Creatistics

Educator & Parent Guide

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Contents

STEAM Kit Science of Light & Colour

This STEAM kit contains a complete range of essential art and craft products, plus an educator guide with ideas for teaching concepts of Light and Colour in the classroom. Investigate, discover, create and reflect with this comprehensive range of products. Kit contents may vary.

This Kit Includes:

- Educator Guide
- SN6725 Kaleidoscope Student Kit - Pack of 10
- MD2560 Magic Black Light Torch
- AM0514 Decorative Plastic Light Bulb - Pack of 6
- TEB1212 Teachables Coloured Highlighters - Set of 12
- CT8138 Flat Mirror - Set of 10 - 21cm x 30cm
- EDU1311 Hexagonal HB Graphite Pencils - Pack of 12
- MND4108 Drawing Paper Pad 9x12" - 50 Sheets
- BY1048 Crayola Sidewalk Thick Chalk - Box of 48
- FA0034-M Resealable Medium Plastic Bag Pack of 24
- CS1412 Round Bristle Paint Brushes Short - Pack of 12
- IP0400 Paint Tray with 6 Pots
- TH891 Sunpaper Kit - UV Reacting Paper
- TH880-FP Poster Paint Colour Fluoro Palette
- K28L Heavy Duty 28L Storage Container

STEAM

What is STEAM?

STEAM is an educational approach that incorporates Science, Technology, Engineering, the Arts and Mathematics to guide students' learning. Students that are exposed to experiential learning are proven to be better problem solvers, more creative and develop higher level critical thinking skills. These attributes are essential for all students, in order to meet the needs and expectations of the 21st Century workforce and future careers.

Science and Young Children

Young children are natural scientists. From birth they are actively constructing an understanding of how the world works. Their natural curiosity and interest in their surroundings is science at its most fundamental.

The Early Years Learning Framework emphasises the importance of active and involved learning and the development of dispositions such as curiosity, creativity and perseverance. As children ask questions and explore their world they engage in experimentation, problem solving, theory making and complex thinking.

For this reason it is important that science for young children is not simply about learning "facts" or watching "experiments". While facts and experiments are important, science in early childhood is best thought of as being about learning to think and act scientifically. A questioning mind and a willingness to experiment are vital.

It is important to think holistically when we think about science. Science concepts tend to be complex and interconnected. While it is sometimes helpful to think about an idea or concept in isolation this is rarely a true reflection of the actual world. Rather than seeing science as a "stand alone" subject contemporary approaches to science education see it as being interconnected with a range of other curriculum areas. A STEAM (Science, Technology, Engineering, Arts and Maths) approach considers science in relation to the related areas of technology, engineering and maths, and by also including the arts seeks to also emphasise the importance of creative thinking and experimentation to the scientific procees.

Experiences which take a STEAM approach are likely to be more complex, interesting and valuable than those that treat each STEAM component separately.

Using this Kit

This kit is designed to stimulate children's interest and learning in relation to the science concepts related to light and colour.

The materials provided allow multiple ways to explore the chosen topic and suggestions for specific experiences using the materials provided.

Remember that children learn best when they are interested in a topic and when they are able to make connections between what they are learning and what they already know. Where an experience follows on from an existing interest it is likely to be more meaningful. Rather than seeing these experiences as "one-off" ideas that can be slotted into your program at any point look for connections to ideas and interests that the children are already exploring.

As an educator remember too that your role is to support children's learning. One way to do this is to be knowledgeable about the topics that the children are investigating. We have provided some information on the potential learning in each of the suggested experiences but doing your own research will also help you to guide and extend the children's thinking.

Be careful not to introduce a "correct" explanation or answer to a question too quickly. While "answers" are important the process of exploring a topic is just as important. Children will gain more if they learn how to find something out rather than just being given the factual information. Science is often a process of trial and error, of making and testing theories, and it is this aspect that we should aim to encourage.

Ask questions and encourage the children to do the same. Resist the urge to provide an answer straight away (even when you know it!). Wonder about the things that you can see and model curiosity – "I wonder why that happened?" This is often the only invitation children need to start suggesting their own ideas.

Activity 1:

A Human Sundial

Use your body to observe how the sun moves throughout the day. For older children this can be linked to the passing of time and exploring the ways that the sun can be used to tell the time.

