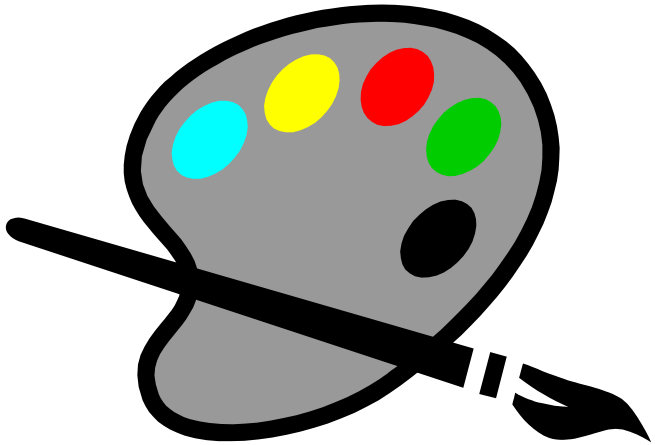
Knox Academy

Design Technology Department



Curriculum for Excellence
National 4 - 5
Graphic Communication

Colour Theory

Colour

Colour affects us in just about every aspect of our lives. We cannot avoid coming in contact with it. A multitude of colour surrounds us in nature.
Could you imagine a butterfly without colour?

Colour is used to identify different things like flags, and sports teams.

In this technological world we live in, manufactured objects are more colourful than ever before.

Colour affects our mood and how we see things.

Have you ever wondered why male babies were traditionally dressed in blue and female babies in pink?

Our speech is full of colour references:

"As red as a beetroot" …… "Green with envy"……. "White as a sheet".

Colour has an enormous affect on the fashion industry.

In order to understand colour, we have to realise that it is not just a useful tool to decorate our lives with, but a very powerful means of expressing our mood and personality.
The communication power of colour is as complex a language as our use of words and music.
The words ***light*** and ***pigment*** are used regularly in this book.
A short description of each word is given below.

Light

In 1860, **James Clerk Maxwell** showed that light was a form of **electromagnetic energy**. In the same way that a radio can receive electromagnetic energy of certain frequencies and turn them into sound, the eye is able to receive light waves between 400 billion cycles per second and 800 billion cycles per second, and we see these light waves as colour.

The colour components of light will vary according to the light source. The colour components of **sunlight** will be slightly different from those of **fluorescent** light or **incandescent** light.

Pigments

Pigments are colouring materials which are used in paints or dyes. These materials are found in nature in animals and plants. They can also be produced by the Chemical Industry.

Paint is usually produced by mixing a pigment with a binder and solvent. It is the pigment that gives the paint it's colour.

Mixing Colours

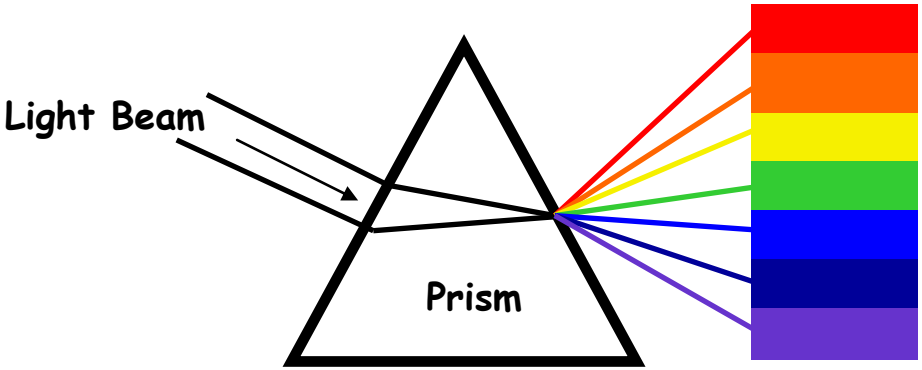
Colour can be mixed in two distinct ways:

1. By mixing coloured light.
2. By mixing coloured pigments. (dyes and paint)

Mixing Coloured Light

It is very important to understand the way in which light works in order to appreciate the difference between mixing colours in light and mixing colours in pigments.

