ART I: UNIT TWO
PRINCIPLES OF COLOR

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PRINCIPLES OF COLOR

For this Unit, you will need a few basic supplies. These can be purchased at any arts and craft store. Some items can even be purchased at places such as K-Mart or Wal Mart.

1. Tempera paint* (liquid, not solid) in the following colors:

    Red

    Blue

    Yellow

    Black

    White

    *You will be mixing all of your other colors from various combinations of these five colors. No others are needed.

2. Artist brushes* in several sizes.

    #3

    #2

    #1

    #0

    *These should be natural or synthetic hair and need not be overly expensive, but not the cheapest either.

It is important the brush have a tapered tip, or a rounded one, not a flat tip.

3. Paint mixing trays or cups. You can buy individual cups, you will need six, or a paint tray that contains six cups. Plastic or wax cups, or even an old ice cube tray will also work for this.

4. Wax palette paper is an option for mixing colors on but is not a necessity. Some people find it easier to mix on a larger flat surface instead of in cups. Wax palette paper has the advantage of being disposable, but a plastic or ceramic plate will also work, as long as the surface is not porous. I choose to mix my colors on a piece of glass.

INTRODUCTION

Of all the elements and principles the artist or designer has to work with, color is probably the most exciting. It is constantly changing with the time of day and the amount of sunlight or artificial light in the atmosphere. It affects our senses directly, in a way no other element does and it is universal in its appeal and effects on people and animals. Color is also the only element of design that effects can be measured directly by science.

When any one element can have as much impact on our perceptions, it is imperative that the artist have an understanding of how color works, so it may be used effectively, as well as to get the utmost meaning and enjoyment out of others artwork and the world around us in general.

Before beginning this Unit, take a moment and write in the space below, what you expect this Unit to be about. What will it include, what do you expect it to be like and what do you expect to learn?

_____

_____

_____

_____

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_____

_____

OBJECTIVES

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this Unit.

When you have finished this Unit, you will:

1. Have an understanding of what color is and how it works.

2. Have insight into how color is used by the many different types of artists.

3. Learn to better interpret a work of art.

4. Have an appreciation for the many factors an artist or designer must consider when using color.

5. See how color affects our everyday lives.

Note: All vocabulary words in this Unit appear in **boldface** the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

WHAT IS COLOR?

It is important to understand how we perceive color before we can begin to use color. The brighter the **light**, the more intense the color; the less intense the light, the less color we see. It is possible to see evidence of this on any night brightly lit by a full moon. If you stand in a room with the lights on you can see a full range of colors, but if you turn out the light and wait for your eyes to adjust to the moonlight, you will notice that if you can see any color at all, it will be very dull and gray-looking.

The sun gives off radiation and electromagnetic radiation. What we call white light is only one small part of this radiation. White light is the radiation we can see, and it is this radiation that creates color.

Gamma Rays	X-Rays	White Light*	Infrared Rays	Radar	Radio Waves	A-C Circuits

*White Light or the Spectrum-violet, blue, green, yellow, orange, red.

COLOR AS LIGHT

Sometime around 1676, Sir Isaac Newton passed a beam of sunlight (or **white light**) through a prism. This caused the light to break up into what we call the **spectrum**, or a range of light wave lengths. We see a transition from red to blue to green. These wave lengths are called "additive" color because if a blue light, a red light, and a green light are mixed together the result is "normal white light."
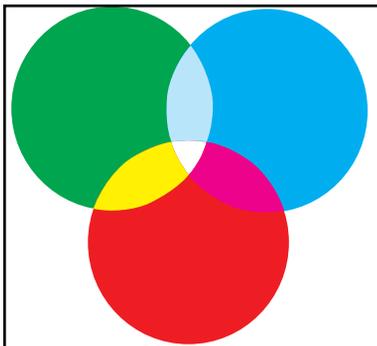

The primary colors of light are red, green and blue. It is varying mixtures of these wave lengths that give objects their color.

The process works as follows. White light shines onto an object such as an apple. The apple absorbs almost all of the light rays, with the exception of the red wavelengths. These are reflected back into our eyes, where receptors called rods and cones perceive the sensation we call *red*. If the apple reflects a bit of blue light along with the red, we see it as more of a purple color.

REFLECTED LIGHT
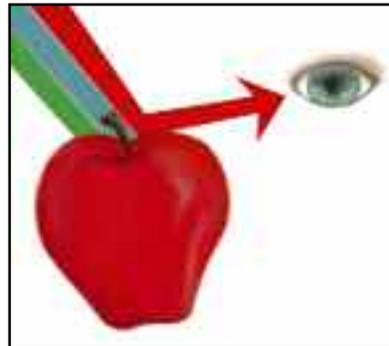
Reflected light is light that bounces off an object into our eye which causes the object to take on the color of that light.

