Light - Oh I see

1. When we talked about echoes, we learned that an echo is a sound wave bouncing off something. Since light is a wave as well, why don't we see "light echoes"?

2 Is a light year distance or time?

3. I know that sound needs a medium. Does light need a medium? Give me proof.

4. Is light a transverse or longitudinal wave?

5. Other than the visible light (that we see) are there any other waves zipping around us?

6. Where do these electromagnetic waves come from?

7. On the electromagnetic spectrum, which waves would pose the greatest threat to our health? WHY?

8. Which electromagnetic waves travel the fastest?

9. Which electromagnetic wave has the longest wavelength?

10. How much of the electromagnetic spectrum is made up of light we can see (visible light)?

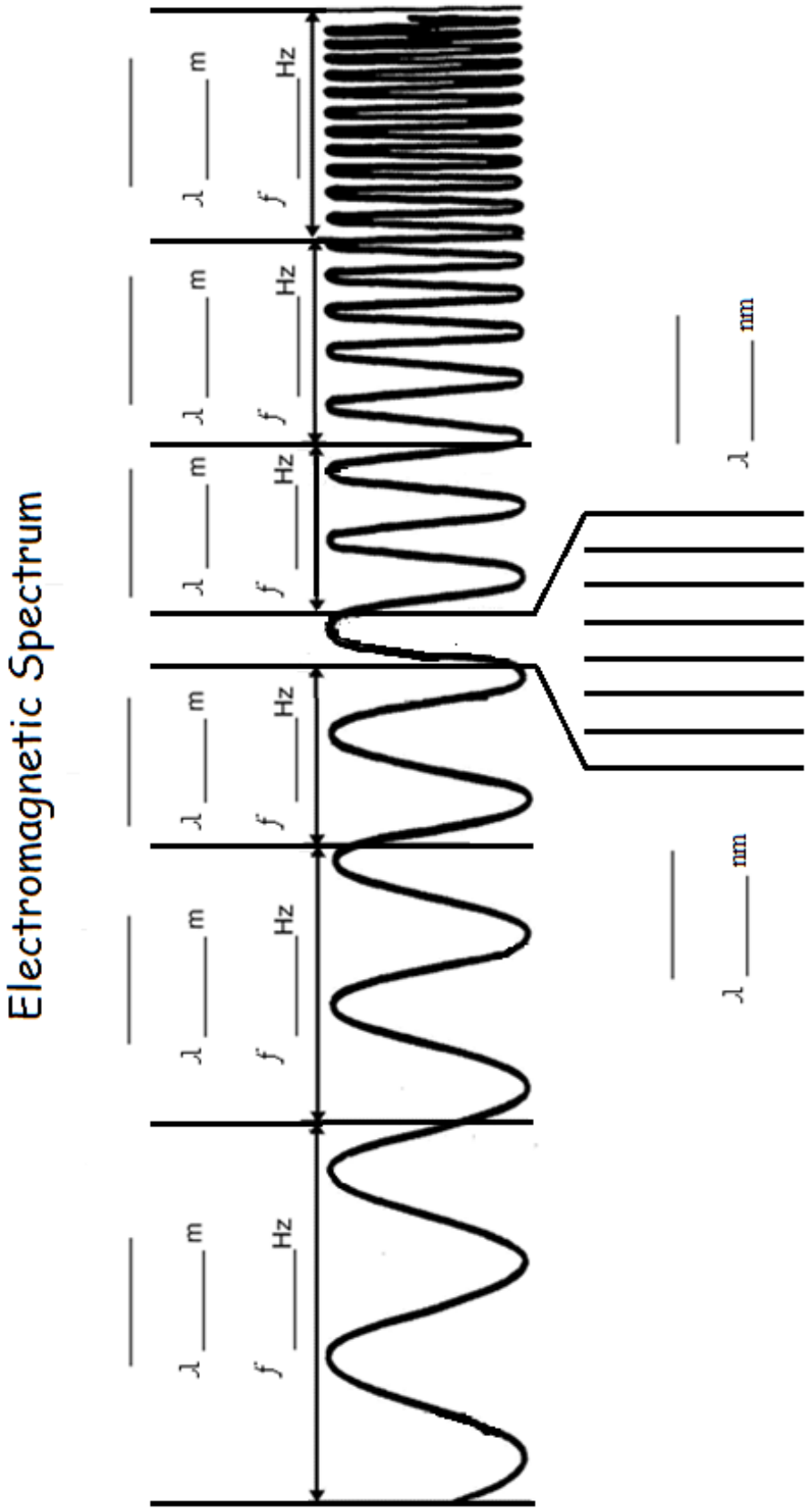
11. What are some of the uses of the different electromagnetic waves?

