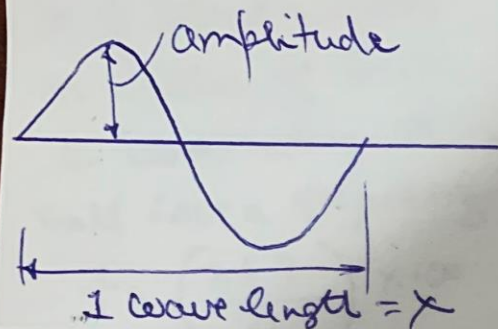
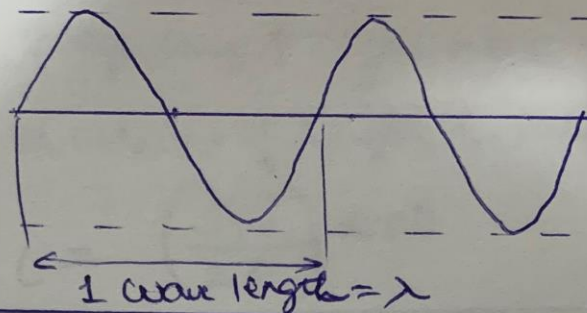


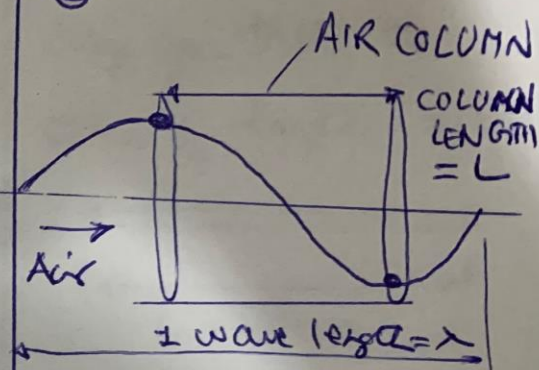
①



②



③



④

Speed of sound  
 = 343 m/sec  
 i.e. it travels 343 m  
 in one second

⑤

If wave frequency =  $f$  Hz  
 the sound makes  $f$  waves  
 per sec

⑥

So sound travelled/sec  
 = Number of waves  
 $\times$  wave length

⑦

So  $343 = f \times \lambda$   
 But  $\lambda = 2L$   
 So  $343 = f \times 2L$

⑧

So if sound is made in a  
 column of length  $L$  meters  
 it has a frequency  

$$f = \frac{343}{2L}$$

⑨

If  $L$  is in centimeters  

$$f = \left[ \frac{343}{2L} \times 100 \right]$$

(10)

So if sound is made in a column of length  $L$  centimeters, it will have a frequency

$$f = \left( \frac{343}{2L} \right) \times 100$$

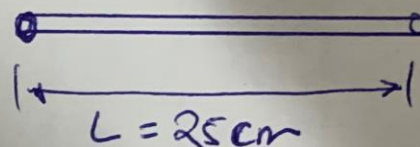
(11)

OR to make a sound of frequency  $f$ , you need a column of length  $L$  centimeters

$$L = \left( \frac{343}{2f} \right) \times 100$$

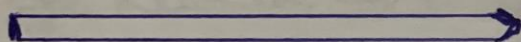
(12)

Say you take a straw of length 25 cm



(13)

And now you cut the tip off with a scissor



(14)

And now you blow into the straw



(15)

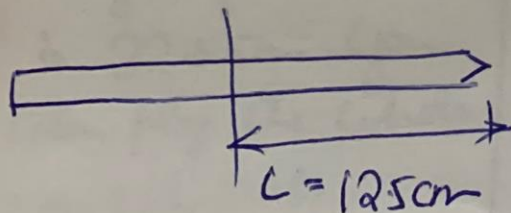
The straw will make a sound with frequency

$$f = \frac{343}{2 \times 25} \times 100$$

$$= 686 \text{ Hz}$$

(16)

And now you cut the straw in half



(17)

And now you blow into the shortened straw



(18)

The shortened straw will make a sound with frequency

$$f = \frac{343}{2 \times 12.5} \times 100$$

$$= 1372 \text{ Hz}$$

(21)

Thus, you double the pitch of sound.  
So the sound will be very shrill

(22)

The musical scale of Saptaswara ~~is~~ start from Sa = 261.6 Hz and end with higher Sa = 523.2 Hz

(23)

SWARA	f
Sa	261.6
Re	279.1
Ga	327.0
Ma	348.8
Pa	392.5
Dha	436.0
Ni	490.6
Sa	523.3

Higher Sa

(22)

Thus to make the sound of the first Sa you need an air column of length L

(23)

$$L = \frac{\cancel{343} \times 100}{(2 \times 261.6)} = 65.6 \text{ cm}$$

(24)

And to make the sound of the higher Sa, you need an air column of length  $L = \frac{343}{2 \times 523.3} \times 100 = 32.8 \text{ cm}$

(25)

And if you change the length from 65.6 cm to 32.8 cm, you can play the whole musical scale

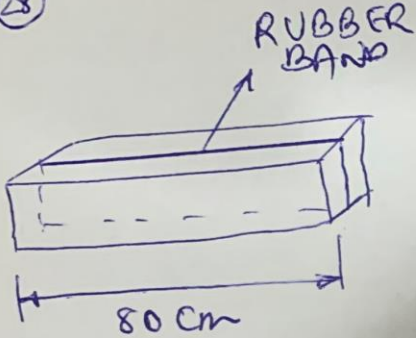
(26)

Swara	f	L
Sa	261.6	65.6
Re	279.1	61.5
Ga	327.0	52.4
Ma	348.8	49.2
Pa	392.5	43.7
Dha	436.0	39.3
Ni	490.6	35.0
Sa	523.3	32.8

(27)

To generate the whole musical scale take a box and wrap a strong rubber band around it. Let the box have a length of at least 80 cm

28



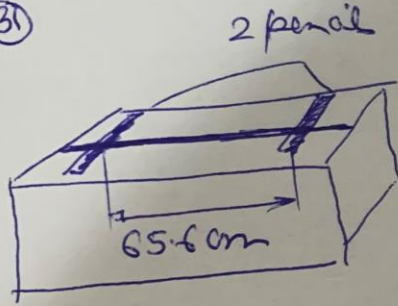
29

The rubber Band should go around the box and be tight & strong

30

Now place two pencil 65.6 cm apart on the top of the box. The pencil should be under the Rubber band (between the rubber band & the box)

31



32

Now pluck the string at the middle of the string between the 2 pencil using your fingers

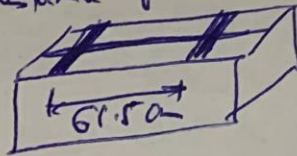
33



Now the rubber band will make the sound Sa

34

Now ~~move~~ move the second pencil close to the first pencil to make a distance of 61.5 cm.

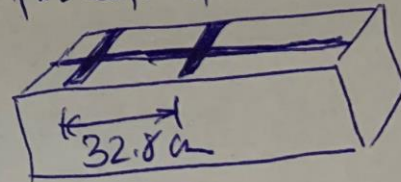


35

Now when you pluck the string, you will get sound Re. Keep moving the 2nd pencil towards the first pencil to get the other SWARAK

36

Continue till you move the 2nd pencil to be 32.8 cm from the first pencil to get Higher Sa



Higher Sa