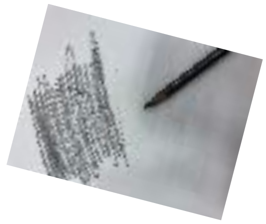
CYANOTYPE INITIALS

POSITIVE AND NEGATIVE SHAPE AND SPACE

1. Get Initials from your teacher and 2 squares of card stock

2. Color back of initial paper with an ebony pencil



3. Trace the letters onto the squares by pressing firm and taking the letter with the paper underneath

4. Borrow an exact knife from your teacher. Use safe and best practice for exacto knife use. This includes:

Always having a cutting mat and always cutting away from you!

5. Cut the letters out you will need the last initial to have the positive space cut away and the the 1st initial will be missing its negative space.

6.Once you are complete go to the backyard. You will get a Cyantype paper and there will be items to choose from or you can go find your own .
7.Put the Cyantype paper down then your initials. Then a piece of plexi. Then your items to make a design. (make sure you have the 1st initial positive shape and surname initial negative shape)

8. Now leave in the sun for the time your teachers says for that time of day. Darker light requires more time, brighter sun is less time.
9. Remove all items put them back in correct bins. We are not your maids.
10. Now take blue paper inside and put in water bin for 1 min. Then put on dry rack to dry.

11. Next day get from dry rack and turn it in.

History & Cyanotype process

Photochemical blueprinting (also known as cyanotype process, from the Greek *kyanos*-blue) is one of the historically oldest photographic techniques that produce intensively blue pictures. Today it is classified as the member of a family of alternative photographic processes. This process was developed in 1842 by the English natural scientist and astronomer Sir John Frederick Herschel (1792-1871). Cyanotype was thus the third photographic technique after daguerrotype and talbotype (calotype), with which stable photographic pictures could be obtained. Unlike previous silver-based techniques, cyanotype is based on the light sensitivity of iron(III) complexes, which makes it comparatively inexpensive. Herschel himself is the author of today's common expressions such as *negative*, *positive*, *photograph* and *snapshot*.

Figure 1: Sir John Frederick Herschel, English astronomer, mathematician, chemist and pioneer of photography, especially the cyanotype

The intensive blue color of cyanotypes was only suitable for a limited number of subjects, e.g. it was completely unacceptable for depictions of landscapes and portraits that were the most common themes in the nineteenth century. Peter Henry Emerson (1856-1936), an English photographer and founder of naturalistic photography, had at that time declared: "*Only a vandal would print a landscape red or cyanotype.*"

The cyanotype technique found much more enthusiasm in technical circles for the representation of copies of construction and machine drawings where the blue color no longer disturbed. From the original duplication, which was carried out completely manually in the sunlight, one went over commercially available light-sensitive papers, electrically operated lighting devices to fully automatic copying devices of the twenties of the 20th century, which took over the illumination, development, fixing and drying of the copies. For example, over 1000 m2 of cyanotype paper has been consumed when copying technical drawings of an English war ship. From the 1940s onwards, this wet reprographic process was replaced by a more user-friendly diazotype process (Ozalid®) and other dry processes (Xerox®).The cyanotype was used by photographers of the 19th century as a low-cost technique for the production of test prints of photographs before passing to the final projection on the paper template. Anna Atkins (née Children, 1799-1871), English botanist, was the first female photographer in the world and her first experiments are closely related to the cyanotype process. Thanks to her acquaintances with the members of the Royal Society William Henry Fox Talbot and Sir John Herschel, she learned about the newly discovered photographic techniques.By means of the cyanotype on a light-sensitive paper, she had made direct photographic footprints (photograms) of the sea-algae occurring on British Isles. This work culminated in the first work called *"Photographs of British Algae: Cyanotype Impressions"*, which was published in 1843 in several copies. This book was historically the first photographically illustrated book and a clear proof that photography can be both esthetically pleasing and offer scientific value.

Figure 2: Photogram of an algae from the book of Anna Atkins

In recent decades, the cyanotype process has been rediscovered by the artistic community as an affordable, technically relatively simple and esthetically interesting technique for the creation of exceptional motifs on paper and textile surfaces and is thus used in various creative workshops.The advantages of cyanotype lie in the simple processing of copies after exposure – the development and fixing is done by one step – by washing out in water.Almost everyone who sees the cyanotype process for the first time with their own eyes is fascinated by how the light creates visible projections of the original on the photosensitive paper, for example pictures of fern leaves, bird feathers or a transparent negative template, and how this projection turns into an intensely blue picture by washing out in water.Thanks to the low toxicity of the chemicals used and the use of relatively dilute solutions, creative and impressive activities can be carried out during art classes or interdisciplinary projects.

How does the cyanotype process work?

