physics 2nd Kanti study sheet for the test on the 9/28/10

author:
Linus Metzler

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OPTICS

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INFO

This is a study sheet by Linus Metzler about Optics, which was mentioned in the 1st Kanti at Mr. Geist. There is no claim for completeness. All warranties are disclaimed.

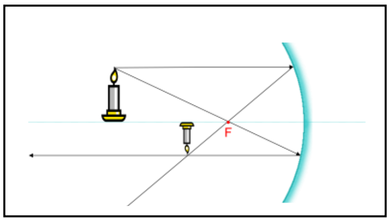
STUDY PART

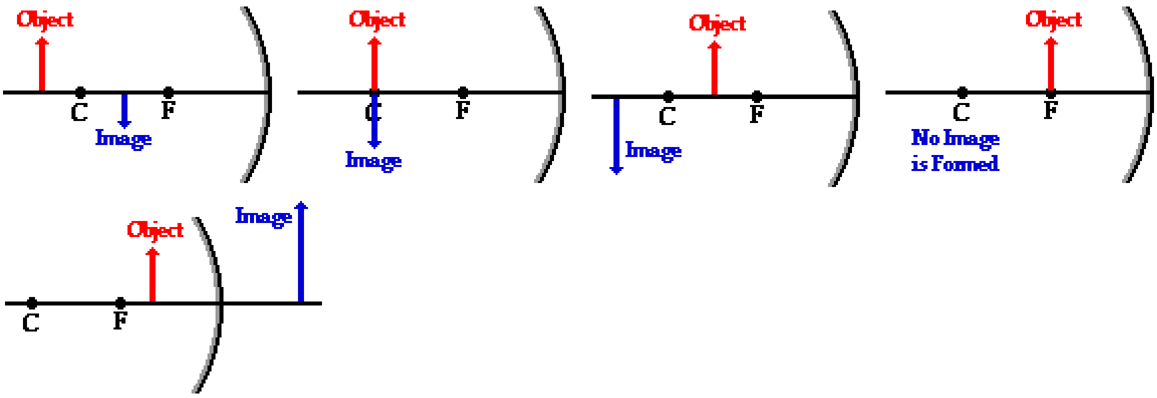
PLANE MIRRORS

- Sight Line
- Angle of incidence = Angle of reflection (careful: measure angle with respect to the normal); $\theta_i = \theta_r$
- Image distance = Object distance; $d_i = d_o$
- Image is virtual and upright.
- Ray diagram to construct image.

CONCAVE MIRRORS

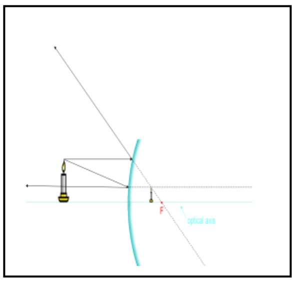
- Radius of mirror r, focal length = $\frac{r}{2}$
- Focal point in front of mirror, **focal length positive.**
- Use principal rays to construct image:
- Image can be real or virtual, enlarged or reduced, inverted or upright, depending on object location.

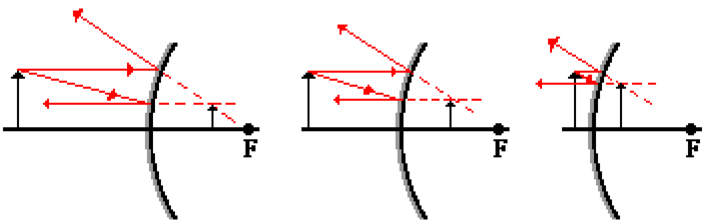




CONVEX MIRRORS

- Radius of mirror r, focal lenght = $\frac{r}{2}$
- Focal point behind mirror, **focal length negative**.
- Use principal rays to construct image:
- Image is always virtual, reduced and upright.





APPLICATIONS OF MIRRORS

Know some off the basic applications of concave, convex and plane mirrors.

MIRROR (LENS MAKER) EQUATION

$$\frac{1}{d_i}+\frac{1}{d_o}=\frac{1}{f}$$

Sign convention: Everything that's in front of mirror has positive sign, everything that's behind the mirror has negative sign.

Example: Object is between a concave mirror and its focal point (d_o<f) therefore

$$\frac{1}{d_i}=\frac{1}{f}-\frac{1}{d_o}<0$$

This means that image is behind the mirror (and therefore virtual).

MAGNIFICATION EQUATION

$$m=\frac{h_i}{h_o}=-\frac{d_i}{d_o}$$

Note the minus sign, which is chosen such that

$$m\begin{cases}+\rightarrow \textit{image upright}\\ -\rightarrow \textit{image inverted}\end{cases}$$

Example: An 6cm tall object that is 3cm in front of a mirror produces an image that is 6cm behind the mirror.

