adafruit learning system

Circuit Playground: F is for Frequency

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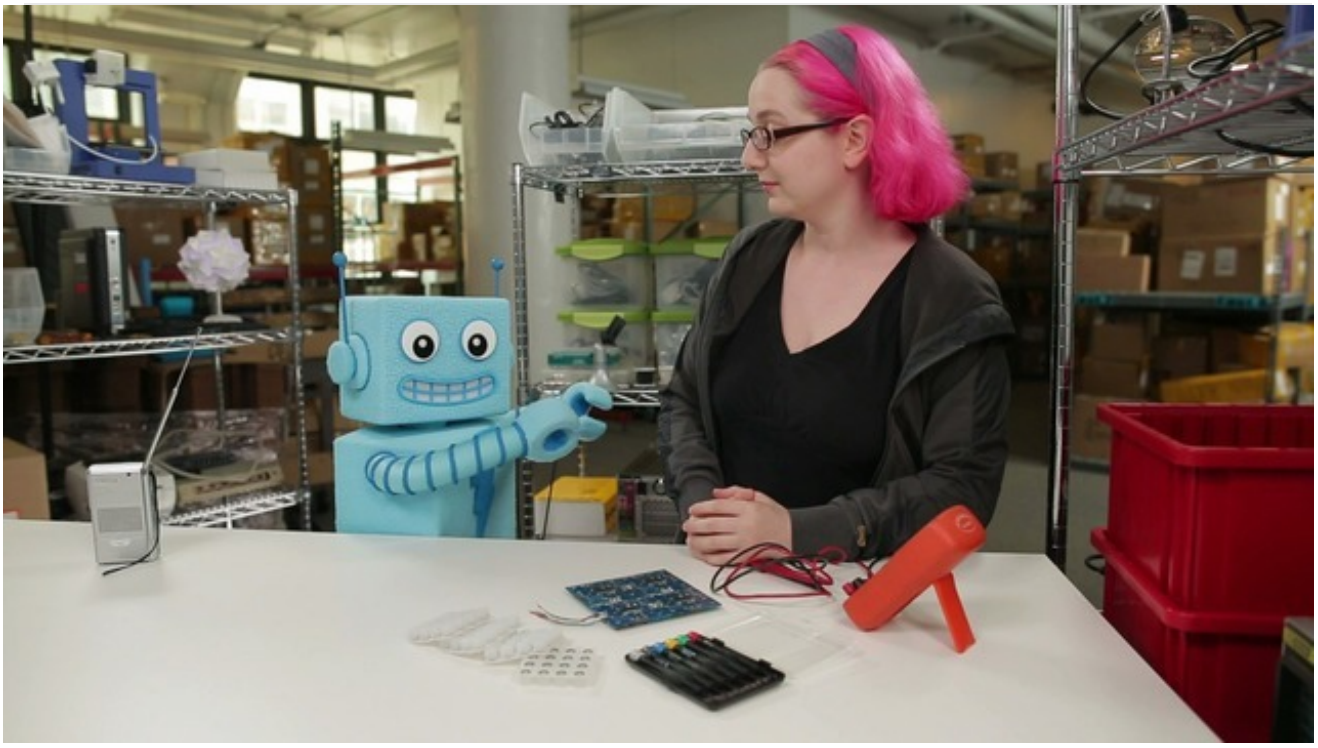
Guide Contents

Video

What is frequency? Why is it so important for radio and sound waves? Find all the answers with Adabot, Ladyada and a new friend who knows quite a bit about the subject.

Transcript



Adabot: Ladyada …

Ladyada: What's up Adabot?

Adabot: I was wondering … why does each radio station have its own number?

Ladyada: Oh those numbers are the frequency of each station's broadcast.

Adabot: What is this "frequency" you speak of?

Ladyada: Well … Frequency is the measurement of how often something happens.

Adabot: huh …

Ladyada: Hmm - It might be easier to tell you about frequency … with the help of my oscilloscope here.

Ladyada: Just need to find my oscilloscope probes … I'll be right back - wait here, ok?

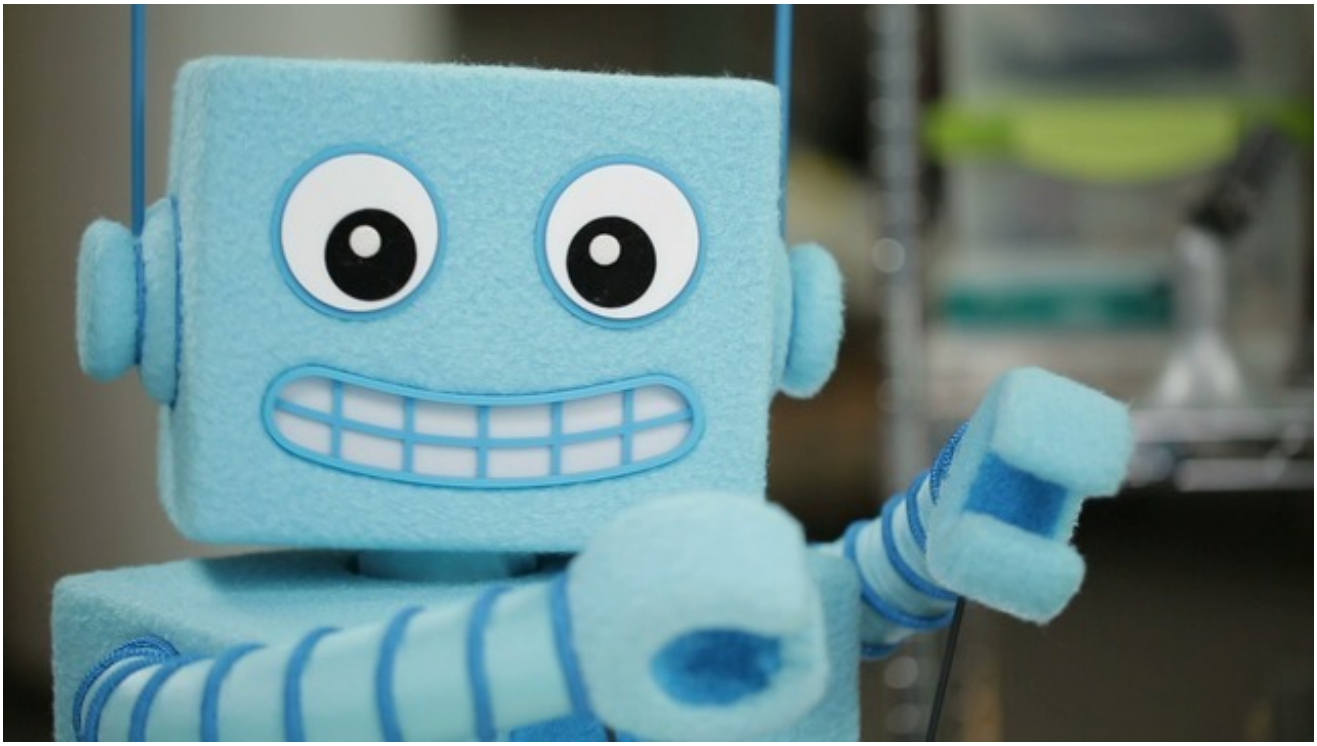
Adabot: OK!

