

# Producing Patterns of Pitches



## Student Data Sheet

1. In this exploration, we will begin by investigating the properties of a piece of colored plastic pipe. After you obtain your pipe, record as many descriptive terms as you can that characterize your pipe.
2. After completing your observations, pair up with a partner who has a different pipe. Compare and contrast your pipes and list as many similarities and differences as you can muster.
3. Next, compare the sounds produced by the pipe by pushing the bottom of it onto the palm of your hand. Describe your observations
4. Compare the sounds of your pipe to the sounds of your partners. Describe how they are similar and different. Use as many sound related terms as possible in your explanation.

5. You can calculate the approximate frequency of sound that any length of pipe will produce. Your job is to calculate the frequency produced by both you and your partner's pipe.

Here's how:

The velocity of a sound wave ( $v$ ) is equal to its frequency ( $f$ ) times its wavelength ( $R$ ).

Rearranging this equation gives  $\text{frequency} = \text{velocity} / \text{wavelength}$ . The value for the velocity (speed) of sound is about 350 m/s in air under normal conditions. The wavelength can be calculated by multiplying the tube length (in meters) by 4 (which is the number of pulses needed to make one sound wave inside the tube).

**Frequency of sound (waves per sec) = velocity of sound (m/s)/4 x length of pipe(m)**

Frequency calculation for my pipe	Frequency calculation for partners pipe

6. Describe the relationship between the frequency of your sound and the length of your pipe.

While vibrating objects, like an alarm clock, might be somewhat stimulating, things get real interesting when these sounds are produced in meaningful patterns. Patterns of vibrations can be interpreted as warnings, music, intelligible language, or gibberish. While the interpretation of these sound patterns may now seem automatic to us, it takes a great deal of our brain's time and energy to understand these wave patterns when we are young. Understanding the patterns of a spoken language is very complex and it becomes even more difficult if we try to master the patterns of a language different than our native tongue.

Fortunately music, the art of giving structural forms and rhythmic patterns to sound, provides a design for vibrations that can be created and enjoyed by all cultures- even if you don't speak the language. One set of palm pipes provides us with a complete scale of notes with differing pitches. That's all we need to start making some cool music together.

7. The next challenge for you and your partner is to find six more palm pipe players so that you have a complete musical scale. In color terms that means a white, red, orange, yellow, green, blue, purple, and black pipe. In number terms it means pipes 1-8. Try playing the scale from 1-8 a couple of times (Do-Re-Mi-Fa-So-La-Ti-Do). Try backwards too.
8. Now that you have your band together, it is time to play a few songs. Choose one person (7 or 8 maybe) to direct the rest of you pointing the notes before you play them. Here are a few songs you may recognize. Make sure to exchange pipes since 7 and 8 aren't used in these songs. **If this makes for too much sound in one room – do the songs together as a class.**

**Mystery Song 1:**

3 2 1 2 3 3 3    2 2 2    3 5 5  
3 2 1 2 3 3 3    3 2 2 2 3 1

**Mystery Song 3:**

5 6 5 4 3 4 5    2 3 4    3 4 5  
5 6 5 4 3 4 5    2 5 3 1

**Mystery Song 2:**

1 1 5 5 6 6 5    4 4 3 3 2 2 1  
1 1 5 5 6 6 5    4 4 3 3 2 2 1  
1 1 5 5 6 6 5    4 4 3 3 2 2 1

**Mystery Song 4:**

3 3 4 5 5 4 3 2 1 1 2 3 3 2 2  
3 3 4 5 5 4 3 2 1 1 2 3 2 1 1

9. Now it's time to create your own group composition. Try out some combinations as a group and then write the score for your favorite composition below.