Colour Mix Magic

Description

Students will participate in a variety of hands-on stations to understand basic properties of colour and light – additive colour mixing (more colours of light are reflected, such as mixing coloured light to make white light), subtractive colour mixing (fewer colours on the spectrum are reflected, like when we mix many colours of paint to make a dark, muddy colour), we can separate colours to see which colour components were present (chromatography).

Materials

DEMO

- Red/Blue hidden image (See Handout)
- Red coloured lens or cellophane frame

LIGHT MIXING

- Cellophane frames, or coloured lenses – various colours
- Flashlights or light table
- OPTIONAL: transparent coloured objects such as magnet tiles

COLOURED WATER MIXING

- Plastic cups (4+)
- Water
- Food colouring
- Pipettes, syringes and/or spoons

CHROMATOGRAPHY

- Paper Coffee Filters
- Clothespins
- Washable, water-based markers
- Spray bottle of water
- Paper Towels
- Table cloth or other table protector

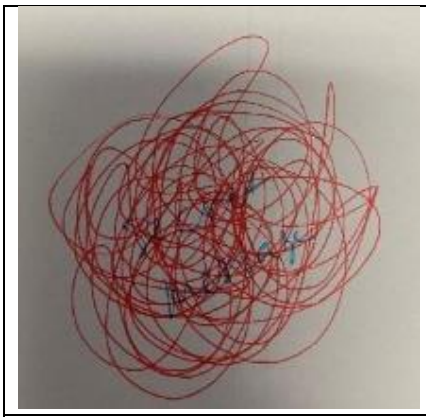
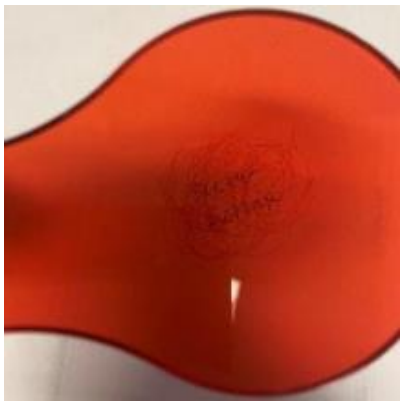
Explicit Teaching Points	Specific Expectations
• Colour is Reflected Light: light is energy, and we perceive different wavelengths of light as different colours. In humans, colour perception, or the way we see colours, happens because objects absorb certain wavelengths and reflect others. The reflected wavelengths of light determine the colour that we see! It's important to introduce students to scientific language like energy, and for them to differentiate between colours. It might be helpful to explain to students that red objects, for example, absorb all of the colours of light EXCEPT red, and bounces it back (reflects it) for our eyes to see! • Additive & Subtractive Colour Mixing: when we perceive colour, we are either seeing it directly from a light source, or reflected off an object. In additive colour mixing, we are mixing colours of light, which, if we mixed all of the colours of visible light together, would produce white light. This is the principle behind a prism – white light can be split into its components (i.e., the entire colour spectrum of visible light). We can also see this in LED screens and lighting for stage and screen productions. Subtractive colour mixing, on the other hand, happens when we mix pigments or other objects that	**B12.2** make predictions and observations while exploring, investigating, and designing **B12.4** draw conclusions and communicate results **B13.1** ask questions about and describe some natural occurrences

reflect or absorb light. The more colours we add, the more colours are absorbed, until we get black. Adding pigments reduces the amount of reflected light, resulting in darker or muddier colours. This is the concept in painting or printing, and why our colour theory ideas of colour mixing don't always result in the new colour we were expecting! Have you ever tried to mix red and blue paint or food colouring? Instead of a vibrant violet, we usually get a muddy reddish-purple colour that leaves a lot to be desired. This concept is sometimes tricky to explain to children, but with the hands-on experiments, hopefully differentiating light mixing in its ability to make things brighter and whiter, and pigment mixing in its ability to make things duller and darker, will help them to understand the concept. Highlighting the idea that the more colours of pigment we add, the more colour is absorbed is more concrete, and a great place to start when talking about colour mixing. • Colour Separation (Chromatography): we can separate the pigments in a paint, ink, or other pigmented medium using a technique called chromatography. This allows us to see all of the colour components that are absorbing or reflecting light. Chromatography in the classroom typically uses a medium	

like a paper coffee filter and a solvent like water to separate the different pigments in paint or a marker's ink. The pigments typically move through the medium with the help of the solvent at different speeds, and this creates a display of their component colours. It helps students to understand that most colours we see are made up of other pigments that are mixed together to create that specific perceived colour. It's easiest to explain to students that when we're doing a chromatography experiment, we're using tools (paper filter and water) to pull apart the colour we see so we can understand which colours mix to make it!	