When an object is transparent, such as the glass in a Tiffany lamp, the light passes through the object. The object filters out most of the light waves, and what passes through into our eye, is what we perceive as the color of that object. **Additive color**, or colored light mixtures, is how your television works. A set designer for a stage will use additive color to create the mood of a play.
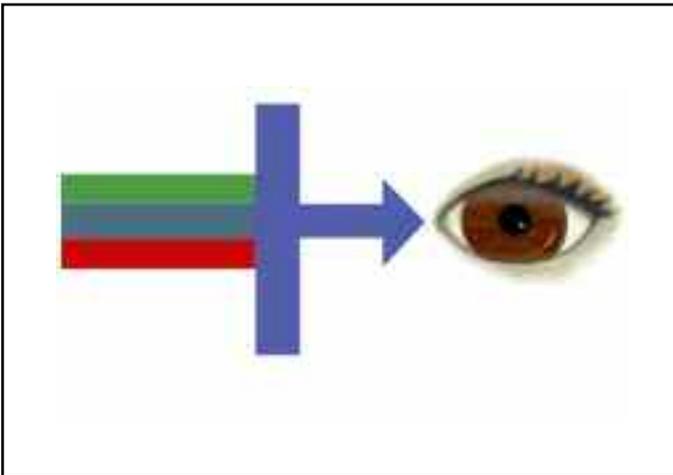

TRANSMITTED LIGHT—Transmitted light waves pass through an object. All but some are absorbed, causing an object to take on the color of the non-absorbing light.

COLOR AS PIGMENT—Through the centuries, artists and scientists have discovered that certain objects can be ground up and mixed together to form pigments or dyes. When these pigments or dyes (ground up insect or plant parts or certain minerals) are applied to the surface of an object it can change its "color" or what light wavelengths it reflects. **Subtractive color**, or pigments, is how printed matter works.

When working with pigment (subtractive color), the three primary colors are red, blue and yellow.
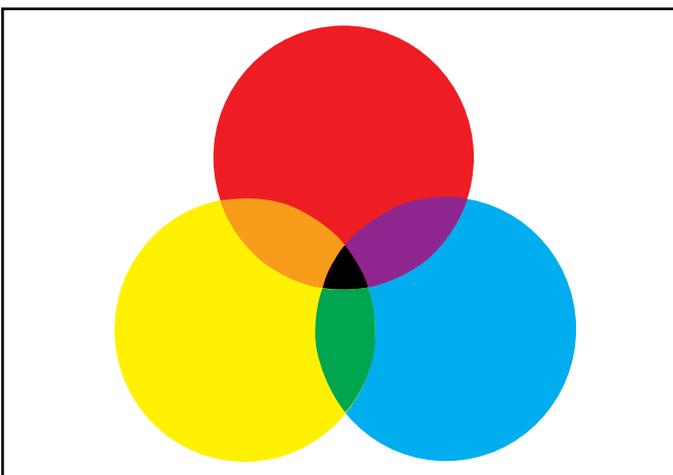
When printers mix pure pigments called "**process colors**" the results can be seen in the chart at the left. An equal mixture of all three produces black.

Artist pigments are rarely as pure as "process colors," however so, artists arrange color a bit differently on what is known as a color wheel.

Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

SELF TEST INTRODUCTION

Complete the following activities (each answer 5 points).

I.01   Define color.

_____

I.02   What is another name for the range of wavelengths that make up white light?

_____

I.03   Name one other type of solar radiation besides white light.

_____

I.04   What did Sir Isaac Newton do in 1676 that was important to artists?

_____

I.05   Explain the difference between reflected light and transmitted light.

_____

I.06   Why does an object appear to have a specific color?

_____

I.07   Who would be more likely to work with additive color, a painter or a set designer? Why?

_____

I.08   Which primary color does not belong when working with subtractive color? _____
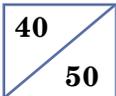   a. red   b. yellow
      c. green   d. blue

I.09   Define process color.

_____

I.10   Which primary does not belong when working with additive color? _____
      a. red   b. yellow
   c. green   d. blue

# I. THE COLOR WHEEL AND ARTISTIC USE OF COLOR.

When an artist uses color, it is in a very different way from the way in which science uses color; therefore artists set up color, or organize color in a different way. The artist also uses slightly different terminology to talk about color. Understanding how and why the artist organizes color, and how the artist talks about color is of the utmost importance when creating or even looking at art.

The color wheel is the traditional way in which artists separate color. Over the years three separate "wheels" have come into popular use. For our purposes, we will present the most common, the Ives color wheel. The Oswald and Munsell wheels will be used for comparison only.
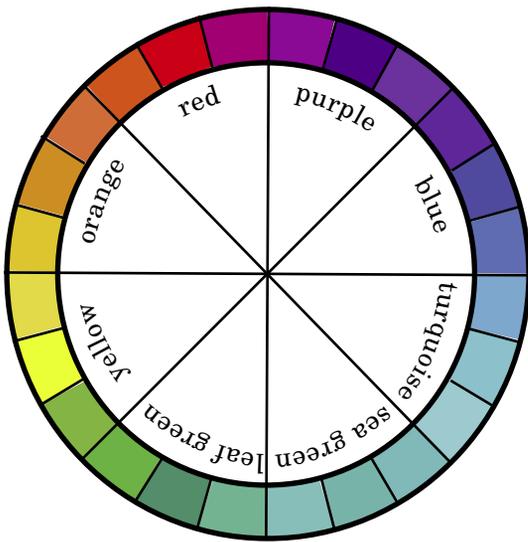
Wilhelm Oswald created this wheel based on four primary colors, mixing everything else from these four (yellow, red, blue and green).

