Lab Science **Section 19.2 Notes**

Light travels at _____ in a _____

Light traveling through air travels _____

When light enters a medium like water or glass, it _____

Light travels _____ in different materials (media).

The _____ is a number that tells how much a material slows down light.

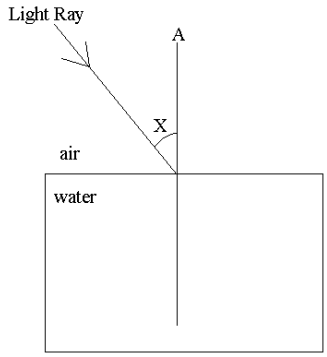
The index of refraction of water is 1.33 and light travels at 2.25 x 10^8 m/s in water. The index of refraction of certain glass is 1.5 in which light travels at 2.00 x 10^8 m/s.

Based on the information above, we can say that the _____ the index of refraction the _____ light will travel.

The bending of light as it travels from one medium into another is called _____

There are 2 requirements for refraction:

1. light must _____ as it enters the new medium
2. light must enter the new medium _____



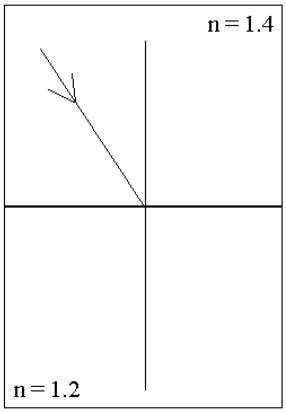
The angles are measured to line A, called the _____

Angle X is called the _____

As the light ray goes from the air into the water it will _____

The angle of the light ray to line A in the water will be _____ angle X. This angle is called the _____

Draw the refracted light ray on the diagram to the left.



In the diagram on the left, n indicates the _____

As the light ray enters the new medium it will _____

The angle of refraction will be _____ the angle of incidence.

Draw refracted light ray on the diagram to the left.

To summarize, when light enters a new medium _____
and _____, the light changes its angle or _____

If the light slows down in the new medium, the angle of refraction is _____
the angle of incidence.

If the light speeds up in the new medium, the angle of refraction is _____
the angle of incidence.

Preview Lab: Refraction in Liquids

If light travels from a higher index of refraction to a lower index of refraction, its speed _____
and the angle of refraction _____. At a certain angle of incidence, the angle of refraction is 90°. This angle of incidence is known as the _____ angle.

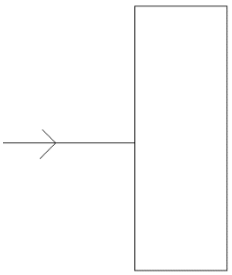
If the angle of incidence is greater than the critical angle, _____ occurs.

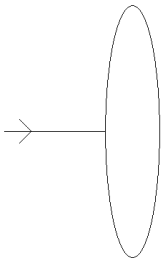
This phenomenon is used to transmit light through _____

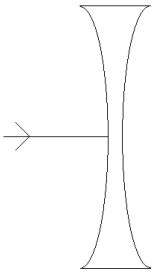
Fiber optics is used in _____ to transmit signals in the form of light over long distances with little interference or signal loss. It may even connect your _____

Fiber optics is also used to perform surgeries to make them _____
and reduce _____ and _____

Label each of the lenses based on its shape and draw path of the light ray through the lens. Give an example of where you might find each of these types of lenses.



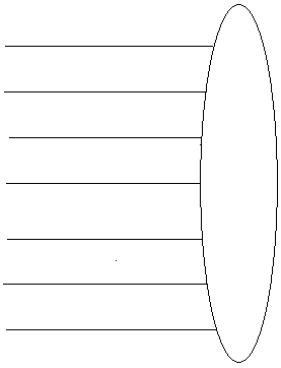


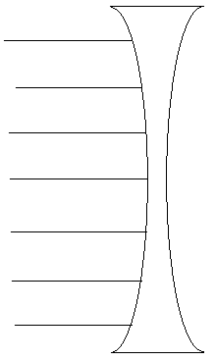


Type _____ Type _____ Type_____

Ex._____ Ex._____ Ex._____

Draw the refracted rays as the pass through the lenses and tell the type of each lens based on what it does to parallel incident rays of light.