12. What does it mean to say something is transparent? What does opaque mean?

13. I know glass is transparent to visible light. Is glass transparent to the whole electromagnetic spectrum?

14. What causes the glass to not transmit (be transparent to) an electromagnetic wave?

Electromagnetic Spectrum



Light and an introduction to colors

1. What color do you see when you look at the fluorescent lights in the ceiling?

   What colors do you see when you look at the same lights through a spectroscope?

2. Use the spectra scope and examine the color of the light emitted by the sun. What colors do you see?

   List the colors of the rainbow in order of lowest to highest energy

3. What colors do you see when looking at the following light sources:

   a. Hydrogen

   b. Helium

   c. Air

   d. Neon

4. How is color produced from these different gasses?

5. What is different about the gasses in question 3 that make you see different sets of colors?

6. How can scientists use this information to determine what stars are made of?

7. What makes light in a regular light bulb?

8. Why are fluorescent lights bright and more efficient?

9. What color of light would you see from the sun if you were in space?

10. Why is the sky blue?

11. What color is the sun as seen from earth? Why?

12. What two structures in our eyes detect light?

    a. Which if these are used to detect black and white?

    b. Which of these is used to detect colors?

    c. What colors do they detect?

13. Why do green houses heat up?

Mixing Light = Color Addition

1. The diagram below depicts the primary and secondary colors of light. Primary colors are shown where there are no overlapping circles. These colors correspond to the cones in our eyes. The three primary colors are:

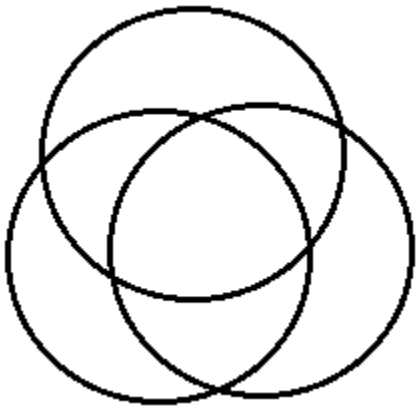
2. The secondary colors are where two circles overlap. The secondary colors are the addition of two primary colors.

   Red + Green = _____

   Red + Blue = _____

   Blue + Green = _____

   Label the secondary colors on the diagram.



Mixing pigments = Color Subtraction

1. The secondary colors of light make up the primary colors of pigments. Mix the following combinations of clay to determine what happens when pigments are mixed.