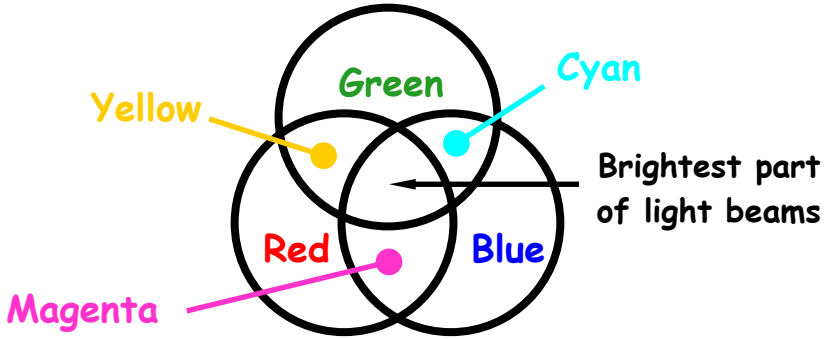
Sir Isaac Newton showed that white light (daylight), can be split up into several different colours - **Red, Orange, Yellow, Green, Blue and Violet** (This is known as the **Spectrum**). He did this by passing a beam of daylight through a triangular glass prism.
Newton believed that there should be a further colour between blue and violet. He called this "new" colour **Indigo**.



The range and order of the colours of the spectrum can be easily remembered by using the following Mnemonic:

Red	Richard
Orange	Of
Yellow	York
Green	Gave
Blue	Battle
Indigo	In
Violet	Vain

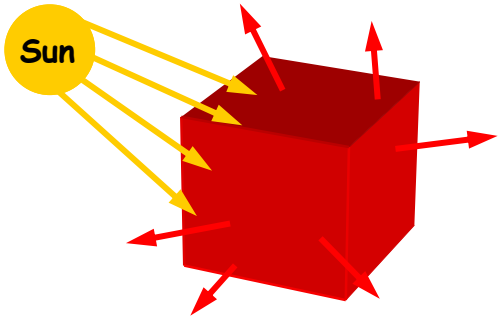
The spectrum does not actually consist of seven separate colours, but is a continuous band which blends from one colour to another.
When mixing colour in light, each **additional** beam of colour concentrating on one spot, will act in an **additive** way making the final blend **brighter** than any one individual light beam of colour.
We call the colours so formed **additive colours** and they are created by **additive colour mixing**.



Mixing Coloured Pigments

Pigments absorb light wavelengths. When light falls on an object, most of the light is absorbed by that object except for the colour in the spectrum which is the same colour as the object.

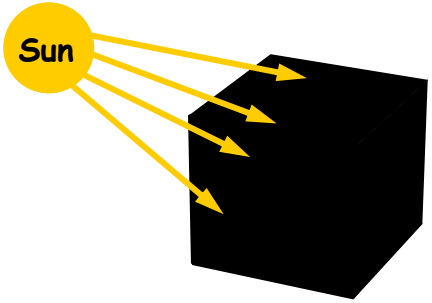
If the cube opposite was painted using a pure red pigment then the object would absorb all light wavelengths except the red wavelengths. These would be reflected away by the cube.



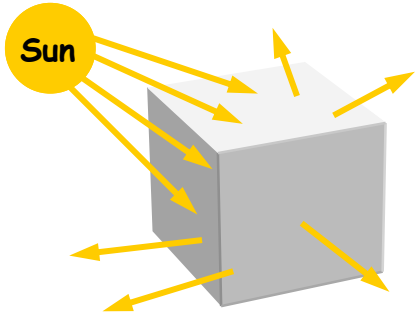
In theory, we can say that:

1. The lighter the object the more light it will reflect.

2. Dull or dark objects will reflect less light (i.e. will absorb more)



A pure black object will absorb all light.



