EF 152 Rocky Top Team Project

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Introduction:
We designed two homemade instruments with the purpose of playing Rocky Top. Our first instrument is a closed-pipe flute. We used a 1.5 foot long PVC pipe in which we drilled air holes throughout the length of the pipe. Our second instrument is a series of six glasses of varying size and amounts of water inside of them. These serve as a sort of glass chime.

Final Design: Instrument #1(The PVC Flute):
Our team decided to do a wind instrument, because one of our members was familiar with that specific type of instrument and knew how to play it. Our original ideas were a flute made from a plastic straw and a ukulele made from an Altoid can with guitar strings. After we tested these two instruments, we found that we could not produce enough volume for our project to succeed. The creation of the ukulele was also very time consuming. With the PVC flute we could create the required volume and change the pitch by the maneuvering of fingers over the holes of the pipe, so it was the team’s ideal choice.

The pipe is 1.5 feet long, has a 1.5 inch diameter. It has six holes, one-tenth of an inch in diameter, each one .75 to 1.5 inches apart. The sound is created by a member blowing air into the mouthpiece and using his fingers to alter the pitch by covering and uncovering the holes in the pipe.

Materials:
- 1 two foot long PVC pipe
- Power drill
- Power saw
- Ruler
• 2 drill bits

**Design Details:**

The PVC pipe is two feet long and we cut off six inches. We then drilled in a proper-sized mouthpiece for the performer. Then with a ruler we measured out the various space between each hole. We then used the 1/10 inch diameter drill bit to make six holes in the pipe.

![Diagram of PVC flute design](image)

**Analysis of the PVC Flute:**

The flute required the following equations and calculations:
- Fundamental frequency of a closed flute
  \[ f_1 = \frac{v}{4L} \left( \frac{1}{4\left(\frac{11}{12}\right)} \right) = 225 \, \text{Hz} \]
  - 2nd harmonic: \[ 2f_1 = 2 \times 225 = 450 \, \text{Hz} \]
  - 3rd harmonic: \[ 3f_1 = 3 \times 225 = 675 \, \text{Hz} \]
  - 4th harmonic: \[ 4f_1 = 4 \times 225 = 900 \, \text{Hz} \]

- We used a frequency detector to find the different frequencies of the note. We then used the following calculation to find the actual note played:
  \[ n = 12 \log_2 \left( \frac{f}{440} \right) + 49 \]
  *Note A, B, C, F, G, D, E*

Using the fundamental frequency:
- \[ n = 12 \log_2 \left( \frac{225}{440} \right) + 49 \]
  \[ \approx 3.99 \] - Note A 

We experimented with how to find the notes filling note by note and their frequencies:
- \[ n = 12 \log_2 \left( \frac{410}{410} \right) + 49 \]
  \[ \approx 3.99 \] - Note B

- \[ n = 12 \log_2 \left( \frac{365}{440} \right) + 49 \]
  \[ \approx 4.9 \] - Note C

- \[ n = 12 \log_2 \left( \frac{265}{440} \right) + 49 \]
  \[ \approx 3.4 \] - Note F

Note F continues
Final Design: Instrument #2 (The Glassy Finish)

For our second instrument we chose The Glassy Finish. We chose this instrument, because creating it was not time consuming and the instrument was easy for us none musically inclined people play properly.
There are six glasses marked with notes “C, B, A, F#, E, D”. Note “A” was filled with 75% water, note “E” had 60% water, and note “C” had 50%, while the other three glasses were left empty. Note “D” required some physical manipulation, so we broke off part of the top-section of the glass to make the proper pitch. We then used a stainless steel spoon to create the sound.

**Materials:**

- 6 glasses
- 1 stainless steel spoon
- 40 ounces of water

**Design Details:**

There are six glasses, each of different height. Three glasses are filled with water to a particular height. Two glasses are left as is, and then the sixth glass is physically altered to make the proper tune. The instrument is then played using a spoon.
Results

The PVC flute required an extensive amount of air flow to create the type of volume we needed for the entire recitation group to hear, but overall it did its job in producing multiple pitches. Our team member being familiar with how to play the song and knowing how to play wind instruments is what really brought out the flute’s great sound. The Glassy Finish was a very good instrument, as even without an experienced musician, it was still able to create amazing pitch and lots of volume.

Both instruments were easy to construct and the chimes was the best instrument to play as we got to smack a spoon against some glass, while the flute caused dizziness from all the hot air you had to blow into it.
Conclusion

The simplicity of our designs allowed us to recover from the time we lost trying to build more complicated instruments. The instruments’ simplicity also made it easy for us to play Rocky Top at the correct pitch and gave us time to practice our routine.

References

How to read music: http://www.datadragon.com/education/reading/

Note frequencies: http://www.phy.mtu.edu/~suits/notefreqs.html

How to design a flute: http://www.instructables.com/id/Making-Simple-PVC-Flutes/

Flute knowledge: http://www.flutopedia.com/keys.htm