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Nature Print Paper

SPP-40 / SPP-200

Background:

This sun-sensitive paper is used to make shadow prints. It is based on the 1842 discovery by Sir John Herschel. The process has been known as cyanotype, blue print (as in the construction plans), or photograms. Several artists have also used the process, starting in 1843 with Anna Atkins, who is known as the first female photographer. She created cyanotype images of botanical specimens. Other artists who have used this process include Man Ray (Rayographs) and Christian Schad (Schadographs).

The process uses chemicals applied to paper. Other absorbent materials, such as fabric or wood, have also been used. These chemicals include ferric ammonium citrate and potassium ferricyanide. When combined they make “Berlin Green,” which is water soluble, and “Prussian Blue,” which is insoluble. The chemicals applied to paper are safe and nontoxic.

How Prints Are Made:

Nature Print Paper is light sensitive. It is strongly affected by sunlight, and weakly affected by room light. The treated paper should be kept in a light-blocking container and is best used within six months of purchase.

The print design needs to be set up indoors, out of the sun, and then carried to sunlight to be exposed. You can use a plastic cover to hold the items in place when being moved. You can easily make one by using a piece of clear transparency film (like those used for overhead projections in a classroom) or clear plastic report cover stapled as a flap to a stiff sheet of cardboard. This will hold items in place, keep them from blowing away, and also flatten things like leaves for a crisper edge when exposed.

Exposure of the print can be as short as two minutes in strong sunlight. The paper can also be used on cloudy days, but this may change the exposure time. You can cut up small squares of the print paper to experiment with timing. When exposed to sunlight, the paper turns light blue.

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After exposing, you need to stop the chemical reaction. This is done by rinsing the paper in plain water. After dunking in water, the green tint is washed away (the soluble chemical) and the strong blue color remains on the paper (the insoluble chemical.) Dry the papers flat and out of sunlight. You can use a hair dryer to speed this up. The blue color will darken as the paper dries.

You can get other color effects after the sun exposure by using other chemicals as part of the rinse. For example:

To darken the final blue:

Rinse the paper in a solution of water combined with vinegar or lemon juice. Then re-rinse in plain water to stop the final chemical reaction. Use test squares to experiment with different concentrations of vinegar or lemon juice to get the effect you seek.

To lighten the final blue:

Add some household borax or Sunlight brand laundry detergent to water for the first rinse solution. Re-rinse in plain water after to stop the final chemical reaction. Use test squares to experiment with different concentrations of borax or detergent in the water to get the effect you seek.

To change the color of the paper:

Soak the water rinsed paper in a solution of brewed tea. Rinse quickly in plain water and dry the paper flat. This makes a peach to purple color in the final print. Experiment with different strengths of tea for different colors.

Online Resources:

Read more about the history and process of cyanotypes:
http://en.wikipedia.org/wiki/Cyanotype

A middle elementary lesson with extensions—from the Orange County Public Schools in Orlando, Florida:
http://www.mrsruss.com/Teachers/ResourceFiles/Science/35_Energy_FunInTheSun.pdf

Photographs of British Algae by Anna Atkins, Flickr portfolio from the New York Public Library:
http://www.flickr.com/photos/nypl/sets/72157610898556889/detail/

General Use and Ideas

Nature Prints can be used to make gift cards, and to illustrate writings about the objects used to make them. Nature Prints can be mounted on card stock and cut up to create puzzles for students to reassemble—a simple shape, such as bookmarks, should be used to make these puzzle pieces, as the students should be concentrating on the picture, rather than the large shape of the puzzle piece. (Puzzles can be identified on the back with writing that crosses over the whole size of the card stock, such as the name of the child who made that print. This can be used to identify if the shapes belong to this print, or if they were assembled correctly.)

Making Shadows

After investigations about objects that make shadows, those objects that create sharp distinct edges in their shadows, and those that create soft edges in their shadows, students can choose object to use in making Nature Prints. Each student might use small "sharp edge" items and small "soft edge" items on his or her print to create contrasts.

Poetry Prints

Have students write haiku or other poetry to explain their Nature Print pictures.

Translucent and Transparent

Investigate materials that are transparent (lets light pass through without being distorted) or translucent (lets light pass through, but makes it distorted or fuzzy in some way.) Examples are clear glass or plastic, vs. wavy or pebbled surface glass/plastic. Find object that can be tested on the Nature Print Paper to see what effects they have on the exposure prints. Of particular interest might be thin slices of foods like citrus or onions.

