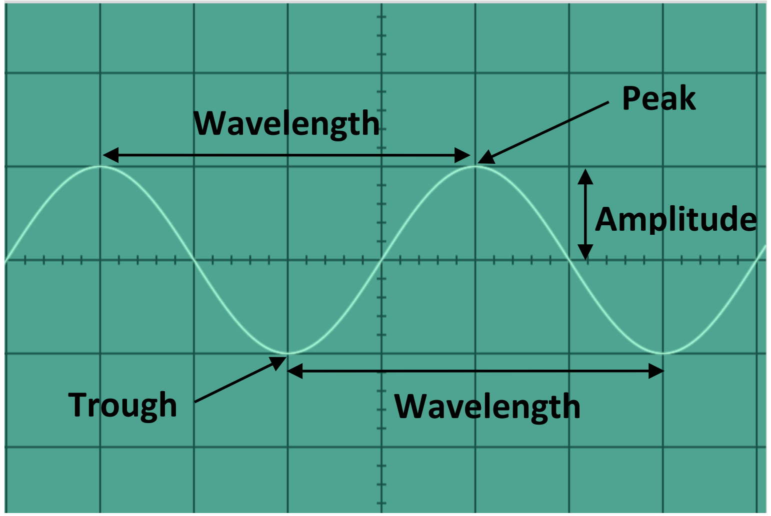
Key Stage 4 - Let's get digital

Student worksheet

1. Sound Waves



The picture above shows a sound wave displayed on an oscilloscope.

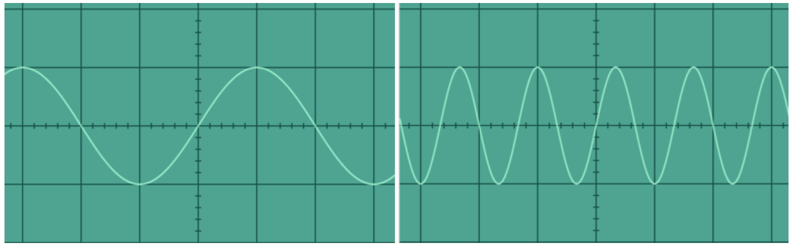
The amplitude of a wave is the height of the peak (or the depth of the trough) from the centre line. The **larger the amplitude** of a sound wave the **louder** it is.

The wavelength of a sound wave is the distance from peak to peak or trough to trough (see diagram).

The **shorter the wavelength** of a sound wave the **higher the pitch or frequency**.

https://www.oxfordsparks.ox.ac.uk/content/what-are-quantum-rainbows

1(a) How would these two waves sound different?



Hint: Has the wavelength or amplitude changed? If so, how?

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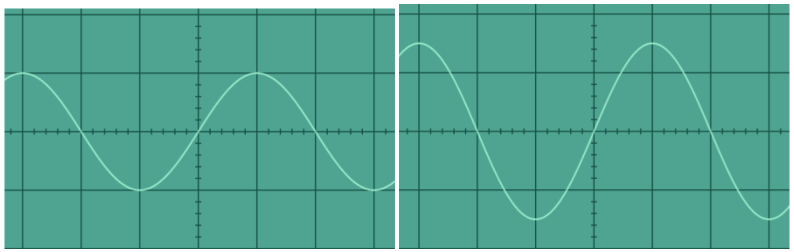
1(b) How would these two waves sound different?



Hint: Has the wavelength or amplitude changed? If so, how?

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2. Converting to numbers

The diagram below shows part of a sound recording. This could be a small section of music, speech or other sound. This is an example of an ***analogue*** signal. Analogue signals are continuous (i.e there are no gaps). Computers have to convert sound or music into numbers before they can process or store it.