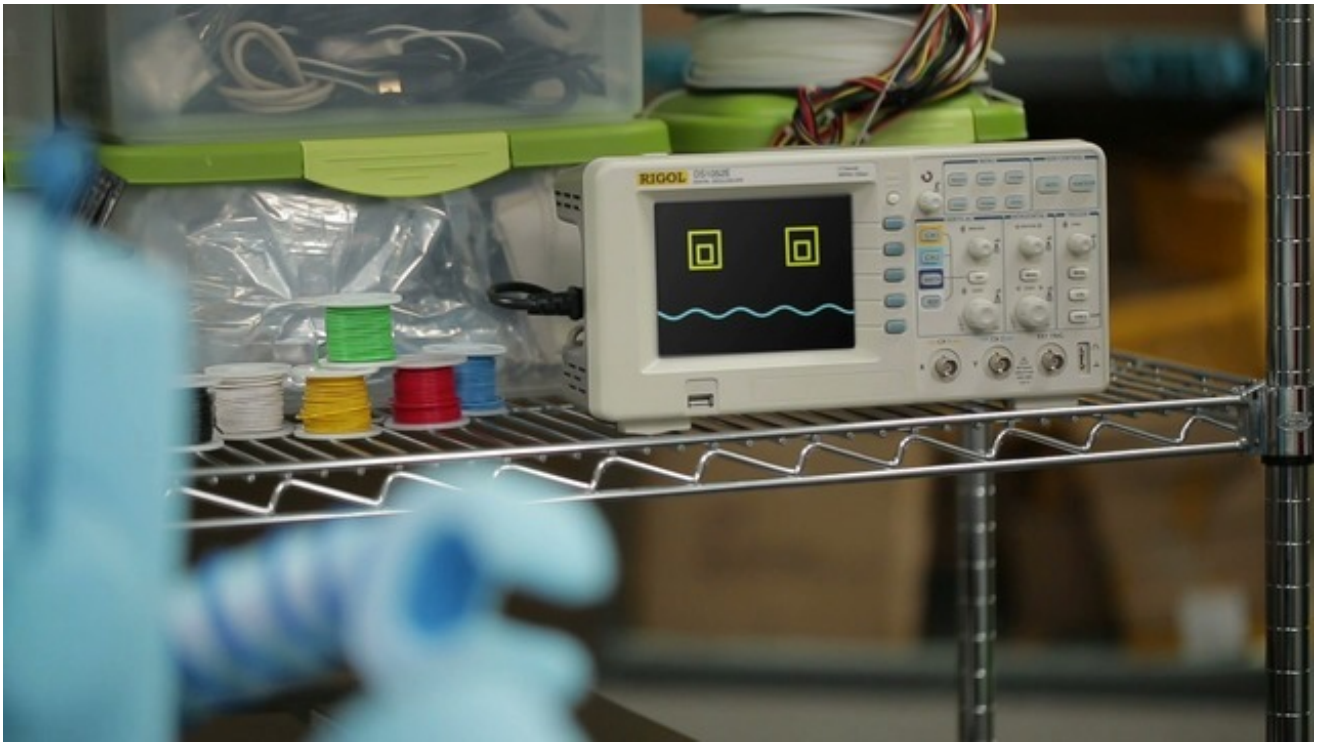
Oscilloscope: *psst* - hey over here!

Adabot: Who said that?!

Oscilloscope: Me - the talking screen over here.

Adabot: Oh hello, talking screen!





Oscilloscope: I'm not just a screen - I'm an oscilloscope! - and I could tell you quite a bit about frequency.

Adabot: Oh really? Like what?

Oscilloscope: Well - like Ladyada was saying - frequency is how often something happens

over time. And we measure frequency in units called “Hertz”

Adabot: (troubled) Oh - does frequency hurt?

Oscilloscope: No, not at all! That’s a totally different word :)

Adabot: Oh good!

Oscilloscope: Hertz is spelled H-E-R-T-Z. It tells us how many times something is happening per second.

Adabot: Huh.

Oscilloscope: Watch this -

Oscilloscope: Right now my screen is flashing once per second. So we can say it is flashing at a *frequency* of one *hertz*.