Identifying Plants in the School Yard

Using plant and flower identification charts, take a schoolyard tour to map and identify the plants that live near your school. (Caution should be taken to scout the area for plants such as poison ivy ahead of time, and to discuss these with students, and avoid contact.)

Make a collection of pieces or leaves from the identified plants in the schoolyard. Create a book or wall display of the plant prints, identifying each. Digital photos can also be used beside your Nature Prints. Have each child choose one plant as his or her favorite, create a Nature Print of this plant, and write an explanation of why it is a favorite.

Creating a Fair Test: Sunscreens

Students can develop a test of various sunscreen products using the Nature Print Paper. Discuss the purpose of sunscreens and possible questions that can be investigated, such as:

- how effective different products are (same SPF level/ same amount/same exposure)
- application (thin coat vs. thicker coat/same product)
- different strengths (different SPF levels/same amount/ same exposure)

Students can also experiment with different exposure times, but these may be difficult to control for when using the Nature Print Paper.

Have students bring in small samples (one ounce) of sunscreen lotions from home (provide small plastic bottles or covered cups from takeout restaurants). Use several sample bottles in the classroom for the students to read product information and to develop a data collection sheet that will include necessary information (i.e., brand, SPF factor, type of product, cost per ounce) of the samples they bring in from home.

Students should also discuss and decide on the classroom procedure to create a fair test of their samples. Consideration should be given to things like how to identify the samples, how to test the lotions or sprays (using a clear overlay, like plastic, rather than applying directly to the Nature Print Paper), standardizing application amounts (amount of product, applied how, and over what sized area), and standardized sun exposure times.

Carry out the procedure and collect data on the performance of the products. Discuss as a class how the performance can be measured and graphed. Discuss the results of the experiment and the real-world consequences that can be derived from the information gathered.

NGSS Correlations

Our Nature Print Paper and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

1-PS4-3
Students can use Nature Print Paper to plan and conduct an investigation to determine the effects of placing objects made with different materials in the path of a beam of light.

3-LS3-2
Students can use Nature Print Paper to gather evidence to support the explanation that traits can be influenced by the environment.

K-2-ETS1-2
Students can use Nature Print Paper to develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Middle School

MS-PS4-2
Students can use Nature Print Paper as they develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MS-LS4-2
Students can use Nature Print Paper to apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms in infer evolutionary relationships.

High School

HS-PS4-1
Students can use Nature Print Paper in conjunction with mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4-4
Students can use Nature Print Paper to evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Suggested Science Ideas correlated with the NGSS

MS-LS4-2
Students can use Nature Print Paper to create photo negatives of modern organisms like plants and animals. These two-dimensional images will aid students in observation skills of details. The shadow prints will simplify interpreting and understanding the fossil record, as well as the form and function of structures / traits.

HS-PS4-1
It would be interesting for students to use various media over the Nature Print Paper to see how the frequency, wavelength, and speed of waves travel differently. Exposure on the paper should vary.

HS-PS4-4
Students can use Nature Print Paper and vary the exposure time to evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, "*Teachers Serving Teachers*" isn't just a slogan—it's our promise to you!

Please visit our website for more lesson ideas:

TeacherSource.com/lessons

Check our blog for classroom-tested teaching plans on dozens of topics:

http://blog.TeacherSource.com

To extend your lesson, consider these Educational Innovations products:

Ultraviolet Detecting Beads (UV-AST)

Watch white beads change to colored when taken outside the building! When returned they turn back to white. What causes the change? The beads contain pigments which react with ultraviolet light from the sun, even on a cloudy day. Great for teaching UV awareness! Use the beads to test the UV blocking effectiveness of sunblock, sunglasses, windows, etc. Lesson activities are included.

UV Filter Set (FIL-235)

Set of two plastic disks, 7 cm (2.75 in.) dia.; one absorbs UV-A Light, the other doesn't. Great for experimentation with our UV Beads!

UV Outside Detector (UV-360)

This detector contains UV Detecting Beads inside of a clear plastic bottle preform. When the detector is shielded from UV radiation, the beads are white. When exposed to UV radiation (between 360 and 300 nm in wavelength), the beads turn purple. This detector can change color thousands of times. Our favorite workshop give-away!

UV Color-Changing Nail Polish (NP-530)

When exposed to ultraviolet light from the sun (or other long-wave UV source), UV nail polish changes color! The change is reversible. When the UV Nail Polish is removed from sunlight, it returns to its original color! Although the product is great for nails, it can just as easily be painted on an index card or acetate to make an ultraviolet light detector that can be used for testing the effectiveness of sunscreen lotion or any other UV filter.