,3828
10,0000	27,1405	2,5635
11,0000	28,6649	2,7339



W_i is the width of the edge, indexed; $i \in [1, 2, 3, \dots, 11]$

α_i is the angle of the edge, indexed; $i \in [1, 2, 3, \dots, 11]$

Power

The Sun power is about 1370 W/m², the radius R of the lens is 0.65 metres, the theoretical power = $\pi R^2 \approx 1800$ watts but lets assume that half of the power is lost. Then the effective power = 900 watts.