Oswald's wheel shows twenty-four colors for use by the artists.
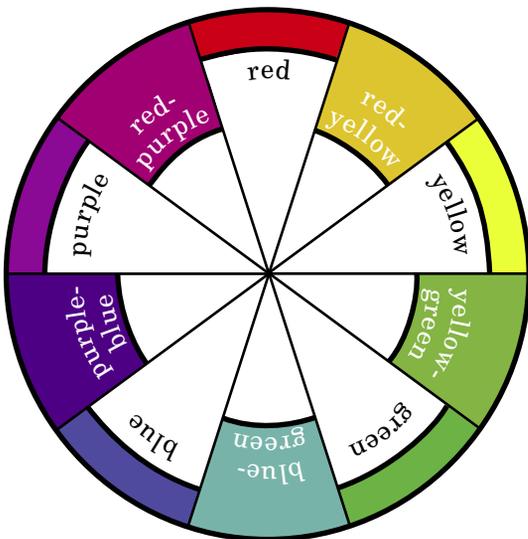
Albert Munsell created a wheel based on five basic colors chosen for their psychological impact. These colors were red, yellow, green, blue and purple. For working ease, Munsell limited his wheel to a total of ten colors.

The most commonly used and the easiest to follow is the Ives color wheel created by Herbert Ives. This wheel is divided into three sets of colors; the three **primary colors**, three **secondary colors** and six **intermediate colors** making a total of twelve basic colors.

The Ives wheel is organized as follows:

A. The three primary colors; red, yellow and blue. These are called *primary* because all other colors are mixed from combinations of these three. These are also the three colors that cannot be made from mixing other colors together. For example, try as you might, no combination of other colors will produce blue.

B. Located between the primaries are the *secondary* colors of green, orange and purple. Secondary colors are created by mixing two primaries together. They are also located between the mixing colors on the wheel. For example, blue and yellow produce green, so green is placed between blue and yellow on the wheel. Purple is produced by mixing blue and red; and orange by mixing red and yellow.

C. The final group of colors are called *intermediates*. These are created by mixing a primary and a secondary color together. Again, the resulting color is placed between the two used to create it, and is also named after those two colors (with the primary always coming first). For example, red and orange will produce a color called red-orange and placed between red and orange on the wheel. Notice how the complete wheel creates a spectrum, going from blue to red to yellow and back to blue again. The six intermediate colors are red-orange, red-purple, blue-purple, blue-green, yellow-green and yellow-orange.
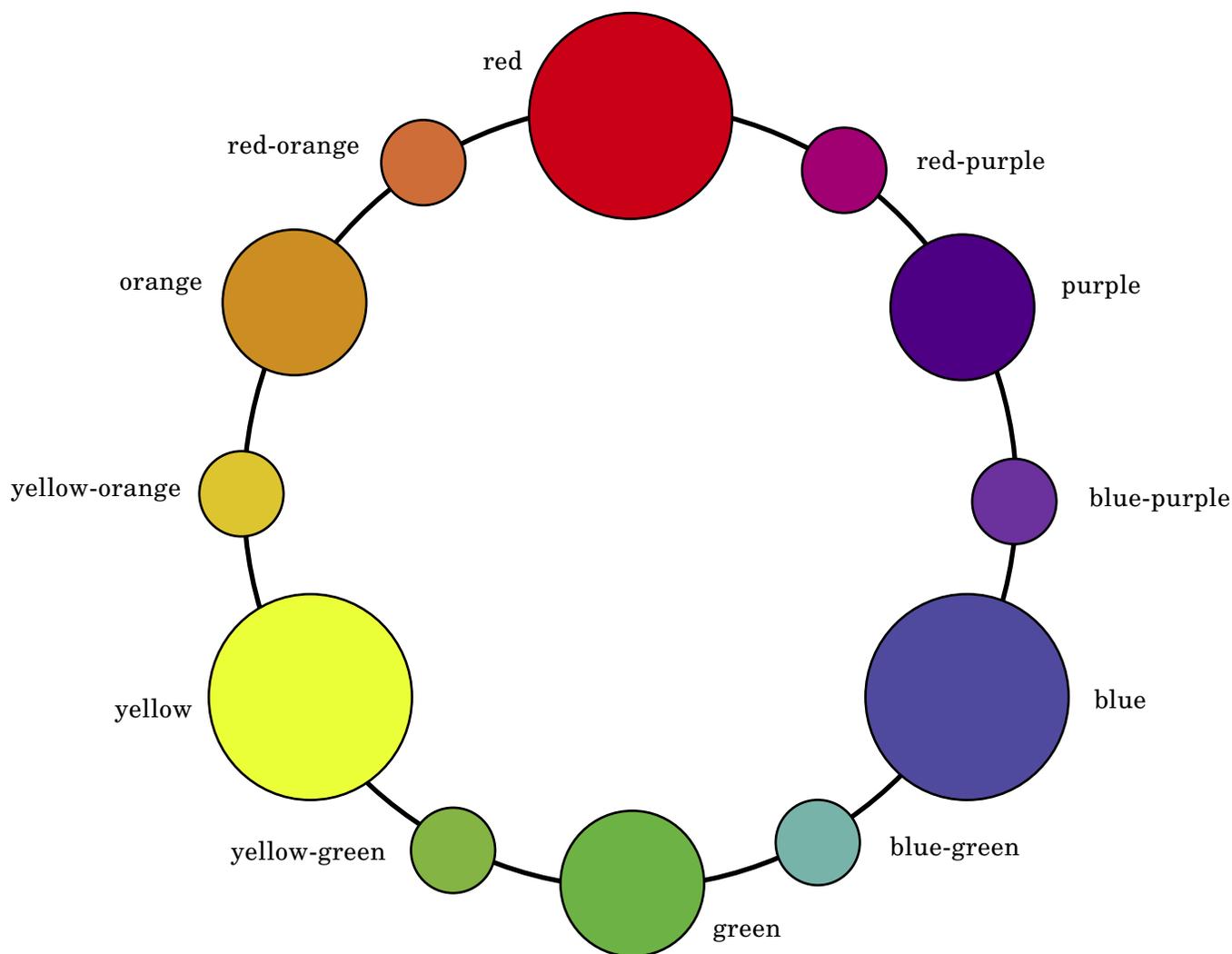
To see how colors mix, we will begin by drawing and painting a basic Ives color wheel.