You Will Need

- sidewalk chalk
- a paved surface that receives full sun most of the day
- a sunny day

The Science

Each day the sun moves from east to west through the sky. The shadows cast at different times will be of different lengths and fall at different angles because of the changing position of the sun. Because the sun's path is predictable these shadows can be used to tell the time of day – this is how a traditional sundial works!

What To Do

Starting in the morning, locate a spot that will be in the sun for most of the day. To use the chalk it will need to be paved or have some other sort of hard surface that you can draw on. Mark the spot with an "x" so that you can come back to the exact position throughout the day.

Ask a child to stand on the spot and another child/children to trace around the shadow that is cast. If you have enough space you could trace around the shadows of several children.

Once this is finished use chalk to write the time that the shadow was drawn next to it.

Explain to the children involved in the experience that you will come back each hour to check on the shadow and see if it has changed. Ask them what they think will happen to the shadow when you return. Record some of these responses so that you can reflect on them later.

Return to the same spot regularly throughout the day (every hour should produce a reasonable difference between the shadows) and redraw the shadow, remembering to record the time. This will work best if it is the same child's shadow each time (but you can take turns amongst the other children to trace the shadow).

Each time discuss what you can see happening. Encourage the children to predict what they think will happen and hypothesise as to why it is occurring. Avoid giving an explanation too early – the value is in encouraging the children's thinking.

Potential Learning

The learning from this experience will vary depending on the children's ages and interests.

Younger children will probably be most interested in simply comparing the different shadows and looking at how they change in size and direction depending on where the sun is. For young children the idea that you can cast a giant shadow (many times bigger than you actually are) if the sun is in the right spot is a powerful one!

Older children may also be interested in the link between the time and the shadows cast and this can lead to more formal discussion of sundials and the ways that the sun can be used to tell the time.

Following Up

Repeating this experience may help children to make the realisation that the sun's path is predictable and similar from day to day.

Depending on what aspect of the experience the children are most interested in you could take this is in a more mathematical direction – measuring the length of the various shadows and calculating when they are longest and when they are shortest.

You could repeat this using the shadow of an object (rather than a person) – see Activity 2 (An Object Sundial)

For older children who are interested in the links to time introducing an actual sundial could be a good follow up. You could also consider creating a more permanent "human sundial" that could be used to tell the time (add weblink here for further details)

Activity 2:

Shadow Tracker

If you don't have a paved area to use for a human sundial (Activity Sheet 1) try this alternative to track the movement of the sun and observe how shadows change over the course of the day

You Will Need

- drawing paper
- pencils
- a table or flat surface placed in a sunny spot
- an interesting shaped object to cast a shadow (depending on the children's drawing skills you might start with a relatively simple shape that will be easy to trace; for more skilled drawers complex shapes can cast interesting and unusual shadows that will be come a topic of interest in themselves)

The Science

As the sun moves through the sky the angle and length of the shadow that an object casts change. In the morning and evening when the sun is low in the sky shadows are at their longest. In contrast, at noon when the sun is directly overhead shadows can seem to almost disappear. For young children this experience offers opportunities for predication and problem solving as they work out when and where shadows will fall at different times of the day.

What To Do

Starting in the morning locate a spot where you can place your table that will get sun for all (or at least most) of the day. Cover the table with the drawing paper - it is best to stick this down in some way so that it doesn't move or blow away during the day! Show the children the object that you are planning to use to cast your shadows and discuss its shape. Ask the children to predict what its shadow will look like before placing the object into the sun.

Ask one of the children to trace the shape the shadow leaves on the paper. If you want they could also shade it in so that it looks like a shadow.

Once they have finished compare the actual outline with the children's predictions. What did they predict? What was different? Can they suggest any reasons for this? What do they think will happen to the shadow over the course of the day? Will it change or will it stay the same?

Note the time next to the outline so that you can remember when it was drawn later on.

Return to the table periodically throughout the day (every hour should allow time for the shadow to change) to redraw the outline and continue discussion about what is happening. Depending on how quickly they can draw the shadow they may notice that it moves/changes even as they are drawing!

Avoid giving an "answer" to what is happening too early on – the value in this experience is exploring the children's thinking and theory making. Keep a record of the children's ideas and explanations to refer back to as you go on.

