Science 8

5.3 Lenses

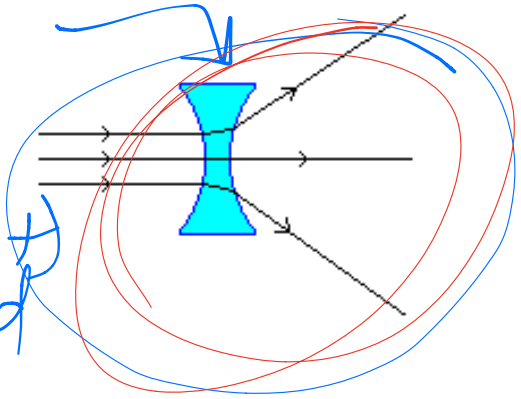
We have seen lenses in our microscopes, cameras or eyeglasses.

Lens: transparent material that refracts light predictably

Lenses are usually made of glass or plastic and have 2 curved surfaces.

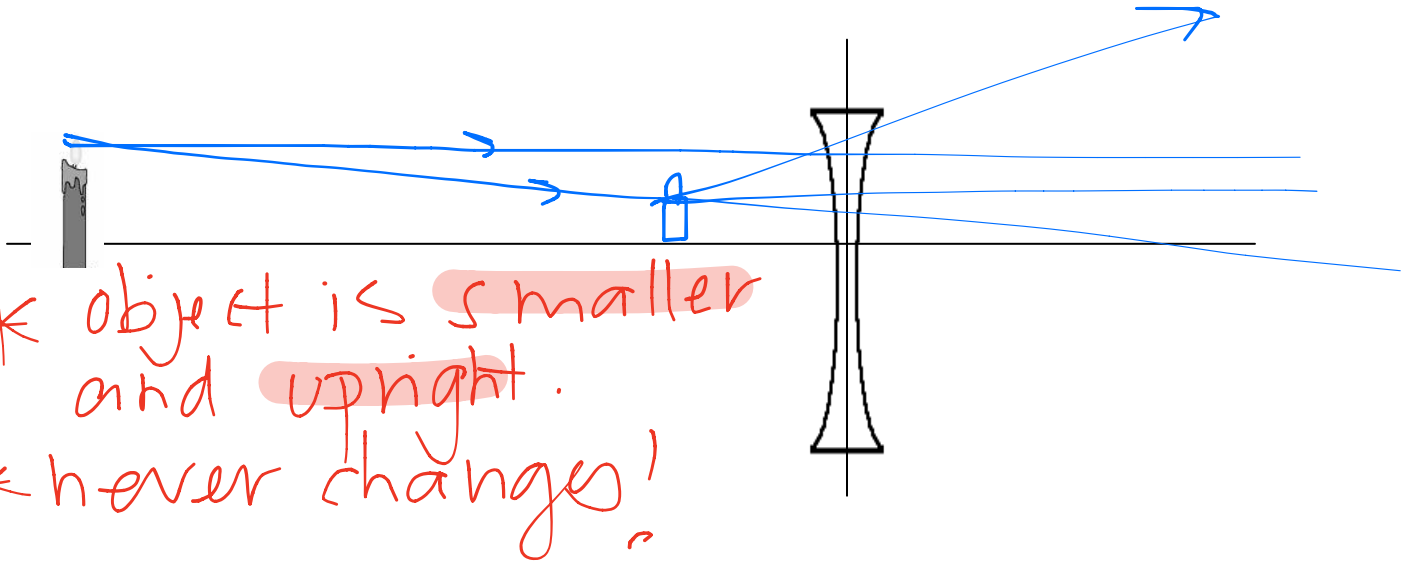
1

Concave lens: A lens curved inward



- Thinner at the centre than at the edge
- Makes things look smaller
- Diverges (spread out) light rays
- cannot be focused on a screen.