1. To begin, draw a large circle on a sheet of 9" x 12" of white construction paper. Be sure to leave about 1" of space between the edge of the paper and the circle. Lightly, label the circle as if it were the face of a clock.

2. Next, use a ruler to draw a straight line through the center of the circle connecting 12 and 6. Draw one which connects 2 to 8 and one which connects 10 to 4.

3. Use the compass, or a circle template to draw a large circle where your lines touch 12, 4 and 8. Draw a smaller circle at 2, 6 and 10. Draw a slightly smaller circles at 1, 3, 5, 7, 9 and 11.

4. Take your six-dish paint tray and fill cups. One with red, one with yellow and one with blue. Paint the large circles red, yellow and blue. You now have three primary colors.

In one of the remaining cups, add one brush of red and one brush of blue, being sure to clean your brush out in between. Mix the two colors fully to create purple. Do this two more times to create green and orange.

5. Clean your paint tray and start again. Using equal amounts of each primary, mix two cups of green, two cups of purple and two cups of orange. You are now ready to create your intermediate colors. In one of the purple cups, add an additional brush full of blue and mix fully. You will see a purple that is slightly more blue in color, but not a true blue. Paint this in the small circle between blue and purple. In the remaining purple cup, add a brush full of red and mix. You will now have a purple that is a bit more reddish in color, but still not a true red. Paint this in the small circle between red and purple. Continue this process until you have created all six secondary colors.

8
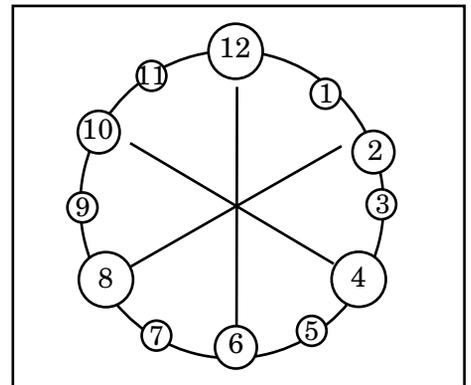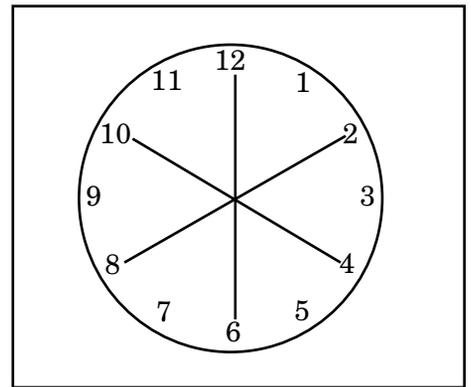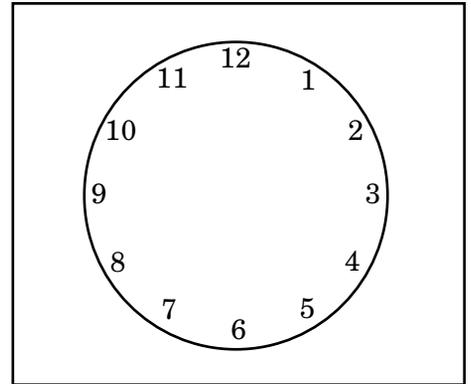
Obviously, these twelve colors do not account for the huge numbers of colors you see in works of art or in the world around you. There are countless numbers of intermediate colors in countless variations between the primaries and secondaries. Even these however do not account for all the color we see in the world around us. There is another way artists can alter or change colors for their use.

You may have noticed that none of the color wheels mentioned show any black or white. These are called **neutral colors** and are not on the color wheel because they are not actual colors, but either the absence of color, or the mixing of all color.

White is created when no pigment is present, so all the light waves are reflected and we see a lack of color.

Black, in theory, is created when all the colors are mixed together. However, since pigments are not pure, a more brownish black is usually produced and special materials (such as iron) are added to create a perfect black.

Gray is a mixture of equal parts of black and white, and is also used by the artist to alter colors.