A pure white object will reflect all light.

In practice, pigments are never pure

True black is rarely found in nature. When we describe a colour in nature as being black, it will normally be found on close examination to be a very dark variation of another colour. Even the darkest material which we consider to be black, reflects at least three percent of light falling on it, which means that colour must be present.

In the same way, on close examination, white tends to be a very pale variation of another colour.
Most colours reflect a little of some other colours. If we look at yellow and blue pigments, both reflect a little of some other colours. When yellow and blue are mixed they create green because green is the one colour which is reflected by both them.
Since pigments absorb light, they look less bright than coloured lights. The more they are mixed, the **duller** they get.
If all pigments were mixed together, **in theory**, they should create **black** because all the light waves should have been absorbed.

In practice, because pigments are never pure, the combined mix of pigments would produce a brownish grey colour.

Colours which are created by pigments are called **subtractive colours** and are created by **subtractive colour mixing**.

Primary Colours

A primary colour is a colour that cannot be achieved by mixing other colours.

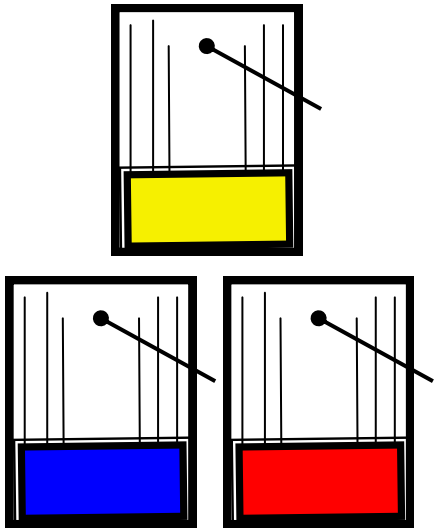
For the moment, we are only interested in pigment colours.

There are three primary colours…….

Yellow

Red

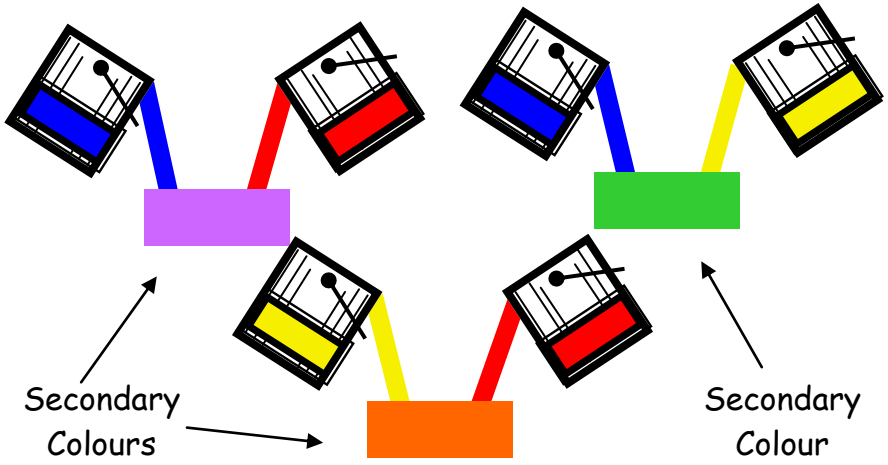
Blue



Primary Colours

Secondary Colours

A secondary colour is achieved by mixing **two** of the primary colours.