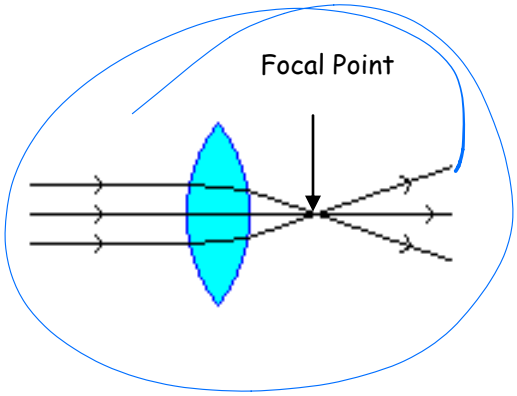
Draw figure 5.23 on Page 191. Label it clearly and use a ruler for the light rays.



* object is smaller and upright.
* never changes!

Convex lens: A lens curved outward

- Thicker at the centre ~~at the centre~~ than at the edge
- magnifies or makes things bigger



Science 8

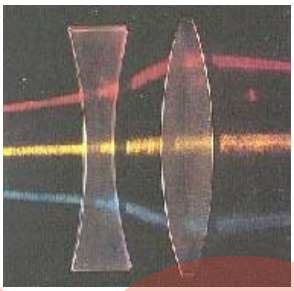
- Converges (brings together) light rays to a focal point
- Light that passes through a convex lens can be focused on a screen or other surface (projectors or cameras.)

Focal Length

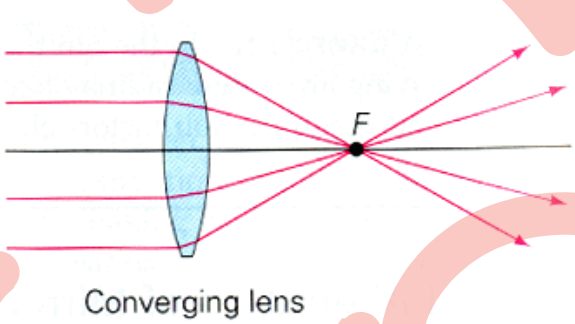
Different lenses have different focal lengths

- Depends on the strength of a lens
- The **stronger** the lens, the shorter the focal length.
- The **weaker** the lens, the longer focal length.
- A strong lens is more curved
- Concave lenses are often used together with convex lenses to help convex lenses give sharper images.

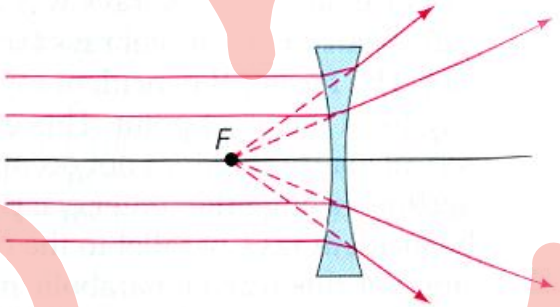
A concave and convex lens together can correct eachother!



Another diagram!!