Provocation (Introductory Book, WOW Demo, etc)

Start by asking the students if they'd like to see a trick, highlighting that it's not magic, but a cool science trick. Show students the red/blue image, and ask what they OBSERVE. You can prompt them by telling them that there is a hidden message or image, or highlighting that it might be tricky to see what is hiding! Remind them that the colour we see is reflected light, and that we can use SCIENCE to change the colours of light that are absorbed or reflected by adding a special tool, called a lens. A lens changes the way light behaves, and these lenses change the colour that we see! Place the red cellphane or coloured lens over the hidden image to reveal the image or message written/printed in cyan ink. Explain to students that colour can be tricky, but that we are going to explore the ways that we can mix or separate colours to understand more about how cool (and scientific, not magical!) colours can be!

Learning Plan

Introduction

After the demo, you may show students accompanying video, giving more context to colour mixing/separating. You may then prompt students to make connections to previous learning or experience by asking leading colour questions: have they mixed colour before? How do they mix colour? What have they noticed when mixing colour? Then, you can introduce the 3 stations, and connect to the demos in the video: Mixing Coloured Water, Mixing Coloured Light, and Chromatography Butterflies. This can also be run as 3 separate whole-class activities, if desired.

Mixing Coloured Light

For the light station, you'll need cellophane frames or coloured lenses and flashlights or a light table. You can make the coloured frames using cardboard, and cellophane or another transparent coloured plastic, like coloured dividers. You can also buy these cool coloured lenses, but the DIY works just as well! Students can combine coloured frames or lenses with the light to make new colours. Questions at this station from educators should focus on encouraging students to make observations, notice the brighter colours, and make predictions as they continue to try different combinations of coloured lenses and light.

Mixing Coloured Water

For the coloured water station, you'll need to set up 3 water cups coloured with food colouring – red, yellow, and blue – and some empty containers for students to mix their colours in. Students can use pipettes, syringes, or spoons to let them transfer the coloured water from

their original container to their mixing cup to see if their mixing predictions were correct! Questions at this station should again focus on observations and predictions, and encouraging students to try different combinations, noticing how the colours get muddier or darker with more colour addition.

Chromatography Butterflies

For the chromatography station, you'll need paper coffee filters, clothespins, washable markers, and a spray bottle of water. Students will colour large swaths of colour on their filters, clipping them in the middle to make wings for their butterfly. They'll then spray their colourful butterflies with a little bit of water – watching the colours separate as they dry. You'll want to put them down on some paper towel to dry, writing each child's name with permanent marker on their paper towel, and probably cover the table with paper or a tablecloth to protect it. Questions at this station can focus especially on making predictions, selecting a strategy for colouring or spraying, and observing differences between different strategies. Noticing interesting colour separation, making connections between similar results, and asking lots of "I wonder what would happen if…" questions will help students make connections and encourage their participation in scientific methodology, specifically connecting to previous learning, making informed predictions, observations, and repeating experiments to understand more deeply.

Consolidation/Extension

- Translucent shapes, such as magnet tiles, can be used at your light table to explore mixing coloured light AND 3D shapes!
- Sort and find naturally occurring colours outdoors – prompt students to make connections by asking them how they see the colours they do, and which colours are being REFLECTED by the object so we can see them!
- Advanced chromatography: to expand on this learning, you can use a different kind of marker and solvent to demonstrate the effect. Using permanent markers and a spray bottle of alcohol, you should be able to achieve similar, but unique effects!

Notes/Context/Reminders	Assessment and Evaluation
• Students can create their own hidden messages by first drawing or writing with a light blue pen, then scribbling over it to cover with red pen. Using their red cellophane frames, they can then reveal their own secret messages! Ballpoint ink pens work best for this. • If the effect from the cellophane is too dark or not giving you the effect you were hoping for, try placing it closer to the light, or using two lights together. Bright flashlights work best and though they aren't very hard to find in stores, but we might not always have them in our classrooms! • Coloured water not mixing? Try using warm water! • Use washable, water-based markers for a fast and dramatic separation for chromatography. • Encourage students to make larger chunks or sections of colour when decorating their butterflies, as small and detailed designs don't give the same effect. • If you're looking to include more Indigenous perspectives, reach out to the Indigenous Education	Pedagogical Documentation – observation, student questions, action plan for next steps Success Criteria *Students will:* • Make predictions and observations while investigating and creating with colour • Draw conclusions about their observations and communicate them with their educators and peers • Describe and question natural occurrences using their own observations • Describe the likelihood of familiar events (i.e., similar colour mixing outcomes) happening based on previous observation

Lead at your school board who can help connect you to resources, community members, and other authentic and locally relevant relationships that can help enrich your programming.	