Language of Colour

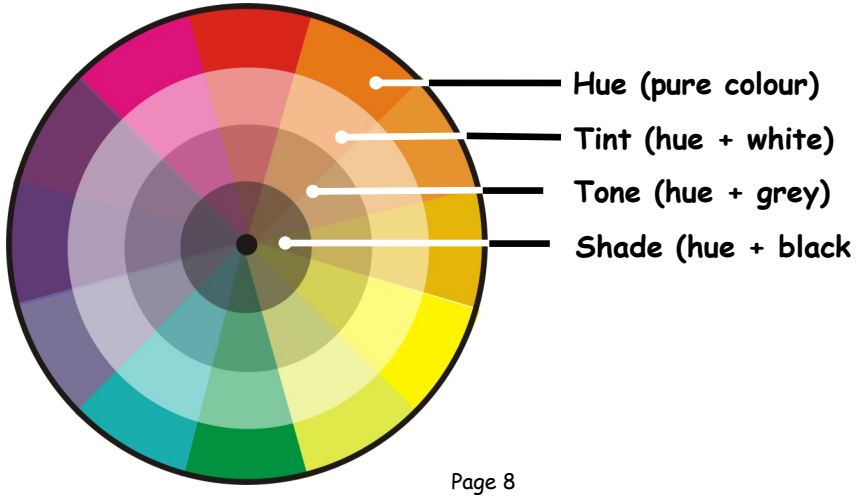
When dealing with colour, it is not enough to simply describe a colour as say red or blue. There are bluey-reds, yellowy-reds, greeny-blues, dark blues, light reds, etc. To help us with these differing colours we need a **vocabulary** to explain colour in more detail.

Hue

The word hue is what is commonly thought of as **colour**. This is simply the identification of say red, blue, yellow, green, etc.

The **hue** of a colour can be changed by mixing it with another colour.

It is estimated that most people with normal vision can differentiate approximately **ten million** different hues.



Tone

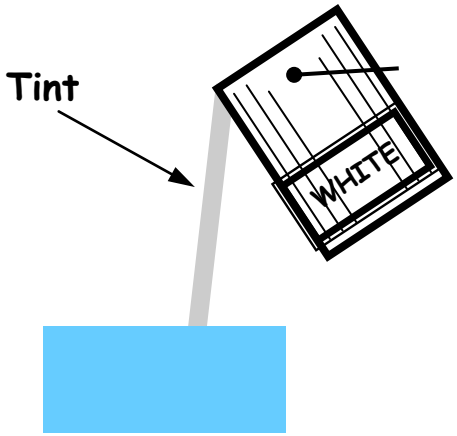
Tones are **weak** and **strong** examples of the same colour. The tonality of a colour can be controlled by adding **black, white, grey** or **another colour**.

Neutrals

Black, white and **grey** are called **neutrals** because there is no colour quality found in them.

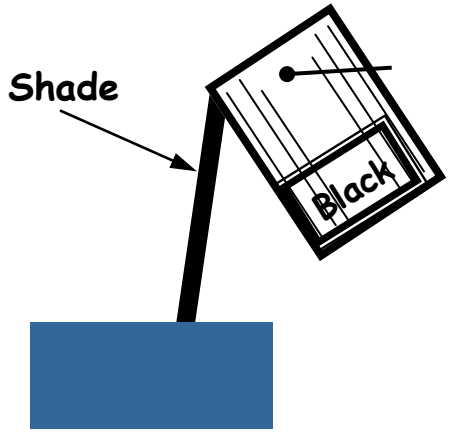
Tint

A lighter **tone** of a colour is called a **Tint**. This is achieved by the addition of various quantities of **white** to the colour. The more white added to the colour the lighter the tint will be.



Shade

A darker tone of a colour is called a Shade. This is achieved by the addition of various quantities of black or grey to the colour.



Saturation

Saturation describes the **purity** or strength of a specific **colour**. A printer would use the word **saturation** to describe the strength of a colour while someone working in television would use the word **chroma** to describe the same thing. You can also use words like **colourfulness** and **intensity**.

The Colour Wheel

The colour wheel is a method of organising colour in such a way that it is easier to handle.