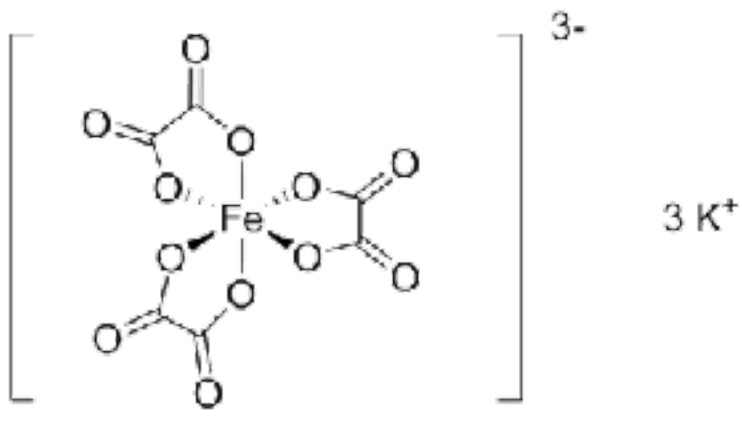
The classical form of cyanotype is that the paper is coated with a solution of a light-sensitive mixture of two chemicals – the light-sensitive iron(III) complex with a readily oxidizable polybasic carboxylic acid, usually citric acid or oxalic acid, and hexacyanoferrate(III). The resulting paint is allowed to dry and then the sensitized paper is covered with a negative original or various objects or opaque originals and exposed to UV light (either from the UV lamp or sunlight).

$$Fe^{2+} + K_3[Fe^{III}(CN)_6] \longrightarrow K[Fe^{II}Fe^{III}(CN)_6] + 2\,K^+$$

blue precipitate

Figure 3: Formation of Prussian blue

The light-sensitive iron(III) complex represents the core of the whole process. The central iron(III) atom coordinates six carboxylate groups contained in the anions of the dicarboxylic acid (or tricarboxylic acid). In the case of oxalic acid, iron coordinates three oxalate anions and forms an octahedral potassium tris(oxalato)ferrate(III) complex, which is a stable, crystalline, relatively water-soluble green crystalline compound.



Tripotassium-tris(oxalato)ferrate(III)

Figure 4: Structure of the light-sensitive complex

The original recipe of Sir Herschel employed the ammonium salt of citric acid while later industrial formulations have, however, prefered the oxalate process, since it allows a faster printing with better contrast. In addition, such formulations are less prone to mold attack (ammonium citrate supports mold growth because it contains both carbon and nitrogen in a well bioavailable form).

The violet and ultraviolet portions of the light spectrum have a sufficiently high energy to excite the tris(oxalato)ferrate(III) complex. The excited complex is unstable and undergoes an internal redox reaction – the central FeIII atom as an oxidizing agent oxidizes the nearby oxalate anion to the carbon dioxide and gets reduced to FeII. The newly formed Fe2+ cations combine directly with the ferricyanide in the interior of the paper fiber to form the insoluble precipitate of Prussian blue. The light-sensitive reaction can be described in a simplified form as follows:

$$2\,[Fe(C_2O_4)_3]^{3-} \longrightarrow 2$$

Figure 5: Photochemical decomposition of tris(oxalato)ferrate(III) complex

The starting chemicals remain unchanged in places that have not been exposed to the light. Washing out the unexposed areas under running water removes all readily soluble chemicals and leaves only the blue image embedded in the structure of the paper fiber.It is interesting to note that a longer exposure time leads to a more profound reduction of the Prussian blue so that the original blue color becomes gray. This is due to the fact that Prussian blue is reduced to Berlin white of the composition FeII2[FeII(CN)6]. When this happens, it is usually a good indication that the exposure should be interrupted. After thorough washing, the image slowly acquires the blue color by oxidation with aerial oxygen. This process can be drastically accelerated by immersing the cyanotype in dilute hydrogen peroxide solution. As a result of this oxidative treatment, the picture turns instantaneously blue and reaches full contrast.

Figure 6: Exposition of the photosensitive layer to sunlight through a transparent negative template

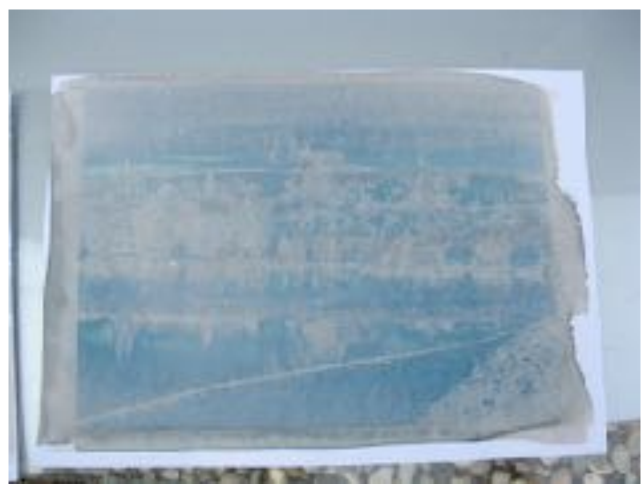


Figure 7: Cyanotype before washing out and stabilisation

Figure 8: Cyanotypes with different exposure times

An image produced in such a manner has an intense blue color and is very stable towards oxygen and light (the original cyanotypes of Sir Herschel are still very impressive after 160 years of storage in the museum), is relatively stable against weak and dilute acids but very unstable to alkali which cause extensive bleaching of the Prussian blue. Bleaching of the image with a dilute sodium carbonate solution followed by washing out and a subsequent bath in a strong black tea or coffee leads to a pleasant brown toning.

The alkaline instability of the photochemical blueprint is the main reason why papers with a high content of alkaline additives (chalk and other additives) should be avoided because they can cause image yellowing, formation of brown spots or inhibition of the photochemical reaction. (Photochemical decomposition of the photoactive complex is best carried out at weakly acidic pH)

The cyanotype process is not only restricted to paper surfaces, but images can also be printed on other surfaces, e.g. on wood, cotton or leather and thus create interesting objects.