   Cyan + Magenta = _____

   Cyan + Yellow = _____

   Yellow + Magenta = _____

2. Using one of the examples above, show how color is subtracted to leave the final color.

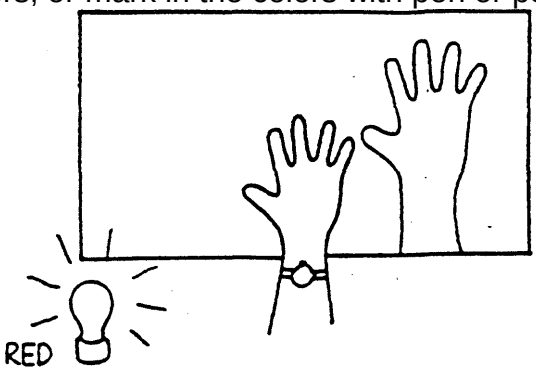
Filters

1. A filter _____ its own color while all other colors are _____.

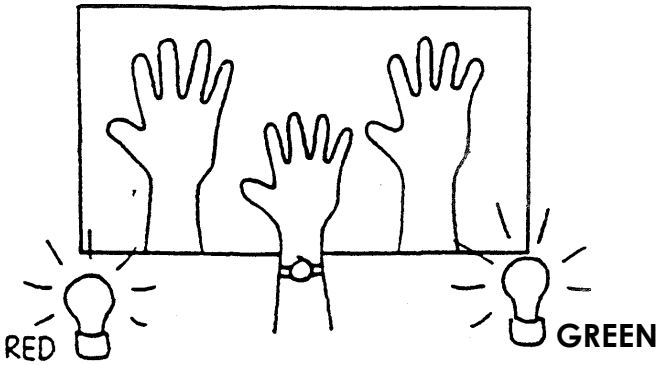
Show examples here

Light Demonstrations

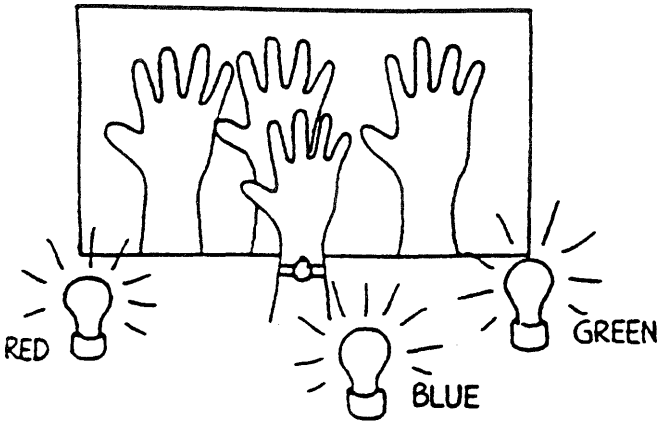
1. The sketch shows the shadow of a hand held in front of a white screen in a darkened room. The light source is red, so the screen looks red and the shadow looks black. Color the sketch with colored markers, or mark in the colors with pen or pencil.



2. A green lamp is turned on and makes a second shadow. The formerly black shadow cast by the red light is no longer black, but is illuminated with green light. So it is green. Color or mark it green. The shadow cast by the green lamp is not black, because it is illuminated with the red light. Color or mark its color. Color or mark the background, which receives a mixture of red and green light.

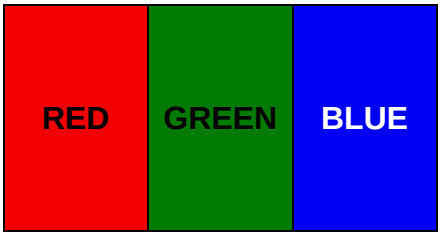


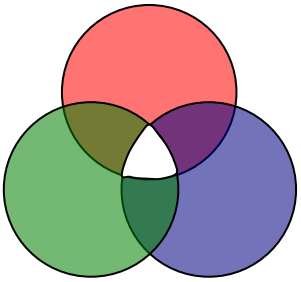
3. A blue lamp is turned on, and three shadows of the hand appear. Color or mark the appropriate colors of the shadows and the background.



Name _____

Color Worksheet





Fill in the blanks. (Some may require more than one color!)

1. Red light + blue light = _____
2. White light - red light = _____
3. White light - blue light = _____
4. Green light + blue light = _____
5. Green light + blue light + red light = _____
6. Magenta light + cyan light = _____
7. Magenta light + green light = _____
8. Yellow paint absorbs _____ light.
9. A magenta filter absorbs _____ light.
10. A cyan filter allows _____ light to pass through it.
11. A piece of cyan paper illuminated with red light will look _____
12. A piece of magenta paper illuminated with red light will look _____
13. A piece of blue paper illuminated with red light will look _____
14. A piece of blue paper illuminated with yellow light will look _____
15. A cyan filter placed over a magenta filter will allow _____ light to pass through it.
16. A red filter placed over a magenta filter will allow _____ light to pass through it.
17. A red filter placed over a cyan filter will allow _____ light to pass through it.
18. In order to get a true green color, an artist would mix _____ paints.
19. In order to get a true red color, an artist would mix _____ paints.
20. Magenta paint mixed with yellow and cyan paints produce._____

Color Phun

The following symbols indicate the color of an object in white light.