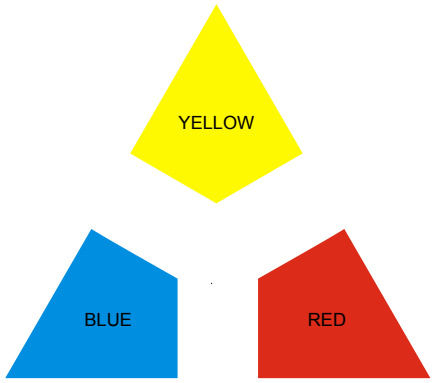
The original wheel was devised by **Sir Isaac Newton**. Over the years it has seen a number of changes, although the basic principles have remained the same.

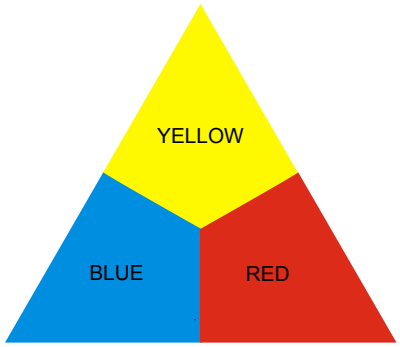
The colour wheel we are going to use was devised by **Johannes Itten** a number of years ago.

Itten was very interested in colour and taught at the famous **Bauhaus** school in Germany in the 1920's.

He wanted to create a diagram that would be easily understood and clearly visualised.

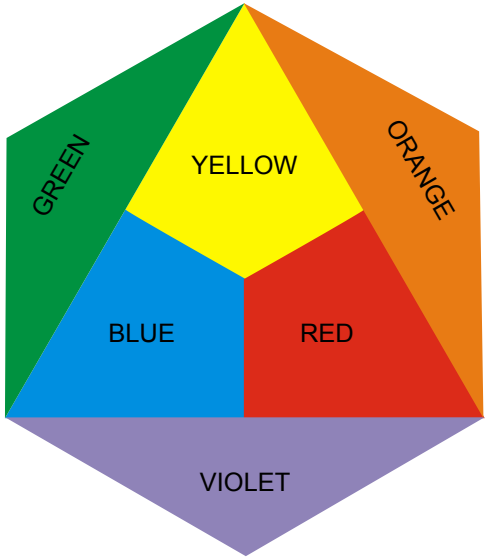
He started with the **primary colours, red, blue,** and **yellow.**

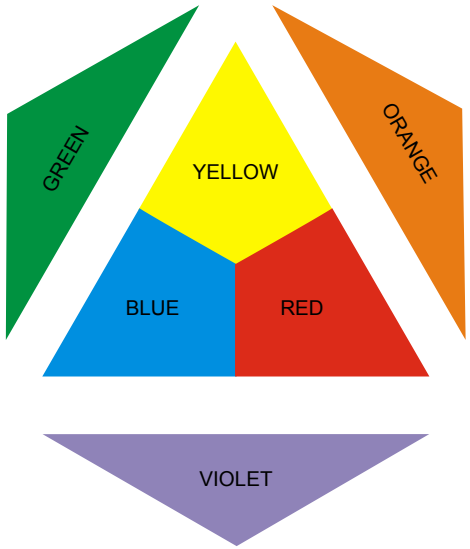




He devised a triangle for the primary colours at the centre of the wheel.

He added the **secondary colours; orange, violet** and **green.**
He placed the secondary colours alongside the primary colours in flat triangles.