Potential Learning

The learning from this experience will vary depending on the children's ages and interests. The complexity of shapes that you are able to explore will also depend on the children's ability to trace the shadows.

Younger children will probably be most interested in simply comparing the different shadows and looking at how they change in size and direction depending on where the sun is. For young children the idea that you can cast a giant shadow (many times bigger than you actually are) if the sun is in the right spot is a powerful one!

Older children may also be interested in the link between the time and the shadows cast and this can lead to more formal discussion of sundials and the ways that the sun can be used to tell the time.

Following Up

Repeating this experience may help children to realise that the sun's path is predictable and similar from day to day.

Depending on what aspect of the experience the children are most interested in you could take this is in a more mathematical direction – measuring the length of the various shadows and calculating when they are longest and when they are shortest.

For older children who are interested in the links to time introducing an actual sundial could be a good follow up. You could also consider creating a more permanent "human sundial" that could be used to tell the time (add weblink here for further details)

If you look at YouTube there are numerous time-lapse videos of shadows that children may find interesting to watch and compare to their own observations (search "time lapse shadows")

Activity 3:

Mirror, Mirror – Part 1

This experience uses two mirrors – taped together so that they can be angled towards each other to explore the effect of multiple reflections as children make patterns. In part 2 we will also explore what reflection can do to a drawing

You Will Need

- flat mirrors (in pairs)
- strong tape
- pattern blocks or other small materials for creating patterns

The Science

Light bounces off reflective surfaces (such as mirrors, other highly polished or shiny materials, still water) causing us to see a "reflection" or image of what is placed in front of the surface. This reflection is a "mirror image" meaning that it is identical to the original but reversed so that what is on the left hand side of the original appears to be on the right hand side of the reflection (and vice versa). Images in a mirror also have depth so that they appear to be twice as far away as the actual distance between the object and the mirror. When we use multiple mirrors to reflect an object this leads to complex reflections that can create interesting optical effects as the images are reflected multiple times.

What To Do

Firstly tape the pairs of mirrors together along one edge so that they can open and close like a book (put the tape on the back of the mirrors only so that it doesn't obscure the reflection).

Open the mirrors and stand them upright on a table (or other stable surface – you can do this on the floor if you like). This will create a v-shaped space between the two mirrors which will reflect whatever is placed inside it (you can experiment with the angle between the mirrors to create different effects). Provide patterning materials for the children to use and encourage or model making patterns between the mirrors to see how they are reflected. A 90 degree angle between the mirrors will produce three reflections of the original pattern. Other angles will produce more!

Encourage the children to describe and try to explain what they can see happening.

Potential Learning

In this experience children are exploring the properties of mirrors and reflection. Young children are unlikely to understand the physics behind what they are seeing but will start to gain a general sense of how reflection works and how it can play tricks on the eye. Some children may even notice that the reflection of a reflection will no longer be a mirror image of the original. In fact it will be a mirror image of a mirror image (ie: the same as the original).

If you have already used the "kaleidoscope kits" this experience may also help children to understand what is happening inside the kaleidoscope and how multiple reflections create a symmetrical pattern.

Following Up

Explore how reflections change as the angle between the mirrors is changed. See how many reflections you can make!

You could also begin to explore reflection in another direction by adding a third mirror to give depth to the children's patterns. You either tape three mirrors together (at 90 degrees to each other to create a "corner" mirror) or else place your two taped mirrors on top of another mirror so that you can still vary the angle between them.

A simpler experiment with reflection is to use one mirror, laid flat, and to build on top with blocks. The reflection in this case adds depth to the what is being built.

Use the "kaleidoscope kit" to further explore the way that mirrors can be used to make patterns.

Activity 4:

Mirror, Mirror – Part 2

Using the same mirrors as we made in Part 1 this experience explores the effect of reflection on the children's drawings.

You Will Need

- flat mirrors (in pairs)
- strong tape
- drawing paper
- pencils (or textas, crayons or other drawing implements)

The Science

Light bounces off reflective surfaces (such as mirrors, other highly polished or shiny materials, still water) causing us to see a "reflection" or image of what is placed in front of the surface. This reflection is a "mirror image" meaning that it is identical to the original but reversed so that what is on the left hand side of the original appears to be on the right hand side of the reflection (and vice versa). Images in a mirror also have depth so that they appear to be twice as far away as the actual distance between the object and the mirror. When we use multiple mirrors to reflect an object this leads to complex reflections that can create interesting optical effects as the images are reflected multiple times.

