

# Physics 221

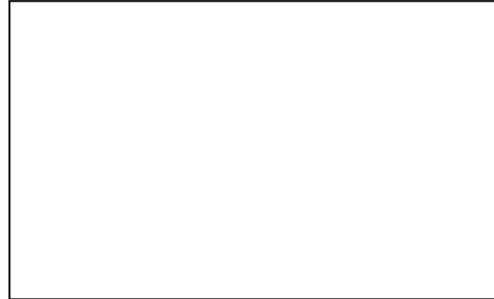
## Spherical "thin" lenses

The format for this lab will be a little different than the past.. Each member of the lab group must complete their own copy -- all copies will be collected.

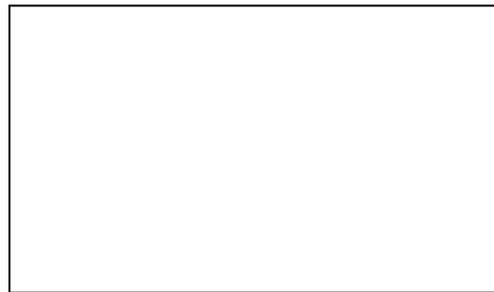
### Prediction

Consider converging and diverging lenses and how they react to parallel incoming beams of light.

1. Draw a **converging lens** in the space at right. Then sketch in five parallel beams of light coming from the left that travel through the lens.



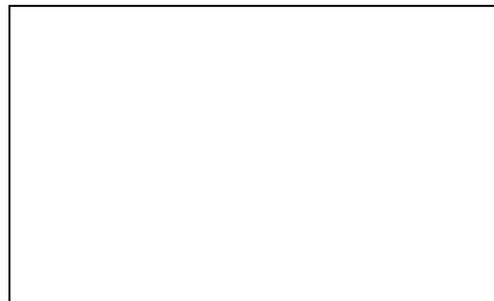
2. Draw a **diverging lens** in the space at right. Then sketch in five parallel beams of light coming from the left that travel through the lens.



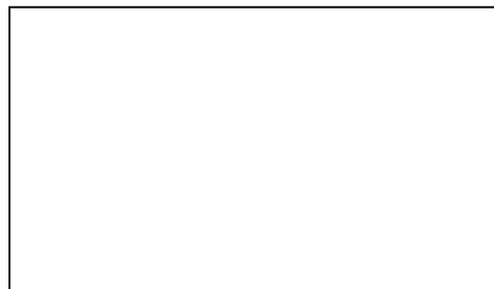
### Experiment

Test a converging lens and a diverging lens with the **ray box** set up on the side bench.

3. Draw a **converging lens** in the space at right. Then sketch in five parallel beams of light coming from the left that travel through the lens.



4. Draw a **diverging lens** in the space at right. Then sketch in five parallel beams of light coming from the left that travel through the lens.



## Investigation

*Materials: Converging lens (Convex), a Diverging Lens (Concave), paper, your eyes, very well lit objects.*

**A. Can you focus the image formed by a converging lens onto a screen? Sketch the results below.**

The best way to do this is to pick a well lit object and have your lens and screen in a room that is dimly lit compared to the object. For example while standing inside, focus objects that are outside onto your screen. Or stand in a room with the lights out and focus objects that are in a nearby lit room onto your screen.

**B. If you don't use a screen and look through the lens, can you see a clear image of the same object?**

1. Describe the image in both cases A and B. Is it upright or inverted, magnified or reduced and is it real virtual.

2. For each case A and B, determine if the position of the screen/your eye can vary and still keep a sharply focused image?

3. Draw a ray diagram to show how light moves from an object, through a converging lens, and forms an image. Label both focal points, the focal distance,  $f$ , the object and image distances  $s$  and  $s'$ , respectively as well as  $h$  and  $h'$ . Include all three special rays.



Our model says that you see things when light hits you in the eye. And, we've said, you can find the image (or object) you're looking at by tracing back the lines of light to the point in space where they intersect. (You did this in a tutorial last week - remember the "Mel and Taylor technique?")

4. The diagram you just drew shows light converging at a location in space - where the screen needs to be to focus the image - and then diverging out again from that point. Suppose that light hits someone in the eye after passing the "crossing point." Where would they see that light as coming from?

5. Explain why the results for 2 above are different for a screen and your eye.

## II. Diverging lenses

Repeat all of the steps in A and B above for a diverging lens.

### Final Question

1. Write a general description of the types of images that can be focused onto a screen and what types can be viewed by an observer. Explain why for each.