Physics exam solution

1-The absolute error of a measured quantity G is the difference δG between the experimental value G_m and a reference value that can be considered as exact, G_e. **Absolute uncertainty** This is the maximum error that can be committed in the evaluation.

2-The general form is :

Absolute uncertainty $G_{ex} = G_m \pm \Delta G$

Relative uncertainty ΔG/G

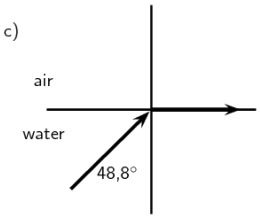
The absolute uncertainty on (f) is generally expressed in the form:

3-

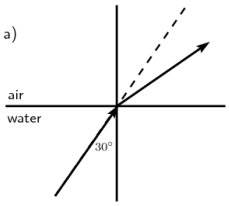
$$\Delta f = \left|\frac{\partial f}{\partial x}\right| \Delta x + \left|\frac{\partial f}{\partial y}\right| \Delta y + \left|\frac{\partial f}{\partial z}\right| \Delta z$$

Exercise1

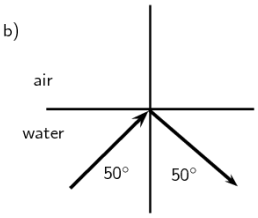
The critical angle for water is 48,8°



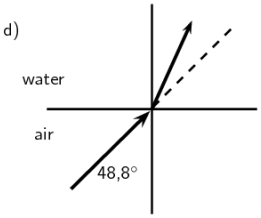
For incident angles smaller than 48,8° refraction occurs (ray is bent away from the normal).



For incident angles greater than 48,8° total internal reflection will occur.



Refraction towards the normal (air is less dense than water).



Exercise 2

f = -4 cm, d_o= -5cm, h_o = 1.5cm.

1- The distance, the magnification and the size of image.

1-

Distance of the Image (

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Longrightarrow \frac{1}{-4} = \frac{1}{v} + \frac{1}{-5}$$

$\boldsymbol{v = -20\,\text{cm}}$ (The image is 20 cm in front of the mirror).

Magnification

$$m = -\frac{v}{u} = -\frac{-20}{-5} = -4$$

Size of the Image

$$h_i = m \times h_o = -4 \times 1.5 = -6\ \text{cm}$$

2-Ray Diagram:

3- Real Inverted:

Ex3

f = -6 cm, d_o= -4cm, h_o= 2.25cm.

1-

image position

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{-6} + \frac{1}{-4} = -\frac{2}{12} - \frac{3}{12} = -\frac{5}{12}$$

$$v = -\frac{12}{5} = -2.4 \text{ cm}$$

the magnification

$$m = \frac{v}{u} = \frac{-2.4}{-4} = +0.6$$

2- ray diagram

3-

Size: The height of the image is

$$h_i = m \times h_o = 0.6 \times 2.25 = 1.35 \text{ cm}$$

Nature: the image is virtual and erect.