

## Station 1: Using your senses...

### Cyanotyping:

#### Materials:

- Cyanotype liquids ([link](#))
- Transparency paper (optional) ([link](#))
- Water color paper ([link](#))
- Sunlight
- Water
- Hydrogen peroxide (optional)

#### Instructions:

- Mix Part A and Part B cyanotype bottles with water separately.
- In a small vessel mix the 2 solutions in equal parts in the dark.
- Coat your watercolor paper with the solution and dry in the dark.
- Tape the paper onto a board to keep it flat in the dark.
- Place everyday objects on top that cast a shadow such as rocks, leaves, or shape paper cutouts.
  - Alternatively, you can use a negative using transparency paper.
- Leave your paper in the sun for 15-20 minutes, undisturbed.
- Take the print indoors and gently rinse in cool water until the water runs clear.
- Allow the print to air dry.
- Display your masterpiece and bask in all the compliments!

### Decoding DTMF tones:

#### Materials:

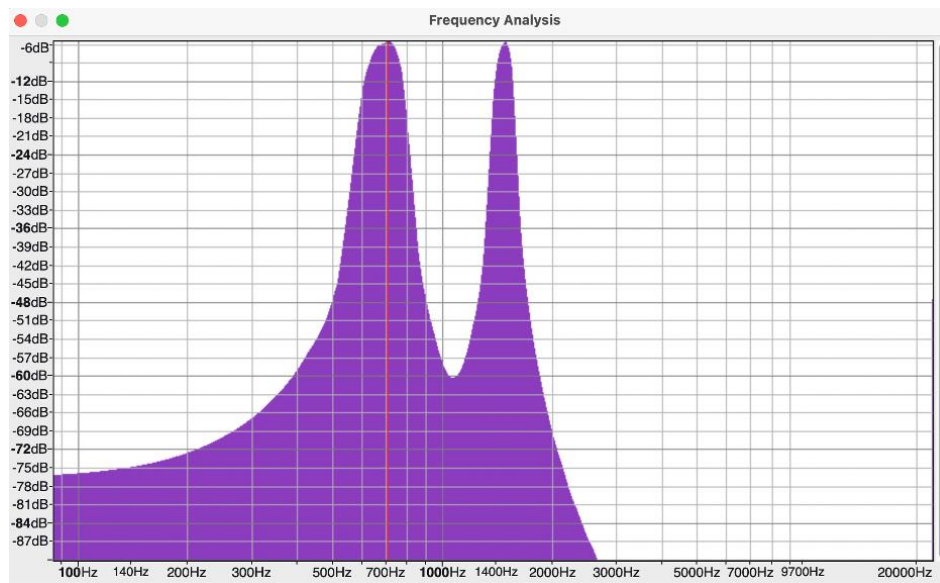
- Recording device
- Audio recording of a phone number being dialed
- Frequency plots of audio recording generated in Audacity

#### Instructions:

- DTMF tones encode numbers dialed on a telephone by representing each number as a unique combination of two audible frequencies: one low, one high. You can generate and download these tones (to simulate a phone being dialed) here: <https://onlinesound.net/dtmf-generator>.
- Then upload your audio recording into Audacity. You can actually zoom in to see the unique combination of sine waves composing each tone!

DTMF Frequencies		
Digit	Low Frequency	High Frequency
1	697 Hz	1209 Hz
2	697 Hz	1336 Hz
3	697 Hz	1477 Hz
4	770 Hz	1209 Hz
5	770 Hz	1336 Hz
6	770 Hz	1477 Hz
7	852 Hz	1209 Hz
8	852 Hz	1336 Hz
9	852 Hz	1477 Hz
0	941 Hz	1336 Hz
*	941 Hz	1209 Hz
#	941 Hz	1477 Hz

- Use tools → frequency plot to generate frequency plots for each tone individually (you'll have to select one block of sound at a time).
- Each plot will have two peaks (see example below - I've highlighted with a red line the first peak, corresponding to 697Hz. This tone is a 3 being dialed). These allow you to decode which number was dialed using the key (also below). Note that both x and y axes will be on a log scale.
- Viola! You've decoded the recording.



## Sation 2: Forensics

### Morse code:

#### Materials:

- Morse code legend: <https://free-printable-paper.com/morse-code-chart/>
- Morse code translator: <https://morsecode.world/international/translator.html>
- PowerPoint/Keynote

#### Instructions:

- Decide a secret message to decode from the Morse code, e.g. MAGIC.
- Scramble the characters, e.g. GCAMI.
- Encode each character into its respective Morse code audio file using the Morse Code Translator (G: - - \*; C: - \* - \*; A: \* -; M: - -; I: \* \*).
- Encode each character's position into its respective Morse code audio file using the Morse code translator (G: 3; C: 5; A: 2; M: 1; I: 4).
- Make a presentation where the first part identifies the scrambled letters of the message by playing the Morse code sounds for each letter (GCAMI).