Type_____ Type_____

The point where parallel rays of light meet after passing through a convex lens is called _____

Because light can pass through the lens from either direction, lenses have_____
which are labeled _____

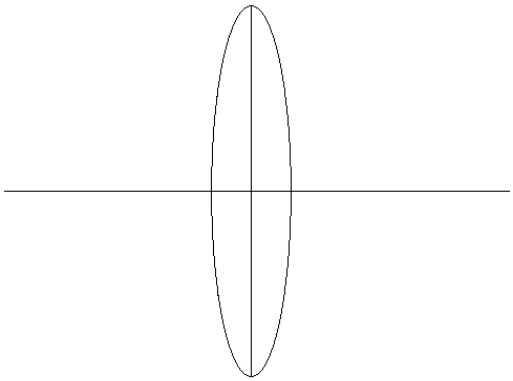
The location of the focal points of a lens are determined by 3 factors: the _____,
_____, and _____ of the lens.

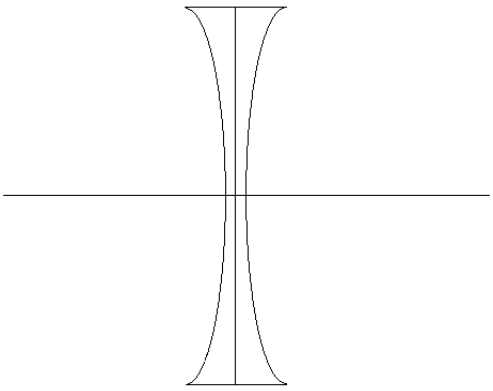
To solve lens problems, we will use a _____ similar to mirror problems
The _____ is a line that runs through the center of the lens
and contains the _____ of the lens.

Just like the mirror problems, lens ray diagrams will use _____ for the object
and will use _____ to locate the _____

Also like mirror problems, we will be using the ray diagram to determine the _____,
_____, and the _____ of the image
and whether it is _____ or _____

On the following diagrams, label the principal axis, the focal points (F_1 and F_2) and draw an object.





Notice that for the concave lens, the F_1 and F_2 are on _____
compared to the convex lens.