Converging lens

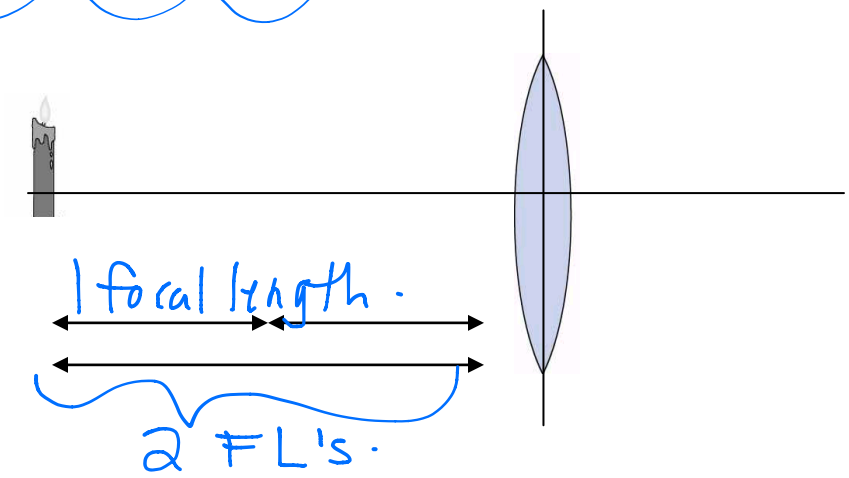


Diverging lens

Science 8

Convex Lenses

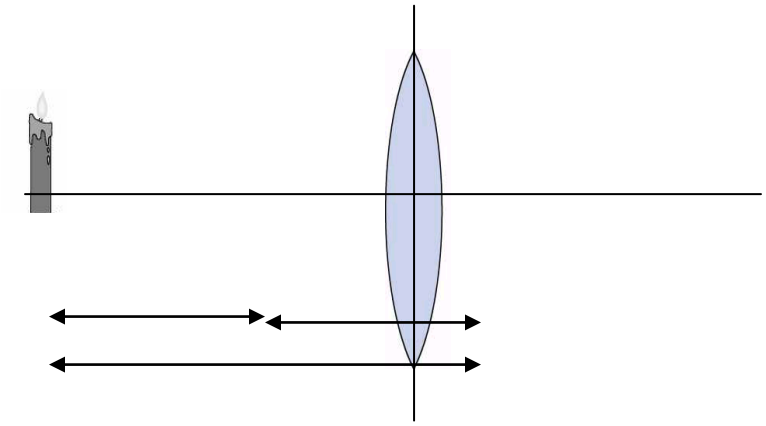
Draw figure 5.25 on Page 192. Label it clearly and use a ruler for the light rays.



A

Description:

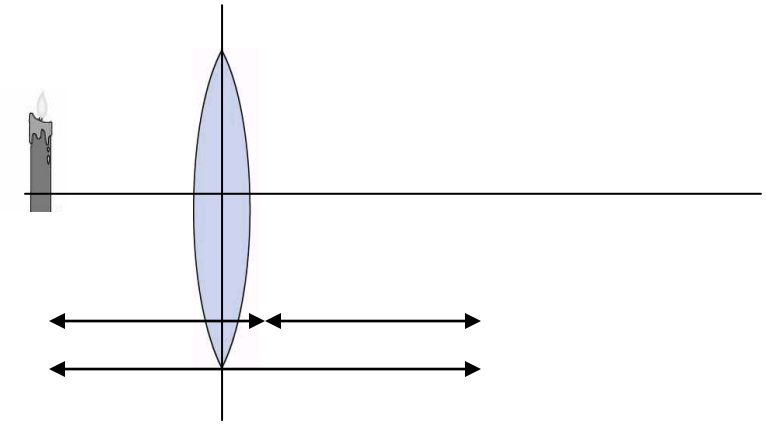
more than 2 FL's away = Image that is Smaller and Upside down.



B

Description:

object is between 1 and 2 FL's away. = Image is LARGER and Upside down.



C

Description:

object is less than 1 FL away = Image is LARGER and UPRIGHT

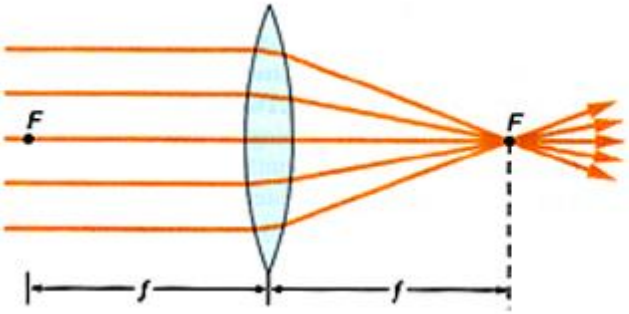
Science 8

Fill in the table below: Convex lenses.

