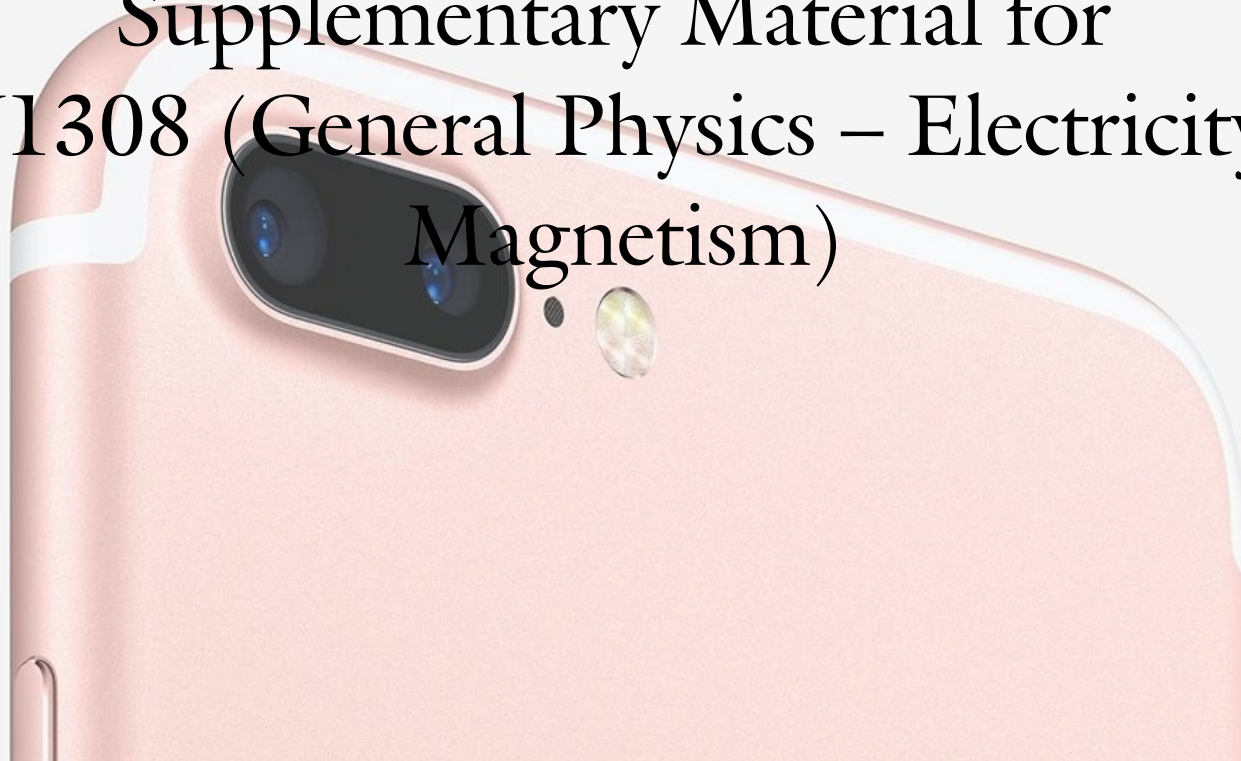


Solving Problems Involving Thin Lenses and Images



Prof. Stephen Sekula
Supplementary Material for
PHY1308 (General Physics – Electricity and
Magnetism)



Class Announcements

- Last two classes:
 - Tues., Nov. 29: “The Human Eye”
 - Thur., Dec. 1: “Special Topics” (Last Lecture)
 - Create topic suggestions, add ideas to current suggestions, and VOTE!
 - <http://tinyurl.com/1308topics>
- Homework 10 – due Thursday, Dec. 1, 09:30
- Grand Challenge:
 - Feel free to send me example write-ups.
 - Keep going! You can do it!

SMU Honors Physics
POSTER NIGHT

Dallas Hall Rotunda
November 29 (Tuesday), 6:15 – 7:30pm

How would you survive
if you had a
catastrophe...

IN SPACE

Join us for free food and an evening
of answers from the laws of physics.
The public is welcome!

Join your fellow intro physics
students for

**HONORS PHYSICS POSTER
NIGHT!**

Dallas Hall Rotunda,
Tuesday, Nov. 29 6:15-7:30pm

Free food.

Trapped in space. Only physics
can save you. What will your
team do next?

Free food.

Drop in. Stay as long as you like.



QUIZ TIME!

ANSWERS TO THE QUIZ QUESTIONS

Question 1:

Regarding images from lenses . . . (Circle one)

1. The images are only ever real.
2. The images are only ever virtual.
3. The image is real when it forms on the same side of the lens as the object.
4. The image is real when it forms on the opposite side of the lens from the object.

Question 2:

Converging thin lenses . . . (Circle one)

1. Creates only upright-real images.
2. Creates only upright-virtual images.
3. Can create both upright-real and inverted-virtual images.
4. Can create both inverted-real and upright-virtual images.

Question 3:

Diverging thin lenses . . . (Circle one)

1. Create only inverted-virtual images.
2. Create only inverted-real images.
3. Create only upright-real images.
4. Create only upright-virtual images.

Demonstrations of Lenses and Images

Solving Problems Involving Lenses and Images

Basic Principles

- Electric charge exists in two kinds, positive and negative. These exert influence on each other via a field of force.
- The electric field is a conservative force field, with associated concepts of potential energy and the new concept of “electric potential”. Fields accelerate charges, and this is the basis of circuits. There are relationships between fields and the energy stored and release in circuits (e.g. in capacitors and resistors).
- Magnetic fields, fields of force exerted by certain materials such as magnetite and iron, also affect electric charges.
- Moving electric charge creates magnetic field. Changing magnetic field flux causes voltage, and thus electric current. Changing electric flux generates magnetic fields.
- Light is an electromagnetic wave. It can be reflected or transmitted by interfaces (boundaries) between materials.