Ray diagrams use three rays to locate image and determine its _____ and _____

All three rays start at or go through the _____
and refract or bend at the _____

Ray 1: _____

_____

Ray 2: _____

_____

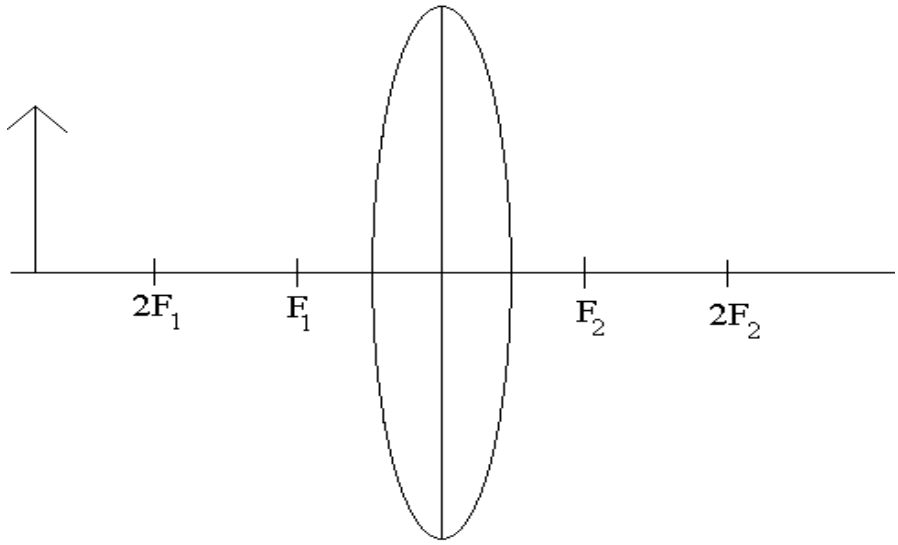
Ray 3: _____

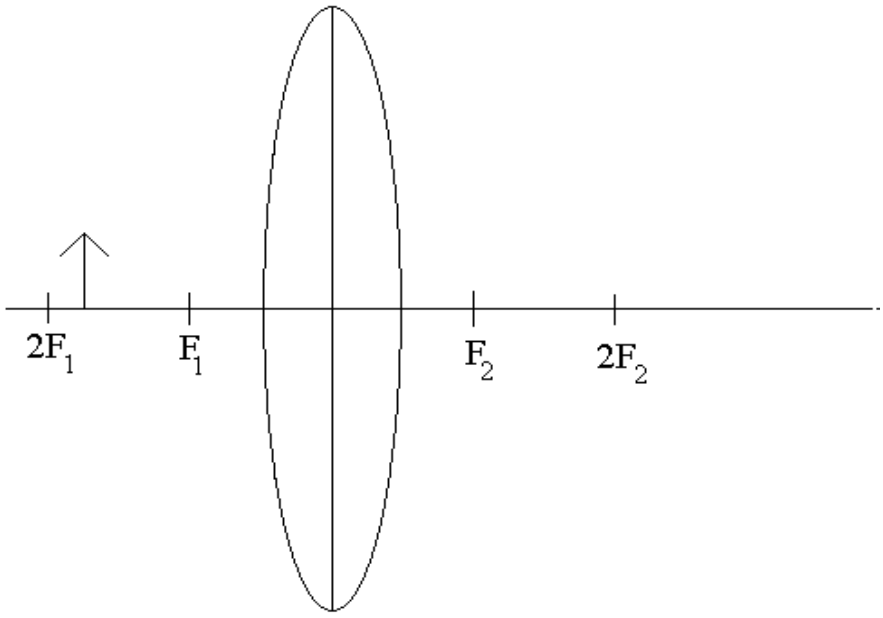
_____

The top of the image is located where _____

Since the object sits on the principal axis, the image _____

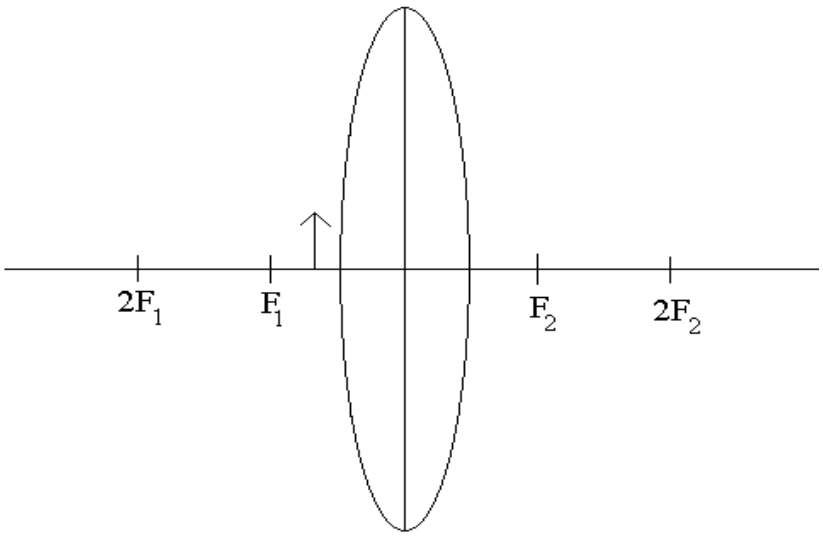
Use a ruler to draw in the three rays on the practice problem below and then draw the image including the top of the arrow pointing in the correct direction. You may want to use a different colored pencil for each ray.