®	Ω	Λ	∝	♥	©	Σ	∅
red	blue	green	yellow	magenta	cyan	white	black

1. Write the color each of the following objects would appear in **green** light on the line below the object.

   ® Λ ∝ © Σ

   _____

2. Write the color each of the following objects would appear in **magenta** light on the line below the object.

   ∝ ♥ ∅ © Λ

   _____

3. Write the color each of the following objects would appear in **yellow** light on the line below the object.

   Σ Ω ® ♥ ©

   _____

4. Write the color each of the following objects would appear in **blue** light on the line below the object.

   Λ Ω ® ♥ ©

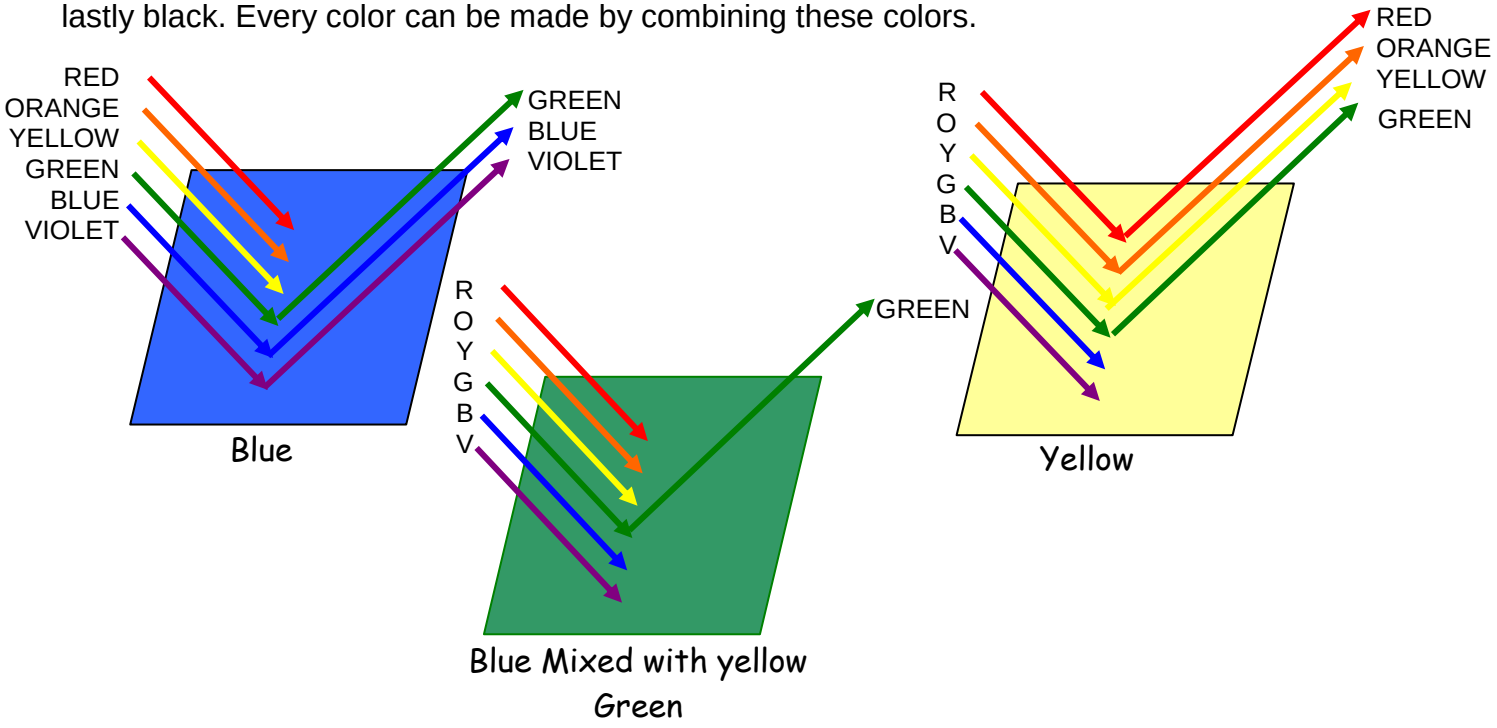
   _____

5. If you were jealous of your friend's dazzling new red sweater, how could you make it turn black at the dinner table by changing the light bulb? In other words, what color would the light bulb need to be? Explain your answer.