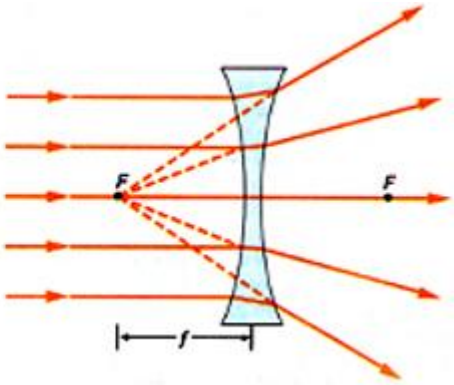
Distance of Object from Lens	**Type of Image Formed**
More than two focal lengths	smaller, inverted
Between one and two focal lengths	larger, inverted
Object at focal point	no image ☹
Less than one focal length	larger, upright!!

Review of parallel light rays hitting a lens

Convex Lens



Concave Lens



- ❑ Read pages 190-196 in your textbook
- ❑ Do Pg. 197 # 1-11 in your textbook

Science 8

Refracted Light, Lenses and Mirrors

Name_____
Date_____ Per__

Purpose: To observe how light rays behave when they pass through a plastic block, a curved lens and a curved mirror.

Materials:

Ray box	Lens/Mirror kit
Baffle	Plastic block

Procedure (Part 1)

1. Adjust the ray box so that the edges of the light beam are parallel. Insert the single slit baffle.

2. Place the plastic block on your paper below.

3. Shine the light ray from the ray box at the plastic block on your paper below. Trace the plastic block.

4. Trace the path of the refracted ray. Use a ruler. Use arrows to indicate the direction of the ray.

5. Remove the plastic block and draw a line connecting your incident and refracted ray.

Observations/Diagrams

Science 8

Procedure (Part 2) - Lenses

1. Adjust the ray box so that the edges of the light beam are parallel. Insert the 5-slit baffle.
2. Place the convex lens on your paper. Trace the lens.
3. Shine the light rays at the lens.
4. Trace the paths of the refracted rays. Use a ruler. Use arrows to indicate the directions of the rays.
5. Repeat steps 2 – 4 for a concave lens.

Observations:

Convex Lens

Concave Lens

Science 8

Procedure (Part 3) - Mirrors

1. Adjust the ray box so that the edges of the light beam are parallel. Insert the 5-slit baffle.

2. Place the convex mirror on your paper. Trace the mirror.

3. Shine the light rays from the ray box at the convex mirror.

4. Trace the paths of the reflected rays. Use a ruler. Use arrows to indicate the directions of the rays.

5. Repeat steps 2 – 4 for a concave mirror.

Observations:

Convex Mirror

Concave Mirror

Science 8

Light, Mirrors and Lenses Review

Name_____
Date_____ Per____

1. Use the following words to complete the sentences below

Transparent a desk absorbed transmitted opaque
frosted glass translucent window glass reflected

a) Three things can happen to light when it hits matter. It can be _____, _____, or _____.

b) Light that is soaked in is _____.

c) Light that bounces off matter is _____.

d) Light that passes through matter is _____.

e) A substance that transmits light as well as detail is said to be_____.

f) A substance that blocks light is said to be _____.

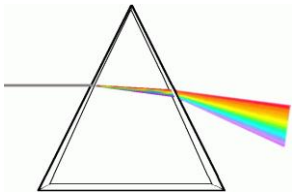
g) A substance that transmits light but no detail of that light is _____.

h) An example of a transparent object is _____.

i) An example of an opaque object is _____.

j) An example of a translucent object is _____.

Science 8
Chapter 4 Review



1. Light is passing through a glass shaped like a triangle.

   What do we call this kind of glass?