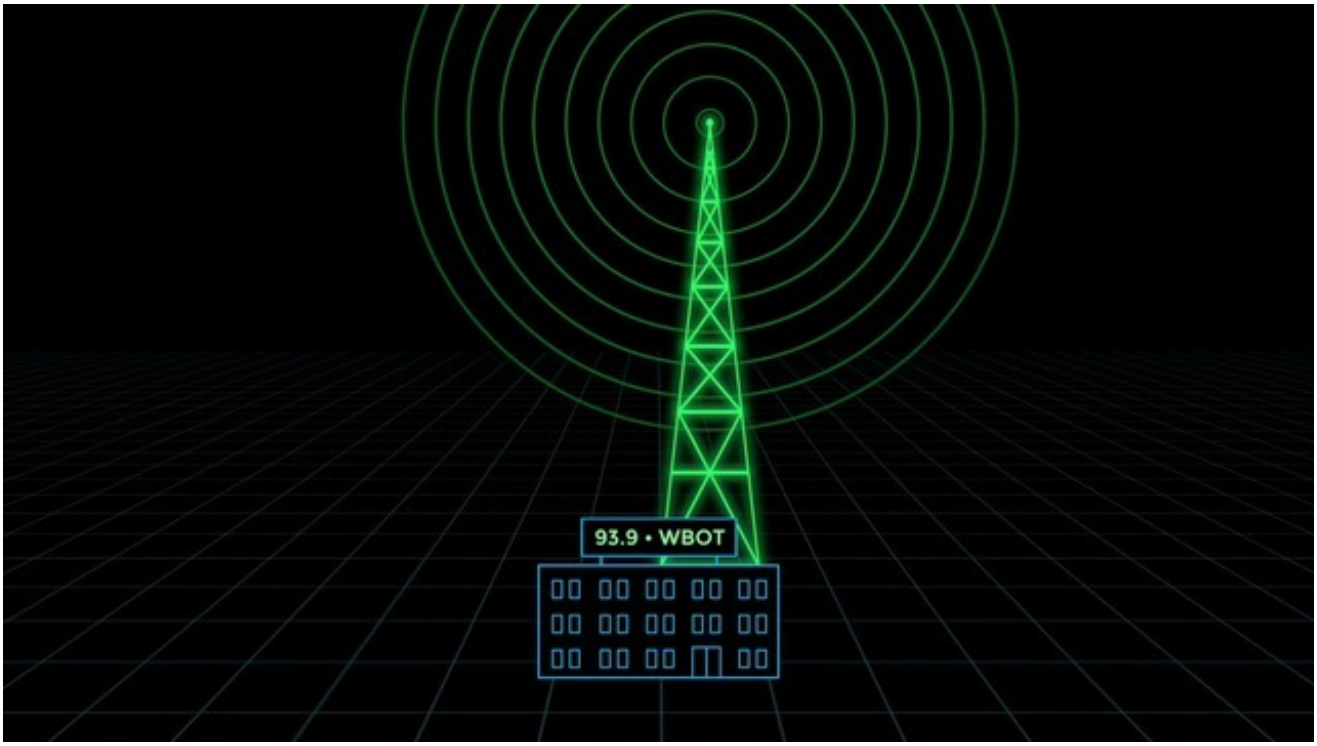
Oscilloscope: Now my screen is flashing a bit faster - 3 times per second which is a frequency of three hertz.

Adabot: Got it - Hertz means - “how many times per second”!

Oscilloscope: Precisely!

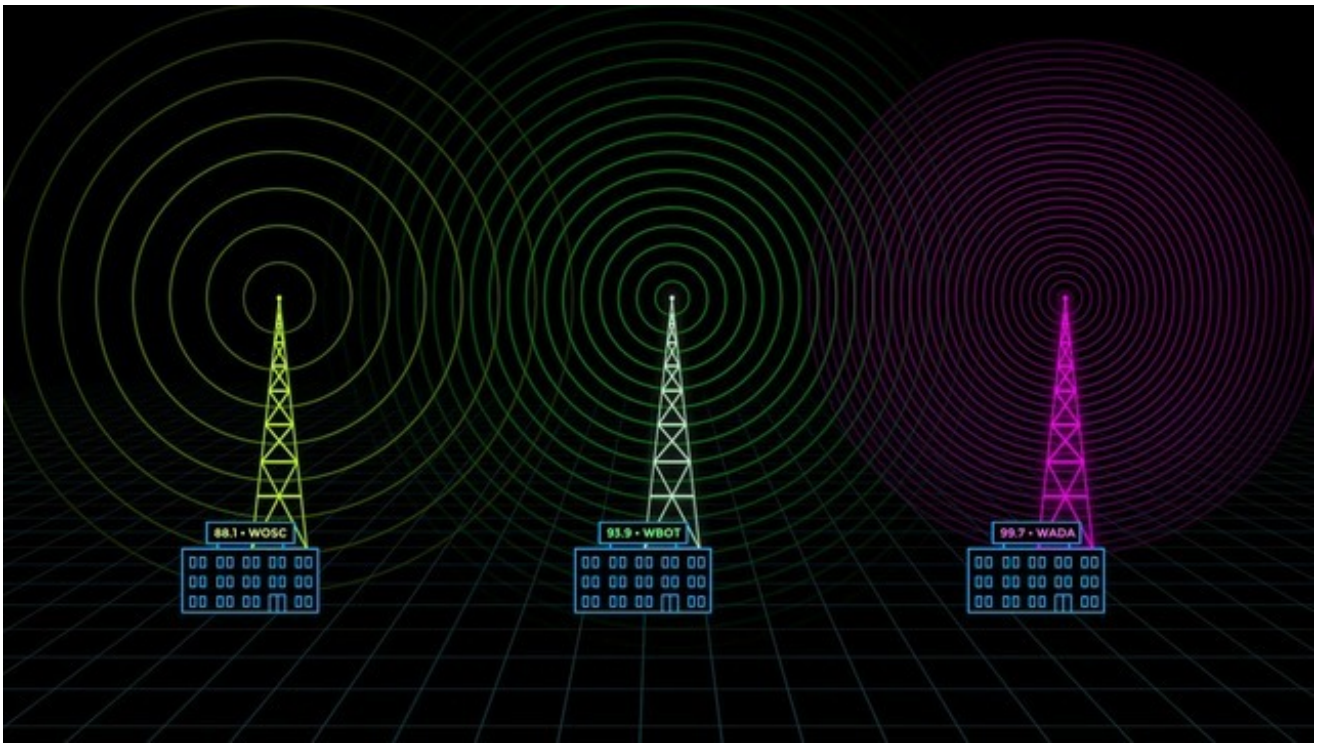
Adabot: So … how is frequency important for radio stations?

Oscilloscope: Good question!