Pigments -Mixing Paint & Printing – Color by subtraction of light

Pigments simply absorb certain frequencies and reflect others. Whichever color the pigment reflects the most will be the color that the pigment appears. For example blue pigment reflects mostly blue, but also reflects violet and green while absorbing all other colors. A yellow pigment reflects mostly yellow, but also reflects red, orange, and green. If you combine these two pigments only green is reflected by both so green is the color produced. This process is called subtractive color mixing (note the difference between additive and subtractive).

Primary colors for subtractive color mixing are magenta, cyan, and yellow. Why? (figure this out for yourself) These colors (plus black) are used in printing illustrations in full color. Each color page is printed four times in succession - first with cyan, second yellow, third magenta, and lastly black. Every color can be made by combining these colors.

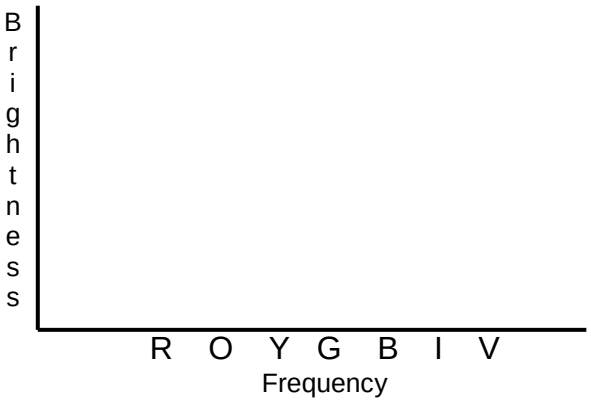


Name _____

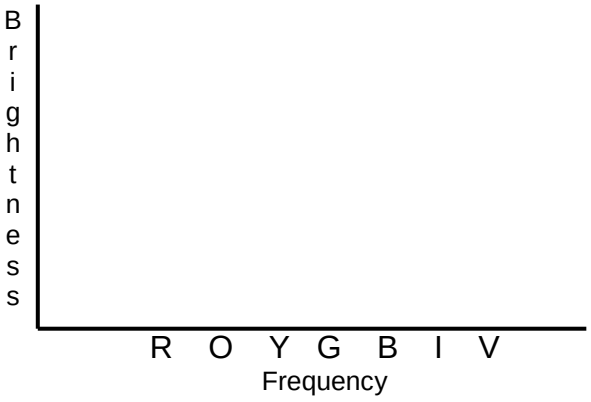
Radiation Curves

1. Draw the radiation curves (frequency vs. brightness) for each of the different light sources and label where each peaks.