What To Do

Use the mirrors that were taped together in Part 1.

Open and stand them upright on a table to create the same "v"- shaped reflective space as we did previously. Either ask the children to do a drawing separately and then place it between the mirrors to see the effect or place the mirrors directly onto the paper so that the children can watch the reflection as they draw.

Encourage the children to describe and try to explain what they can see happening.

Potential Learning

In this experience children are again exploring the properties of mirrors and reflection. As drawing is a different medium to pattern blocks they will see different results. Initially children will probably react to the reflections that occur. As they begin to understand how their drawings are reflected they may begin to take advantage of reflection to create specific effects or patterns. For those children who are beginning to write letters they will probably be fascinated by the way that the letters/ words are changed when seen in mirror image.

Following Up

Explore how the mirrors change the children's drawings. Try different kinds of drawings – different shaped paper, realistic or abstract drawings, letters and numbers, patterns...

Activity 5:

Sunprints

This experience explores the shadows cast by common objects as well as the chemical reactions that underpin traditional photography. Using light sensitive Sunprint paper children can create images using the shapes of objects and the shadows that they cast.

You Will Need

- **sunprint paper**
- **a sunny (or at least light) spot**
- **various objects to create patterns** – those with texture or detail (eg: a feather), or those that allow varying degrees of light through will create more interesting and intricate patterns than solid objects.

The Science

Some chemicals react to light. This is how traditional photography works – light carries an image onto a surface treated with light-sensitive chemicals. As the chemicals react to the light an image is created. A film camera controls this process through the use of a lens and shutter and creates a precise image. The Sunprint paper is a simplified version of this process but still captures detailed and striking images.

What To Do

The Sunprint paper contains detailed instructions.

The process itself is relatively simple – arrange your objects on the Sunprint paper according to the instructions and then expose it to sunlight; wait 1-5 minutes until the paper turns almost white and then rinse the paper under running water for one minute to stop the reaction from continuing and to "fix" the image.

Potential Learning

This process offers a chance to create more permanent images of shadows. Children will usually enjoy exploring the way that different objects create different images. They are also likely to be fascinated by the simple process of creating an image by simply placing it in the sun.

With some children you may be able to talk about the chemical process that is occurring to create the image; for others it may be enough to simply explore the shadows that are cast.

Following Up

Explore how different materials make different patterns – try 2D and 3D objects, objects with areas of transparency or translucency, or those with fine detail or texture to create unusual images.

You could also explore the strength of the sun by using plain paper instead of the sunprint paper and exposing it for much longer periods of time. After several hours in the sun the paper that is not protected by the objects placed on top of it will yellow and show a clear outline of the objects.

A similar technique to this was used by the Surrealist artist Man Ray. He used objects placed directly onto light sensitive paper to create what he called "rayographs". The children may be interested to see some of his work and compare it with their own (google: "man ray rayographs" but select carefully - some of his work includes nudity).

Activity 6:

Glow in the Dark!

These experiences uses a black light torch to explore fluorescent colours that glow in the dark. There are numerous ways to create items that will glow under the torch light using fluorescent ink and/or paint.

You Will Need

- black light torch
- fluorescent markers and paints
- rice
- light coloured flowers (gerberas work well)
- tonic water
- light bulb vase or jar
- re-sealable plastic bags
- paint brushes and paint pots
- paper
- a room (or area within a room) that can be darkened. If this is not possible you could use the torch within a large box to block out as much external light as possible

The Science

Fluorescent materials look "fluorescent" because of the way that they emit light when they are "excited" (ie have energy added to them). Glow in the dark materials react in a certain way to ultraviolet light (a spectrum of light that is usually invisible to the human). This reaction causes them to "glow". In this experience the black light torch emits a beam of ultraviolet light that causes the fluorescent items it strikes to glow.

What To Do

The simplest idea, to introduce the children to the idea of fluorescence, is to do some paintings use the fluorescent paints and then, once they have dried, to display them in a darkened area and look at them with the blacklight torch.