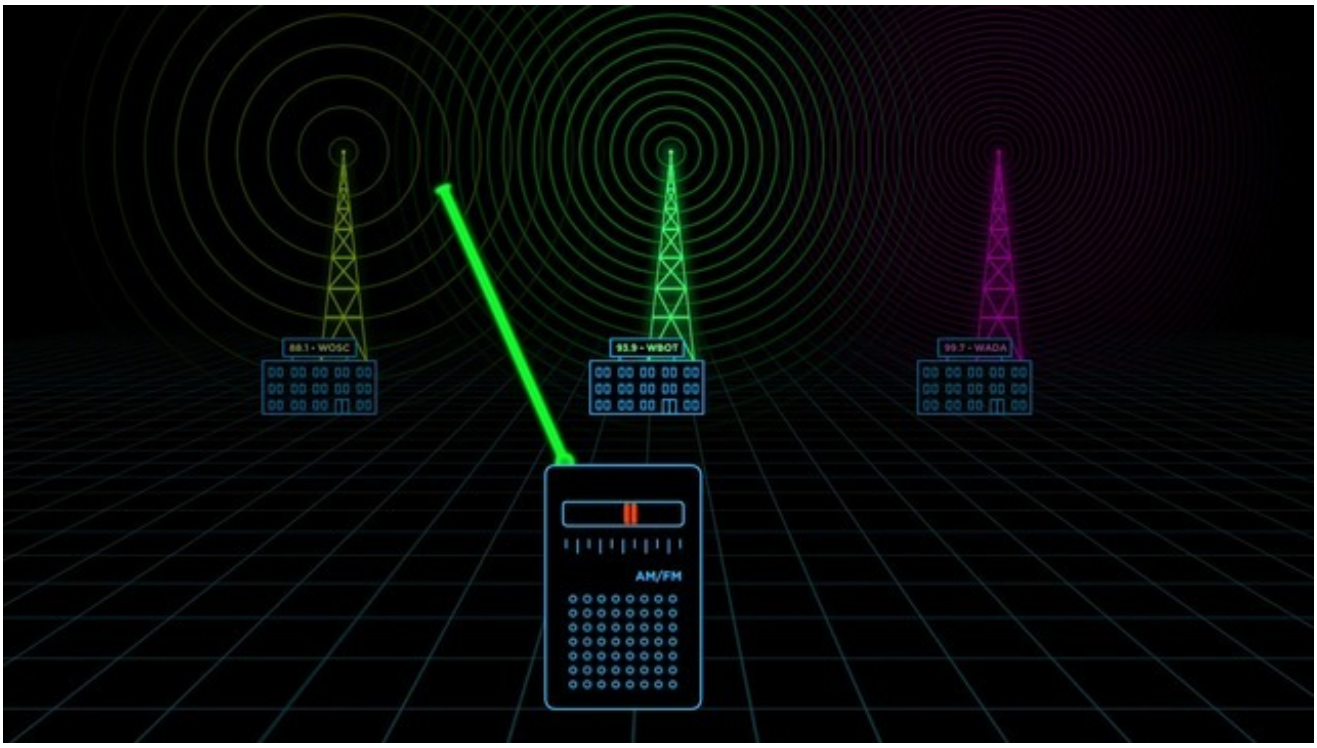


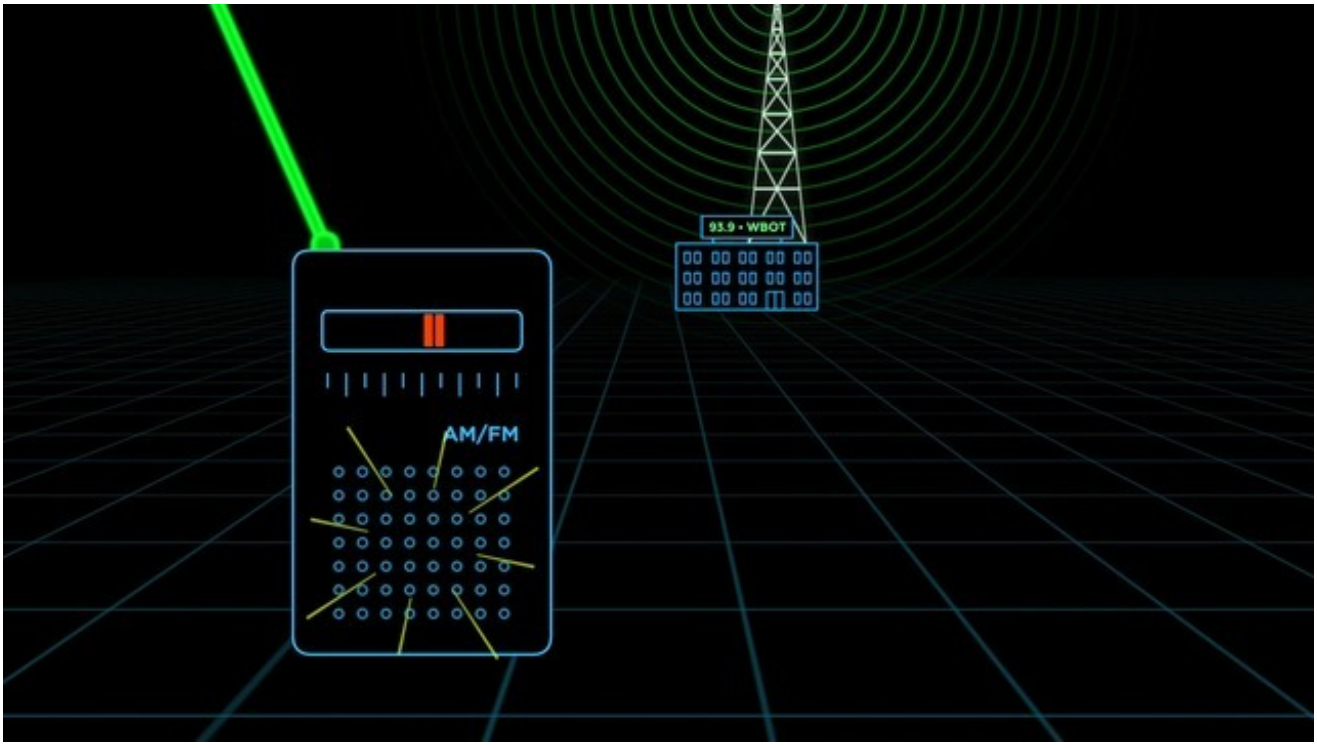
Oscilloscope: You see - a radio station uses a large antenna to send out waves of electromagnetic energy. We call these “radio waves”.

Oscilloscope: Each station broadcasts at its own special frequency, so they don’t get confused with another station.



Oscilloscope: So when you tune your radio to 93.9, for example … you're telling it to only receive radio waves which have a frequency of 93.9 million Hertz. Your radio then converts those radio waves into sound, so you can hear the station which broadcasts at that particular frequency.





Adabot: Wow - all that happens so I can hear music?