These neutral colors are used to alter and change colors, to create additional variations for the artist. A similar wheel can be set up demonstrating how to alter an existing color.
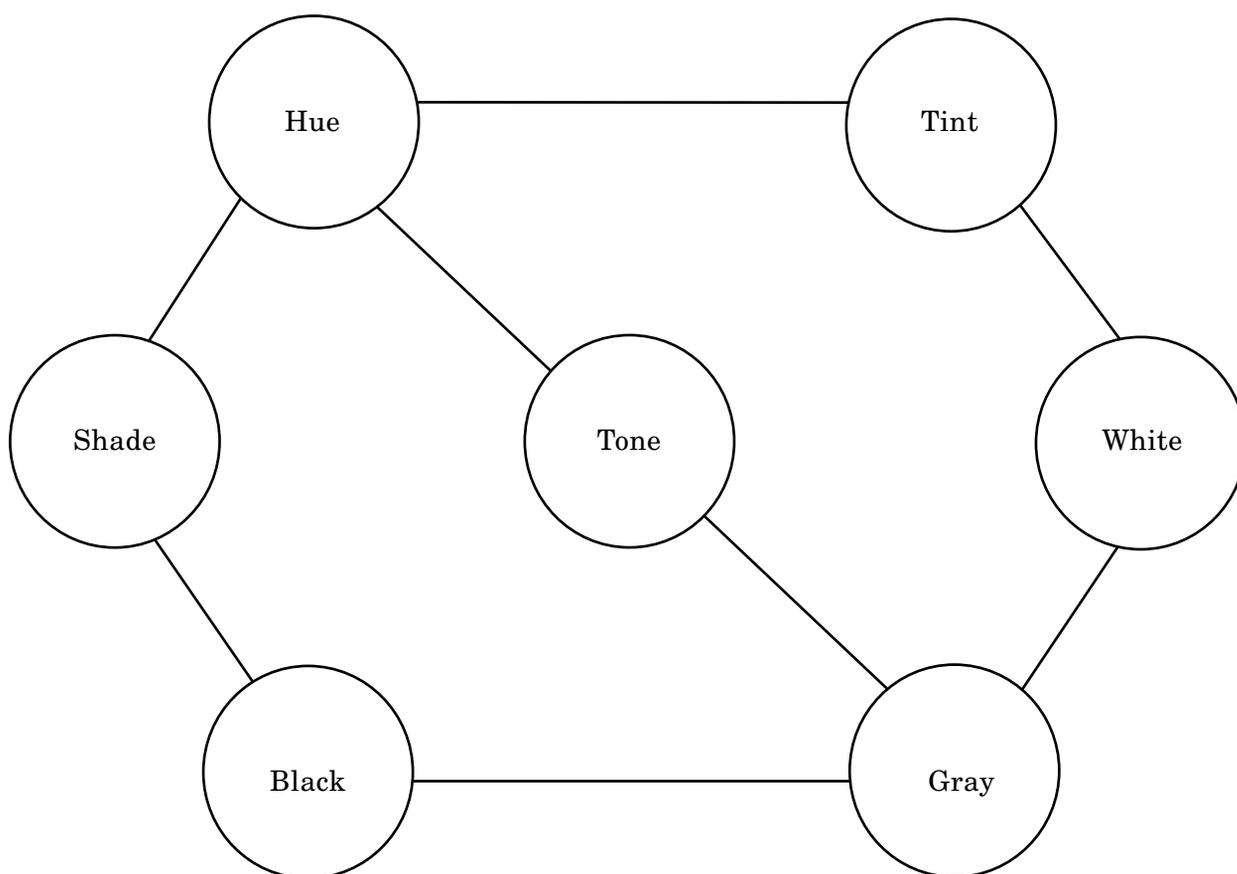
THE TONE WHEEL

Hue is a term that refers to a pure color, straight from the color wheel. Red would be an example of a hue. Each hue has its distinct **value**, or corresponding light or dark. Red for example, is darker in value than yellow, but lighter in value than blue.

