Sound in a nutshell

Sound is physically tiny vibrations or changes in atmospheric pressure, to hear this we absorb these frequencies with our ears and brain to interpret them into something that our mind and brain can understand. The human brain can understand and the human ear can pick up frequencies usually between 20 and 20.000 hz. With age the upper max frequency is usually lowered.

The most basic sound that exist, is the sine wave. A sound which is so pure in frequency that it only contains one, as well as being a sound which does not exist in the natural world.
One can basically build any sound in the world by adding sine waves together, but to create something as unique and complex as say, a human voice, hundreds of sine waves would have to be combined and constantly changed for us to be able to interpret this change into anything useful.

A simple sine wave curve, which is a basic mathematical function, is our way of mathematically interpreting an audio signal, it explains quite well how small atmospheric changes can be picked up by our ears.
A sine wave has a center, 0. and "circles" around this center between any two given values but in the case of sound we just use 1 and -1.

This is to describe the 0 as the standard atmospheric pressure and 1 and -1 as any given change in a higher or lower pressure, this also stating that if at a different atmospheric pressure than 1 (which is standard for air on ground at sea level, 20 degrees celcius) the sound you hear is different from when at other atmospheric pressures (which is quite normal). This doesn't always matter, but just having it in mind explains quite a bit of why sounds are different under water or high up in the air.

These atmospheric changes, are then picked up by our ears, where a tiny system of bones and skin changes the changes into nerve signals which can then be understood.
The ear conscists (very roughly) of the pinna, which is the only outer part of the ear which then leads to the ear tube which untimately ends in the eardrum, a tiny piece of skin covering the whole area.

From here the eardrum sends on the waves into three little bones, call the hammer, the anvil and the xxxxxxxxxxx, which again ends up in a tiny piece of skin, named the oval window. From there the waves are again picked up, but this time sent on into a long rolled tube with a middle piece called "the basilar membrane". This membrane is completely air tight with a sterile liquid covering it. This liquid transfers the sound waves and on the membrane is little haircells which picks up the frequencies and then, and only then, has the sound become a nervous signal which our bran can interpret and work with.

All this, just for a tiny sound.
This gives reason to believe that with so many changes, change in material etc. The sound can impossibly be that same inside our head as it was just outside our ear. Or is that really true?
Well, to some extent.

We cannot know for sure, to be very philosophical, that it is the same, but we know from recorded sounds today that microphones placed deep within our ears or just outside or ears or even connected directly to our eardrum, that the electric signal picked up from the microphone is almost similar to what we could record just outside the ear.

But the human ear is more than that, because at the beginning of time, the ear was probably not used for picking up language or detailed sounds like we want to hear today, most likely it was just a tool to warn our brains of the dangers to come, the same as our mouthes where probably not used to speak languages but only to be a weak signaling tool.

A very strange physical human phenomenon then appears, because the human voice conscists of many frequencies but the ones between 2 and 4000 hz are the ones considered needed for understanding what is actually said. The so called formant area of the human voice.
The pinna and ear tube of the human ear, for a strange reason enhances these frequencies, making it easier to understand what is being said, which leads to the discussion of which was used first? The voice to speak or the ear to hear speech.? A long philosophical discussion which I will leave out of here.

But this states that what we hear is of course not what is there raw in nature, but we hear a humanly naturally filtered version of it. Which then also prove that since no people are alike or built alike in their ears then nobody hears the same thing, yet we build up a common understanding of what is good and what is bad.

Sound is therefore a very abstract thing to understand, it all depends on wether you think of it physically or in the philosofical plane. Myself is of the belief that the philosofical plane is by far the most complex, but as with so many other aspects of philosofy and academic studies things can be studied to death and researched apart and still not come up with a clear conclusion expect that most of us think alike and what is really means is that the physical world is what matters (at least in the craftmanship business).

Therefore more on sound in the physical world:
Just as with frequencies, and a limit to which of those we can hear, there is a limit to how much volume we can take.
Volume is the power of how hard the sound hits, how loud it is, and so on. We can pick up a minimum volume of 20 µ Pa. (Micro Pascal) – which to start with don't make much sense unless you are completely geeky about remembering physics in high school.

Basically you can talk about volume in any form you want, but the used type of measuring is dB (Decibel) – which is a mathematical term for showing the difference between two numbers.
Any two numbers, you could measure the speed of your car in decibels, if you like.

In the mathematical world 3dB is double the number.
So if you have a car driving at 100 km/h then +3dB means 200 km/h. But in sound it's slightly different, because here we need to discuss many things and not just speed, and we need 4 times as much power to double the amplitude of our sound, which results in a sound being audible twice as loud. So in the sound world a sound needs to be increased 6 dB before it's twice as loud.

In the physical world, when we are discussing a sound moving through air (or any other material basically) – we are talking about dB SPL : which stands for Sound Pressure Level.
There are many other forms of dB measuring numbers, but SPL is what is used in open air, you may have heard of dBv or dBvu, dB FS and many more.
They are all used but in different ways, because like we just said, that dB is a mathematical way of telling the difference between two numbers, meaning that you must have two numbers to measure

between. You cannot say that something is a certain dB without knowing what it's compared to.

So to make it short, 0dB SPL is no audible sound at all or just hearable, which is 20 µPa as also mentioned before. So if your sound is 40 µPa, then it's 3dB SPL.
Which is not very loud.

Normally a human can hear sounds up to 100 dB SPL. Above this level it will get painful at some point and at further levels your ears will break, eardrum burst, the anvil or the hammer bones will simply fall apart. Not very nice and don't try this at home.

Of course it is individual for each person where the threshold of pain is, but above 100 dB SPL is seldomly a good idea for the human ear.