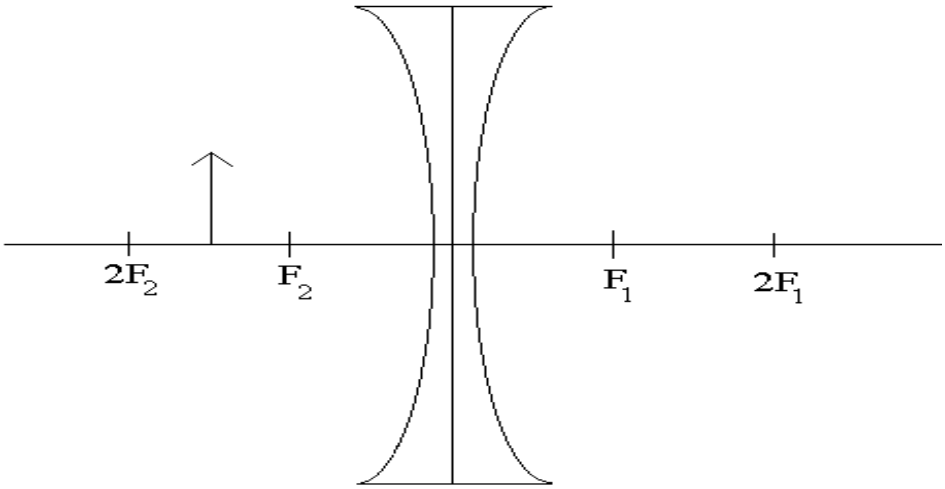


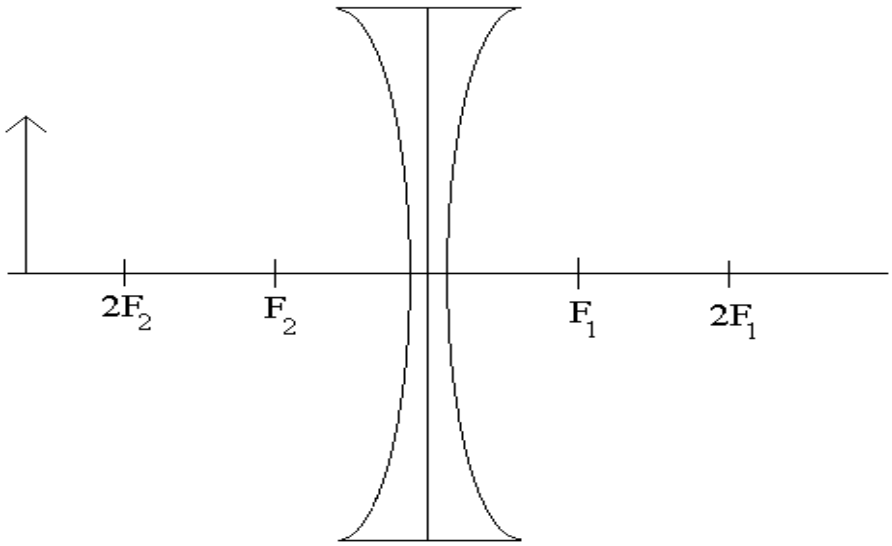
Real Images	Vs.	Virtual Images
-found where _____ actually meet		-found where _____ of rays meet
-orientation = _____		-orientation = _____
-location = _____		-location = _____

If the refracted rays do not meet past the lens, you must extend the _____ rays back until they meet _____



Notice that for a concave lens, the focal points F_1 and F_2 have_____.
This allows us to use the same descriptions for Ray 1 and Ray 2 of the ray diagram





Concave lenses can produce _____ images.

Convex lenses can produce _____ images.

Summary of the 4 different types of mirror problems

1. Convex lens, object outside of $2F_1$ (far from lens)

   Image formed is a _____ image

   Image is located _____

   Size of image is _____ than size of object

2. Convex lens, object between F_1 and $2F_1$

   Image formed is a _____ image

   Image is located _____

   Size of image is _____ than size of object

3. Convex lens, object in front of F_1 (close to lens)

   Image formed is a _____ image

   Image is located _____

   Size of image is _____ than size of object

4. Concave lens, object anywhere in front of lens

   Image formed is a _____ image

   Image is located _____

   Size of image is _____ than size of object