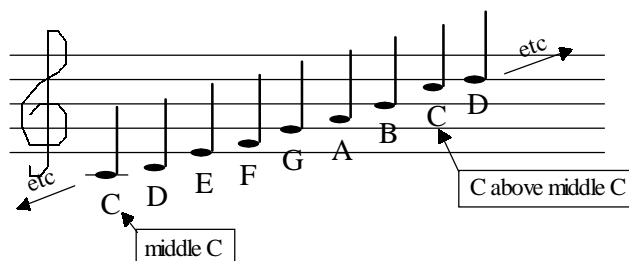


Tips and Tricks: Playing Music on the HP38G

The command **BEEP freq;duration:** can be used to play music on the HP38G but there are ways to make the process a little easier. The first of these is to establish a standard length for a single beat – a crotchet, in music terminology. The second is to use the fact that there is a mathematical relationship between successive notes in the musical scale. The explanation below is necessarily brief. More information is available in many encyclopedias.

In the musical scale shown right, the notes repeat after an ‘octave’ (eight notes). In fact, that octave is made up of thirteen ‘smaller’ notes with semi-tone jumps between almost every one.



ie. C, C#, D, D#, E, F, F#, G, G#, A, A#, B, C

The frequencies of the twelve semi-tone jumps form a geometric sequence, and since the ratio from C to C is 2, the ratio for each semi-tone must be $\sqrt[12]{2}$. The standard frequency used in tuning instruments is usually 440 cycle/sec for the note A. Since much of the simple music used by students is written using the scale of C, I will use $440 / (\sqrt[12]{2})^9$ to calculate that the frequency of C is 261.6 cycles/sec.

We can use this to form a standard ‘header’ for any program we want to use to play music. The header shown right in the rounded box sets up the scale of C major. The code which then follows plays the first two bars of the tune “Strangers in the Night”.

```
.5▶T:
261.6▶C:
12 NTHROOT 2▶R:
R²C▶D:
R²D▶E:
R²E▶F:
R²F▶G:
R²G▶A:
R²A▶B:
```

In this header, the duration of a note (T) is set to 0.5 seconds. It is easy to change the tempo of the music by adjusting this. In this case you may find that the music sounds a little better with T set to 0.55 or 0.6 seconds.

A few points to note are:

1. If a crotchet is T then a quaver is T/2 etc.
2. If a note is repeated then you need to put a WAIT statement between them (as shown right).
3. The value of C defined as 261.6 is ‘middle C’ (see the diagram at the top of the page). If you need to use the C above that then just use a frequency of 2*C to obtain an octave shift. Similarly for other notes above that.
4. If the key signature on your piece of music requires that you use sharps or flats then just multiply or divide by R. For example, the “Strangers in the Night” piece is set in F major with a key signature requiring a B flat. All that is necessary to accomplish this flattening of B is to write BEEP B/R;T: instead of BEEP B;T:.

```
BEEP F; T/2:
BEEP G; T/2:
WAIT .01T:
BEEP G; T/2:
BEEP F; T/2:
BEEP G; 2.5T:
BEEP F; T/2:
BEEP G; T/2:
BEEP A; T/2:
BEEP G; T/2:
BEEP F; 1.5T:
```