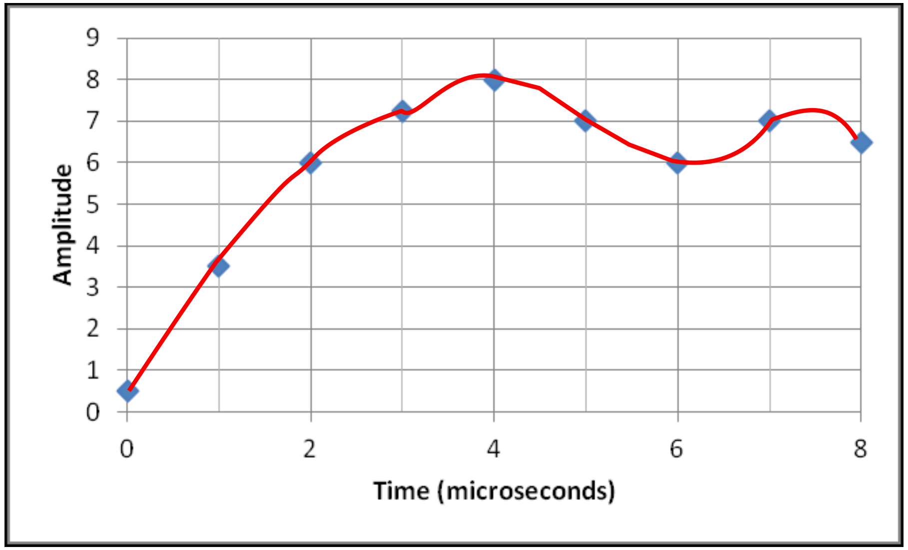
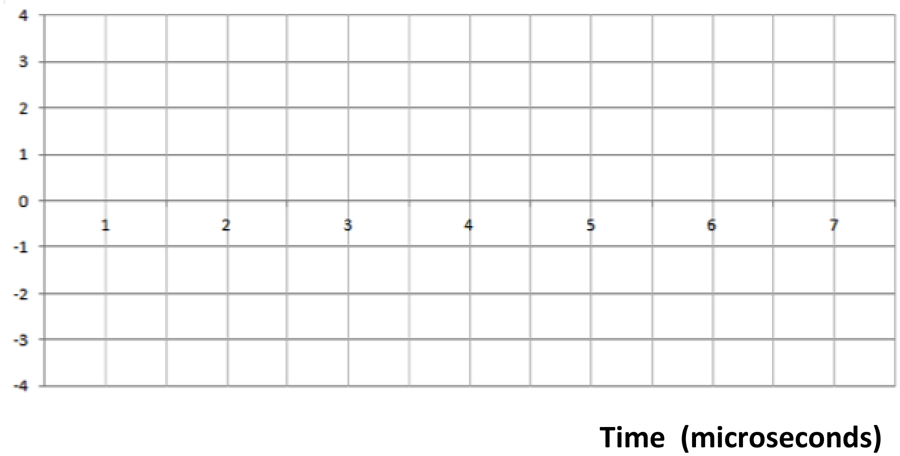


Diagram 2 - Sampling

They do this by slicing up the sound signal and recording the value of the amplitude (height above the centre) at regular time intervals (blue dots in the diagram above). This is called **sampling** as rather than recording the whole wave only a small sample is recorded. This creates a ***digital*** version of the signal (i.e there are gaps between values).

The more slices they split the sound wave up into the closer to the original sound wave it will be, but it will need more space for storage and power for processing. The number of samples per second is called the ***sampling rate***.

2(a) Invent and draw a sound wave similar to the one in diagram 2 on the chart below.

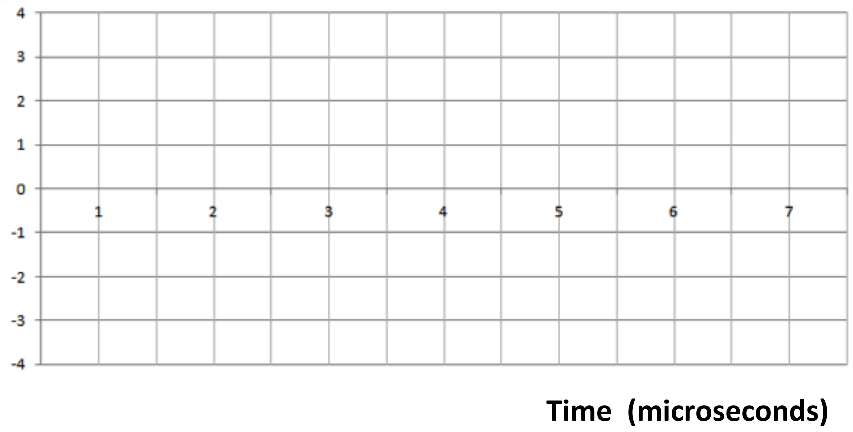


2(b) Use the wave you have just drawn to fill in the table below. Here you are sampling every 1 microsecond.

Time (microseconds)	1	2	3	4	5	6	7
Amplitude							

Table 2a

2(c) Swap sheets with a partner and plot **their** values from table 2(a) on the chart below.



Try to join up the points using a smooth curve. How close does it look to your partner's original wave?

Would it have made much difference if you'd sampled

a) Every 0.5 microseconds?
b) Every 2 microseconds?

In order for you to hear sound/music that has been stored digitally, the numbers have to be converted back into a sound wave – this is like you drawing the sound wave from the table.

3. Sampling Rates

In real life land line telephones use a sampling rate of 8,000 samples per second whereas a CD or MP3 is around 44,000 samples per second.

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Discuss with a partner why you might need a higher sampling rate for music than speech.

Write your answer below:

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