1. Fluorescent/glowing water - Tonic water naturally glows under blacklight and so provides an easy liquid glow experience. You could use it to fill balloons or bottles and observe under blacklight. Alternatively, if you want to make coloured water use the ink from the non-toxic highlighter pens. Remove the end of the pens and take out the "felty" inside that contains the ink. Rinse this under a tap and collect the water that runs off. This will contain the fluorescent from the marker and will also glow under the torch light.

2. Make a flower glow in the dark - Use the glowing water from the earlier experience. A light coloured flower that will "drink" lots of water from a vase or cup – gerberas work well, as do large daisies or even hydrangeas. Cut the ends off the stems of the flowers so that they will soak up water and place in cup of tonic or glowing water. Leave for several hours to allow the flower to absorb the water before placing in a darkened area and shining the dark light torch onto it.

3. Create glow in the dark rice - Use the discs of fluorescent paint from the fluoro paint palette and mix with water to create several tablespoons of liquid paint in each colour. Pour this paint into separate resealable plastic bags. Add plain white rice to each bag and reseal before squeezing the rice and the paint together until all of the rice in each bag is covered in the paint mixture. Pour the coloured rice out onto a flat surface and spread it out to dry. Once dry you can mix the colours together in a tray or jar and use the blacklight torch to make it glow.

Potential Learning

Most children love torches and playing in the dark so they will probably not require much encouragement to engage with these experiences! Initially they will probably be most interested in the way that the colours glow in the dark. As they begin to experiment with this idea you can test different materials to see which glow and which don't. This will encourage the children to hypothesise about what is happening and make predictions.

These experiences also offer the chance to talk about the blacklight torch and consider how it works. You may be able to explore the idea that we can't see all forms of light (such as the ultraviolet light being emitted by the torch) but that this light is still capable of creating reactions that we can see!

Following Up

Explore what materials glow in the dark and what don't! Make a list of those that you try and categorise them into glowing and non-glowing.

If the children are interested in the ultra-violet light emitted by the torch then you could introduce them to infra-red light (as another form of light that is invisible to us).

Activity 7:

Snowflake Symmetry

Use paper snowflakes to explore symmetry and patterns similar to those produced by a kaleidoscope. The finished flakes can be used to decorate the kaleidoscopes provided in the kit.

You Will Need

- **square sheets of paper** (various colours and sizes - if you are going to use them to decorate your kaleidoscopes make sure the paper is not longer than the kaleidoscope tube)
- **scissors**
- **kaleidscope kit**
- **glue stick**

The Maths

Symmetrical shapes are those that can be folded onto themselves perfectly (ie: one side is the perfect mirror image of the other). Symmetrical shapes will have one of more lines of symmetry along which they can be hyphothetically "folded" in this way.

The reflections produced in a kaleidoscope (or in the paried mirrors in the "mirror mirror" activities) produce symmetrical image by reflecting an image or pattern multiple times.

Folding paper, cutting it, and then unfolding it to reveal a "snowflake" is a similar way to produce a pattern.

What To Do

Fold the paper in half multiple times – the more times you do it the complex the resulting snowflake will be.

Use the scissors to snip out random pieces of the folder paper making sure that you cut through all the layers. It doesn't matter what or how many pieces you cut out. When you have finished unfold the paper to reveal the finished snowflake.

Point out how the cuts you made are repeated in each section of the snowflake and ask the children what the snowflake pattern reminds them of (hopefully they will make the connection to the kaleidoscopes and the images they have seen using them).

If you have already made the kaleidoscopes contained in the kit use some of the snowflakes to decorate the outside of the kaleidoscope tube. Depending on the size you could glue one large snowflake around the tube or multiple small ones.

Potential Learning

This experience offers the opportunity to explore ideas about symmetry – both in the folding of the paper (in half and then half again) and in the way the resulting snowflakes is a repeated pattern made up of the shapes that are cut out.

There is also the chance to make comparisons to the kaleidoscopes and the patterns that they make.

Following Up

Snowflakes are a great experience because, as long as a child can cut the pieces out, they always turn out looking good. Once children master the basic technique you can experiment with more and more folds to increase the complexity of the final shape. See how may times you can fold the original paper in half before it becomes too thick to cut!

A similar technique to this was used by the Surrealist artist Man Ray. He used objects placed directly onto light sensitive paper to create what he called "rayographs". The children may be interested to see some of his work and compare it with their own (google: "man ray rayographs" but select carefully - some of his work includes nudity).

Notes:

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