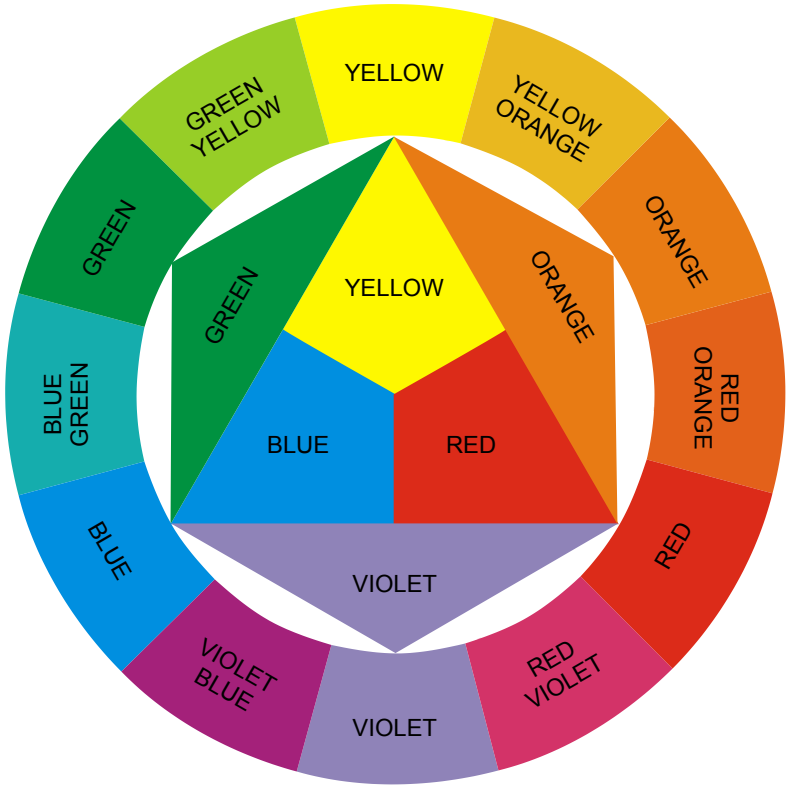
The secondary colours were placed alongside its two primary colours, i.e. violet was placed next to blue and red.
It was important to place colours on the wheel so that the 'connection' between the colours was clearly visible.
The outer wheel was now added containing the primary, secondary and tertiary colours.

Definition of Primary, Secondary and Tertiary Colours

Primary colours; red, blue and yellow are the three colours which when mixed equally produce all other colours.
Secondary Colours; green, orange and violet are made by mixing two primary colours in equal amounts.
Tertiary colours; are created when primary and secondary colours are mixed together in equal quantities. E.g. If the Primary colour **RED** and the Secondary colour **VIOLET** were mixed together they would produce the Tertiary colour **RED-VIOLET**.

The complete wheel shows:

Three Primary Colours, Three Secondary Colours & Six Tertiary Colours



All the colours of the spectrum are contained in the wheel in the correct sequence.

This wheel is meant to give an orderly and logical basis for working with colour pigments or paints. Mixing coloured light does **not** give the same results.

Colour Arrangements

In any arrangement which uses colour, whether it is a room setting, clothes, a design, or packaging; the relationship between colours is as important as the actual choice of colour.

Choosing colours that go well together does not come naturally to everyone. If we introduce too many colours to a room, it may appear hectic and uncoordinated. If we introduce too few colours, the room may look dull and uninteresting.

Colours which are related to each other or close to each other on the wheel are said to be in harmony.

Harmony

There are some colour schemes many people find comfortable, and are not irritated or disturbed by them.

We call these colour schemes harmonious, balanced or pleasing, and by following some simple rules, we can create successful colour schemes.

Monochromatic

The first kind of colour harmony is found a great deal in nature such as the varying shades of green foliage.

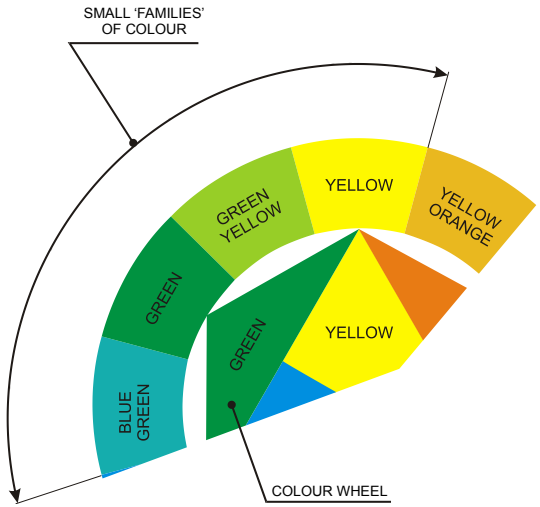
Monochromatic arrangements are based on variations of **one colour** e.g. a room could be decorated using various shades of blue. Black, grey or white can be added to lighten or darken the blue.