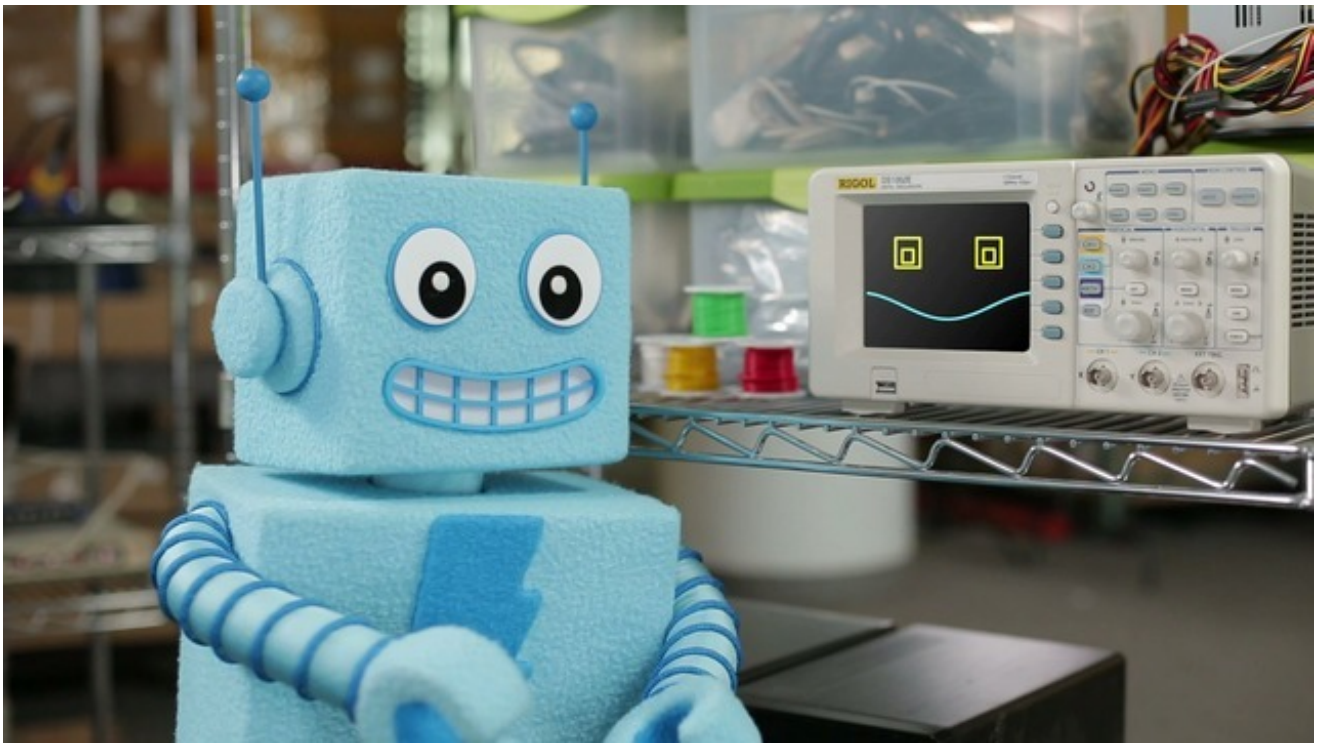
Oscilloscope: Yes it does!

Adabot: Amazing!

Oscilloscope: Indeed - and Frequency is also very important for audio as well.

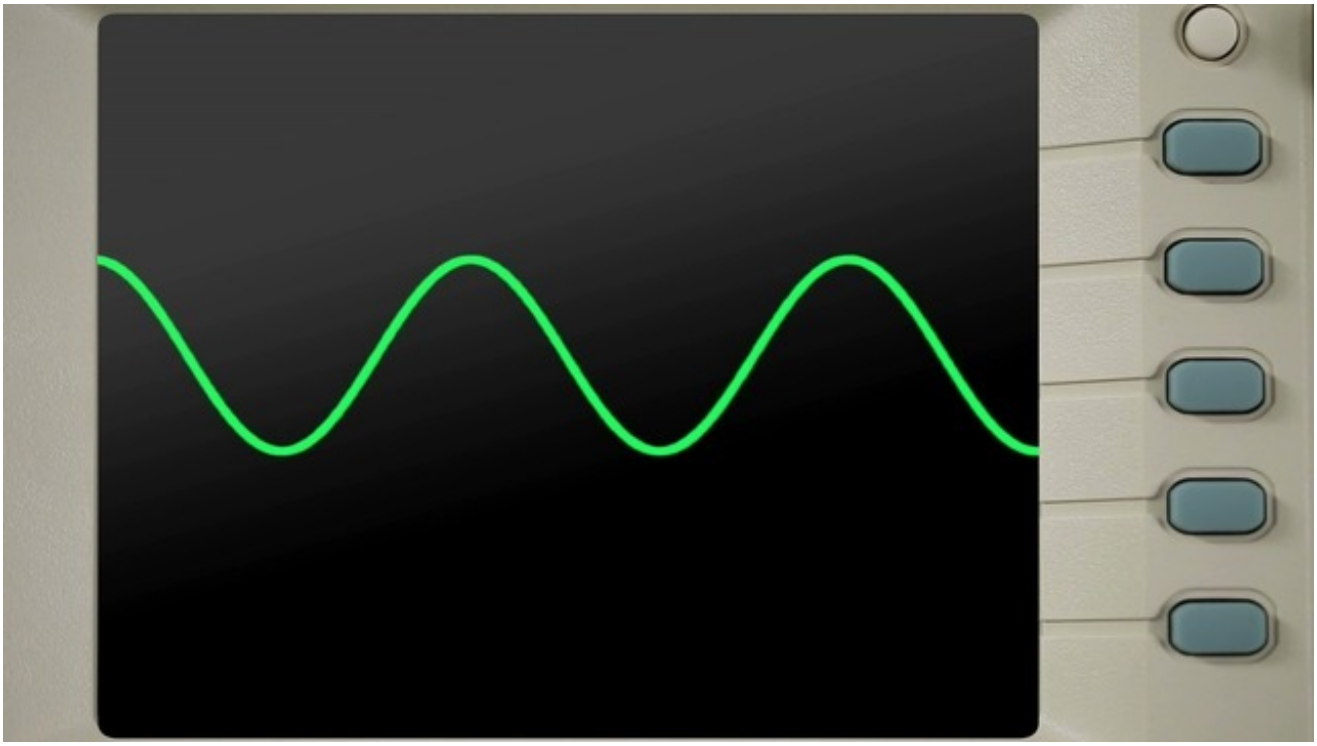
Adabot: Audio - like the sound waves that come from the speaker?

Oscilloscope: Exactly.



Oscilloscope: You see - a sound wave is a vibration moving through the air. And the frequency of a sound wave determines the pitch of that sound.

