TENDER HEART HIGH SCHOOL, SEC-33B CHD. Date ;7/10/24

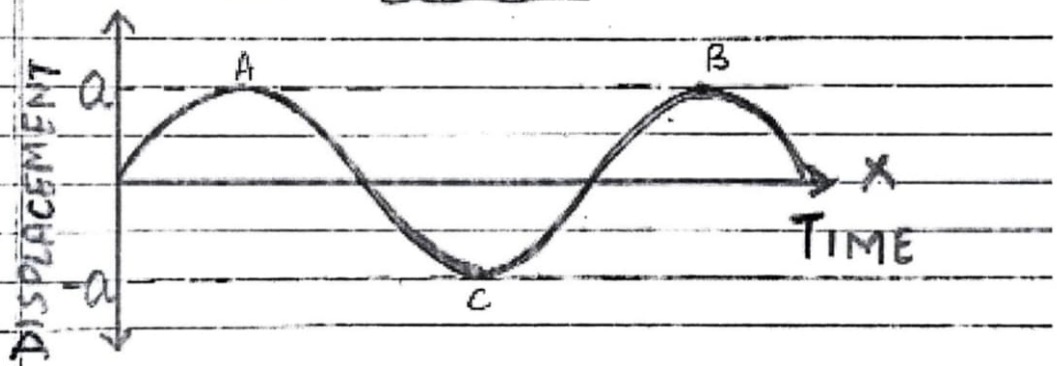
CLASS- X SUBJECT- PHYSICS

CHAPTER- 7 TEACHER- Charanjeet Kaur

Good Morning students. This lesson is of class-X for the subject of 'Physics', Topic -'Natural, Damped and Forced Vibrations and Resonance' which is covered in chapter-7 'Sound' and this particular topic is on Page Number- 155 of your textbook, titled - 'Concise Physics by Selina Publications'.

NATURAL VIBRATIONS: The periodic vibrations of a body in the absence of any external force on it, are called natural (or free) vibrations. A body, capable of vibrating, has a constant natural frequency of its vibrations and its amplitude of vibration remains constant. (see below given figure -1)

FIGURE -1



Points A, B, C shows maximum displacement of vibrating particle as compared to its mean position. It can be observed in figure-1, that the value of amplitude remains constant in such (natural) vibrations.

Every object has its own unique frequency that it naturally tends to vibrate at.

Adjoining picture shows, TUNING FORK (of different lengths)

Students, such vibrations of a constant amplitude can occur only in vacuum because the surrounding medium offers resistance to the motion or we can say due to opposing or frictional forces provided by the surrounding medium, the energy of the vibrating body continously decreases due to which the amplitude of vibration gradually decreases.
Students now you have to pause this session for 5 minutes and in the meantime I want you to take a thread of around 30cm length and stretch it from both of its end. Students, you will be needing a volunteer for your help too. So ask anyone who is free at your home to provide you with a little help. Infact, tell your helper to stretch the thread from its end but not to break it and you pluck this stretched thread from its centre. Kindly write in your Physics Notebook what you observe and then resume this session for further explanation.
Students you may now pause the interactive session and perform the earlier said experiment.

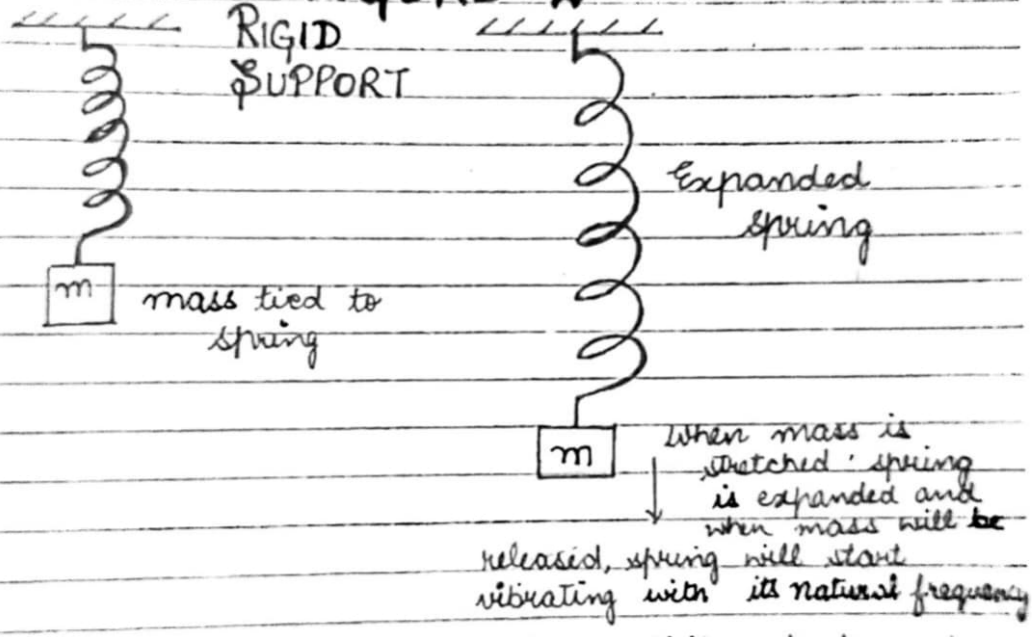
Students, now you must have experienced that there where certain vibrations when you plucked the thread but those vibrations ceased very quickly. This happened because of friction provided by air which is also known as Air friction.
Imagine if there was no air or no medium, then there would have been no forces to oppose the vibrations produced by thread and then those vibrations would have been termed as NATURAL VIBRATIONS.

CHAPTER-7 SOUND

Students, now please open page number - 156 of your Physics Book and try to understand the example number 2, 3, 4 and 5.

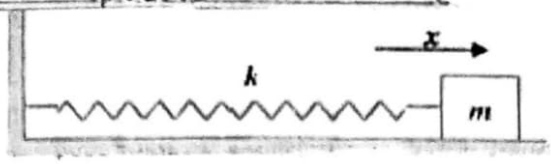
Example-2 : Students, read example 2 on page number-156 - A load suspended from a spring, when stretched (or compressed) and then released, starts vibrating with its natural frequency. For better understanding, see figure -2 drawn below:

FIGURE-2



Students, you can try this activity at home by tying your eraser from one end of the spring with a thread and holding the other end of spring with the fingers of your left hand. Now, stretch the eraser in downward direction and then leave it. Observe the vibrations made by the spring.

Now students, take the same spring but tie two erasers from the end of the spring with the help of same thread and perform the entire activity again. Students, take a break and perform both activities. Write down your



Students, in this case frequency is inversely proportional to mass, that is, $\nu \propto 1/m$, which means that more is the mass, less number of vibrations will take place in particular interval of time.
This is the reason why you observe less vibrations when you tied two erasers with the spring as mass has increased by doing so.

Example-3: Students, when a tuning fork is struck against a hard rubber pad, it vibrates with its natural frequency. The vibrations form longitudinal waves in air, which when reach our ears, sound is heard. The sound produced is of a single frequency and is also referred as a pure note.
Students, a tuning fork is a fork-shaped acoustic resonator used in many applications to produce a fixed tone. You all can see the diagram of tuning fork as shown in figure-7.8 on page Number-159 of your Physics book.

Students, recall the relation - frequency is inversely proportional to length of vibrating air column as done in class - VII. Now, this fact will be used in our next example.

Example-4: When an air column in a flute is made to vibrate, it vibrates with its natural frequency which is inversely proportional to length of air column. Students, flute is also known as a type of organ pipe. The notes of different frequencies are produced by changing the effective length of air column.