It is also called **one-hue harmony**.

Analogous

The second kind of colour harmony is an Analogous or **related harmony**.

Related harmonies are made up from small 'families' of colour, that is, colours that lie next to each other on the colour wheel.
Black, white or grey can be added to lighten or darken the colours.



Contrast Harmony

The third kind of colour harmony is based on related harmony with the edition of a small amount of contrasting colour or colours.

Contrasting colours are those which are not related to each other.

A small dash of blue within a bedroom scheme comprising yellows and pinks can become a visual delight. This use of colour to accent and emphasise a related family of colour is called **contrast harmony**.

Accents can be introduced to a colour scheme in the form of plants or flowers, soft or loose furnishings such as rugs, cushions, curtains or lampshades. The introduction of green plants to accent a pink painted room or red roses to accent a soft green room are ways of providing contrasts. This type of harmony is often used to bring a colour scheme vividly to life.

Complementary

Complementary colour schemes involve the use of various mixes of colour which are directly opposite to each other on the colour wheel, e.g. red and green, blue and orange.

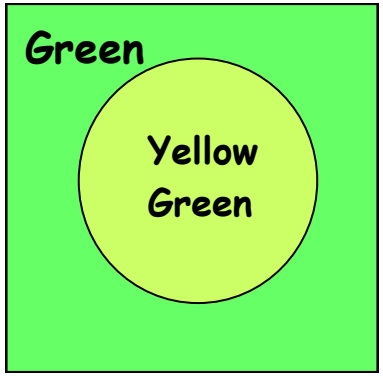
Have a look at your colour wheel on page 13.

Achromatic

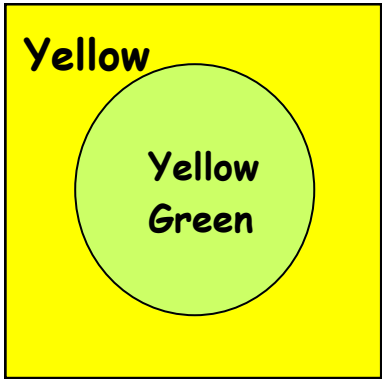
Achromatic schemes contain no colour (hue) at all. They contain variations of black and white mix only.

Simultaneous Contrast

Simultaneous contrast is the effect of one colour upon another. Whenever two colours come into contact with each other, the contact will intensify the difference between them.



A yellow/green surrounded by green will appear YELLOW.



A yellow/green surrounded by yellow will appear GREEN.

Colour Moods

Reds

Hot, bold, exciting, vibrant, festive, active, passionate, aggressive, fire, danger.

Yellows

Bright, happy, sunny, warm, glowing, lively, holidays, easily seen.

Blues

Cool, sophisticated, heavenly, elegant, classy, formal, reliable, royalty.

Greens

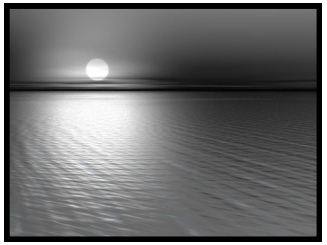
Restful, fresh, cool, smoothing, natural, informal, calm, quiet, go, re-cycle, surgeons gown.

Whites

Pure, elegant, sophisticated, clean, happy, light.

Greys

Old age, neutral, dignified, dull, metal, sedate.



Neutrals

Calm, restful, natural, safe, wood, earth, unobtrusive.

Blacks

Dramatic, death, evil, sorrow, subdued, sad, unhappiness, solemn.

