Name _____ Date _____ Period _____

LAB: Making a Digeridoo

THE PHYSICS OF MUSICS

Background: The didgeridoo is a unique wind instrument of the Indigenous Australians of northern Australia. It is sometimes described as a natural wooden trumpet or "drone pipe". A didgeridoo is usually cylindrical or conical in shape and can measure anywhere from 1 to 2 meters in length, with most instruments measuring around 1.5 meters. Generally, the longer the instrument, the lower the pitch or key of the instrument. Keys from D to $F^{\#}$ are the preferred pitch or traditional Aboriginal players.

Procedure:

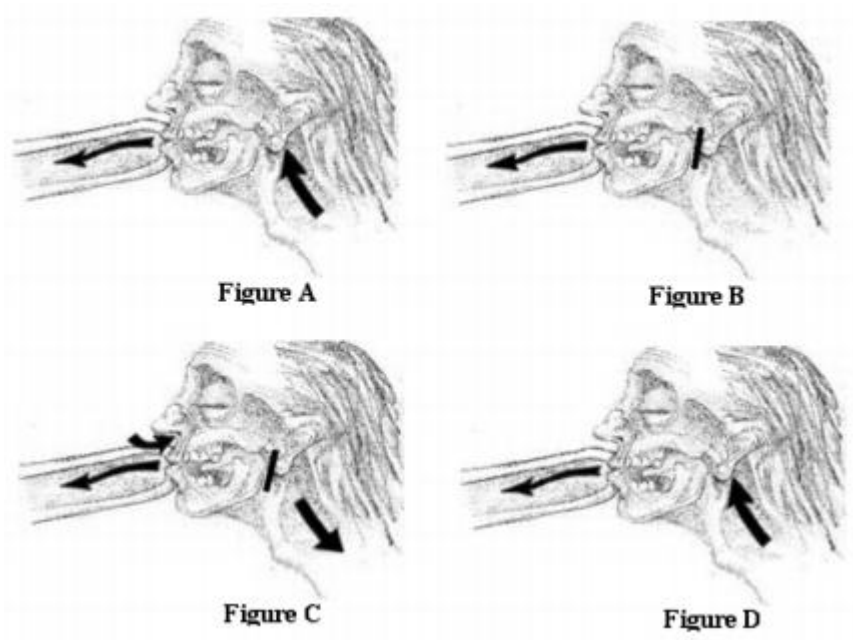
1. Obtain a length of 1½" PVC or ABS pipe. Use the chart below to determine the length required to create the desired pitch of your didgeridoo. Cut it to the length *(ask teacher for assistance)* for the fundamental tone you want it to make. The basic equation shows the relationship between length and frequency: length = velocity / (2 · frequency) where velocity is the velocity of sound in air, about 1087 ft/sec, or more conveniently 13,044 inches/sec.

Note	***Frequency(Hz)***	***Length(inches)***
A	55.000	118.582
B	61.735	105.645
C	65.408	99.713
D	73.415	88.837
E	82.408	79.143
F	87.308	74.701
G	98.000	66.551
A	110.000	59.291
B	123.470	52.823
C	130.815	49.857
D	146.830	44.419
E	164.815	39.572
F	174.615	37.351
G	196.000	33.276
A	220.000	29.645
B	246.940	26.411
C	261.630	24.928
D	293.660	22.209
E	329.630	19.786
F	349.230	18.675
G	392.000	16.638

2. Take some sandpaper and smooth both ends of the didgeridoo before you move on. If you plan on decorating your didgeridoo (with paint of permanent markers) you will want to sand the entire length of the “didge” as well.
3. Decorate your didgeridoo. I have included a couple examples for you to look at. You may also want to go online and do some more research.

4. Once you have completed decorating your didge, you are now ready to prepare the “mouthpiece” using some melted wax. CAUTION: Be extremely careful around the beaker of melted wax……..it’s hot! Slowly dip the end into the beaker of wax until it leaves a coating about 1½” in length. Give it about 30 seconds and repeat this process until you have built up enough layers to make a comfortable feeling mouthpiece. When the wax is still warm, you may also be able to mold it into shape.
5. It is now time to practice. Follow the suggestions below for proper playing techniques:
   - The technique of how to play the didgeridoo is unique among wood instruments. You blow down the tube with loose lips creating a vibration that echoes down the tube coming out amplified as a drone. Similar to a tuba but even looser and more relaxed. It is important to stay relaxed, trying too hard will tighten your muscles which contradicts the need to create loose lips and face. Buzz your lips while gently pushing air down the tube.
   - The lip vibration is similar to giving someone a "raspberry". It can help to stick your bottom lip out a little more than the top lip. To improve the tonal quality of the drone it is important to try to tighten your lips a little after the drone is started, this will increase the pitch and really get the didgeridoo going! If you tighten up too much the drone will abruptly stop and you get a sound we call the "Blow Out". People often ask us how we can get a didge to play so loud and have such an eerie quality to the drone. The secret to a good drone is starting loose and tightening up the lips until you almost Blow Out. If you ride the fine line of playing tightly with almost doing a "Blow Out" you can achieve a loud and intense drone.
   - Getting a good drone is critical because the other noises you make while playing a didgeridoo happen while the drone is going. It takes most people a bit of practice to be able to drone so don't get frustrated and practice, practice, practice. But, you shouldn't really think of it as practice because this instrument is fun to learn!
   - Now try to drone as long as possible with one breath. While learning you will waste a lot of air discovering how to make the noise. As soon as possible start limiting the amount of air you use up. You only need enough air to vibrate the lips, this is what creates the noise. The toughest part of didgeridoo playing is learning to circular breathe. Circular breathing allows a player to be able to continually blow air down the didgeridoo without ever stopping for breath.
6. If you would like to learn how to circular breath, follow the guidelines below:
   - **Circular Breathing Explained!**
     While circular breathing is great to know it is NOT a requirement to be able to play and enjoy this instrument. You can build breathing into rhythms you create when you snatch air between beats. It is best to master the other techniques of playing first and learn circular breathing last.
   - Circular breathing is what allows players to perform continuously without stopping for breath. Many great wind instrument players such as Miles Davis and Kenny G use circular breathing.
   - **Practice these exercises to learn how to circular breathe!**
     Exercise 1: Fill your mouth with water and push a stream of water out using only your tongue and cheek muscles. Make sure not to use any pressure from the lungs to help. Stay relaxed and breathe in and out with your nose while making the stream. Keep trying until it feels very comfortable. This is a good exercise to do in the shower!
   - **Exercise 2:** Get a straw and a cup of water. Twist the end of the straw so that almost no air can come out. Push air through the straw and into the water creating bubbles. Breathe in and out with your nose while doing this as in exercise 1. Keep the pressure even and the flow of bubbles smooth.

- **Exercise 3:** Slowly transition to just breathing in with your nose and keep the bubbles going nonstop. Master this until the muscle contractions you are using feel totally comfortable and the bubbles are flowing smoothly.
- **Exercise 4:** You are now circular breathing. Keep your cup and straw right next to you. Try to play your didge and circular breathe (it is just a bigger straw). You will find this difficult so go right back to the straw and water to practice again. Then, try on the didge again. Keep going back and forth between the cup and water and the didge until you can successfully do it on your didge. Take a look at the diagrams on the next page for a visual explanation of circular breathing.



Questions:

1. What is meant by "***fundamental frequency***"?

2. What does ***resonance*** have to do with the playing of a didgeridoo?

3. What is the relationship between notes that are separated by one ***octave***?

4. What does the term ***timbre*** mean?