Adding white to a color produces what is known as a **tint**, the tint of red is pink, and pink is lighter in value than red.
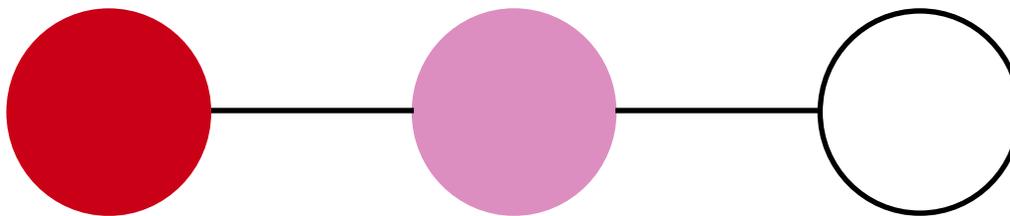
The result of adding black to a color is a darker value of that color, a dark red for example, and is called a **shade**.
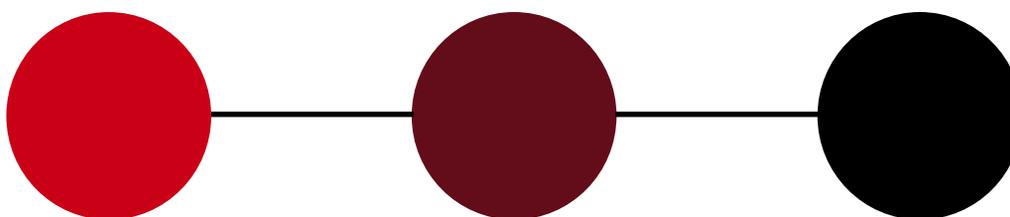
When gray (equal parts of black and white) is added to a hue, a slightly different effect is created. If the gray added is the same value as the color, the color is not changed in value, it gets no lighter or darker, but its intensity changes. **Intensity** refers to how bright a color is; the more gray, the duller the color. This is called a **tone**.
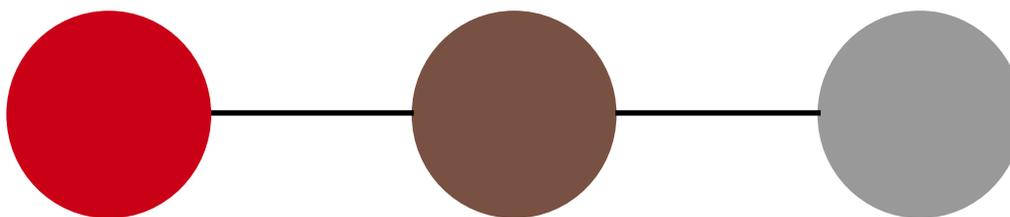
A color can also be "toned down" or made duller by adding its complement. A **complementary color** is the hue that is directly opposite another hue on the color wheel. The opposite of red is green. When green is added to red, a dull red is produced, but with a slightly brown color.
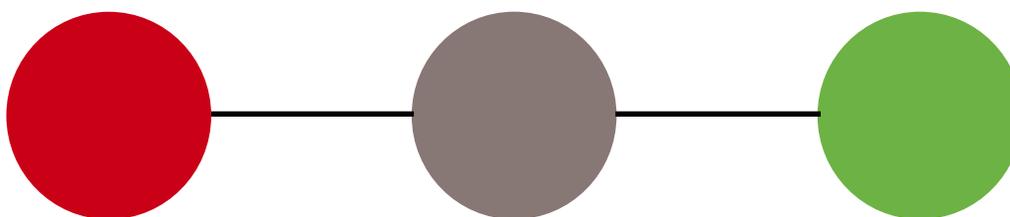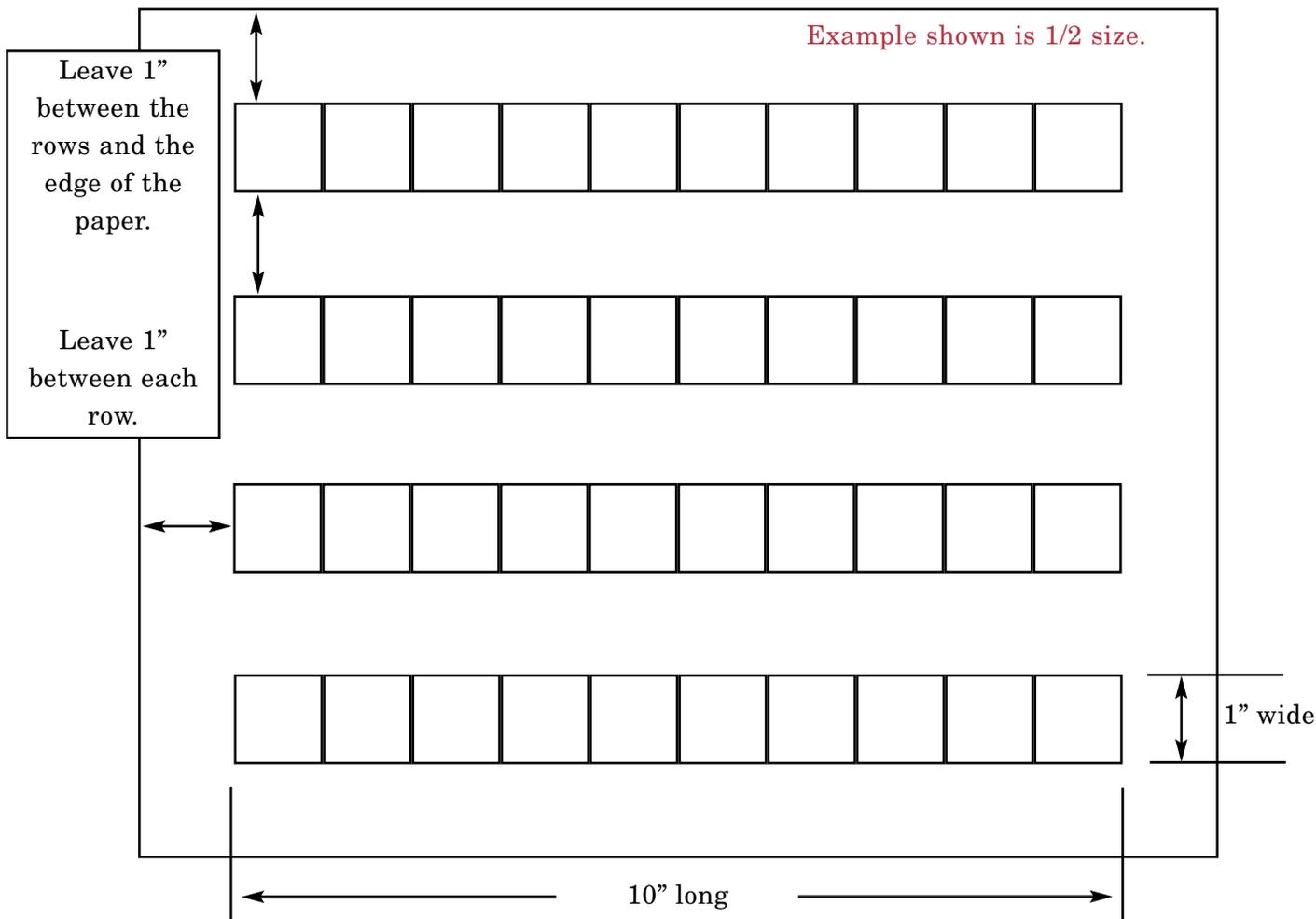
By mixing colors on the wheel and altering them by using varying amounts of white an infinite number of colors can be created.

