16 Oct '24

→ HW on Mayamalava Gowla & Mohana raagams in different scales

→ Sound waves :

A wave is a disturbance that is moving forwards & backwards in a systematic way.

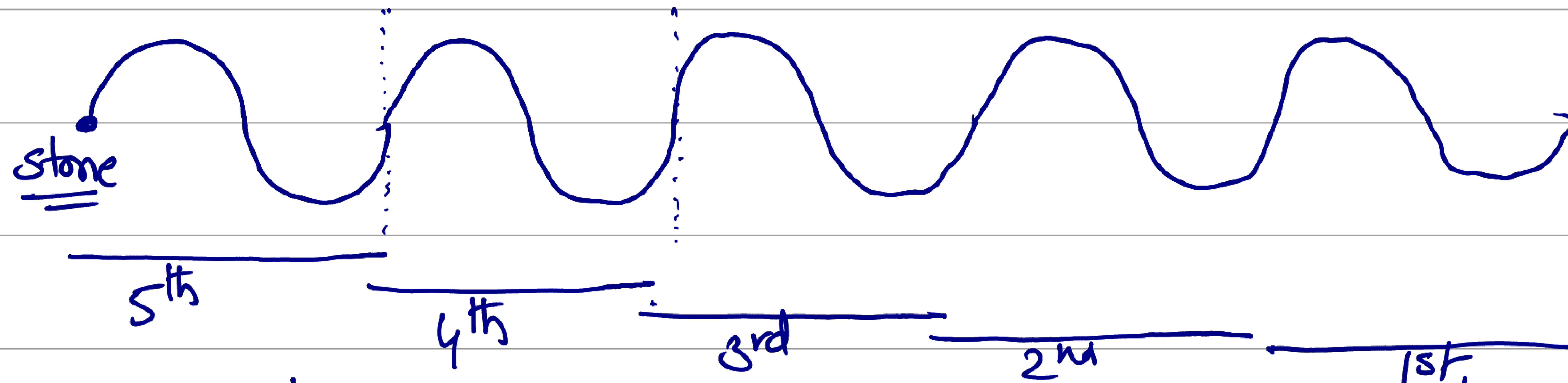
Eg: (1) Waves in water – when you drop a stone in a still (not moving) pond. If you place paper boat on top of the waves, the boat will only move up and down and not go away with the wave.

(2) Sound waves – we can't see –
Eg: When we talk, or play piano, flute etc.

(3) Light waves – some light waves when they fall on our eyes, we can see as different colors.
Some light waves we can not see – like in mobile phones, TV remotes, wifi etc.

HW: Place a paper boat in a bucket of water. Drop a small stone to create water waves. And see if the boat is going in the direction of waves or just up & down.

Properties of waves:



Multiple waves are coming from where the stone was dropped in the pond.

→ The length (size) of each wave is called "wave-length" 'λ' (lambda)

→ Number of waves that come out per second is called "frequency" — ν (nu)

→ The total distance travelled by the waves per second is called "velocity | speed" (v).

→ Relation between velocity, wave-length & frequency is

$$V = \nu \times \lambda$$

If each wave is $\lambda = 4m$ and we have $\nu = 7$ waves coming per second, then $V = 7 \times 4 = 28$ m distance travelled in 1s.

→ Sound velocity in air is fixed - 330 m/s. but its frequency & wave-length can change. If $\nu = 1$, $\lambda = 330$;

If $\nu = 5$, $\lambda = \frac{330}{5} = 66$

In a flute, from the blowing hole to the first hole that is open — that's the wavelength of your sound wave.
As you can close the holes, you can change the wavelength of sound. Then frequency of sound will also change, but velocity / speed of sound doesn't change.
If wavelength is small, frequency will be higher. If wavelength is big, frequency will be smaller.

λ	$\times$	ν	$=$	V
1	$\times$	330	$=$	330
2	$\times$	$\overset{165}{115}$	$=$	330
3	$\times$	110	$=$	330
5	$\times$	66	$=$	330

Higher λ means smaller ν

In piano or flute, when we go from 'C3' to 'D3' .... 'B3' ... 'C4', left to right frequency ν is increasing, wavelength is decreasing. Velocity of sound in air doesnot change.

28 Oct '24

→ Where do we use waves?