Receding Colours

When using the colours blue, violet and green to paint a surface, the surface appears to be further away than it actually is. Colours which give this effect are called receding colours. i.e. they recede away from you.

Receding colours tend to be cool such as **blues**, **greens** and **violets**.

Pale tones of other colours have they same effect, especially

Advancing Colours

When using the colours red, yellow and orange to paint a surface, the surface appears to be closer than it actually is. Colours which give this effect are called advancing colours. i.e. they advance towards you.

Advancing colours tend to warm colours such as **reds**, **oranges** and **yellows**.
Dark tones of other colours have they same effect.

The colours you use in your presentation can make all the difference to your design.

Tips
Don't let the background colour take over.

If the design has a message: safe, friendly, fast, etc. the background colour should support the message.

Safety Signs

As part of this course, all students must be able to recognise and reproduce safety sign shapes, colour and background for six categories of safety signs.

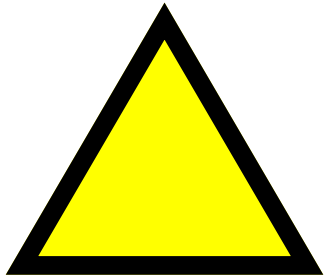
The six categories are:

Mandatory Signs
Fire signs
Warning Signs
Safe Condition Signs
General Information Signs
Prohibition Signs

Just look around you, especially in public places, these signs are virtually everywhere.

Warning Signs (Caution)

Yellow triangle/
Black Border



Background colour shall be yellow. Triangular band shall be black. The symbol or text shall be black and placed centrally on the back ground. Yellow can be most easily seen even in poor light. Black provides striking contrast.

Mandatory Signs (Protection)

Blue Circle

With a mandatory sign the background colour shall be blue. The symbol or text shall be white and placed centrally on the background.

An example may show a graphic of a persons face with goggles on. **"Goggles must be worn"**.

Prohibition Signs (Prohibit)

Red Circle/Red Cross Bar

The symbol shall be black and be placed centrally on the background and shall not obliterate the red cross bar.

Background colour shall be white.

Fire Fighting Signs

Red Square

All fire fighting signs have a red background with white lettering with the exception of fire extinguishers.

An example could be a white fire extinguisher on the red background.

Safe Condition Signs

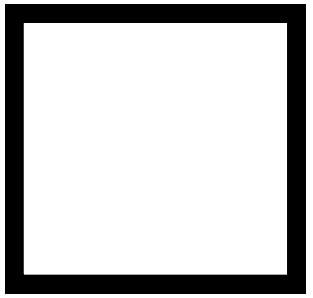
Green Background

All safe condition signs have a green background with the instruction always in white.

An example could be a white arrow on a green background indicating the direction of a fire exit.

General Signs

Black border/ White Background



General signs are used for general information. e.g. "All drivers and visitors must report to reception".

General signs are always a black border with a white background.

Prohibition Signs (Prohibit)

No Smoking

Pedestrians prohibited

Not drinking water

Warning Signs (Caution)

Caution risk of Ionising Radiation

Caution Toxic Hazard

Caution risk of Fire

Use of Colour - in every day objects

For example take the calculator shown opposite, it has been designed with big buttons for ease of use but aesthetically it has been manufactured in **Silver**.

The silver colour enthuses a sense of elegance and sophistication.

Whereas if the target market was for a younger child the colour scheme would be completed different. A younger child would find the three primary colours much more appealing.

Another example of colour with regards children's toys would be a bicycle. Have a look at the two examples and think which of the two would be more appealing to young children.

Travel agents are another example where use of colour is very important. Try to imagine going into such a shop and all the walls were cold colours such as **blues, greens, violets, whites,** etc. This type of décor would not inspire people to want to go on holiday, unless they were going on a skiing holiday.

On the other hand if the shop had posters of sunny destinations and painted in warm colours such as **reds, oranges** and **yellows,** this would more likely result in people being in a joyful mood subsequently encouraging them into booking a holiday.