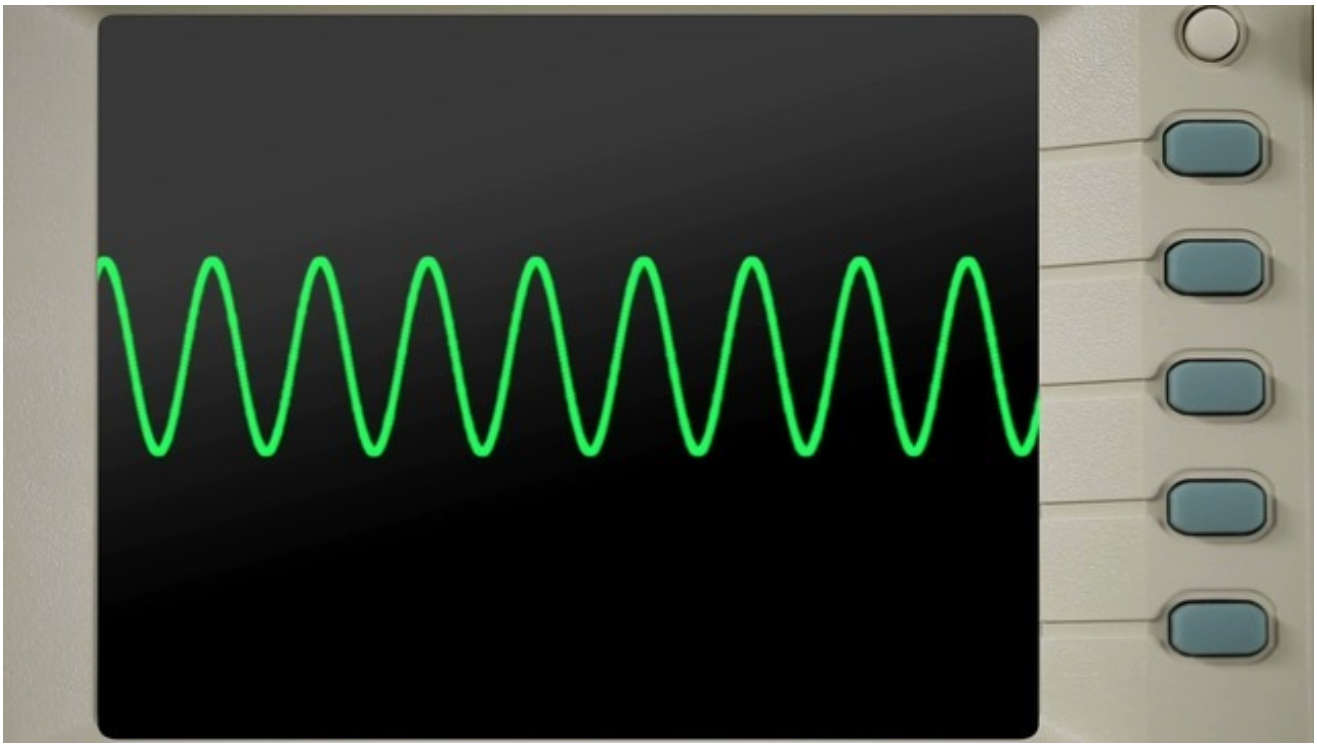
Oscilloscope: A slow moving or *low frequency* wave sounds low-pitched and bassy.

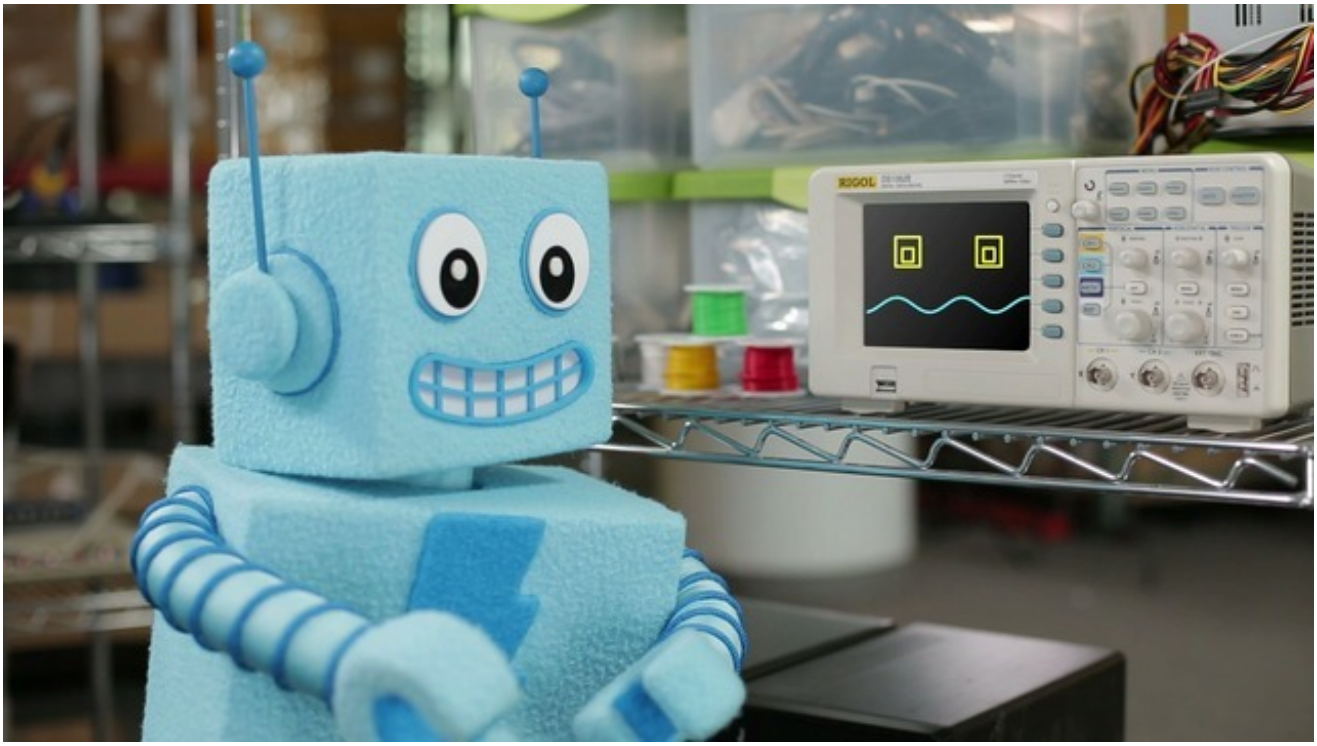


Oscilloscope: And a fast moving, *high frequency* wave has a much higher pitch.

Adabot: So slow waves sound low and fast waves sound high?