The point of this activity is to understand color not only in terms of the hue, but of value and intensity as well.

Begin by taking a sheet of 9 x 12 construction paper. On this piece of paper draw four rows of squares. The squares will be 1" x 1" and you should put 10 squares in each row. The finished page should look like this:

Example shown is 1/2 size.

Leave 1" between the rows and the edge of the paper.

Leave 1" between each row.

1" wide

10" long

In the top row create a value scale by painting square #1 a pure hue, paint square #10 black. The squares in between with eight different shades of red, getting gradually darker from two to nine.

Start by filling a cup with hue and add one drop of black and mix. Use this to paint the second square. Add another drop of black and mix again. Follow this procedure until all the squares are filled.

In the second row, follow the same procedure but substitute white for black (when mixing tints, add the color to the white rather than add the white to the color.)

Row three is an exercise in tone, square #1 is a hue, square #10 is gray, create the steps in between.

Row four is also an exercise in tone, but this time, instead of using gray, use the complement of the hue.

Concentrate on making each square as smooth as possible, with a minimum of brush strokes and neat, clean edges. Concentrate also to make sure each square is is a slightly different value than the one on either side.

Create one of these pages for each primary color and one for each secondary color (a total of six color experiment sheets).

The color wheel can also be used to organize color for the artist to use. For years, artists have used specific groups of colors because they look good together, or are capable of creating a specific response in the viewer. These groups of color are visually called color harmonies or color schemes. When you choose your wardrobe each morning, you unconsciously make use of these harmonies.
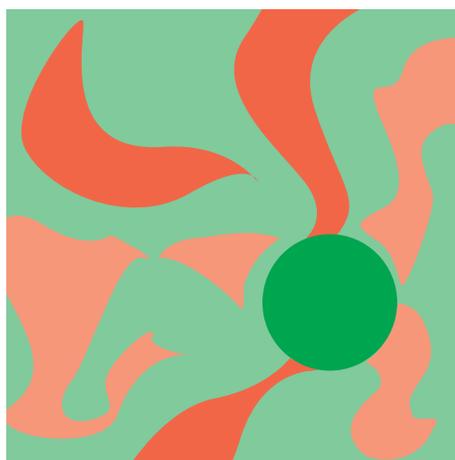

MONOCHROMATIC BLUE

The first, and probably most common, is called a *monochromatic* scheme, *mono* meaning *one* and *chroma* meaning *color*.

A monochromatic scheme uses all one family of colors such as blue and all its assorted shades, tints and tones.

This scheme produces a feeling of unity throughout the design.

COMPLEMENTARY COLORS

A *complementary* color scheme uses colors that are opposite on the color wheel. Placed next to each other these colors tend to make each other look brighter and more vivid.

When mixed, as you may remember, complements cancel each other out making a brownish tone.
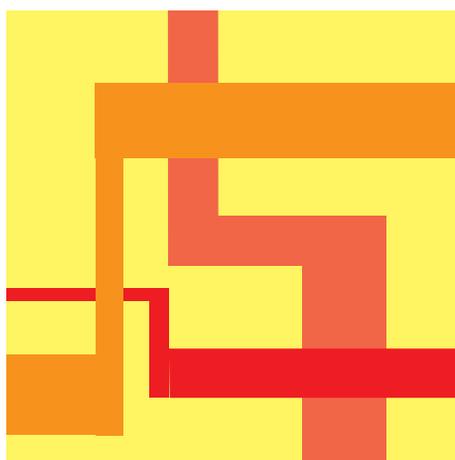
ANALOGOUS COLORS

Analogous colors are related colors. Any three colors that are adjacent on the color wheel and as a result, have a common color can be called analogous.

Along with the tints, tones and shades, this scheme provides a wide variety of colors that still go well together.
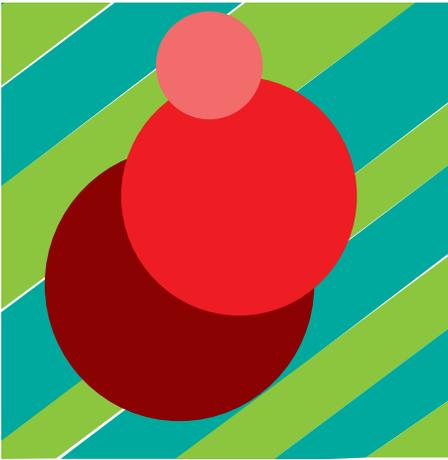
SPLIT-COMPLEMENT COLORS

Split-complement colors are a fourth scheme, a variation on the complementary scheme. If you take the color blue for example, and look at its complement of orange, this scheme would use the adjacent orange colors of red-orange and yellow-orange, the resulting scheme has a great deal of contrast without the jarring effect of straight complements.

Triadic colors are those that are equally spaced on the wheel. Since *tri* means *three*, we will only be using three colors such as red, blue and yellow or green, purple and orange.

TRIADIC COLORS

WARM COLORS

The colors in between yellow and red-purple form the *warm* color scheme. These colors are called warm, because we tend to associate them with warm objects such as sand, fire or the sun. Notice also, that these colors are very similar in value.