How tall ist the image, is it inverted or upright?

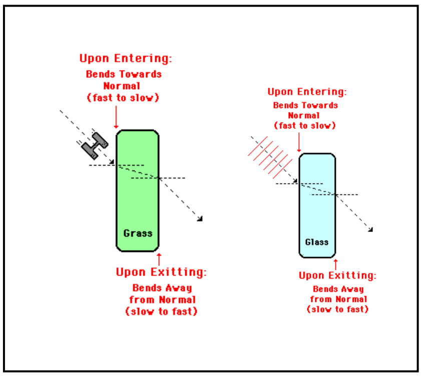
Since image is behind the mirror, $d_i=-6cm$, therefore $m=-\frac{-6}{3}=2$

Since $m>0$, image is upright and the image height is $h_i=2h_o=12cm$

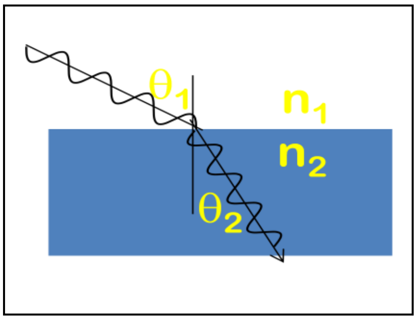
REFRACTION

- Refractive index $n=\frac{v}{c}$

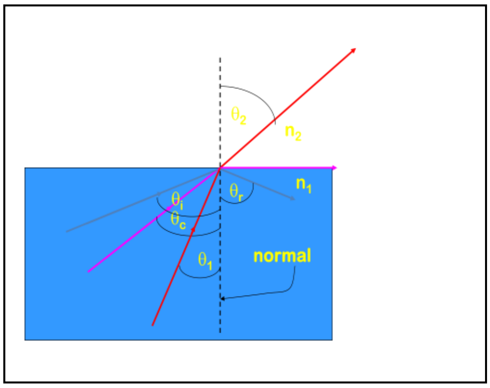
  (c=speed of light in vaccum, v= speed of light in medium<c)



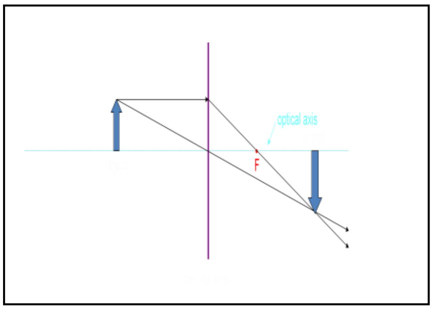
- Snell's law: $n_1\cdot sin(\theta_1)=\ n_2\cdot sin(\theta_2)$



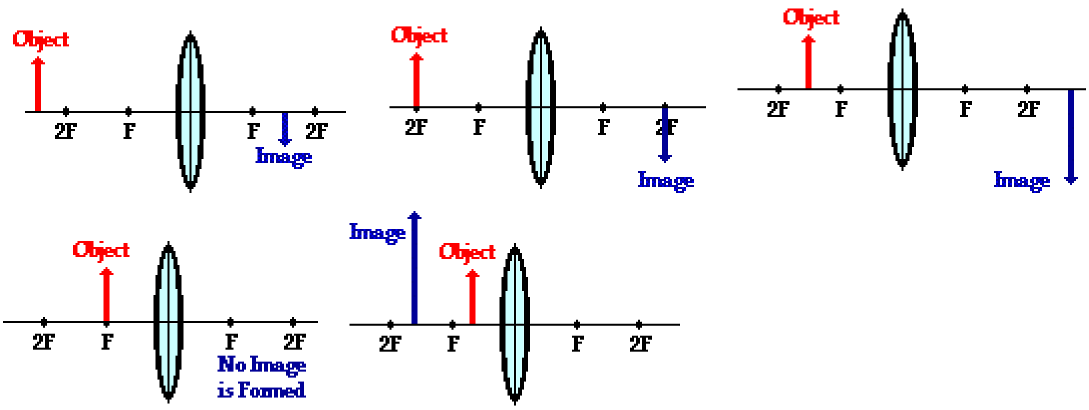
- Total internal reflection: $\theta_1 = sin^{-1}(n_2/n_1)$
  - E.g. Fiber cable



CONVEX (CONVERGING) LENSE



- What is it, how is it built, index of refraction
- Ray diagram to produce image.
- Image can be real or virtual, enlarged or reduced, inverted or upright, depending on object location.
- Applications of convex lenses
  - Projector, camera, magnifying glass (where ist the object placed in each of these appliactions?)
- Positive focal length ($f > 0$)



LINKS

http://www.schulphysik.de/java/physlet/applets/optik1.html (Applet [Java] to construct any kind of mirrors and lenses)

SOURCES

- Parts are copied 1:1 from the test preparation sheet from gsw