Vigyan Pratibha Learning Unit

‘Music': What it means?

Introduction:

Read following conversation between Rahi and her music teacher.

Teacher: For the annual programme, I need one person from your class to sing national anthem from the stage.

Rahi: All of us like our national anthem. So you can select anyone of us.

Teacher: True. But I will take an audition and select the student who can sing it ‘properly’.

Rahi: What you mean by properly? All of us know the exact words of anthem.

Teacher: Yes. But you don’t have to just ‘recite’ it, you should be able to ‘sing’ it.

Rahi: But all of us also know the tune of the national anthem. So all of us can sing it.

Teacher: Singing is not just knowing the tune. You should sing with exact ‘सुर’.

Rahi: I know the seven सुर. They are सा, रे, ग, म, प, ध, नी.

Teacher: Correct. Singing properly means each sound from your vocal chord should hit correct position of the respective सुर.

Rahi: Correct position? What is that? Are they standing somewhere?

What do you think the teacher is trying to say? Do you understand what she means by ‘correct position’?
Let us take the example of a harmonium.

For the following tasks, we will need a smartphone. There are many smartphone apps which show you frequency of sound played in the vicinity of the phone. We will use one of those apps.

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Session-1

Task 0 :

Familiarization with the 'Tuner - DaTuner' app

Da Tuner App

1) We will be using 'DaTuner Lite' app throughout this LU to measure the frequency of different musical notes. When you open the app, the frequency is shown on the bottom left side of the screen. The scale along the left edge shows volume level. Note units of both the quantities.

2) Just to test the app, we will need some volunteers. Take the phone from the teacher. One of you can try saying the vowel 'आ' in an extended way and see what frequency gets displayed. Tell the frequency to the entire class and the pass the phone to next group.

Task 1:

Understanding the relation between different notes on a harmonium

Teacher will play different keys on Harmonium.

For convenience, let us agree to a convention. On the harmonium, you will see a pair of black keys and then a set of three black keys. The white key just before the black pair (first key in the figure) will be called White 1 (W1). As you proceed rightwards from this key, next key will be called Black 1 (B1), the next one is W2 and so on. Note that B3 comes after W4.

Now, note the frequency of the keys in the table below. Further, calculate the ratio of frequency of each key to the frequency of the previous key. For eg., for the row B1 the column 'Ratio' will have the ratio of frequency of B1 to the frequency of W1.
(If you have a calculator, you can use it to do this quickly.)

Key	Freq	Ratio	Key	Freq	Ratio	Key	Freq	Ratio
W1		-----	W8			W15		
B1			B6			B11		
W2			W9			W16		
B2			B7			B12		
W3			W10			W17		
W4			W11			W18		
B3			B8			B13		
W5			W12			W19		
B4			B9			B14		
W6			W13			W20		
B5			B10			B15		
W7			W14			W21		

Mean value of the ratio (r) is =

Let our first frequency (White 1 - W1) be f. Then the second frequency (Black 1- B1) will be $f \times r$.

Third frequency (White 2 - W2) will be $(f \times r) \times r = f \times r^2$.

The frequency of B2 will be = $f \times r^3$

The frequency of W6 will be = $f \times r^9$

In this notation, freqency of White 8 will be f×r—.

Find ratio of the frequencies of W8 to that of W1. The ratio = _____

Hence value of r can be expressed as a power of 2 as _____

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Session-2

Task 2 :

Understanding the seven **सुर** for any given scale

In the beginning, Rahi spoke about seven सुर in Indian music. Let us find the relation between सुर and harmonium keys (in a particular scale). Refer to the table above (in Task 1) and note down frequencies of the keys given in table below (in the second row). In the thrid row of the table, write the ratio of frequency of each key to the frequency of the key W1.

Sur	सा	रे	ग	म	प	ध	नी	सा
Key	W1	W2	W3	W4	W5	W6	W7	W8
Freq.								
Ratio	----							

Task 3 :

Fiinding the frequency of seven **सुर** in any scale

Different scales in music just mean starting your first सुर at another key. Now suppose your first सुर (i.e. सा) is starting with B1 instead of W1. Use the ratios you found above and the table on the previous page to decide which keys will correspond to other सुर.

Sur	सा	रे	ग	म	प	ध	नी	सा
Ratio								
Fre.								
Key	B1							

Play this sequence on harmonium to see if you get similar sequence of sounds as playing W1-W7.

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Session 3

Task 4:

Understanding the working of Jaltarang

Take ceramic bowls / metallic bowls / beakers of different kinds and a measuring cylinder.

Place the 3 bowls / beakers side by side and tap them with a pencil and note down the frequency in each case. Which bowl has the highest frequency?

Description (size and material) of the beaker	Frequency observed

Take the largest beaker, keep adding a fixed amount to water to it (say 25 ml each time) and note the frequency.

Volume of water added	Frequency observed

Is it possible to change the frequency of this bowl/beaker to match that of the smallest bowl/beaker and at what water level will that occur?

What all parameters are important in deciding vibrating frequency of the beaker?