Cool colors run from purple to yellow, green and are so called because of the feel of things we tend to think of as being these colors. Think of water, ice or grass and these colors come to mind.
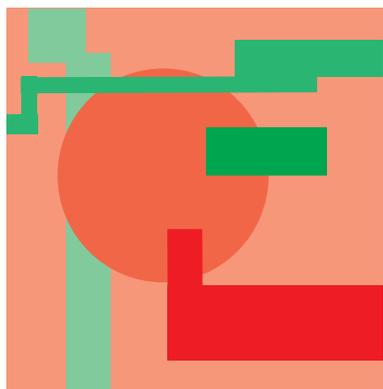
These colors, also not only look good together, but tend to be very similar in value.
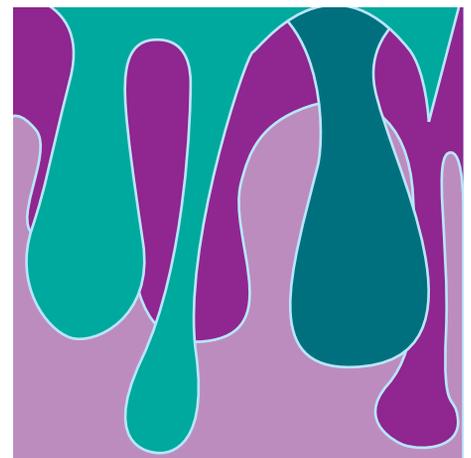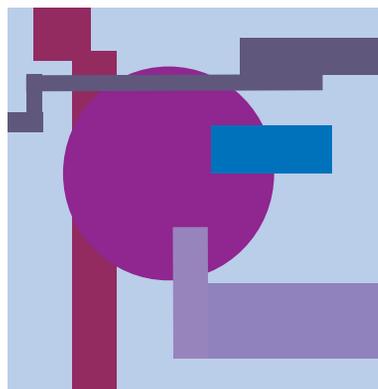

COOL COLORS

The colors that we choose for a particular design can have a great deal of effect on how the finished design looks and is 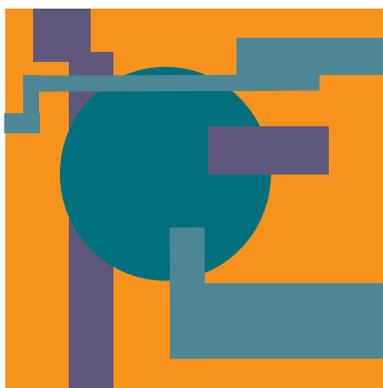interpreted by people. Observe the following design, with the seven previously-discussed schemes, and you can see how different they appear.
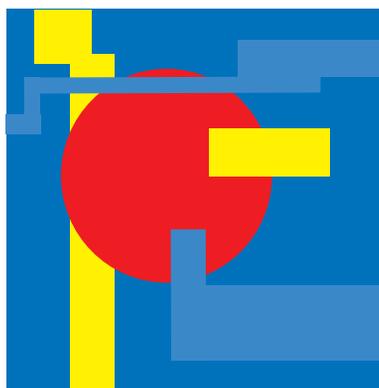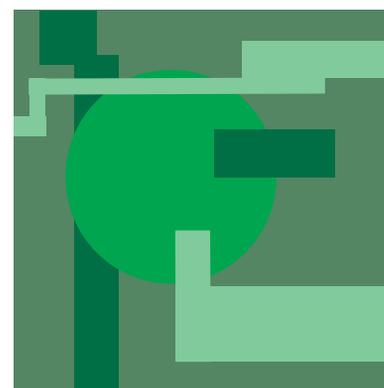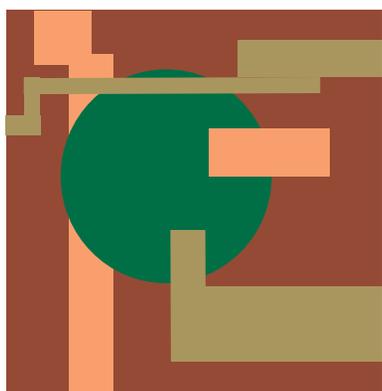

COMPLEMENTARY

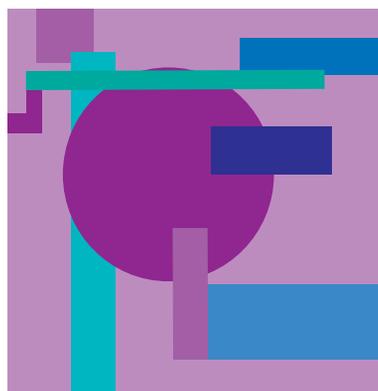**ANALOGOUS**

SPLIT-COMPLEMENTARY

TRIADIC

MONOCHROMATIC

WARM

COOL

You can see how color schemes fill the world around you. Notice the fall leaves, the night landscape, the beach and ocean, the sky and landscape during a sunset. What schemes do you see?

Each of the seven following pages is labeled with the name of a common color scheme. During the course of your study of this Unit, look through magazines and see if you can find examples of the color schemes used in advertising, landscape photography, pictures of artwork or magazine illustrations. Cut as many as you can find for each scheme and tape them to the proper pages.

Example: *Monochromatic*

CLAUDE MONET'S *WATER LILIES* (1906)

COMPLEMENTARY

ANALOGOUS

SPLIT-COMPLEMENTARY