2. What kind of light is entering the prism?

3. The prism is _____ the light.

4. The white light is breaking up. It is separating into a rainbow of colours. What do we call this rainbow of colours?

5. Which colour has the highest frequency?

6. Which colour has the lowest frequency?

7. Which colour has the longest wavelength?

8. Which colour has the shortest wavelength?

9. Which colour is refracted the least?

10. Which colour is refracted the most?

Science 8

Fill in the blanks with the terms below:

Visible spectrum	violet	many	orange	Sir Isaac Newton
blue	red	much faster	green	prism
no	yellow	how fast	indigo	

1. Light from the sun gives off light that seems to have _____ colour.
2. "White" light is really made up of _____ colours.
3. The colours that make up white light are called the _____.
4. The colours of the visible spectrum in order are _____, _____, _____, _____, _____, _____, _____.
5. Colour depends on _____ the light energy vibrates.
6. We can separate the colours of white light with a prism.
7. The scientist who discovered that colours make up white light was _____.

<u>Electromagnetic spectrum</u>

1. List the members of the electromagnetic spectrum from left to right

_____ _____ _____ _____
_____ _____ _____ _____

2. The farther to the right you go on the electromagnetic spectrum, the _____ the frequency of the waves.

3. Which have a higher frequency?
    a) Gamma or radio waves?
    b) Gamma or cosmic waves?

c) Ultraviolet or x-rays?

d) Infrared or ultraviolet rays?

e) Visible light or radio waves?

4. Which is the only form of energy that we can see?

5. Describe how light is affected by

(a) a transparent object

(b) an opaque object

(c) a translucent object

4. Why is frosted glass often used for bathroom windows instead of clear glass or a solid wall?

True or False?

1. Visible light is part of the electromagnetic spectrum.
2. Visible light takes up only a small part of the electromagnetic spectrum.
3. Every member of the electromagnetic spectrum has the same frequency.
4. We can see every member of the EM spectrum.
5. We can see UV light.

6. We can see infrared light.
7. UV light has too high of a frequency for us to see it.
8. Infrared light has too high of a frequency for us to see it.
9. Infrared rays are heat rays.
10. The sun gives off ultraviolet and infrared energy.

Complete the table below. In the second column, classify each material as transparent, opaque, or translucent. In the third column, state whether light is absorbed, reflected, transmitted, or scattered when it strikes the material. In the last two boxes of the first column, write your own examples.

Material	Classification	Behaviour of light
glass		
white clouds		
stained glass window		
aluminum foil		
fog		
cellophane		
cardboard		
wax paper		
black chalkboard		
mirror		
	transparent	
		scattered

Science 8

Use the following words to complete the sentences below

Incident ray	angle of incidence	equal	angle of reflection	
	normal	reflected	is not	refraction
more slowly	away from	more	air	at an angle
towards	less			

(a) A single line of light energy is called a _____.

(b) A ray that strikes a surface is called an _____ ray.

(c) A "bounced" ray is called a _____ ray.

(d) A line that makes a 90^{o} angle to a surface is called a _____.

(e) The angle between an incident ray and its normal is called the _____.

(f) The angle between a reflected ray and its normal is called the _____.

(g) An angle of incidence is _____ to its angle of reflection.

(h) The bending of light as it passes from one medium to another is called _____.

(i) Refraction takes place when light strikes a surface _____ to the normal.

(j) Light that strikes a surface in the same direction as the normal _____ refracted.

(k) Light travels at about 300 000 kilometres per second in _____.

(l) Glass and water are _____dense than air.

(m) Light travels _____ in glass or water than it does in air.

(n) Light that moves at an angle from a less dense medium to a more dense medium is refracted _____ the normal.

(o) Light that moves at an angle from a more dense medium to a less dense medium is refracted _____ the normal.

Use the following words to complete the sentences below

Refracts	smaller	centre	focal length	concave
convex	focal point	larger	edge	

Science 8

1. A lens is a transparent material that _____ light in a definite way.
2. The two main types of lenses are _____ and _____.
3. A concave lens makes things look _____.
4. A convex lens makes things look _____.
5. The thickest part of a convex lens is its _____.
6. The thickest part of a concave lens is its _____.
7. A _____ lens can form an image on a screen.
8. A _____ lens cannot form an image on a screen.
9. The point where converging light meets is the _____.
10. **The distance between a lens and its focal point is called its _____.**

Science 8

Convex & Concave Lenses

1. Describe a concave lens.

2. Light rays _____ when passing through a concave lens.

3. Describe a convex lens.

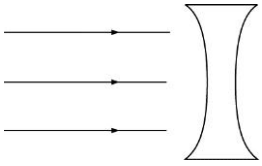
4. Light rays _____ when passing through a convex lens.