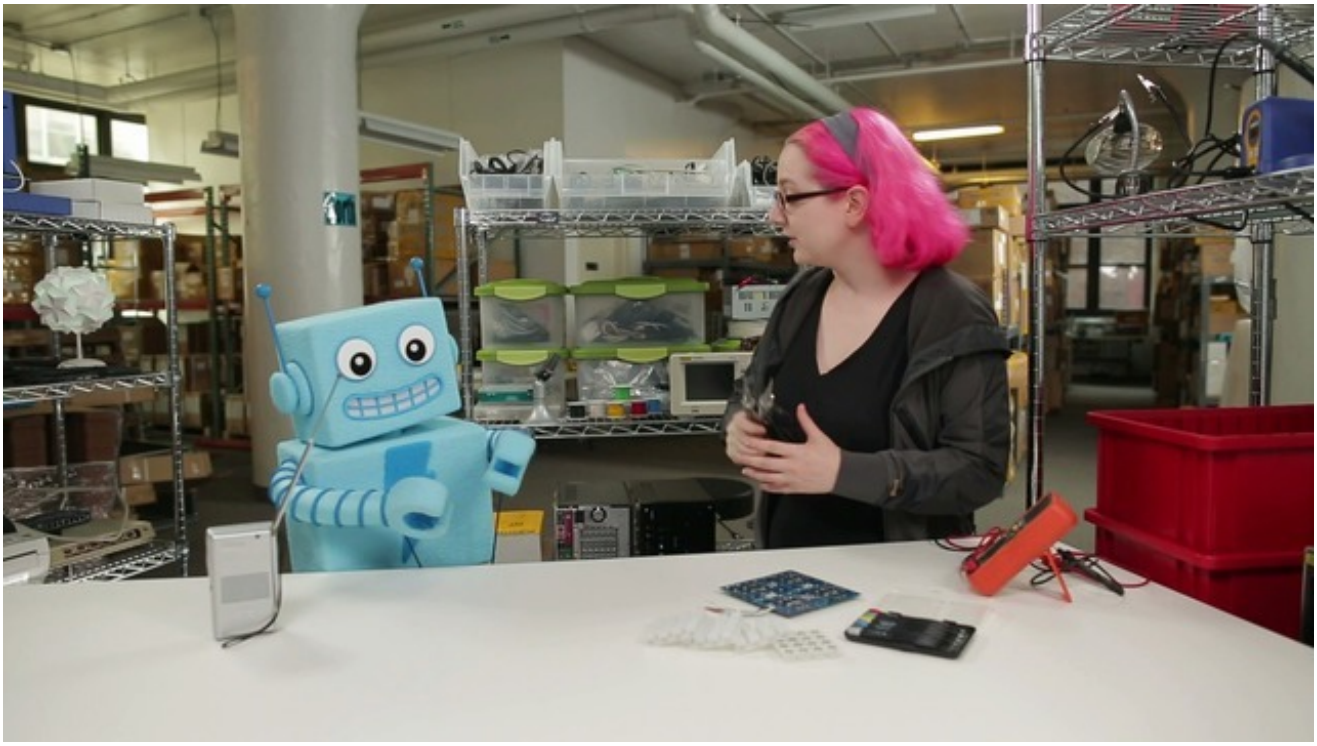
Oscilloscope: That’s right!





Ladyada: Ok Adabot - I think this will help clear up what frequency is all about.

Adabot: No need Ladyada - it all makes sense now!



Oscilloscope: Oop - I think someone's coming - gotta go!

Take care Adabot - stay curious!

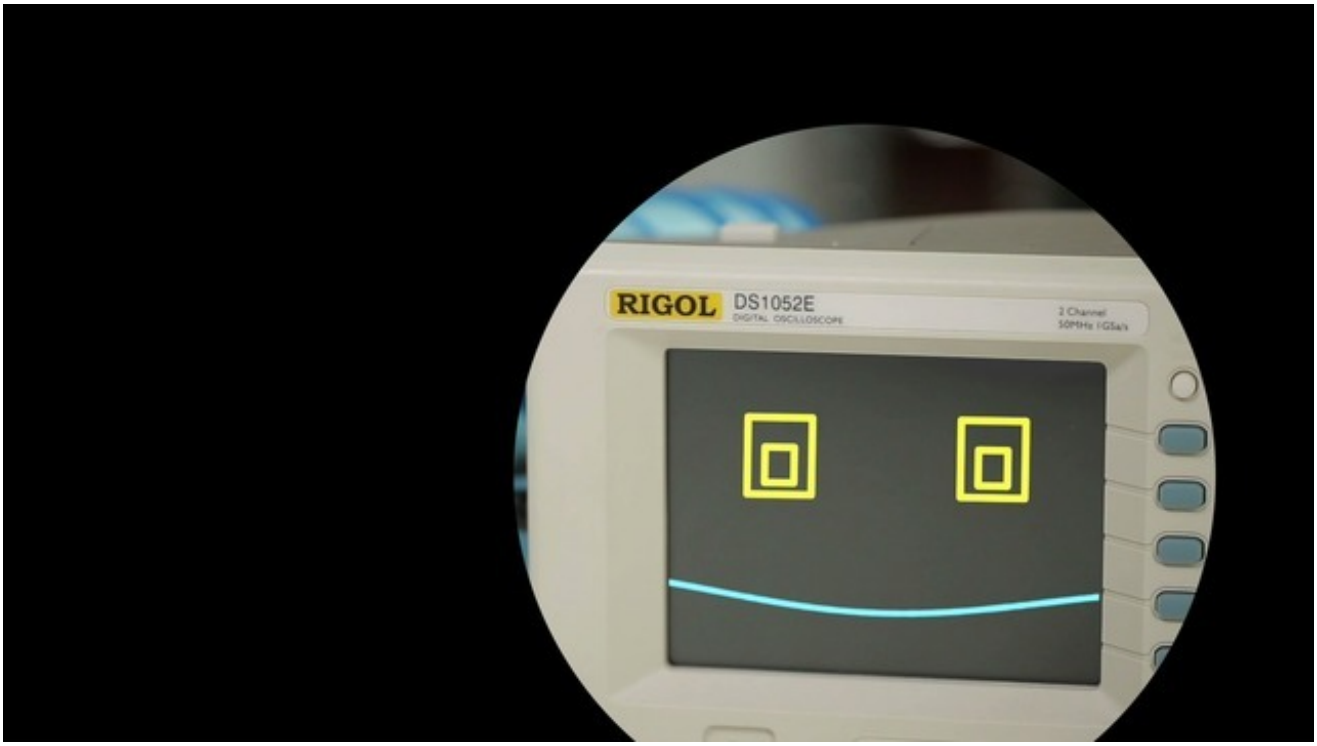
Adabot: Oh - thanks for your help oscilloscope, I will!

