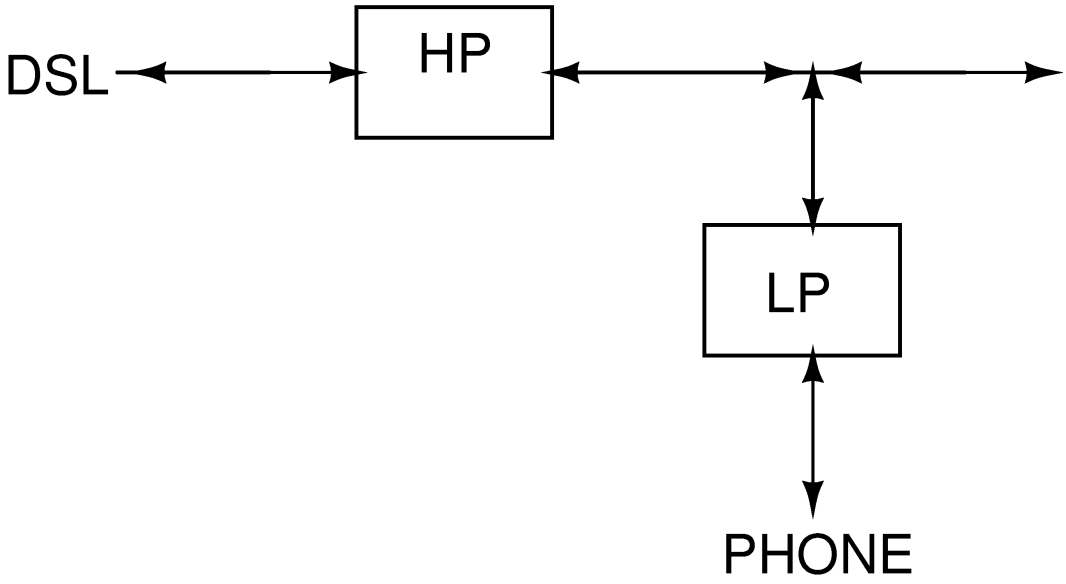

The above block diagram is a representation of a signal splitter in a DSL line. Using the phone line for both DSL signals and phone conversations at the same time is accomplished by sending the DSL signals in higher frequencies and the phone signals in lower frequencies. The phone frequency range is from 0Hz. to 4kHz. The DSL signals depend on the implementation, but in this case assume they are in the range of 8kHz and up. The problem arises in that the human ear can distinguish frequencies up to 20kHz. If the output of the phone line were connected straight to the phone, the user would be able to hear the DSL signals, which would sound like static. In order to reduce this noise, you are asked to design a low pass filter to go between the phone line and the user that will reduce the DSL signals so that they are not heard on the phone but have minimal distortion on the phone's signal. The phone's receiver has a resistance of 4Ω. Only concern yourself with the case where the phone is a receiver. Fourier developed a theory that you will learn in 314, which states that any repeating signal can be expressed as the sum of an infinite number of cosine waves. Using this theory allows you to pretend that the telephone line consists of cosine waves below 4kHz that you want to keep and cosine waves above 8kHz that you wish to attenuate. Use superposition. Limit yourself to a single simple filter.