5. Sometimes people use the phrase double convex or double concave to describe a lens. They are referring to the shape of each surface. To identify concave and convex lenses, it is the thickness of the glass in the middle compared to the thickness at the edges that counts. Classify the following lenses as convex or concave.

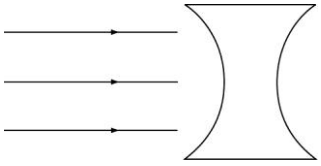
_____ _____ _____ _____

6. Draw the paths of the light through each of the following lenses.

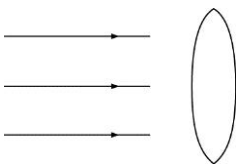
Concave lens with small curve



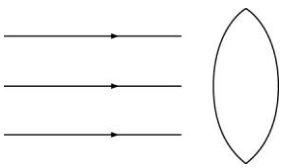
Concave lens with large curve



Convex lens with small curve



Convex lens with large curve

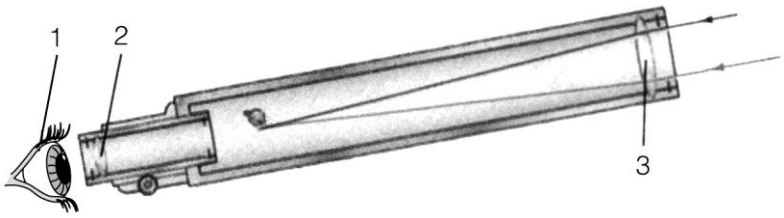


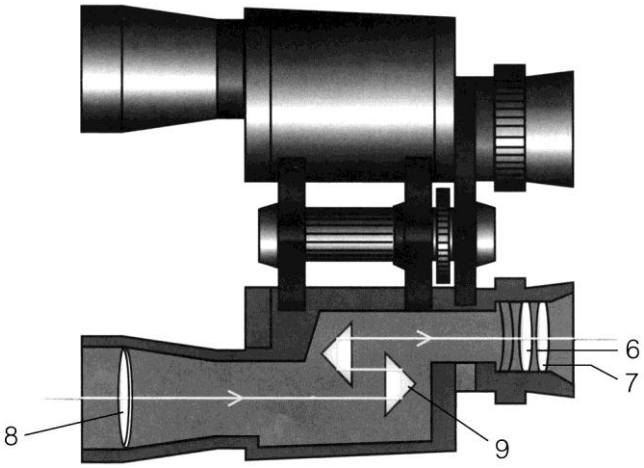
Technology using Mirrors, Lenses and Prisms

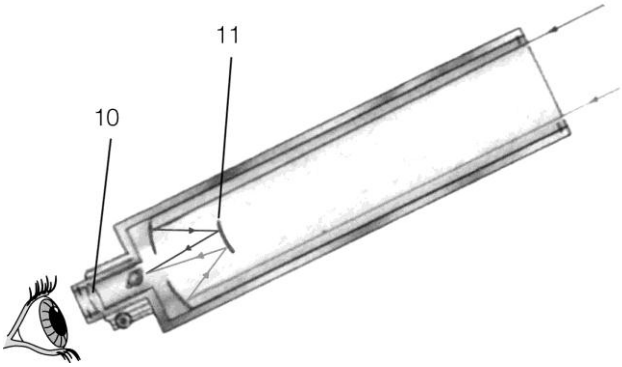
Name_____
Date_____ Per___

Science 8

Label the lenses and mirrors in these diagrams as concave, plane, or convex. Record your answers at the bottom of the page.