Adabot: Frequency is how often something happens over time. Knowing about frequency helps us tune into radio waves, or create sound waves at different pitches.

Ladyada: Wow - you do know about frequency. Where'd you learn all of that?

Adabot: My friend the oscilloscope here just told me *all* about it.

Adabot: Hey, oscilloscope - you ok in there?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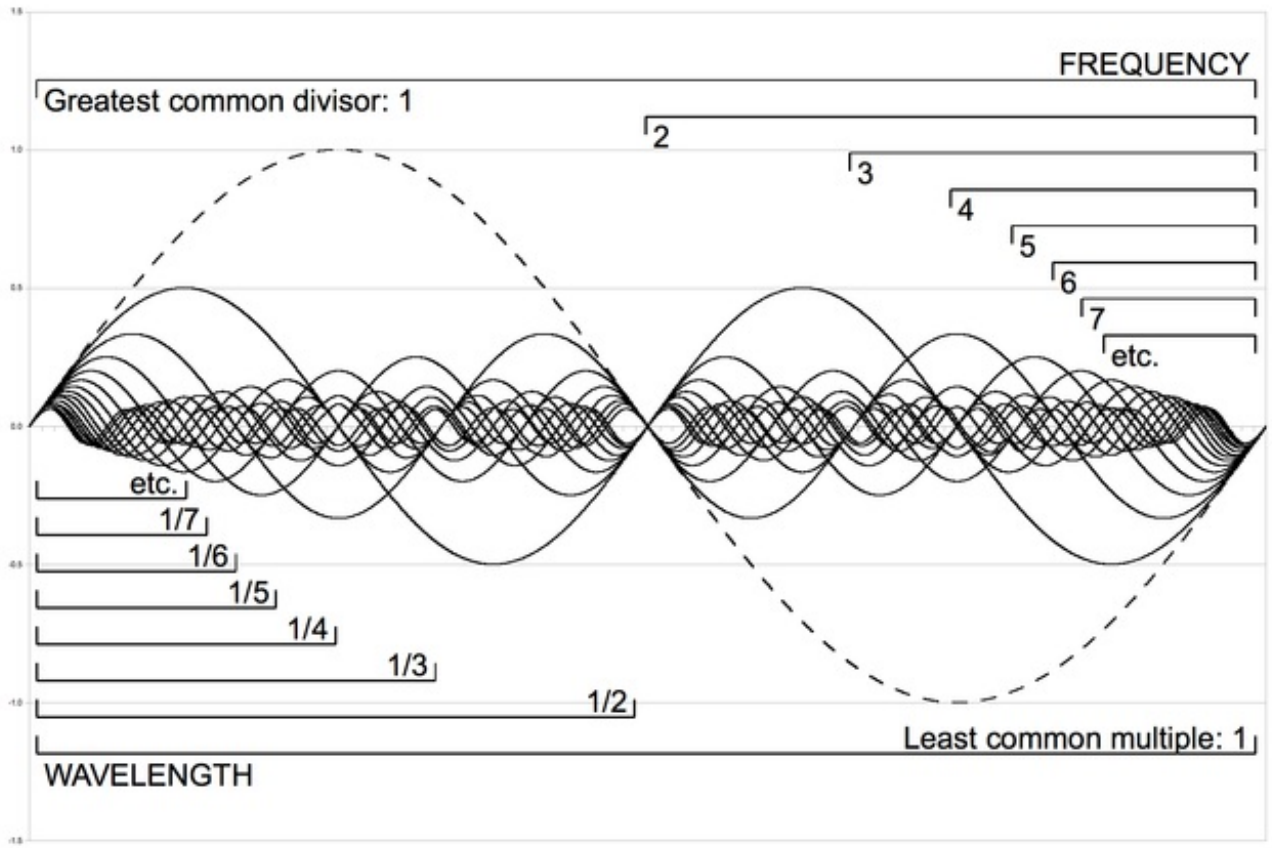
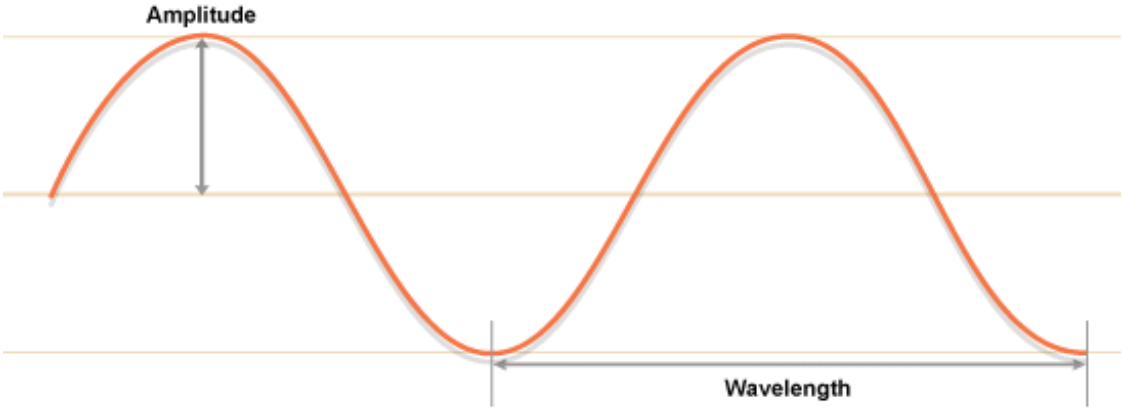


Wikipedia defines frequency (http://adafru.it/dqq) as:

Frequency is the number of occurrences of a repeating event per unit time. It is also referred to as temporal frequency, which emphasizes the contrast to spatial frequency and angular frequency. The period is the duration of one cycle in a repeating event, so the period is the reciprocal of the frequency. For example, if a newborn baby's heart beats at a frequency of 120 times a minute, its period – the interval between beats – is half a second (60 seconds (i.e. a minute) divided by 120 beats).
In some fields, especially where frequency-domain analysis is used, the concept of frequency is applied only to sinusoidal phenomena, since in linear systems more complex periodic and nonperiodic phonomena are most easily analyzed in terms of sums of sinusoids of different frequencies.



To learn more about frequency, amplitude, and wavelength, check out the BBC's excellent Introduction to Waves (http://adafru.it/dXt)