To see (light waves (visible – different colors)), to hear (sound waves), to control TV / mobile internet / wifi (invisible light waves)

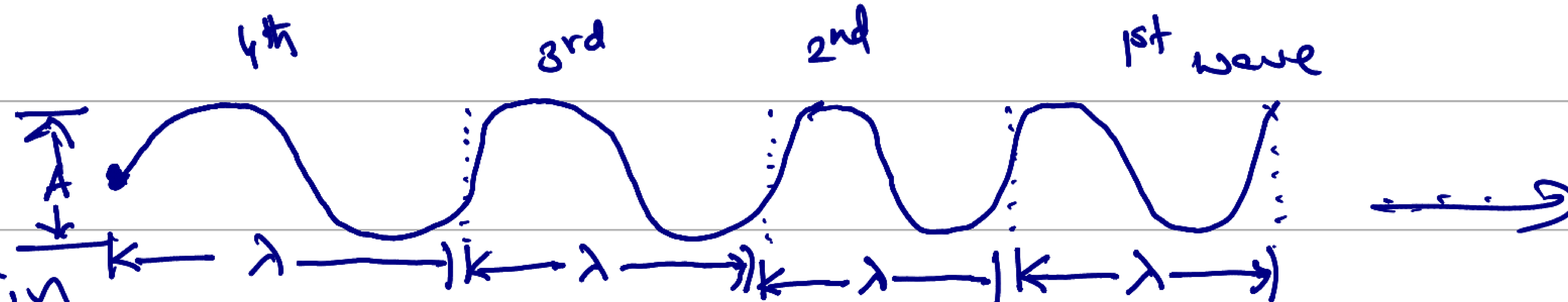
↳ we can't see

→ Properties of waves

(1) Wavelength (λ) (2) Frequency (ν)

(3) Velocity (v) $v = \nu \times \lambda$

(4) Amplitude (A) (5) Attenuation factor (f)

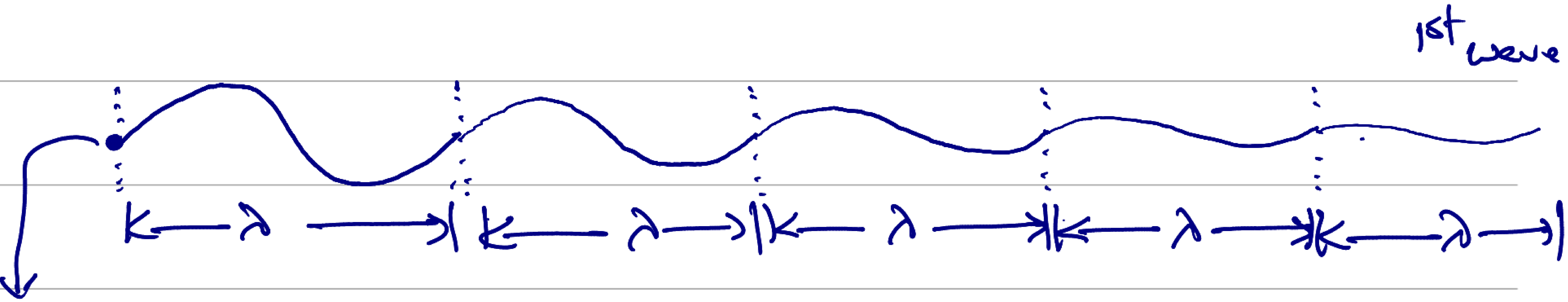


Origin of waves (where they start)

- Eg: Stone dropped in water; Flute

→ Amplitude is the height of the wave — For music, amplitude controls intensity of the wave — (how loud the sound wave is or how bright the light waves are)

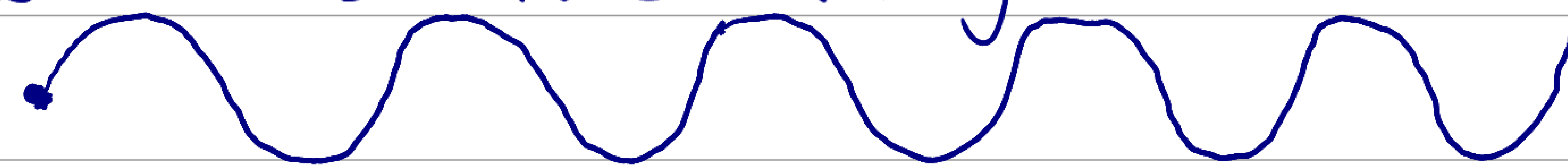
→ When we press 'C3' on keyboard, after a short time the amplitude reduces (decrease - smaller) and so the volume of C3 decreases



Sound origin (source)
↓
where it starts

As the waves move away from the source of sound, their amplitude decreases and so volume / intensity of sound decreases / reduces. This is called attenuation. Attenuation factor 'f' tells how fast the amplitude / volume / intensity decreases.