1. _____ 2._____ 3. _____

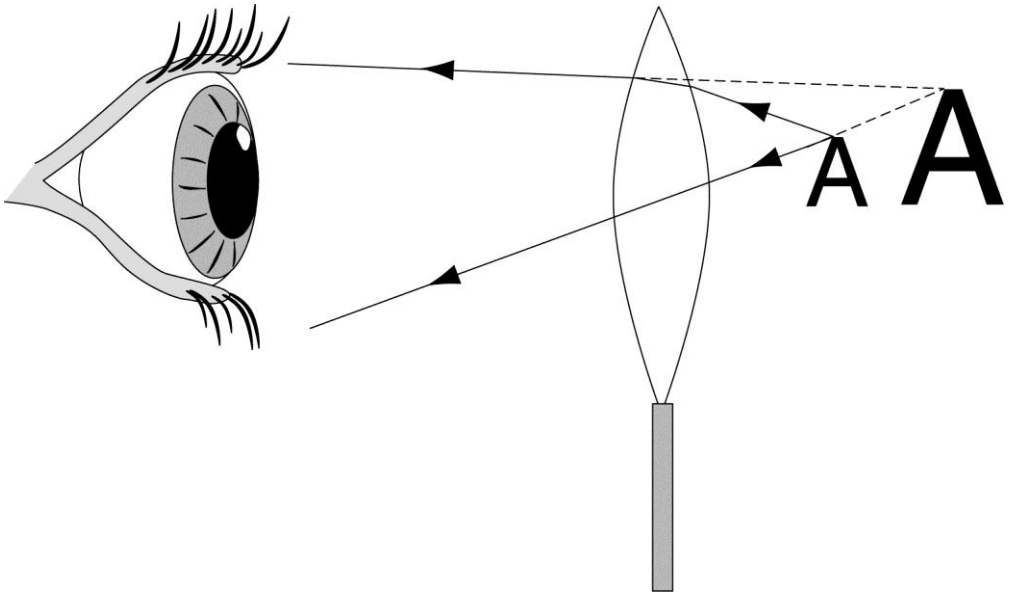
4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____

10. _____ 11. _____

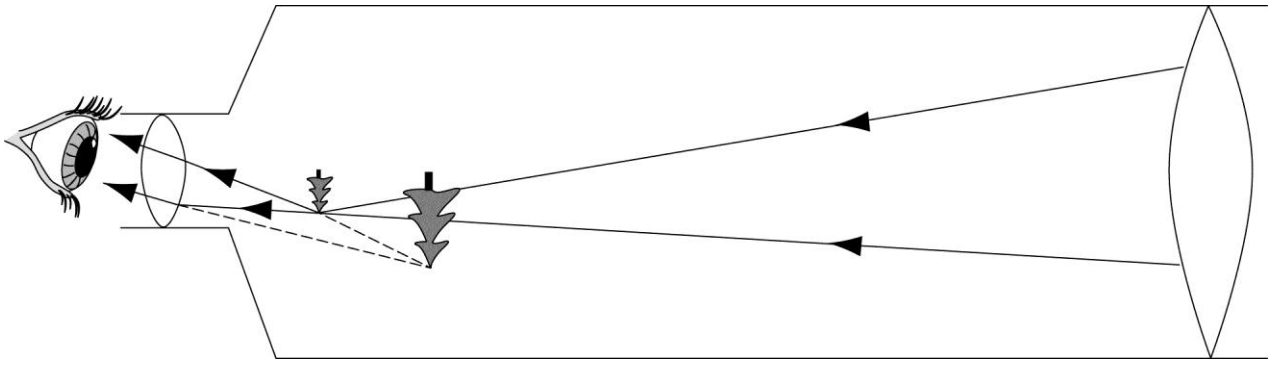
HOW DOES IT WORK?

Magnifying Glass



When viewing an upright object, the observer sees a magnified, upright image.

Refracting Telescope



The eyepiece acts like a magnifying glass, so the observer sees a magnified, inverted image of the real image cast by the objective lens.