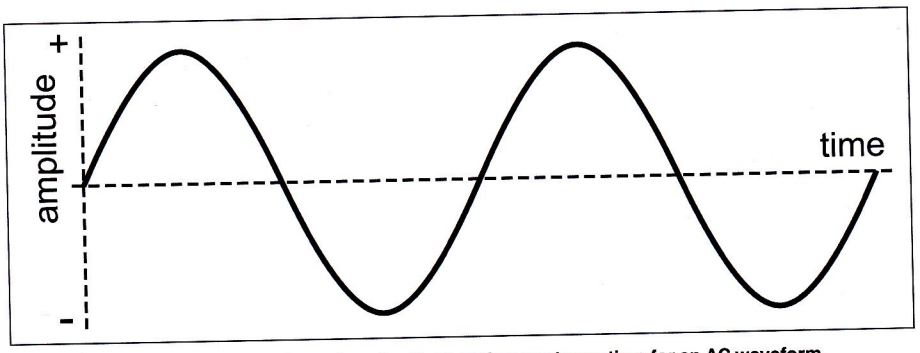


Fig 7: A graph showing the varying value of voltage and current over time for an AC waveform.

Whilst the wire is going up the voltage and current generated has one polarity and moments later when the wire is coming down the voltage and current are of opposite polarity.

The alternator in a car produces AC, but that is no use to charge the car battery or to run many of the electronic items in the car such as the radio. Special electronics are needed to convert the alternating current to direct current. That re-charges the car battery and powers all the car electrical items including the lights (which could use AC or DC).

The same electronics to convert AC to DC in a car is also needed in mains driven electronic equipment, such as televisions. There may also be a need to change the 230V mains to a lower voltage. That is easy to do with AC, using a transformer. It is not nearly so simple with a DC supply. The methods of doing that are covered in the Intermediate and Full amateur licence courses.

Alternating currents and voltages do not suddenly switch from one polarity to the other. As **Fig 7** shows, they build up to a peak in one direction, then reduce back to zero before building up in the opposite direction.This smooth waveform is known as a 'sine wave' (from the sine function in trigonometry).

There are two features of an alternating current or voltage that we need to know. Not only do we need to know the size of the voltage, we also need to know how often the cycles of change occur. That is called the frequency. Frequency is defined as the number of cycles occurring in one second. The unit of measurement is cycles per second or 'Hertz' (Hz).

The domestic mains supply is 230 volts and 50Hz. That means there are 50 complete cycles in one second. Fig 7 shows two complete cycles.

Different frequencies

SOUND IS ALSO an alternating signal. As sound, the signal is carried by the movement of air. A sound of 50 cycles per second (50Hz) is a very low note, as much felt as it is heard.

Human hearing ranges from about 100Hz (a low note) to 15kHz (a very high note). As we get older the upper limit drops, and adults may have difficulty above 10kHz. Many animals, eg dogs, can hear much higher frequencies.

For high quality music the full range of frequencies is desirable, but for speech a much narrower range is quite sufficient. It is usually considered that the range for pleasant communication is about 300Hz to 3kHz. That is typical of a good telephone line. Mobile telephones are a bit poorer, and many people can clearly hear the difference.

Electrical signals in the leads to a loudspeaker are alternating currents and voltages, and many frequencies may be present at the same time, depending on the sounds. A clean whistle will be a single note and a single electrical frequency, whilst a piece of music is likely to contain many notes and hence many frequencies.

Radio frequencies (RF)

RADIO WAVES ARE generated by feeding alternating electrical signals to an aerial (often called an antenna). The frequencies of radio waves are much higher than those we can hear.

Frequency	Wavelength
1MHz	300 metres
3 MHz	100 metres
10MHz	30 metres
30MHz	10 metres
100MHz	3 metres
300MHz	1 metre
1000MHz	30 cms

Table 2: Frequency versus wavelength

For ease of reference, the wide range of radio frequencies are divided into bands (see **Table 1**).

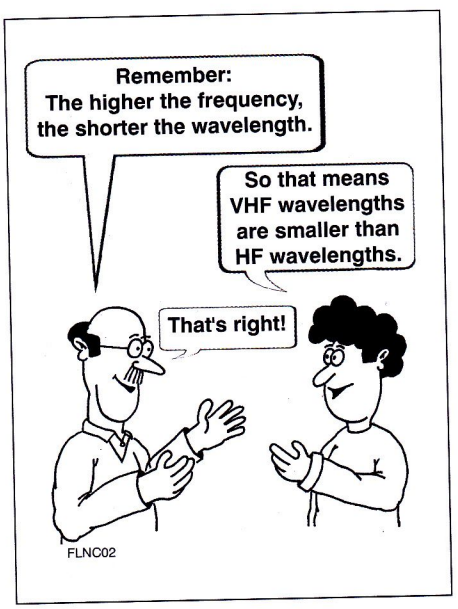
The amateur frequencies of most interest to Foundation amateurs are in the HF, VHF and UHF bands. They are shown in the schedule to the amateur licence. There is also a small band at 137kHz, used mostly for research into how radio waves propagate at those frequencies.

Wavelength

THE WAVELENGTH of a wave is the distance between the same point on two consecutive cycles.

Consider waves in the sea. Two peaks might be about 10 metres apart. If the waves are more frequent they will be closer together. Therefore, the frequency and the wavelength are related. A higher frequency gives a shorter wavelength.**Table 2** shows the relationship between various frequencies and wavelengths.

Fig 8 will convert from Frequency in MHz to wavelength in metres. The symbol for wavelength is the Greek letter lambda, λ.



Frequency range	Band	Name
300kHz – 3MHz	MF	Medium frequencies or "medium wave band"
3MHz – 30MHz	HF	High frequencies or HF band
30MHz – 300MHz	VHF	Very high frequencies or VHF band
300MHz – 3000MHz	UHF	Ultra high frequencies or UHF band

Table 1: You should remember the frequency ranges of the HF, VHF and UHF bands.