Instructor Problem:

Magnifying Glass

A magnifying glass is just a double-convex lens (in thin-lens speak, it's a purely converging lens). Its focal length is large enough that, when placed over text, you see a virtual image of the text on the same side of the lens as the text itself, only larger.

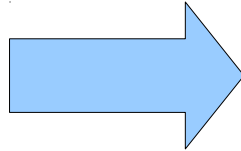
- You hold the magnifying glass 2.0cm in front of your mouth. This makes your teeth look twice as tall as normal to somebody looking through the glass at your mouth. What is the focal length of the lens?



Jupiter

First seen in detail by Galileo Galilei using his telescope designs. He discovered the four largest moons, from inner to outer: Io, Europa, Ganymede, Callisto.

This is a shorter exposure photo of just Jupiter. You can see the cloud banding. Dark regions are lower in the upper atmosphere, rich in Hydrogen; white regions are higher regions of the atmosphere, dominated by ammonia ices.





The Orion Nebula, photographed on 11/20/16 using “Peruna’s Scope”, at about 5:30am.

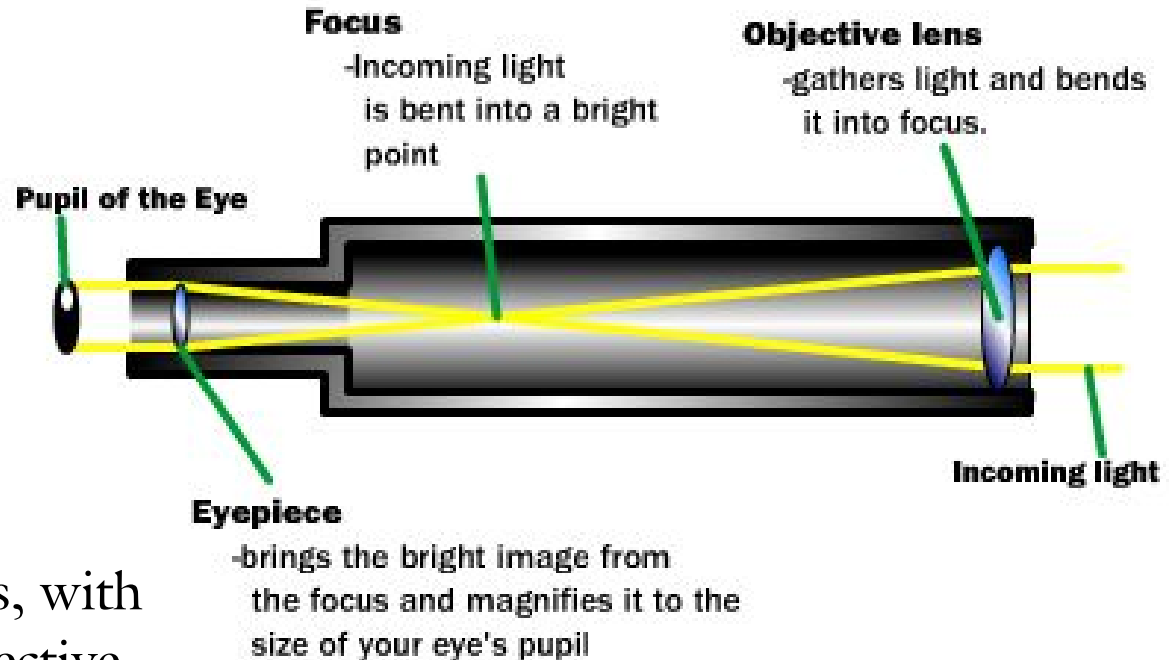
Student Problem:

Telescope

A telescope is made by combining two converging lenses. Parallel rays entering from a distant light source, like a star in the night sky, are bent by the first lens (“objective”) and focused to a point. The second lens (“eyepiece”) is smaller and take the rays emerging from the first lens and make them parallel again on the other side, just the right size to enter your pupil.

Refractor

- You take out the big lens (the “objective lens”) and hold it over a piece of paper. You observe that it enlarges writing on a piece of paper 3.0cm away from the lens by a factor of 1.25. What is the focal length of the objective lens?
- How far apart do the eyepiece lens, with focal length of 2.0cm, and the objective lens need to be placed to make the telescope work as described?



Extra Credit Opportunities

- Honors Physics Poster Night

- Show up, check out the posters, take notes, and grab a voucher. Hand in a 1-2 page answer in response to the following:

“Explain how one of the posters presented by the Honors Physics Students relates to a topic covered in our course (PHYS1308) and explain (including both written descriptions and equations) how the students used that topic to explore their question.”

Please submit your work by email as a PDF file. Conform with the policy on written homework solutions. **Due date: Thursday, Dec. 1, 9:30am.**

- This is worth up to 10 points to be added back to the Exam with the lowest score.
- Honors Physics Students: it doesn't make a lot of sense to distract you with this exercise, since anyway you are obligated to attend. Eric Godat and I have a system in place to reward you similarly.

Extra Credit Opportunities

- Bonus Take-Home Physics Exercise
 - Will be emailed later today.
 - It's a bit more difficult and lengthier than a standard homework or exam problem, because you can take it home and work on it.
 - I will use your results on this to add points to your grade on Exam 2.
 - **Due date: Tuesday, Nov. 29, 9:30am.**