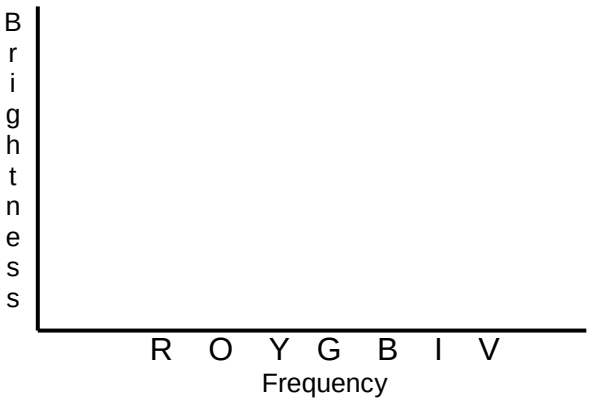
SUNLIGHT



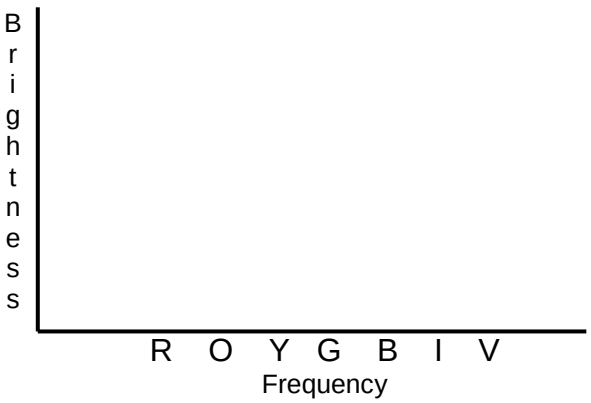
INCANDESCENT LIGHTS



FLUORESCENT LIGHTS



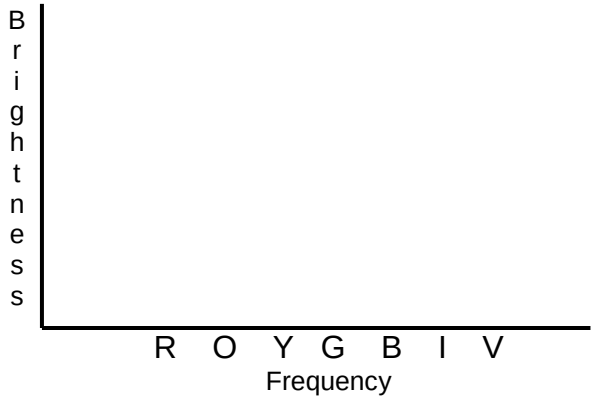
BLACK LIGHT



2. Why do clothes sometimes seem like they match in a department store but not when you go outside?

3. Draw the cone sensitivity for human eyes on the diagram.

HUMAN EYES



4. How does the sensitivity of the different cones compare to the brightness of sunlight? Why?

Why are some fire trucks painted a yellowish green color?

Notes:

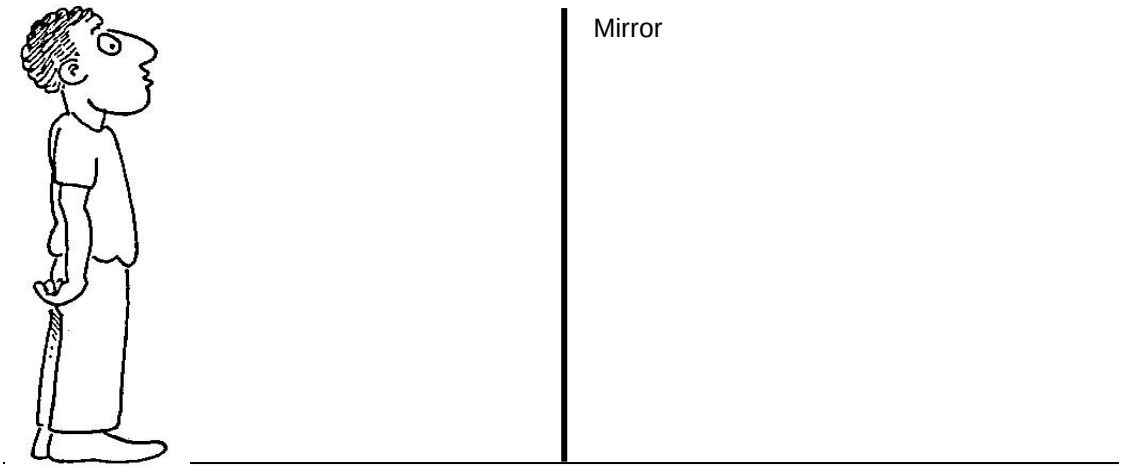
1. Why are fire trucks painted a yellowish green color?