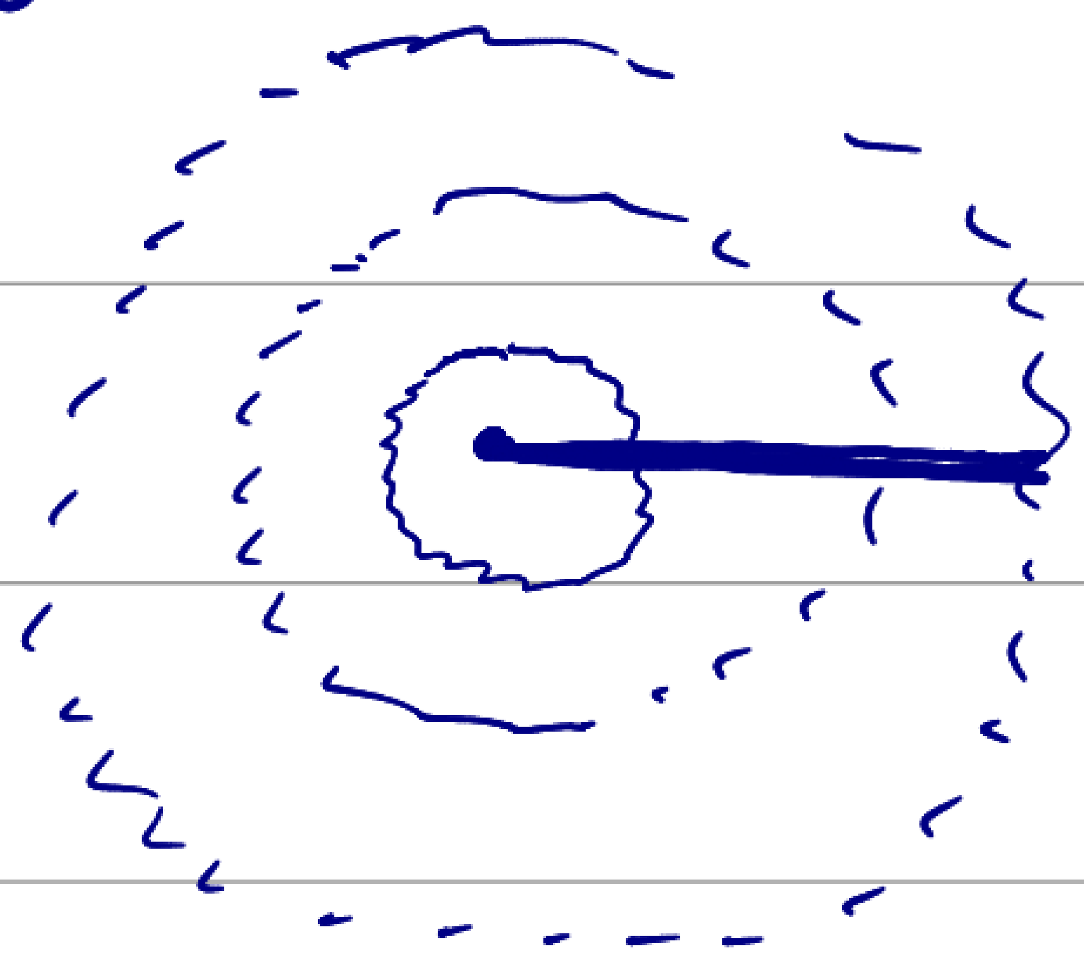
If 'f' is '0', then amplitude doesn't change as waves move away.

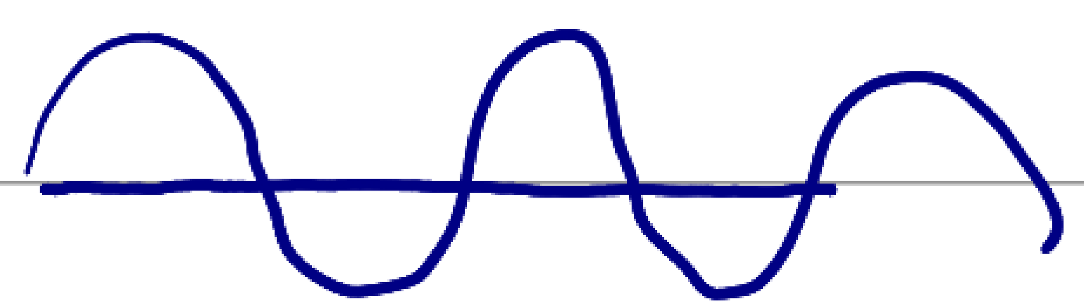


But for real waves, 'f' is not zero so volume/amplitude decreases as they move away.

HW: Practice sarali swaras in low volume and high volume — use vocal pitch monitor to check — all sarali swaras in mayamalava gowla & mohana raagas.

→ Water waves actually look like circles – like small circular hills growing bigger and moving away from the stone





Two-dimensional   1-dimensional

If we look along a radius (a line from center of circle to a point on the circle), then we get 1-dimensional waves.

→ See programming example

(12. Wave Animations Circular - 2D1D - Attenuation - A1.py)

→ For 2D water waves, the distance between blue hills is the wavelength
→ It is also the same as the distance between the red valleys ($= \lambda$)

→ <u>HW:</u> Play with λ, A, V, f and see how the waves change — in both 2D & 1D (after programming class)

→ <u>HW:</u> (1) Learn notes for one sahaj song you know — vocally, and with an instrument