- The second part of the presentation should allow identification of the positions of the scrambled letters of the message by playing the Morse code sounds for each letter's position (35214 for GCAMI respectively).
- Once both the letters and their positions are decoded, unscramble the message by arranging the letters in the increasing order of their positions (MAGIC for positions 12345 respectively). This reveals the secret message!

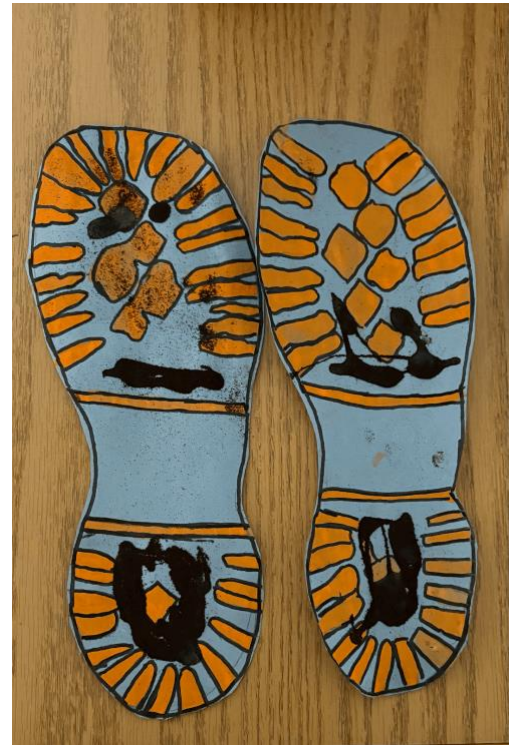
## Footprints:

### Materials:

- Colored construction paper
- Paint palette and brushes
- Colored markers
- Cotton rounds
- Clear glue
- Scissors

### Instructions

- Cut the construction paper into the shape of a footprint or different shoe based on story clues.
- Paint the footprints enabling clues about the wearer's activity (e.g. boot patterns with glued on coffee grounds to represent dirty boots for horse riding).



## Station 3: Sneaky communications

### Cup phone:

#### Materials:

- Paper clips
- Cups (red solo work better than clear plastic)
- String
- Scissors

#### Instructions:

- Make a cup phone by tying a string to two paper clips and threading it through two cups.
- Test it by pulling the string taught between the cups and speaking into the phone (quietly).
- Try to decipher the hidden clue, one person has half of the sentence, and the other person has the other half.

### Chromatography:

#### Materials:

- TLC paper
- Markers to test

- Pencil
- 70% ethanol (or another alcohol)

Instructions:

- Mark the bottom of the TLC paper in pencil with names or numbers to distinguish markers used.
- Mark a dot on the TLC paper above its designated pencil mark with the marker of interest.
- Quickly transfer to cup with ethanol and let sit for about 10 minutes or until ink spot spreads up the paper.
  - Make sure the ethanol is touching the bottom of the paper but has not submerged the spots of marker.

## Station 4: Physical evidence

### Microscopy:

Materials:

- Water and dirt (collected from a park)
- Petri dishes
- Microscope
- Pipettes/scoopula (optional to move samples)

Instructions:

- Place the sample in the petri dish, if water have enough to cover the bottom of the plate.
- Place the petri dish under the microscope and look for anything swimming or moving.

## Distraction station

### Invisible ink:

Materials:

- Water
- Baking soda
- 70% ethanol (or another alcohol)
- Turmeric powder
- Paper
- Cotton swab
- Paintbrush

Instructions:

- Mix  $\frac{1}{2}$  cup water with 1 tbsp baking soda (ink).
- Take a cotton swab, dip it in the baking soda/water mixture and write/draw something on paper (preferably something on the thicker side like an index card).

- Wait for the mixture to dry fully.
- Mix ½ cup rubbing alcohol and 1 tsp turmeric (revealer).
- Once the mixture is dry, use a paintbrush to dip in the turmeric mixture and paint over your paper (cotton swab is too small for this part).

Source: <https://www.artofmanliness.com/skills/manly-know-how/two-methods-for-homemade-invisible-ink-one-of-which-works/>

## Slime:

### Materials:

- Liquid school glue
- Shaving cream
- Baking soda
- Food coloring
- Saline solution

### Instructions:

- Add 3 cups of foam shaving cream to a bowl.
- Add food coloring as desired.
- Mix in a 1/2 cup of glue.
- Stir in 1/2 tsp baking soda.
- Mix in 1 tbsp saline solution and stir until slime forms and pulls away from sides of the bowl.
- Add a few drops of saline solution to your hands and knead the slime; add more saline solution if the slime feels too sticky.

Source: <https://littlebinsforlittlehands.com/make-witch-fluffy-halloween-slime-recipe-kids/>