2. Tennis balls used to be white. What advantage is there to making tennis balls yellow-green?

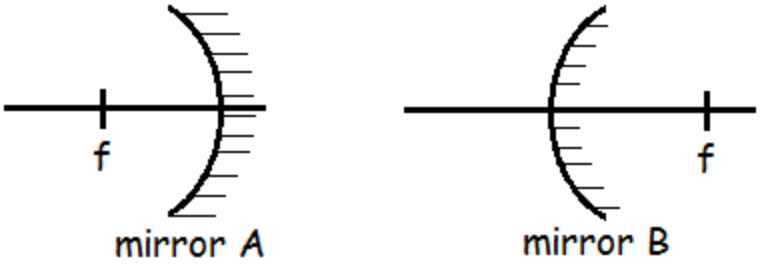
3. Many road signs are being repainted. What advantage is there to having yellow-green road signs?

4. What color(s) are our eyes most sensitive to? Why?

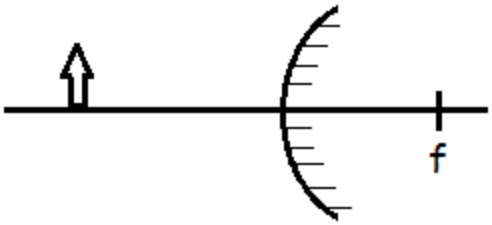
1. Ray diagram for a flat mirror:



2. The mirror A in the diagram below is a _____ mirror. The light converges to what point? Mirror B is a _____ mirror and diverges light in what direction?



3. Using the diagram below, draw a ray diagram for the convex mirror.



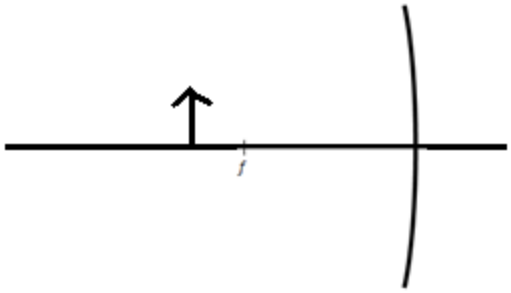
a) The image formed by this mirror is always:

_____ and _____

b) Examples of this type of mirror include:

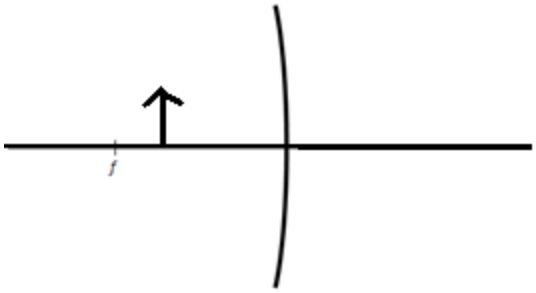
4. Draw a ray diagram for a concave mirror with an object outside the focal point.

   The image for this location is _____ and _____



5. Draw a ray diagram for a concave mirror with an object inside the focal point.

   The image for this location is _____ and _____



Summary:

A concave mirror is curved _____ while a convex mirror is curved _____

If an image is upright then it must be _____

In a concave mirror, the image is _____ and _____outside the focal point and switches to _____ and _____ inside the focal point.

LIGHT REVIEW SHEET

Answer the following in two or more full, thoughtful sentences?

1a. What is the source of all electromagnetic waves?

b. How fast do light, radio waves, microwaves, etc. travel in a vacuum?

3a. Write the electromagnetic spectrum in order of increasing energy.

b. in order of increasing wavelength.

c. in order of increasing frequency.

4. Why does light travel faster through a vacuum than through a medium?

5. What happens to various parts of the electromagnetic spectrum when they strike glass? Give examples.

6. What does the word transparent mean? What does opaque mean?

7. What is the difference between polarized and unpolarized light? How can you tell if light is polarized?

8. Define both black and white.

9. What are the primary colors of light?

10. Define and give examples of complementary colors.

11. Distinguish between color mixing by addition and color mixing by subtraction?

12. Why is the sky blue during the day but red at sunset and sunrise?

13. Why is water cyan? Why do lobsters look black from above water?

14. How do you know what elements are in the sun and what instruments are used to determine this?

15. What colors would the following objects appear in each color light?

color in white light	red	green	magenta	cyan	yellow
color in blue light					
color in cyan light					
color in yellow light					